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# Contents

Editorial	<b>4</b>
SCRIME shows which crop rotations pay	<b>6</b>
Herbicide resistance management is not a one-year decision	<b>12</b>
<b>AHRI insight...</b>	
An Australian first we did not want! Glyphosate resistance in wild radish	<b>14</b>
Is inoculation of pulses worthwhile?	<b>18</b>
Crops worldwide to take nitrogen from the air	<b>22</b>
Bee sensors take flight to help farmers	<b>26</b>
Indian Ocean Dipole helps predict extreme weather	<b>28</b>
<b>Marketing...</b>	
March USDA report benign but winter crop a worry	<b>29</b>
Looking deeper into the world's wheat crops	<b>32</b>
<b>Classic Tractor Tales...</b>	
The Farmall story	<b>34</b>
New farm machinery sales mixed – large supply of second hand gear	<b>38</b>
<b>Modern Machinery Matters...</b>	
Protect your crop in all conditions	<b>40</b>
<b>Weed Smart...</b>	
'Ask an expert'	<b>42</b>
Our Mystery Soup Mix garden	<b>44</b>
Drought tolerant wheat wins international recognition	<b>46</b>
<b>News &amp; New Products</b>	<b>48</b>
<b>District Reports</b>	<b>52</b>

## Focus Sections

### Southern Australia Focus

*Covering cropping systems of Southern NSW, Victoria, South Australia, Western Australia and Tasmania*

**Consultants' Corner...**

Measuring and managing soil water – 'money in the bank'	<b>i</b>
Growing pulses in 2014	<b>vi</b>
New Fathom barley out-performs Hindmarsh	<b>viii</b>

### Northern Focus

*Covering Northern NSW and Queensland*

**Consultants' Corner...**

Elite wheat resistant to crown rot close to reality	<b>i</b>
Northern Panel evolves with new GRDC direction	<b>iii</b>
Fallow weed management pays off	<b>iv</b>
Another new glyphosate resistant species confirmed in northern NSW	<b>vi</b>
Risk management key to fertiliser investment	<b>vii</b>
Respected Qld entomologist wins prestigious GRDC award	<b>viii</b>

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**N**OT wanting to sound too parochial, but I think it's important we all spare a thought for grain and livestock producers in pretty much all of the northern region. Rainfall has been very scarce – and for a longer time than most care to remember. Queensland currently has the very unwanted statistic of having the largest area of the state drought declared at any one time in its history. And south of the border in northern NSW the picture is also pretty grim. This of course has had a huge impact on the 2013–14 summer crop and the prospects for the rapidly looming winter crop.



Summer crop production is forecast to drop 25 per cent on last season to around four million tonnes. Of this decline, ABARES estimates Australian sorghum production will drop by more than a third on last year to 1.3 million tonnes. Put this into the context of a five-year average production figure for sorghum of more than two million tonnes, and we're looking at a big impact on not only the bank balances of individual farms, but also the nation's ability to cash in on a huge current demand for this commodity out of Asia, particularly China. And, isn't it always the way, record prices – nearing \$350 per tonne Brisbane – are on offer.

Cotton production will also be back by around eight per cent reflecting a smaller area planted to dryland cotton. Even rice farmers in southern NSW are adversely impacted with forecasts of a 20 per cent plus drop in rice production compared to 2013.

So, you get the picture – not a good result for northern region growers this summer season – unless you've been one of the few lucky ones under some isolated and crop-saving thunder storms. And just before I leave my own back-yard, a dry summer in the northern region also means generally depleted subsoil moisture reserves coming into the winter crop planting period. The region will need some very good – but unseasonal rain – to brighten winter crop prospects.

Let's hope all of the Australian grain belt enjoys a wet autumn allowing for fence to fence planting of winter crops – and into plenty of subsoil moisture.

## Farm study tours

If you are thinking of broadening your farm horizons this year, the *Australian Grain/Greenmount Travel* study tours on offer from July onwards will do just that. There are four tours which include time in far-flung destinations such as Siberia, Morocco, Norway and Pacific Northwest Canada. Early and detailed planning, as well as multiple visa applications, are needed to make the most of our time in the farming, and other, regions of these exotic locations. So if you are interested in one of our tours this year (see the insert with this magazine) we are encouraging people to make early bookings.



# AUSTRALIAN GRAIN

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## In this issue...

### SCRIME shows which crop rotations pay

Long-term agronomy trials can unearth new information on how on-farm management practices impact long-term productivity, disease, pests, water and nutrient balances in soils. Some land and soil characteristics change slowly while other factors may quickly change the landscape.



**See article . . . . . Page 6**

### An Aussie first we did not want

Every situation provides us with a choice, and that gives us the opportunity to do things differently. Recently, Australian Herbicide Resistance Initiative researchers in Western Australia detected the nation's first glyphosate resistant wild radish population.



**See article . . . . . Page 14**

### Crops worldwide to take nitrogen from the air

The University of Nottingham (UK) scientists have developed a new technology that could potentially enable all of the world's crops to take nitrogen from the air, instead of requiring expensive and environmentally damaging fertilisers.



**See article . . . . . Page 22**

### Bee sensors take flight to help farmers

Thousands of honey bees in Australia are being fitted with tiny sensors as part of a world-first research program to monitor the insects and their environment using a technique known as



'swarm sensing'. The research is being led by CSIRO and aims to improve honey bee pollination and productivity on farms as well as help understand the drivers of bee Colony Collapse Disorder, a condition decimating honey bee populations worldwide.

**See article . . . . . Page 26**



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# SCRIME shows which crop rotations pay

■ By Deanna Lush

**L**ONG-TERM agronomy trials can unearth new information on how on-farm management practices impact long-term productivity, disease, pests, water and nutrient balances in soils. Some land and soil characteristics change slowly while other factors may quickly change the landscape.

But arguably the best part is that there is so much to be learnt from the different options trialled without making a mess of your own paddocks at home.

The Victorian Department of Environment and Primary Industries has three agro-ecological experiments focusing on grain cropping, covering a range of nitrogen, phosphorus, stubble management and tillage research questions. The oldest is the Longerenong Rotation 1 (LR1) trial, started in 1916, near Horsham.

The Sustainable Cropping Rotations in Mediterranean Environments (SCRIME) trial is a bit younger, running since 1998 at Longerenong College.

Both trials are funded by DEPI and were visited by Grains Research and Development Corporation Southern Panel members during their spring tour last year.

SCRIME is assessing long-term impacts of different rotation and tillage management systems on productivity and soils, focusing on nitrogen and water dynamics. It is producing some interesting results to back-up on-farm cropping practices. SCRIME feeds in data to GRDC projects on improving phosphorus and nitrogen management.

## Rotation

The SCRIME trial is managed by DEPI Future Farming Systems Research senior scientist Roger Armstrong and senior technical officer Roger Perris.

Roger says SCRIME's rotations reflect the diversity used by grain growers on-farm in the medium rainfall zone of south eastern Australia. Rotations include:

- 1 Continuous wheat (reduced tillage);
- 3 Pulse (peas), wheat, barley (reduced tillage);
- 4 Green manure (vetch) fallow, wheat, barley (reduced tillage);
- 6 Canola, wheat, pulse (peas) (reduced tillage, stubble burnt);
- 7 Canola, wheat, pulse (peas) (conventional tillage);
- 8 Lucerne, lucerne, lucerne, canola, wheat, pulse (peas) (conventional tillage);
- 9 Green manure, canola, pulse, medic pasture, wheat, barley (reduced tillage);
- 11 Canola, wheat, pulse (peas) (zero-till); and,
- 12 Fallow, wheat, pulse (chickpeas) (reduced tillage).

Rotations have been tweaked over time in response to industry



**Roger Armstrong.**



The SCRIME trial is finding soil organic carbon changes are very slow in the site's alkaline, grey, self-mulching clay vertosol soil. After 14 years, there is only just starting to be measurable SOC differences between rotations.

## SCRIME KEY OBSERVATIONS...

- Disease levels under continuous wheat may not increase for several years under below average rainfall conditions and then can suddenly build up to significant levels, resulting in major yield reductions.
- Tillage method is not having the major effects on yield.
- Extra application of nitrogen at sowing is not generating the yield increases expected. It has taken two bumper back-to-back crops to deliver a visible yield response to N in following years.
- There can be huge year-to-year variations in soil N mineralisation. Putting nitrogen back into the soil through manuring and fallow is one thing – keeping it there for subsequent crops is another.
- Changes in soil organic carbon are very slow. After 14 years of the trial, there is only just starting to be measurable differences between rotations.





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**SEED HAWK**



**There was a huge increase in cereal cyst nematode in the continuous wheat rotation in the past two years after the 2010 and 2011 wet seasons.**

interest and agronomic management. Rotation 2 was changed because of the interest in zero-tillage from growers while Rotation 5 was changed due to a rapid build-up in broadleaf weed problems resulting from a high frequency of pulse crops in the rotations.

The trial is located on an alkaline grey self-mulching clay vertosol soil, with a long cropping history before the trial, in an average 414 mm rainfall zone.

## Disease

The sudden impacts of disease on a crop have been clearly demonstrated in the SCRIME trial's continuous wheat rotation.

For the first 12 years, grain yields in continuous wheat rotations were not that different to more diverse rotations. But

after the end of the drought in 2010, yields started to decline and took a major blow in 2012.

SARDI's PreDicta B tests confirmed disease levels had shot up with cereal cyst nematode the main culprit. Roger says this result reflects the lack of moisture during the millennium drought kept disease levels relatively low but when the Wimmera returned to more long-term average rainfall, this situation changed significantly.

"One Wimmera grower says the SCRIME and Longerenong Rotation 1 trials are Victoria's best kept secrets in terms of the lessons they hold for farmers," Roger said.

## Tillage

Three tillage methods are used in the trial:

- Conventional tillage, including mechanical cultivations using a disc plough and scarifier or harrows after harvest. Stubble is incorporated into the soil.
- Reduced tillage, where plots are not cultivated other than at sowing. Stubble is burnt if required after fire bans are lifted and before sowing in April. No burning occurs if stubble loads are light, such as after a drought.
- Zero-tillage, in which stubble is retained on the surface.

The trial has not found any significant impact so far on crop yield due to tillage practice. Zero-till yields were only slightly less than conventional-tillage plots, most likely reflecting poor emergence due to stubble handling issues.

Highest wheat yields were in rotation 12 at 5.66 tonnes per hectare and rotation 4 at 4.45 tonnes per hectare (see Table 1).

But those yields can be reduced by half because the fallow or green manure phase that preceded the wheat phase provided no immediate economic advantage.

"By comparison, rotation 7 using canola, wheat and pulses, such as field pea, has been pretty robust from an economic perspective," Roger said.

## Nitrogen

Early in the trial, putting out more fertiliser nitrogen did not give the yield responses that growers might have expected out in the paddock.

Nutrient applications have included:

- Mono-ammonium phosphate (MAP) is banded and urea direct-drilled for wheat and canola at 35 kg N per hectare.
- Green manure is disced into the soil at flowering time.

**TABLE 1: Effect of rotation and tillage/stubble management on wheat grain yield and soil carbon**

	Grain yield (tonnes per hectare)			Organic carbon	
	2010	2011	2012	2010 0–10 cm (%)	2010, C stocks in 0–30 cm (tonnes per hectare)
1. Continuous wheat – reduced tillage	3.83	3.31	3.11	1.00	25.76
3. Pulse (peas), wheat, barley – reduced tillage	4.65	3.93	4.22	0.94	24.50
4. Green manure (vetch) fallow, wheat, barley – reduced tillage	5.15	4.81	4.45	1.06	25.82
6. canola, wheat, pulse (peas) – reduced tillage, stubble burnt	4.25	4.97	4.01	0.93	24.10
7. Canola, wheat, pulse (peas) – conventional tillage	5.06	5.43	3.78	1.01	25.44
8. Lucerne, lucerne, lucerne, canola, wheat, pulse (peas) – conventional tillage	4.88	3.47	2.75	0.99	25.53
9. Green manure, canola, pulse, media pasture, wheat, barley – reduced tillage	5.22	3.74	3.79	No data	No data
11. Canola, wheat, pulse (peas) – zero-till	5.05	4.49	3.93	0.99	25.41
12. Fallow, wheat, pulse (chickpeas) – reduced tillage	5.23	6.59	5.66	0.82	22.39





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**TABLE 2: Soil nitrate-N (kg/ha) in profile (0–120 cm) at sowing of wheat phase in SCRIME rotations trial**

Rotation	2009	2010	2011	2012	2013
1. Continuous wheat – reduced tillage	44	59.3	27.3	44.8	15.1
3. Pulse (peas), wheat, barley – reduced tillage	57.8	87.9	48.1	58.5	23.3
4. Green manure (vetch) fallow, wheat, barley – reduced tillage	67.7	205.9	127.3	91.2	33.6
6. Canola, wheat, pulse (peas) – reduced tillage, stubble burnt	53.6	104.5	67.9	53.8	17.6
7. Canola, wheat, pulse (peas) – conventional tillage	49.8	no data	no data	no data	35.4
8. Lucerne, lucerne, lucerne, canola, wheat, pulse (peas) – conventional tillage	68.4	167.4	47.7	72.5	90.1
11. Canola, wheat, pulse (peas) – zero-till	62.9	124.2	84.8	54.6	30.8
12. Fallow, wheat, pulse (chickpeas) – reduced tillage	129.1	131.3	181.7	128.6	83.7
No data collected from rotation 9					

- Lucerne is slashed as plants started to flower, usually once a year but in 2010 and 2011 up to three times a year. Slashed lucerne is retained on the soil surface except immediately before a cropping phase, when it is disc-ploughed into the soil.
- Phosphorus is banded at five cm at sowing as MAP to wheat and canola at 11.3 kg P per hectare; as single superphosphate to lucerne at 9.9 kg P per hectare in the first year of the three-year phase; and as 'Grain legume P' to field pea at 16 kg P per hectare.

Roger says in the past seven years, an extra split application of nitrogen (urea) at 23 kg N per hectare applied to wheat at sowing has not resulted in any significant yield response at harvest. This probably reflects the 10-year drought experienced where the Wimmera's vertosol, alkaline soils in the paddock where SCRIME was located were already fertile and the lack of rain constrained yields.

"It's taken a long time for us to see more yield from extra

fertiliser nitrogen," Roger said. "Growers have been applying nitrogen and not seeing much bang for their buck in the past decade, now with a return to more normal seasons and with two good seasons starting in 2010, we're starting to run down nitrogen reserves and the response to nitrogen fertiliser should be more visible.

"A response to higher rates of N fertiliser is likely to occur more frequently."

## Mineralisation

Pre-sowing levels of profile soil mineral nitrogen (0–120 cm, measured in late April) found there was significant variation in the rate of mineralisation between years (see Table 2).

Roger says the stand-out was rotation 4, where after the wet summer of early 2010, there was 206 kg N per hectare when it came time to sow wheat. Rotation 8 was also significant at 167 kg per hectare.

"There's a real concern if you have some kind of fallow or green manure building up large amounts of nitrogen that if an exceptionally wet summer occurs that some nitrogen can be lost from the profile," he said.

"Rotation 4 was back to 91 kg per hectare in 2012 and rotation 8 back to 72 kg per hectare, the result of two good seasons and heavy demand for N by the crops. The benefits of fallow is as much about the extra nitrogen in the soil as it is the extra water but you need both."

## Organic carbon

After 14 years, the SCRIME trial is only just starting to see significant changes in soil organic carbon (SOC) in the top 10 cm of soil. SOC was measured in April 2010 and will be measured again in 2014.

Roger says rotations 4 and 12 are interesting comparisons:

- Four has the highest SOC, mostly contributed by the wheat and barley which, with plenty of water and nitrogen, helped build up levels.
- SOC in rotation 12 (fallow-wheat-chickpeas) has been significantly lower than any other rotation.

"This rotation just doesn't have the carbon input going back to the soil all the time. The chickpeas are good at fixing nitrogen but not as helpful with organic carbon while rotation 1 of continuous wheat is quite high despite the plot being nitrogen deficient.

"In most cropping systems, the rate of change of in-soil carbon is very slow, it doesn't happen overnight and this trial confirms that. This trial highlights the challenges for farmers wanting to sequester soil carbon."

More information: Roger Armstrong, 03 53 622 336 or [roger.armstrong@depi.vic.gov.au](mailto:roger.armstrong@depi.vic.gov.au) or for more about the trial, visit [www.dpi.vic.gov.au](http://www.dpi.vic.gov.au) (search SCRIME)



The Sustainable Cropping Rotations in Mediterranean Environments (SCRIME) trial started in 1998 and is assessing long-term impacts of different rotation and tillage management systems on productivity and soils, focusing on nitrogen and water dynamics.





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# Herbicide resistance management is not a one-year decision

**H**ERBICIDE resistant weeds can be controlled within a few years using a planned strategy, according to Dr Chris Preston, University of Adelaide (UA) Associate Professor – Weed Management. Chris advocates using a few different integrated weed management tactics to maintain pressure on weeds. He suggests that the costs associated with herbicide

resistant weeds are so great that there are situations where weed control opportunities may need to take priority over other crop outcomes.

Starting with the worst weed and worst paddock, Chris said it is possible to see significant results within two years, particularly with weeds like annual ryegrass that do not stay dormant in the soil for a long time. The next step is to include weed seed set prevention strategies for all weeds in all paddocks.

"A reduction in weed populations can be achieved if in-crop tactics are used in consecutive years to minimise seed set," he said. "A single operation to reduce weed seed set with no follow-up is rarely as effective as using a number of weed control tools."

"Weeds that have survived the growing season and set seed at harvest time are the source of a continuing weed burden on cropping land," said Chris. "Growing crops specifically for the weed control options they offer is one tactic to combat weed seed set."

Promoting strong crop competition is an important tactic that should be factored into every crop production phase, especially for cereals. "High seed rates, narrow row spacing, early sowing when the soil is still warm and correct use of pre-emergent herbicides all create the best opportunity for the crop to out-compete weeds."

"Growing a brown manure crop or croptopping can be effective options in the long term," he said. "Using a variety of tactics will remove herbicide resistant weeds whilst conserving herbicide chemistry."

All pulses can be grown as brown manure crops and will add vital nitrogen and organic matter to the soil. Growing pulses, such as field peas or lupins – specifically for the opportunity to croptop – can also be very effective if the operation is done when the weeds are most susceptible.

"Croptopping is less effective if it is done as a last minute response to a weed blow-out," said Chris. "But if it is planned and the weeds are monitored to determine the best time to apply the croptop herbicide then it will achieve a significant reduction in weed seed set."

Croptopping is usually used to control grass weeds but it is important to note that it can be difficult to implement in lentils and faba beans and does not usually offer a high level of effective weed control in chickpeas.

In the lead-up to harvest it is worth considering the use of mechanical harvest weed seed control tactics such as producing hay or windrow burning.

"Producing oaten hay is a very valid weed control strategy to use against both broadleaf and grass weeds. But after cutting the hay it is essential to go back with a clean-up operation using a paraquat-based herbicide, which is very effective on new regrowth."

Mechanical harvest weed seed control tools are a good addition to a weed strategy, with windrow burning being an effective tactic against wild radish.

"The overall key is to be diligent. Monitor the effectiveness of each weed control tactic used and be ready to implement operations at the right time," Chris said. "Intensive management of small problem areas or patches can greatly reduce the threat of a weed explosion."

For more information on managing the risk of herbicide resistance, visit: [www.weedsmart.org.au](http://www.weedsmart.org.au)



**Chris Preston, University of Adelaide Associate Professor, Weed Management, is encouraging farmers to be diligent with the implementation of a range of tactics to reduce the threat of herbicide resistance in weeds.**

An advertisement for agricultural tracks. The top section features the 'camoplast Agricultural Tracks' logo in white and blue on a dark blue background. Below the logo, it says 'Suits tractors by:' followed by images of four different tractor models: John Deere, CAT Challenger, Case-IH Quadtrac, and AGCO Challenger. Under each tractor, the specific track series are listed. The middle section is titled 'DURABUILT™ 2500, 3500 &amp; 5500 SERIES' and describes the tracks as being made from premium-quality rubber and high-resistance steel. Below this, it says 'Midrollers' and lists compatibility with Caterpillar Legacy Rowcrop &amp; Legacy Tillage Tractors, as well as Challenger models. The bottom section features the 'Neil's Parts Australia' logo with a stylized kangaroo and the phone number '1800 463 457' and website 'www.neils.com.au'.



**What  
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# An Australian first we did not want! Glyphosate resistance in wild radish

■ By Brogan Micallef and Michael Ashworth,  
Australian Herbicide Resistance Initiative

**E**VERY situation provides us with a choice, and that gives us the opportunity to do things differently. Recently, Australian Herbicide Resistance Initiative (AHRI) researchers in Western Australia detected the nation's first glyphosate resistant wild radish (*Raphanus Raphanistrum* L.) population.

This discovery is big news in Australia and should serve as another warning – if we rely exclusively on herbicides they will eventually fail.

It also presents us with a choice – do nothing, or be proactive.

### Diversity, diversity, diversity!

Where glyphosate was once predominantly a pre-sowing knockdown herbicide, it is now also used post-emergent in glyphosate tolerant crops, in chemical fallow, for crop topping and is the backbone of most summer spraying programs. Australian grain cropping is heavily reliant on glyphosate and this over-reliance has led to resistance evolving in a number of weed species.

According to the Australian Glyphosate Sustainability Working Group, at the end of 2013 there were six different weed species that have evolved resistance to glyphosate Australia-wide:

- 411 documented glyphosate resistant populations of annual ryegrass,
- 95 of awnless barnyard grass,
- 57 of fleabane,
- 11 of windmill grass,
- 3 of liverseed grass, and
- 3 of great brome.

Now we can add three populations of wild radish to the list. And in March this year there have also been two cases reported of glyphosate resistant sowthistle in northern NSW.

### Resistant wild radish populations identified

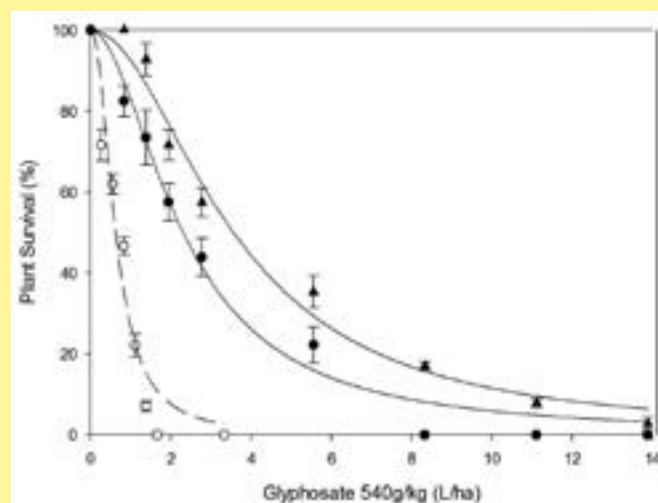
The three glyphosate resistant wild radish populations were

identified by GRDC sponsored PhD scholar Michael Ashworth, who is based at AHRI at The University of Western Australia.

Two field populations of wild radish were sampled in the northern wheatbelt of WA. These populations were then rigorously screened at AHRI and confirmed to have evolved moderate levels of glyphosate resistance.

These two populations exhibited high rates of survival (63 and 86 per cent respectively) following glyphosate application onto two leaf plants at the label rate to control wild radish in Australia (540 g ha). Furthermore, more than half of both populations

**FIGURE 1: Survival percentage of the susceptible wild radish population (○) and two field collected glyphosate resistant populations (● and ▲) from low dose screening**







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survived and flowered at the higher rate of 810 g ha (applied to two leaf wild radish).

Michael says that both populations also exhibited cross resistance to label rates of:

- The ALS-inhibiting herbicides Glean (chlorsulfuron), Oust (sulfometuron-methyl), Eclipse (metosulam) and Raptor (imazamox);
- The PDS inhibitor diflufenican; and,
- The synthetic auxin 2,4-D amine.

"The presence of such a diverse cross resistance profile highlights the continual difficulties of controlling wild radish solely with herbicides," he says.

Subsequently, 239 paddocks – representing more than 24,000 hectares of WA's northern and central wheatbelt – were surveyed in 2010 and 2011 with one additional glyphosate resistant population found.

Is Australia on the verge of developing a significant glyphosate resistance problem? Thankfully, glyphosate resistance in wild radish is still rare and the evolution of additional populations can be limited if weed management is optimised. This means that we need to think in terms of reducing populations.

### Glyphosate resistance is a global issue

This issue is not limited to Australia. The US is now the world leader in glyphosate resistant weeds and Australia may soon follow suit, unless we incorporate more diversity into our weed control programs.

Professor Stephen Powles, AHRI Director, says that the introduction of glyphosate resistant crops in the US was so effective that there was almost universal adoption and then exclusive use of glyphosate for weed control.

"Initially the weed control was outstanding, encouraging

even more overreliance on glyphosate. But the economic savings experienced are now being eroded by the evolution of glyphosate resistant weeds.

"Nearly all the US corn, soybean and cotton crops are glyphosate resistant and many of these fields are starting to show glyphosate resistant weeds. This problem will only double, triple and quadruple in the coming years due to over-reliance on glyphosate," Stephen says.

Brazil and Argentina are not far behind. Like the US, growing glyphosate resistant crops means continuous and intense selection pressure with glyphosate, resulting in the evolution of glyphosate resistant weeds and shifts to naturally glyphosate tolerant weed species.

The increase in glyphosate resistance evolution around the world verifies why we need diversity in our systems – resistance evolution is jeopardising the benefits of this valuable technology.

### Add non-herbicide tools to the mix

What does this mean for wild radish in Australia?

"The good news is that the evolution of glyphosate resistance in wild radish is currently rare," Michael says.

"Finding these populations' early means growers have the opportunity to adopt proactive control strategies."

He says the aim should be to control weed survivors, eliminate weed seed set and maximise the diversity of control strategies.

"We have the non-herbicide tools of crop competition and harvest weed seed control to greatly reduce weed numbers," he says.

"We also need to look for non-herbicide alternatives as a second knock in chemical fallow and summer spraying situations. Depending on the situation, this could consist of cultivation and including sheep in the rotation.

"By maximising diversity in the system and eliminating seed set at harvest, Australia has the opportunity to get onto this problem before it becomes widespread, and avoid replicating the rapid rise of glyphosate resistant weeds occurring in the US."

Stephen Powles agrees and says that when diverse weed management practices are used, including both herbicide and non-herbicide tools, weed control by glyphosate can be sustained in cropping systems.

"Don't rely solely on glyphosate, maintain diversity in weed management techniques to provide glyphosate longevity and sustain future harvests," Stephen says.

We have a choice – do nothing, or be proactive. The life of glyphosate depends on it.

#### Further information:

Additional information is at <http://www.ahri.uwa.edu.au/news/AHRI-insight/Glyphosate-resistant-wild-radish>

Information about sustainable IWM practices is available at [www.ahri.uwa.edu.au](http://www.ahri.uwa.edu.au) and [www.weedsmart.org.au](http://www.weedsmart.org.au).

For more information on managing glyphosate and paraquat resistance visit the AGSWG website [www.glyphosateresistance.org.au](http://www.glyphosateresistance.org.au)



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# Is inoculation of pulses worthwhile?

■ By Maarten Ryder, University of Adelaide and Ross Ballard, SARDI

**P**ULSES are grown in crop rotations for several reasons, including their potential to fix atmospheric nitrogen and boost soil fertility. They don't do this job alone and if their symbiotic rhizobial partner is not present in high enough number in the plant root zone there will be reductions to the amount of nitrogen fixed – and sometimes little to no nitrogen fixed.

The pulse crop may survive if sufficient soil nitrogen is present but there will be a net loss of soil-N rather than the potential net gain.

Across the southern region we estimate that 75 per cent of pulse crops and 50 per cent of legume pastures are sown with rhizobium inoculant. Paddock history and soil type are the key factors influencing the need for inoculating pulse crops with rhizobium bacteria.

If a pulse crop has not been grown in the paddock, then inoculation is always required. If the pulse crop has previously been grown, there will be paddocks where inoculation is not required at every sowing, while others will benefit from topping-up the number and nitrogen fixation capacity of the soil rhizobia, using inoculation.

Table 1 outlines the response you can expect from inoculating various pulses across a range of paddock histories and soil types.

Rhizobia bacteria are able to live free in the soil without a host for a time but generally only when soil conditions – especially pH – are favourable to their survival. Rhizobia and their host legume tend to have similar pH tolerance. So for pulse legumes that dislike strongly acid soils such as pea and bean, the rhizobia tend not to



Maarten Ryder.

survive well in soils with pH below 6 (CaCl<sub>2</sub>) or below 6.5 (in water). Research has shown that pulse crop response to inoculation is more likely on low pH soils (except lupins), so inoculation is generally



Pea inoculation responses.

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**Most pulse growers apply an inoculant slurry to the seed.**

recommended on these soil types. Inoculation of acid sensitive pulses should always be practiced on very acid soils.

Lupins are much more tolerant of low pH (acidic) soils as are their rhizobia, and so inoculation is less critical for lupins on acid soils, so long as they have been recently been grown in the paddock and good nodulation has been observed.

### Rule of thumb

In higher pH soils, rhizobia associated with all pulse crops can survive for several years without a host plant. Even so, as a rule of thumb, we suggest using inoculant if it is four or more years since you have sown the same pulse in a paddock. For example, if you plan to sow field peas and it is four or more years since pea, bean or vetch (which can all use the same rhizobia) have been grown in that paddock, then inoculation of the seed with rhizobia is recommended to top-up the background rhizobia.

In a national survey of farmers who grow pulse crops or legume pastures only one per cent of respondents indicated that the cost of inoculant was a factor in their decision whether to inoculate. The more common reasons for not using inoculant

were that the benefit of inoculation was not clear or that the process of applying inoculant was messy and inconvenient.

The benefits of inoculation can sometimes be hard to see, but many studies have shown that improving nodulation is important to optimising nitrogen fixation. Even if there is no immediate benefit to the yield of the pulse crop, often there will be substantial benefits to the yield and protein levels of the cereal and oilseed crops that follow.

Pulse plants without nodules can not fix nitrogen. This means that if there is a nodulation failure the pulse crop itself may become deficient in nitrogen, which is very difficult to remediate. If the value of the crop is high enough, the addition of nitrogen fertiliser may be a viable way to produce some yield from the pulse crop, but there will be no residual fixed nitrogen for following crops.

If in doubt about the paddock's history, the use of inoculant is the most effective, and a much cheaper option at \$5–10 per hectare, than any remedial action and will ensure the maximum residual N benefit of growing pulses in the rotation.

Eighty per cent of growers use the traditional peat inoculants, applied in a slurry to the seed. Some growers are choosing to use granular, freeze-dried and seed coating products to allow them additional flexibility.

Using traditional peat inoculants and sowing after breaking rains is still regarded as the best strategy to ensure good nodulation, especially for crops that are highly responsive to inoculation, such as chickpea. For other pulses that have been widely sown, dry sowing carries less risk. For instance, faba bean and field pea can be dry sown on alkaline soils in South Australia if there has been a recent history of these crops in the paddock. In this situation the risk of nodulation failure is minimal.

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*Inoculating legumes: a practical guide*, GRDC (2012)

*Inoculating legumes: the back pocket guide*, GRDC (2013)

*Rhizobial inoculants: harvesting the benefits of inoculating legumes*, GRDC (2013)

**TABLE 1: Pulse crop response to inoculation**

Crop	High response	Moderate response	Low response
Chickpea	Chickpea not previously grown	Previous inoculated chickpea crop more than four years ago, or recent crop performed below expectation	Well-nodulated chickpea crop in past two years
Field pea, vetch	Crop not previously grown, or soils with pH (CaCl <sub>2</sub> ) below 6.0 and high summer temperatures (over 35°C for 40 days)	Previous inoculated pea, vetch (or bean) crop more than four years ago, or recent pea/vetch crop nodulated poorly and performed below expectation	Soils loam or clay, neutral to alkaline pH, and recent well-nodulated host crop
Faba bean, broad bean, lentil	Crop not previously grown, or soils with pH (CaCl <sub>2</sub> ) below 6.0 and high summer temperatures (over 35°C for 40 days)	Previous inoculated bean or lentil more than four years ago, or recent pea/vetch crop nodulated poorly and performed below expectation	Soils loam or clay, neutral to alkaline pH, and recent well-nodulated host crop
Lupin and serradella	No previous lupin or serradella grown in paddock	More than four years since growing inoculated legume host, or recent crop performed below expectation	In the north and central regions of WA wheat/sheep belt OR vigorous lupin/serradella growth and good nodulation in past four years
Mungbean and cowpea	No previous mungbean, cowpea or other related vigna species grown in paddock	Previous inoculated crop more than four years ago, or recent crop performed below expectation	Recent and or intensive mungbean or cow pea cultivation

Source: Inoculating legumes: The back pocket guide, GRDC, September 2013. Available online at [www.grdc.com.au/GRDC-BPG-InoculatingLegumes](http://www.grdc.com.au/GRDC-BPG-InoculatingLegumes)



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# Crops worldwide to take nitrogen from the air?

**T**HE University of Nottingham (UK) scientists have developed a new technology that could potentially enable all of the world's crops to take nitrogen from the air, instead of requiring expensive and environmentally damaging fertilisers.

Nitrogen fixation, the process by which nitrogen is converted to ammonia, is vital for plants to survive and grow. But only a very small number of plants, most notably legumes (such as peas, beans and lentils) have the ability to fix (use) nitrogen from the atmosphere, with the help of nitrogen fixing bacteria.



**Professor Ted Cocking from University of Nottingham with a plant grown using nitrogen fixation N Fix technology.**  
(Photo: The University of Nottingham)

The vast majority of plants have to obtain nitrogen from the soil, and for most crops currently being grown across the world, this also means reliance on synthetic nitrogen fertiliser.

## Adding nitrogen-fixing bacteria to roots

Professor Ted Cocking, Director of The University of Nottingham's Centre for Crop Nitrogen Fixation, has developed a unique method of putting nitrogen-fixing bacteria into the cells of plant roots.

His major breakthrough came when he found a specific strain of nitrogen-fixing bacteria in sugarcane known as *G. diazotrophicus* could intra-cellularly colonise all major crop plants.

This ground-breaking development potentially provides every cell in the plant with the ability to fix atmospheric nitrogen. The implications for agriculture are enormous, as this new technology can provide much of the plant's nitrogen needs, he suggests.

Known as N-Fix, the method is neither genetic modification nor bioengineering. It is based on naturally occurring nitrogen fixing bacteria that take up and use nitrogen from the air.

## It's all in the seed

Applied to the cells of plants via the seed, it provides every cell in the plant with the ability to fix nitrogen. Plant seeds are coated with these bacteria to create a symbiotic, mutually beneficial relationship and naturally produce nitrogen.

N-Fix is a natural nitrogen seed coating that provides a sustainable solution to fertiliser overuse and nitrogen pollution. It is environmentally friendly and can be applied to all crops.

Over the past 10 years, The University of Nottingham has conducted a series of extensive research programs which have established proof of principle the technology in the laboratory, growth rooms and glasshouses.



**Dr Philip Stone from The University of Nottingham tending to the plants undergoing the atmospheric nitrogen fixation trials.** (Photo: The University of Nottingham)

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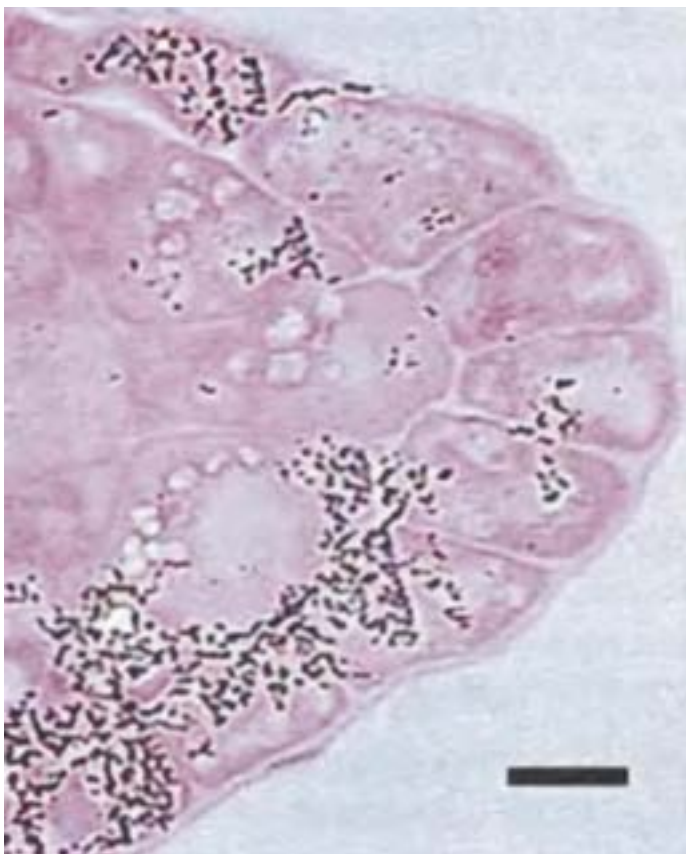
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**Section of root tip after inoculating with *G. diazotrophicus*, showing extensive intracellular colonisation.**  
(Photo: The University of Nottingham)

## BROADACRE FIELD TRIALS

During 2013, Azotic Technologies and the University of Nottingham collaborated on the first batch of broadacre field trials of the N-Fix technology. Analysis of the generated data has given very positive results.

The first batch of field trials – carried through to harvest – on wheat, oilseed rape (canola), pasture and amenity grass were done during the northern hemisphere summer. They have demonstrated that the inoculation of seed with N-Fix prior to sowing leads to:

- Successful colonisation by the nitrogen-fixing bacteria in each of the field grown crops; and,
- Benefits to the plants at levels at least equivalent to between 25 and 50 per cent of the recommended rates of N fertiliser treatments.

These field results – based on measures of leaf chlorophyll and total leaf nitrogen content, and crop yield – confirm laboratory findings that N-Fix has the potential to substitute for a significant amount of nitrogen fertiliser use.

More field trials and laboratory tests are underway developing this new technology. Future issues of *Australian Grain* will present the results of this ongoing research. For further information see: [www.azotictechnologies.com](http://www.azotictechnologies.com)

The annual cost of damage caused by nitrogen pollution across Europe alone has been estimated at \$100 billion to \$500 billion.

Ted said: "Helping plants to naturally obtain the nitrogen they need is a key aspect of world food security.

"The world needs to unhook itself from its ever increasing reliance on synthetic nitrogen fertilisers produced from fossil fuels with its high economic costs, its pollution of the environment and its high energy costs."

### Making N-Fix available worldwide

The N-Fix technology has been licensed by The University of Nottingham to Azotic Technologies Ltd to develop and commercialise N-Fix globally on its behalf for all crop species.

Peter Bleazard, CEO of Azotic Technologies added: "Agriculture has to change and N-Fix can make a real and positive contribution to that change.

"It has enormous potential to help feed more people in many of the poorer parts of the world, while at the same time, dramatically reducing the amount of synthetic nitrogen produced in the world."

Azotic is now working on field trials to produce robust efficacy data. This will be followed by seeking regulatory approval for N-Fix initially in the UK, Europe, US, Canada and Brazil, with more countries to follow. It is anticipated that the N-Fix technology will be commercially available within the next two to three years.

The University of Nottingham's Plant and Crop Sciences Division is internationally acclaimed as a centre for fundamental and applied research, underpinning its understanding of agriculture, food production and quality, and the natural environment. It also has one of the largest communities of plant scientists in the UK. For more information see: <http://www.nottingham.ac.uk>

### Nitrate pollution

A leading world expert in nitrogen and plant science, Ted has long recognised that there is a critical need to reduce nitrogen pollution caused by nitrogen based fertilisers. Nitrate pollution is a major problem as is also the pollution of the atmosphere by ammonia and oxides of nitrogen.

In addition, nitrate pollution is a health hazard and also causes oxygen-depleted 'dead zones' in our waterways and oceans.



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# Bee sensors take flight to help farmers

**T**HOUSANDS of honey bees in Australia are being fitted with tiny sensors as part of a world-first research program to monitor the insects and their environment using a technique known as 'swarm sensing'. The research is being led by CSIRO and aims to improve honey bee pollination and productivity on farms as well as help understand the drivers of bee Colony Collapse Disorder (CCD), a condition decimating honey bee populations worldwide.

Up to 5000 sensors, measuring 2.5 mm x 2.5 mm are being fitted to the backs of the bees in Hobart, Tasmania, before being released into the wild. It's the first time such large numbers of insects have been used for environmental monitoring.

"Honey bees play a vital role in the landscape through a free pollination service for agriculture, which various crops rely on to increase yields. A recent CSIRO study showed bee pollination in faba beans can lead to a productivity increase of 17 per cent,"

CSIRO science leader Dr Paulo de Souza, who leads the swarm sensing project, said.

"Around one third of the food we eat relies on pollination, but honey bee populations around the world are crashing because of the dreaded Varroa mite and Colony Collapse Disorder. Thankfully, Australia is currently free from both of those threats."

The research will also look at the impacts of agricultural pesticides on honey bees by monitoring insects that feed at sites with trace amounts of commonly used chemicals.

"Using this technology, we aim to understand the bee's relationship with its environment. This should help us understand optimal productivity conditions as well as further our knowledge of the cause of Colony Collapse Disorder," Paulo said.

## AT A GLANCE...

The swarm sensing technology is being used to better understand the bee's relationship with its environment.

### Varroa mite

Varroa mites are external parasites of bees. The mites, which are about the size of a pinhead, use specialised mouthparts to attack developing bee larvae or adult bees, resulting in deformed bees, reduced lifespan and ultimately the destruction of the colony or hive. These mites are the most important pest of honeybees around the world.

### Colony Collapse Disorder

CCD is a phenomenon in which worker bees from a beehive or European honey bee colony abruptly disappear. Colony collapse is significant economically because many agricultural crops worldwide are pollinated by European honey bees.



Thousands of honey bees in Australia are being fitted with tiny sensors as part of 'swarm sensing' program. (PHOTO: CSIRO)

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**Honey bees are a major pollinator of flowers and crops, up to one third of the food we eat relies on pollination. (PHOTO: CSIRO)**

The sensors are tiny radio frequency identification sensors that work in a similar way to a vehicle's e-tag, recording when the insect passes a particular checkpoint. The information is then sent remotely to a central location where researchers can use the signals from the 5000 sensors to build a comprehensive three dimensional model and visualise how these insects move through the landscape.

"Bees are social insects that return to the same point and operate on a very predictable schedule. Any change in their behaviour indicates a change in their environment. If we can model their movements, we'll be able to recognise very quickly when their activity shows variation and identify the cause. This will help us understand how to maximise their productivity as well as monitor for any biosecurity risks," Paulo said.

Understanding bee behaviour will give farmers and fruit growers improved management knowledge enabling them to increase the benefit received from this free pollination service. It will also help them to gain and maintain access to markets through improving the way we monitor for pests.

"We're working with the University of Tasmania, Tasmanian Beekeepers Association, local beekeepers in Hobart and fruit growers around the state to trial the technology. Many growers rely on wild bees or the beekeepers to provide them with pollinators so they can improve their crops each year. Understanding optimal conditions for these insects will improve this process," Paulo said.

To attach the sensors, the bees are refrigerated for a short period, which puts them into a rest state long enough for the tiny sensors to be secured to their backs with an adhesive. After a few minutes, the bees awaken and are ready to return to their hive and start gathering valuable information.

"This is a non-destructive process and the sensors appear to have no impact on the bee's ability to fly and carry out its normal duties," Paulo said.

The next stage of the project is to reduce the size of the sensors to only 1 mm so they can be attached to smaller insects such as mosquitoes and fruit flies. ■



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# Indian Ocean Dipole helps predict extreme weather in the east

**A** PHENOMENON in the Indian Ocean that affects events in southeast Australia is helping to predict extreme weather up to six months in advance. The phenomenon, the Indian Ocean Dipole, is the difference in sea-surface temperatures between the western and eastern part of the Indian Ocean, and until recently has been one of the most influential – but the least understood – natural forces affecting Australia's climate.

An international team of scientists, led by CSIRO Wealth from Ocean Flagship's Dr Wenju Cai, confirmed the link and have published their findings in the journal *Nature Geoscience*.

A better understanding of the relationship between the Indian Ocean Dipole and extreme weather events will enable farmers, industry, communities and governments to better anticipate and prepare for droughts and increased bushfire risk, up to six months in advance of the event.

Just as the *El Niño* Southern Oscillation (ENSO) affects weather patterns across the Pacific Ocean, the Indian Ocean Dipole influences weather and extreme events across the Indian Ocean. While ENSO fluctuates between 'El Niño', 'neutral' and 'La Niña' phases, the Dipole fluctuates between 'positive', 'neutral' and 'negative' phases approximately every three to eight years.

The positive phase is characterised by greater-than-average sea-surface temperatures, more rain in the western Indian Ocean region and cooler waters in the eastern Indian Ocean. It tends to cause droughts in East Asia and Australia, and flooding in parts of the Indian subcontinent and East Africa (see map).

Positive Dipole activity has, to date, preconditioned major wildfires in southeast Australia, caused coral reef death across western Sumatra, and exacerbated malaria outbreaks in East Africa.

Wenju said the findings provide greater confidence in predicting extreme weather up to two seasons in advance, and furthermore, projecting positive IOD events into the future.

"Over the past 50 years, the Dipole has been trending upwards, increasing the number of positive events, occurring an unprecedented 11 times over the past 30 years," Wenju said.

"For example, there were three consecutive positive Dipole events between 2006 and 2008, which preconditioned the catastrophic Black Saturday bushfires in Victoria."

He said the increased frequency is due to the tropical Indian Ocean warming faster in the west than the east, due in part to the increasing temperature of Earth's surface.

"This warming pattern will continue in the decades to come, according to the state-of-the-art global climate models used in the study," Wenju said.

He said that as the warming pattern continues, future changes will include drier winter and spring seasons over southern Australia, particularly during positive Indian Ocean Dipole years.

Research into the Indian Ocean by CSIRO's Wealth from Oceans Flagship enables better understanding of climate processes affecting Australia, detecting our changing climate, and reducing uncertainty in Australian climate projections.

**This research is the result of collaboration between CSIRO's Wealth from Oceans Flagship and Water for a Healthy Country Flagship, the Ocean University of China, the University of Exeter (UK), the Laboratoire d'Océanographie et du Climat (France), the First Institute of Oceanology (China), and the Japan Agency for Marine-Earth Science and Technology.**

Dr Wenju Cai's paper, *Projected response of the Indian Ocean Dipole to greenhouse warming*, was published in *Nature Geoscience* in November 2013.

Dr Cai's work is partly funded by the Goyder Research Institute. ■

## WHAT IS THE INDIAN OCEAN DIPOLE?

The Indian Ocean Dipole refers to a pattern of sea surface temperature variations in the tropical Indian Ocean that varies from one year to another. At its positive phase, the eastern Indian Ocean (off Sumatra-Java) is cooler than normal whereas the west is warmer than normal.

These changes alter the atmospheric circulation, enhancing convection (hot and moist air rising) and rainfall over the west, suppressing convection and rainfall in the east Indian Ocean and surrounding countries including Australia.

The change in convection induces easterlies along the equator and alongshore Sumatra-Java, which causes upwelling (subsurface cold water to surface), further enhancing the sea surface temperature contrast between the west and the east.







# NORTHERN FOCUS

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## THE RESEARCH VIEW

# Elite wheat resistant to crown rot close to reality

### AT A GLANCE...

- Researchers and plant breeders are close to developing wheats with increased resistance to crown rot.
- Crown rot costs the industry close to \$100 million dollars a year.
- Researchers have identified between three and five genetic regions that can work together to create resistance against the destructive fungal disease.

**R**ESearchers have edged ever closer to the development of high-yielding 'elite wheats' with increased resistance to crown rot, a disease which costs the industry close to \$100 million a year.

Researchers at the University of Southern Queensland in Toowoomba, supported by the Grains Research and Development Corporation (GRDC), have been trawling through the chromosomes of several wheat lines that show resistance to the fungal disease.

They hope they have finally unlocked their secret, identifying between three and five genetic regions in each line that work together to create resistance.

These key genetic regions are now being incorporated by commercial breeding companies into the DNA of high-yielding varieties to create adapted, high-yielding wheats, which will reduce losses due to the disease and be highly desirable to farmers due to an improved financial bottom line.

### On the right track

Leading the research is Professor of Molecular Plant Sciences Mark Sutherland, who said the research was at an exciting stage, with the most recent field trials showing promising early results.

He was hopeful the first of the adapted wheat germplasm could be available to commercial wheat breeding companies in three years to be used in commercial variety development, although he stressed that the research was still a long way from complete and results were not yet guaranteed.

"We are as confident as you can be when you are dealing with the difficult genetic systems present in wheat that we are on the right track," Mark said.

Crown rot, (*Fusarium pseudograminearum*), is a destructive fungus that causes an estimated \$97 million damage to Australian wheat and barley crops each season and can devastate individual crops.

## 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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Mark said the first step in finding a solution was identifying lines of wheat with significantly better resistance – these were five low-yielding, unadapted wheat varieties that did not grow well in Australian conditions.

“The aim then was to get this resistance into lines of wheat with other traits that farmers require,” Mark said.

“After we successfully cross a resistant line with a susceptible variety, then we screen the plants in subsequent generations for the presence of genetic markers linked to resistance, to identify those lines most likely to express the desirable trait.”

Paddock trials of potentially resistant wheats were recently harvested and are currently being rated for disease symptoms, yield and the presence of the genetic markers.

“We have already been able to discern differences in the paddock in small experimental rows, with crown rot much more obvious in the populations without resistance,” Mark said.

“Now we have to demonstrate whether the more resistant lines maintain their resistance across multiple large plot yield trials in different cereal growing environments across several states.

“The research is certainly at an exciting stage.”

Mark said one of the most difficult aspects of researching crown rot was that disease levels varied from year to year depending on the environmental conditions.

“In some years crown rot is not very obvious in the field and has a low impact on yield while in other seasons the impact is very significant, particularly if you get good crop growth early in the season and then a dry finish,” Mark said.

“The typical symptoms are basal browning and in more severe cases you will see these tillers with completely whiteheads which are empty of grain.

“Alternatively grain in apparently healthy heads will fail to grow to full size, producing small and pinched grain which either blows out of the back of the header or grades as screenings.”

Mark said the field trials currently underway over several seasons were the culmination of many years of work involving collaborations with researchers around Australia.

## National consensus

One key collaboration was a GRDC-funded national project led by USQ, which compared the different screening techniques used across Australia for rating crown rot disease.

This project produced a national consensus on the most discriminating tests for disease in both seedling pot trials and tests in the field on adult plants.

“As a result it is now possible to compare disease screening results from research groups across Australia with confidence that any differences in response are not an artefact of different rating methods,” Mark said.

The research currently underway, conducted through four different projects working in national collaboration and again funded by GRDC, is attempting to transfer the resistance from the identified lines that are poorly adapted to Australian conditions, into elite high-yielding breeding lines being prepared for release as varieties.

“We don’t have anything that is completely resistant but some of these elite materials appear to be partially resistant, so we are now screening them to determine which of the resistance markers they carry,” Mark said.

In each of the original lines resistance is the result of the action of between three and five genes of small effect, spread across different chromosomes.

“Keeping these genes together in subsequent generations when the line is crossed to an elite but susceptible breeding line is a bit like herding cats.

“Large numbers of progeny need to be generated in order to select, using the presence of markers, the relative few that retain all the genes involved.

“Once sufficient seed is available the most promising materials are distributed to the commercial breeding companies who use them to produce further crosses into high performance material in which many other desirable traits are fixed, with the aim of releasing elite high-yielding varieties with improved resistance.

## Five to 10 years away

“I would expect that within the next five to ten years we will see a new generation of varieties with improved resistance although obviously, as scientists, we are wary of putting time frames on things, because there are a lot of factors that come into play. But at this point as a rough guide that is what I would expect.”

Mark is also involved in a new five year research project, funded by the GRDC and led by USQ researcher Dr Anke Martin, aiming to create a more crown rot resistant strain of durum wheats.

Mark said durum wheats, used in many pastas, are highly susceptible to crown rot, and the likelihood of crops developing the disease is limiting the industry's growth in Australia.

“Working in collaboration with NSW Department of Primary Industries, Anke has been able to cross partially resistant bread wheats with durum wheats and produce a stable durum plant that has good field characteristics and appears on initial testing to have significantly improved resistance to crown rot,” Mark said.

“We have developed efficient techniques for moving resistance out of bread wheats into durums and selecting progeny with the right chromosome composition required in durum wheats.”



**Crown rot, (*Fusarium pseudograminearum*), is a destructive fungus that causes an estimated \$97 million damage to Australian wheat and barley crops each season and can devastate individual crops.**



"It would be a real game changer for the industry if this project is successful, but that is still some years away."

Mark stressed that wheat varieties with improved but not complete resistance are definitely on the horizon.

"They will not be a magic bullet for controlling this disease, but will be one of the tools in the toolbox. Careful management practices which include crop rotations to prevent build-up of fungal inoculum via cereal stubble in no-till farming systems will always be required to complement the use of partially resistant varieties." ■

## THE COMMERCIAL VIEW

### RESISTANT VARIETIES THE CROWN ROT HOLY GRAIL

Farmers have been hoping for a solution to crown rot for as long as they have grown wheat, according to B&W Rural and Crown Analytical Services agronomist Rob Long.

This fungal disease costs the industry \$100 million a year and can wipe out a crop in days, leaving nothing but empty seed heads – and bank accounts – in its wake.

Rob said the worst scenario for crown rot was a wet start to the season promoting fungal growth and creating crops with lots of biomass and yield potential, followed by a dry spring.

Last season's average start followed by the very hot, dry spring meant crown rot was very evident.

2007 was also a disaster year for the fungus – that year the Northern Grower Alliance (NGA) ran a series of trials analysing the impact of crown rot on winter cereal yields.

Rob said across all sites monitored that year, crown rot wiped out 58 per cent of durum yield and 24 per cent of the bread wheat yield, costing the industry millions and devastating individual farmers.

"It is not uncommon during an average year for farmers to suffer 10–30 per cent losses; it has a huge impact on our industry."

Rob, who deals with farmers throughout the northern region, said farmers managed crown rot by routinely rotating away from wheat and planting chickpeas, canola, sorghum or another non-host crops.

"Planting wheat on wheat is really discouraged because of increased disease risk, especially for crown rot, and farmers need to know that risk before planting the same crop on stubble," Rob said.

It is possible to test stubble for crown rot, while SARDI and NSW DPI are developing protocols to test soil for crown rot using Predicta B.

But he said a variety of wheat with increased tolerance to crown rot would provide more cropping flexibility for growers.

"The hope for the industry really rests with science, and developing new ways to quantify the risks as well as breeding varieties with improved tolerance."



Rob Long.

# Northern Panel evolves with new GRDC direction

THE long-standing Grains Research and Development Corporation's (GRDC) advisory panel system has evolved with the organisation's recent restructure, says Dr Steve Thomas, GRDC executive manager commercial programs.

"The role of the panels has not so much changed as become more tailored with the recent restructure of GRDC," Steve says.

"The investment strategy that we have in place is a broadscale strategy set by the GRDC board.

"The role of the regional panels in terms of understanding issues and identifying them in the region hasn't changed – they are still an integral part of that.

"The difference for the panel is providing more and more information as to what the actual issues are and what the best way of addressing those might be."

Steve says the panels are an integral part of GRDC's process for interacting directly with growers and industry and feeding current concerns back into the organisation.

"In the northern region some of the issues that have been raised extend from problems like herbicide-resistant weeds, feathertop Rhodes grass, matching inputs to meet quality requirements and delivery specifications in different years; as well as issues like nutrient mining in the soils and how we go about replacing those nutrients.

"GRDC invests on the basis of themes within the investment strategy which target the higher level outputs and outcomes that we are striving for on behalf of grain growers.

"This includes issues that need to be addressed, either from a production or resource management or marketing perspective to meet those."

Steve is part of the northern panel, which includes representatives from a wide geographic spread, from Central West NSW to Central Queensland.

"I would urge all growers if they do have an issue to raise or comment to make that they contact either one of their local panel members, the panel chair, James Clark, or a GRDC staff member."

Steve has served on the northern panel for more than two years as the GRDC executive representative.

"I've been very lucky to be on the GRDC northern panel as it is integral to how GRDC tailors its investments to ensure we target issues that are going to give the greatest return to our major stakeholder, which is grain growers."

He says the danger as an executive is becoming disenfranchised from the grower base, but serving on the panel is an opportunity to maintain linkages with growers and advisers through panel members. ■



Dr Steve Thomas.

# Fallow weed management pays off

**D**ILIGENT fallow weed management can pay excellent dividends through weed seed reduction and reduced weed pressure in-crop. Dr Michael Widderick, principal weeds research scientist, Queensland's Department of Agriculture, Fisheries and Forestry, and the DAFF weed science team have investigated fallow weed management tactics that can save growers money.



**If individual plants or a group of plants 'survive' a herbicide application, collect samples for testing then remove and destroy the plants so they do not make any (more) contributions to the seedbank.**

"In the northern growing region we are fortunate that our cropping systems include both winter and summer fallows," he said. "This means growers have the opportunity to tackle both summer and winter weeds during the crop rotation."

During a fallow period it is easy to see the extent of the weed problem and there are many tactics, both chemical and non-chemical, that can be implemented.

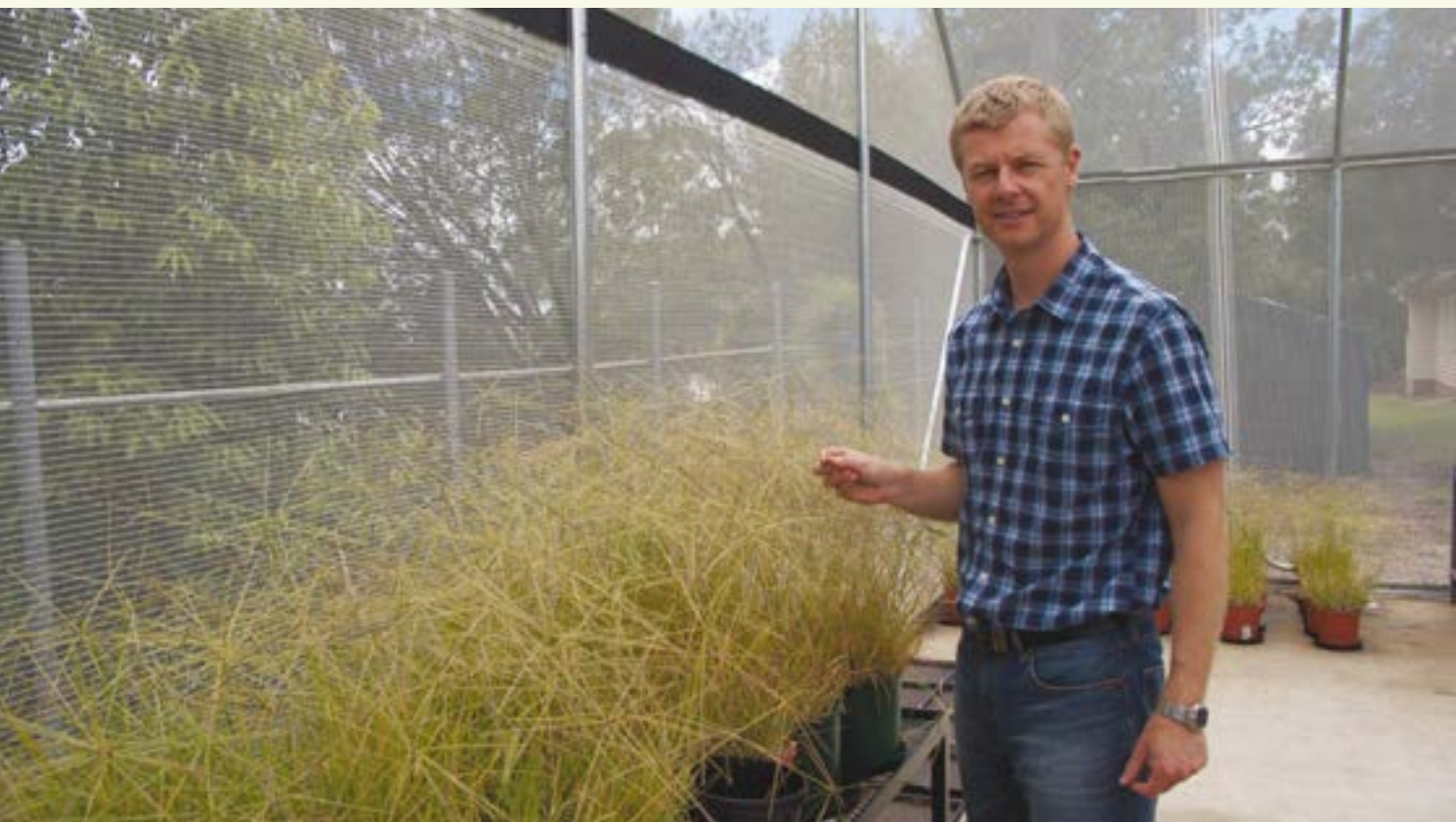
"A well planned and executed fallow weed management program can give a great result in just one year and even better results if implemented over two years," said Michael.

The DAFF weed science team has simulated over 250 scenarios involving different farming systems, different weeds and the impact of preventive approaches on both delaying herbicide resistance and depleting the seedbank. Their modelling indicates that in a high risk situation, glyphosate resistance is likely to develop after 13 summer fallows for barnyard grass, 11 for liverseed grass, nine for sweet summer grass (in CQ) and 18 for sowthistle (Figure 1).

"Targeting one germination flush in two of five summers, had little to no impact on delaying resistance," said Michael. "But targeting all flushes in two of five summers delayed resistance by more than five years, provided action was taken when resistance was at low levels."

"The key to an effective program is to monitor emergence and target small weeds," he said. "This has been proven over and over to be critical, particularly when using herbicides, which are more effective on small plants than on more mature plants."

"This will be most effective if growers wait until there is



**Dr Michael Widderick, Queensland Department of Agriculture, Forestry and Fisheries principal research scientist (weeds) says glyphosate resistant weeds are impossible to identify visually. The double-knock tactic aims to kill the majority of weeds with the first knock herbicide application and kill any survivors with a different, second knock, tactic.**



maximum germination from the weed seedbank but still act before the oldest seedlings from the germination begin to tiller."

Paddock history and the effectiveness of the in-crop weed control program will usually alert growers to the type of problems that may carry over into the fallow. Michael said there are often situations where the pre-emergent herbicide applied has provided good early weed control but may not last for the whole season. This can result in weeds such as fleabane and sowthistle being mature at harvest.

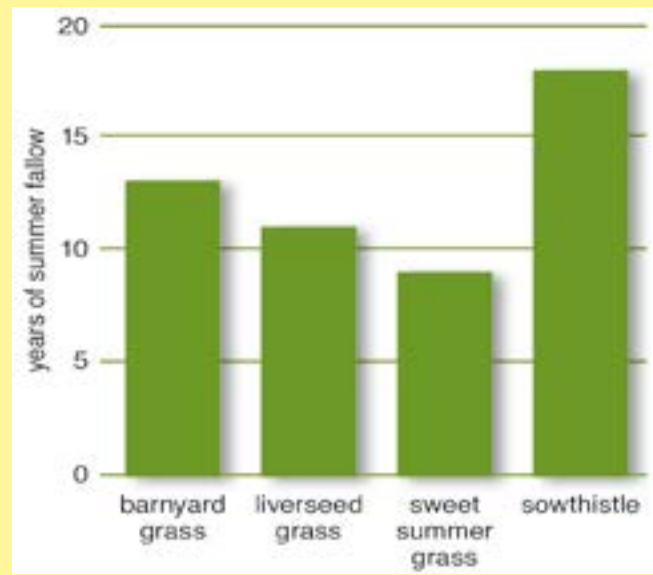
An effective fallow weed management program is likely to include a variety of tactics including glyphosate applications to small weeds, one or more double-knock operations, to target individual weeds and small patches using WeedSeeker technology and possibly a non-herbicide tactic such as incorporating a mungbean crop, strategic cultivation or grazing phase.

Michael said that increasing the frequency of summer crops, and including a mungbeans phase, can extend the useful life of glyphosate by several years.

If glyphosate appears to be less effective on some weed species, send suspect plants for testing and implement intensive weed control measures to remove all survivors of a herbicide application.

For more information on managing the risk of herbicide resistance, visit [www.weedsmart.org.au](http://www.weedsmart.org.au)

**FIGURE 1: The number of glyphosate-only summer fallows expected to result in glyphosate resistance in weeds**



## DOUBLE-KNOCK: SECOND KNOCK IS ESSENTIAL

Preventing weeds from setting seed is a central tenet of integrated weed management. The double-knock principle helps achieve this by using one tactic to kill the bulk of the weeds present and a different tactic to kill any survivors – two applications of the same chemical is not a double-knock and is actually likely to increase selection pressure, hastening the development of herbicide resistance.

Michael Widderick says the key to implementing the double-knock strategy is to understand that it is a two-phase tactic targeting weeds of the same generation. This means the double-knock tactic can be used several times during a fallow period, targeting different generations of weeds.

"Rainfall events are usually the trigger for a double-knock," says Michael. "Soon after rain a new generation of weeds will germinate and the first knock application should occur while the weeds are small. The optimal time between the first and second knock depends largely on the weed or weeds being targeted and can be as short as two days – but it's generally within one or two weeks of the first knock application."

Glyphosate remains an effective first knock herbicide but with the increasing number of glyphosate resistant weeds being identified, research is underway to investigate the efficacy of alternative chemistry.

"Group A herbicides are being tested as an alternative first knock treatment for summer grass species, either on their own or mixed with glyphosate," says Michael.

"The risk of Group A resistance developing is high so if these chemicals were introduced for fallow weed control it would be vital for any survivors to be controlled."

For the second knock the options are limited to diquat for broadleaf weeds and paraquat or glufosinate for grasses.

"The double-knock tactic works well and can achieve very high levels of control when implemented correctly," he said. "Success hinges on the tactic being applied when the weeds are small. We have found that the first knock needs to achieve at least 70 per cent control so that the second knock does not have

to work too hard and this is best achieved when the weeds are small.

"If the first knock is applied to large weeds the rate of control is likely to be low and then it is hard to achieve adequate coverage of the large survivors with the contact herbicide, making the second knock ineffective."

If some large weeds are present, Michael suggests looking for a non-chemical option for the second knock. "Chipping or strategic cultivation is likely to be more effective in removing large survivors than applying contact herbicide."

### Glyphosate resistance

Herbicide resistance is commonly seen following regular use of glyphosate over a period of 15 years or more. "If a grower has relied heavily on glyphosate in the past I would recommend they consider replacing one or two of their fallow sprays with a double-knock application," Michael says.

"For some weed species the first emergence in the fallow is the biggest and so this would be the best generation to target with the double-knock."

If glyphosate resistance has been identified then using glyphosate on its own is no longer an option in the affected paddock. Double-knock using a different mode of action for the first knock can be highly effective and some minor use permits are in place for alternative herbicides, provided they are applied as part of a double-knock treatment.

"The use of residual herbicides as a mix partner for either the first or second knock is currently being investigated," says Michael. "If applied at the end of the fallow, a residual does not usually reduce the knockdown efficacy of the tactic and can provide useful residual control during the fallow and even into the following crop. But careful planning would be required to ensure the residual did not affect future planting options."

For more information on managing the risk of herbicide resistance, visit: [www.weedsmart.org.au](http://www.weedsmart.org.au)

# Another new glyphosate resistant species confirmed in northern NSW

**T**HE world's first cases of glyphosate resistant sowthistle (*Sonchus spp.*) have been confirmed in northern New South Wales. Sowthistle is a major summer growing broadleaf weed in many parts of the Australian cropping regions.

The two populations come from mixed cropping farms on the Liverpool Plains, the same area that produced the latest glyphosate resistant liverseed grass that was confirmed this January.

"Sowthistle and other surface germinating weeds are becoming bigger problems with the widespread adoption of reduced tillage agriculture and an over-reliance on glyphosate," stated Tony Cook, Technical Specialist (Weeds) with NSW Department of Primary Industries and leader of the team that conducted the testing.

"Having glyphosate resistant populations is really going to make weed management more complicated, especially with each plant being able to produce thousands of wind-blown seeds."

There is also widespread resistance to Group B herbicides such as chlorsulfuron and metsulfuron in the northern cropping zone, so this reduces the number of successful herbicide options. Antagonism between glyphosate and 2,4-D when tank mixed also reduces control of sowthistle.

At stem elongation-early flowering, which is when many growers spray sowthistle, 80 to 90 per cent of the resistant populations survive the application of 1.6 L per hectare glyphosate CT.

"Just like the barnyard grass and wild radish stories, the size of plants treated and rate of herbicide applied have a big effect on the level of control. Importantly, the smaller plants are more easily controlled with glyphosate despite having some resistance," said Tony Cook.

"As yet we are not seeing some of the extremely high levels

of resistance seen in other species where herbicide rate has no effect, so this is good for managing sowthistle. The research shows that once a resistant plant grows beyond the rosette stage its ability to survive glyphosate increases rapidly."

The following points will be critical to successful sowthistle management:

- Get sowthistle tested for glyphosate and Group B resistance.
- Spray weeds when rosettes are no bigger than the top of a drink can. This may mean spraying more often.
- Use full label rates when sowthistle is present and use appropriate water volumes for the herbicide.
- Have spray rigs properly calibrated to deliver the maximum amount of the herbicide to the weeds.
- 'Double knock' with another mode-of-action.
- Use other modes of action such as Group L, I, L+Q.
- Control large survivors by spot spraying which includes using the Weedseeker or Weed-it sprayers.
- Control sowthistle and other weeds around fences, buildings, roads, irrigation channels.
- Use targeted cultivation where appropriate.
- Stop all seed set.

"We have already collected nearly 50 populations of suspected sowthistle from around northern NSW which are currently undergoing testing. This is likely to be the start of a much bigger problem with the rapid spread of wind-blown seed."

**If you suspect glyphosate resistant sowthistle on your farm phone Tony Cook at Tamworth on 0447 651 607.**

**For more information on managing glyphosate and paraquat resistance visit the Australian Glyphosate Sustainability Working Group website [www.glyphosateresistance.org.au](http://www.glyphosateresistance.org.au)**

**For information on herbicide sustainability visit the WeedSmart information hub at [www.weedsmart.org.au](http://www.weedsmart.org.au)** ■



**Effect of 4 L/ha glyphosate (450 g/L) on the two resistant populations (left and centre) and the known susceptible population eight days after treatment. (Photo: Tony Cook)**



# Risk management key to fertiliser investment

■ By Jack Williamson, GRDC Northern Panellist, Goondiwindi

**I**N dry seasons like the one we're currently experiencing, it can be a challenging task to decide if, when and how much nitrogen to apply before winter sowing.

That process normally begins with soil testing, calculating the amount of nitrogen needed for the crop to reach a farmers' target yield and protein, and available cash after a frosted 2013 winter crop and a scorching summer period which saw summer crop yields suffer.

Most farmers in this region would prefer to then apply their nitrogen to soils with a full moisture profile to maximise the benefit to the crop of their fertiliser investment. This also reduces the risk of waiting for an in-crop rainfall event that may not arrive later in the season when rainfall events are traditionally more unreliable.

But due to the lack of summer rain, grain growers may need to re-assess their preferred approach and prepare 'Plan B'.

That decision will have to be made sooner for some than others – many growers ordered urea six months ago when prices were low; they now need to decide whether to accept those orders and apply their usual rate to their full farming area, or let those early orders go and take more expensive product when it does decide to rain.

The upside of applying nitrogen in dry conditions is that it will



Jack Williamson.

remain in the soil until activated by rainfall and infiltrate down the profile, whereas applying fertiliser N to a full moisture profile can lead to high gaseous losses through ammonia volatilisation and denitrification in the event of further heavy rainfall and waterlogging as it has nowhere to go.

But some farmers are reporting plant available moisture levels of only five per cent, which has them re-thinking whether or not to sow at all.

In order to manage risks and minimise exposure to potentially losing their fertiliser investment, it may be worth considering only fertilising a portion of the intended sowing area, or splitting the fertiliser application, with a reduced rate applied at sowing and a second application in-crop.

While splitting the application is a more expensive approach depending on the product and application method and the opportunities for incorporating nitrogen in-crop are fewer due to the scarcity of winter rainfall events, it is a lower risk strategy and allows farmers to time their fertiliser investments in line with when those rainfall events occur.

The key issue farmers need to understand in working through these scenarios is what level of risk they are comfortable with.

A number of tools are available to growers to help them work through these decisions, including the booklet *Managing Legume and Fertiliser N for Northern Grains Cropping*, which is available from the GRDC website, [www.grdc.com.au](http://www.grdc.com.au).

The Climate Kelpie website, [www.climatekelpie.com.au](http://www.climatekelpie.com.au), also offers a Nitrogen Fertiliser Calculator designed to assist farmers in projecting the likely crop yield response to nitrogen for a given starting soil moisture and regional rainfall projections. ■

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# Respected Qld entomologist wins prestigious GRDC award

ONE of Queensland's most highly respected entomologists Hugh Brier was recognised for his exceptional contribution to science communication recently winning the prestigious 2014 Grains Research and Development Corporation (GRDC) *Seed of Light* Award.

Hugh was presented with the award during a gala dinner as part of the GRDC's Northern Region Grains Research Update at Goondiwindi.

Initiated in 1999, the GRDC's *Seed of Light* Award is presented annually to an individual who has made a significant contribution to communicating the importance and relevance of research outcomes to the wider grains industry.

GRDC Northern Region panel chair James Clark said Hugh's commitment to furthering growers' knowledge and understanding of key crop pests was widely recognised and an invaluable step toward improving business profitability.

"The Australian grains industry is incredibly fortunate to have skilled professionals like Hugh Brier who dedicate significant time and effort to furthering the industry's knowledge and understanding of insect pests and how to manage their impact through integrated pest management programs.

"The communication of research work being undertaken and its relevance for growers' management at a paddock level is critical in the on-going quest to improve profit margins within the farming system."



**GRDC Northern Region panel chair James Clark presents the 2014 GRDC *Seed of Light* award to respected Queensland entomologist Hugh Brier.**

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Hugh's career began in 1974 as an experimentalist with the Queensland Government based in Toowoomba before being transferred to his current base of Kingaroy in 1975.

In the late 1970s and into the 1980s he undertook the original survey work on peanut white grubs in the South Burnett including the time-consuming process of associating larvae and adults by rearing stuff through.

Over that same period he made connections with entomologists in the US working on plant resistance in soybeans to lepidoptera and began testing the US material against local lepidoptera.

Hugh's professional interest expanded to podsucking bugs during the 1980s and his work with species such as *Helicoverpa* culminated in the award of a masters degree from The University of Queensland and subsequent promotion to the position of entomologist.

More recently he has pursued the development of economic thresholds for *Helicoverpa*, mirids and podsucking bugs in mungbeans and soybeans.

His passion for Integrated Pest Management (IPM) underpinned the provision of IPM courses for coastal soybean growers and he has played a key role in the development of Queensland's coastal soybean industry.

He has produced numerous publications to assist growers and agronomists in correctly identifying and managing the multitude of possible insect pests in pulses including a summer pulses chapter in the 2007 *Pests of Field Crops and Pasture* book (PT Bailey ed), the IPM workshop manuals and agronomist accreditation manuals and more recently the *Good Bug Bad Bug* book.



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## THE RESEARCH VIEW

# Measuring and managing soil water – ‘money in the bank’

**G**ROWERS have a strong interest in measuring and managing soil moisture, which can be seen as ‘money in the bank’.

A three-year research project funded by the Grains Research and Development Corporation (GRDC) aims to improve grower and consultant understanding of how to best use soil water information in farm decision making.



**CSIRO researcher Yvette Oliver is leading a project aimed at creating a better understanding of soil water information.**  
(Photo Melissa Williams)

## 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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The national 'Measuring and managing soil water' project will also determine whether current soil water monitoring tools meet the industry's needs.

CSIRO researcher Yvette Oliver, who is leading the project in Western Australia, recently presented initial findings from a scoping study to the Agribusiness Crop Updates, supported by the GRDC and Department of Agriculture and Food (DAFWA).

"The importance of better understanding soil moisture is demonstrated by previous GRDC supported research which showed that 10 per cent yield gains are possible from improved management of soil water," she said.

"The new 'Measuring and managing soil water' project will deliver information to assist in the management of farming systems, which require an understanding of the relationship between soil water, yield benefits and other factors.

"These factors include a long fallow in the rotation; summer weed control; early sowing; water use and canopy management; drought-proofing crops; and, managing subsoil constraints.

"In addition, other uses of soil water information are for in-season decisions, such as nitrogen top-ups or spray topping."

## New research

Yvette said the project would be assisted by a new 'Soil Water Champions' panel – comprising researchers, GRDC Regional Cropping Solutions Networks (RCSNs) representatives, grower groups, consultants and agronomists.

"The panel will improve links between relevant parties and provide information on who is doing what, and local issues," she said.

"The GRDC project will coordinate and disseminate this information."

Yvette said the project would provide training to help participants increase their base soil and soil water knowledge.

"Training will also be provided on how to use the soil water tools available, such as *Yield Prophet*, *MyCrop* and soil water probes."

Yvette said the project would 'characterise' 105 soils in WA over the next three years.

'Soil water characterisation' is the measurement of the plant available water capacity (PAWC), soil chemistry, soil physical properties and soil classification.

"Characterisations at these sites will help overcome regional and soil type 'gaps' in characterisations," Yvette said.

## Scoping study

Yvette said a recently completed scoping study aimed to explore opportunities for linkages and to determine the needs of soil water information and training in WA by investigating:

- Who is doing what in soil water measuring and managing trials;
- Soils in *APSoil/Yield Prophet* – gaps and issues;
- Other issues with soil water measuring and managing; and,
- Training requirements.

"Given the increasingly prominent use of tools such as *Yield Prophet* in WA, the scoping study focused on *Yield Prophet* and similar decision support tools," Yvette said.

"In 2013 there were 234 *Yield Prophet* sites spread across WA."

The scoping study found the main issues relating to the use of the tool were:

- Difficulty picking a soil from the database (APSoil);
- Characterisations – can be considered time consuming and costly, and there is some difficulty in doing characterisations correctly on duplex soils and gravels;
- Adjusting soils for subsoil constraints;
- Uncertainty about level of accuracy required;
- Need for better understanding of *Yield Prophet* outputs and how to link them to management decisions;
- Better understanding required about the limitations of models; and,
- Need for improved extension of soil water and *Yield Prophet* information.

## Soil water and yield prediction tools

Yvette said that while models such as *Yield Prophet* and APSIM were increasingly being used in WA to support crop management decisions, other tools such as *MyCrop* and *CliMate* iPad App were also becoming more popular.

### *Yield Prophet*

- Requires a measurement, or estimate, of soil moisture content at the start of the growing season.
- Can help optimise nitrogen management, make yield predictions to support grain marketing, help with variable rate fertiliser applications, evaluate inputs versus yield potential in-season and assess the benefits of soil amelioration.
- Soil characterisations for this system jumped between 2010 and 2013.
- Costs about \$500 per year, including \$120 for soil analysis sampling.

### Other tools relating soil water and yield potential

- These include the online resources *AgSeasons* and *CliMate*, *MyCrop*, DAFWA's *Potential Yield Calculator* (PYCA), APSIM and *HowWet*.

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## Soil water probes

- These measure soil water at 15 minute intervals and at 10–20 cm increments down the profile and, over time, can be used to characterise the soil at that site;
- Can cost up to \$6000 per site (plus an annual fee) and provide near real time data;
- Data can be linked to *Yield Prophet* to compare soil water predictions with the probe data, but not as a direct input to the model (except for setting the initial water content at the start of the growing season);
- Value in using soil water probes to see the effects of management and amelioration on the crop's ability to extract water from the soil at depth and over time.

More Information: Yvette Oliver, CSIRO, 08 93336469, [yvette.oliver@csiro.au](mailto:yvette.oliver@csiro.au)

### Useful resources:

2014 Agribusiness Crop Updates Papers: <http://www.giwa.org.au/2014-crop-updates>  
MyCrop & Yield Constraint Calculator: [www.agric.wa.gov.au/mycrop](http://www.agric.wa.gov.au/mycrop)  
MySoil: <http://grains.agric.wa.gov.au/mysoil>  
SoilMapp: [www.csiro.au/soilmapp](http://www.csiro.au/soilmapp)  
SEPWA soil water probe data: <http://www.sepwa.org.au/index.php/2011-11-15-05-40-21/soil-moisture-probes>  
Precision Agronomics Australia soil water probe data: [http://www.precisionag.com.au/probes\\_and\\_prophets.php](http://www.precisionag.com.au/probes_and_prophets.php)  
APSIM: <http://www.apsim.info/>  
APSoil: <http://www.apsim.info/Products.aspx>  
ClimAte: <http://www.australianclimate.net.au/>  
DAFWA Yield Prophet in WA: <http://grains.agric.wa.gov.au/node/yield-prophet-central-and-southernwheatbelt-wa>  
GRDC Water Use Efficiency Supplement: [www.grdc.com.au/GCS103](http://www.grdc.com.au/GCS103)

## THE COMMERCIAL VIEW

# MEASURING AND MANAGING WATER

■ By Craig Topham, Agrarian Management

The uptake of the decision-making tool *Yield Prophet* in Western Australia in recent years is what really sparked the region's current interest in measuring and managing soil moisture.

As this tool has become more accurate for WA soil types, the level of interest has grown.

There is now a groundswell of activity taking place in the field of soil water measurement and management, with soil moisture probes and automated monitoring of soil water also being used.

I see the new Grains Research and Development Corporation (GRDC) 'Measuring and managing soil water' project as one of the key initiatives that will help improve knowledge about effectively using soil water information in farm decision making.

I am one of the representatives on a 'Soil Water Champions' panel which is assisting the project by improving links between agencies and providing information on who is doing what and identifying local issues.

I believe that more standardised, accurate methodologies for measuring soil water will be the main benefits of the GRDC project, led by CSIRO's Yvette Oliver.

Greater consistency in the different systems used to measure soil water will encourage more growers to increase their understanding of soil moisture.

### Water Use Efficiency

This is important, as the more growers measure and monitor soil moisture, the greater their understanding will be of water use efficiency (WUE).

WUE is about converting rainfall into grain and a key driver of increasing productivity and profitability.

Work so far in WA using *Yield Prophet* and moisture probes has highlighted significant variations between the plant available water capacity (PAWC) of different soil types.

Soils with high PAWC have the potential to be highly productive.

With increased knowledge and use of technology we can capitalise on these soils while reducing our exposure to risk on low PAWC soils.

Management of soil water goes hand in hand with variable rate technology (VRT), which allows growers to vary input rates in different zones on their farm.

Smart farmers are already capitalising on their ability to measure and manage water holding capacity.

They are adjusting their management of different soil types and paying more for land with higher water holding capacity.

Growers are saying they need to invest in these soils with a 'big bucket' to maximise productivity.

This investment also includes maximising the potential of high PAWC soils by using amelioration methods to overcome soil constraints such as acidity and compaction.

These methods include liming, mouldboard ploughing and spading.

Conversely, growers whose farms include soils with a 'small bucket' are reducing their inputs to reduce risk, or changing farming practices including increased grazing rather than continuous cropping.



**Craig Topham believes that there are big benefits for growers from more standardised and accurate soil water measurements.**





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# Growing pulses in 2014

■ By Mary Raynes and Wayne Hawthorne, Pulse Australia



Mary.



Wayne.

**T**HE 2013 season was one of contrasts for pulse growers across the southern region (Victoria, South Australia and southern NSW) with valuable insights gained into managing future seasons with inevitably variable growing conditions. The season started with a dry summer and late sowing, winter was wet, then a dry spring, some frosts and a quick finish in some areas.

Successful establishment remains a critical success factor for pulses. Sowing into a profile of stored soil moisture and maintaining soil moisture with limited in-crop rainfall is key. Stubble retention in 2013 proved very important over summer, particularly when spring rain was below average, and had the added benefit of aiding summer weed control. In drier years the combined value of weed control and reduced evaporation is measured in more stored soil moisture.

Timing of sowing involves weighing several considerations. Generally, early sowing promotes yield potential, but if early sowing in marginal conditions means poor establishment then a decrease in yield potential is likely. Shallow sowing depth and the potential for herbicide damage can result from dry sowing into tight soils. Heavy cereal stubbles can also cause establishment problems.

Wet conditions in winter and early spring placed many pulse crops under foliar disease pressure in 2013 with some neighbouring pulse stubbles presenting a high disease risk from the previous season. This was generally well managed and disease risk diminished in some areas over time with dry spring conditions and short rain events.

Correct application timing and choosing the correct fungicide to control the full range of likely diseases is central to a disease management program in pulses. Disease presence in the lower crop canopy puts immense pressure on subsequent growth, even when protected with later fungicide applications. Achieving adequate leaf coverage with a foliar spray at or close to canopy closure usually helps to avoid later, uncontrolled infection in the lower canopy. Spraying ahead of a rain front is more effective than afterwards, and this was highlighted in 2013 bean crops late in the season.

Seed quality is expected to be very good this year but it is still important to test for germination and vigour every year. Poor seed quality is a common culprit in cases of poor establishment.

Yield potential aside, sowing too early increases the potential disease risk and the need for effective disease management. It can also influence variety choice and the crop's susceptibility to frost. Unfortunately, the dynamics of disease development changes with every season. In 2011 bean crops, rust was the biggest issue but in 2012 and 2013 it was chocolate spot and we cannot underestimate the impact of botrytis on flowers and pod set. Black spot in field peas was severe in 2013 because of the lack of summer–autumn rain and early sowing. Bacterial blight after late frost was the biggest issue in field pea in 2012.

Infected stubble and seed transmission are potential disease sources to be aware of in 2014.

## Pulse choices

It is often unwise to change from one pulse to another based solely on last year's price or performance (good or bad). Each year a different pulse crop type seems to be favoured over the others in either yield or price, or both. We can not predict what 2014 will bring for individual pulses, but we can play the odds by assessing the production and marketing risks associated with each pulse species. Matching the pulse species to the correct soil type and conditions, and managing the crop accordingly generally achieves the most consistent result.

## Southern chickpeas take a check

Following two years of respectable yields and exceptional prices for chickpea, we are now seeing a marketing issue with large global supplies and low prices. The area of chickpea in southern Australia may fall in 2014 after several years of hard-earned gain.

When choosing a chickpea variety it is essential to consider its resistance to ascochyta blight along with yield, price potential, marketing, delivery, maturity, lodging resistance and other agronomic features relevant to your growing region.

Choose a desi or a kabuli type that suits your marketing plans, the region and farming system. Larger-seeded kabuli chickpeas like Genesis Kalkee are later maturing than Genesis 090. A price premium for kabuli over desi is necessary to compensate for lower yields and higher seed costs. Gross margins, marketability and personal choice can often be deciding factors.

Chickpeas do not fit into rotations and farming systems as easily as other pulses, and are far less competitive against weeds. Terbyne and Balance offer effective control of most broadleaf weeds, but post-emergent options are limited and can affect crop yield potential. Croptopping is not possible with most chickpea varieties and, if attempted, will affect yield and quality, even with the earlier flowering desi varieties like PBA Striker, Ambar, Neelam and the kabuli varieties like PBA Monarch and Genesis 079.

## Faba beans on the rise

The area of faba bean in southern Australia is set to rise again on the back of acceptable yields and exceptional prices in the past three seasons and ongoing strong market interest. Foliar disease management is now better understood and, while management was tested in 2014, disease was largely well held. Recent experience has confirmed the need for early protective fungicide applications and being aware of the potential impact of botrytis on flowers and pod set if early control is inadequate.

Bulky canopies and lodging in some crops reduced the



**Choose a pulse variety that suits your marketing plans, the region and farming system.**



effectiveness of disease control, light penetration and the number of pollinators reaching the flowers. All these factors combined to reduce pod set in these crops.

On acidic soils faba beans require inoculation and attention to the nutritional needs of both the rhizobia (such as molybdenum) and the crop to ensure adequate nodulation and growth.

Growers and agronomists will benefit from the faba and broad bean training courses being run this season at selected locations in the southern region.

### Lupins are back

After several years of low prices and demand, the lupin has declined in favour of other options with better returns. But this past year lupin yields and prices have been good with more international and domestic demand. The Australian end-users looking for lupins will need to provide growers with confidence in their market if the area sown to lupins is to increase.

Albus lupin markets have improved since record production in 2010 swamped the limited export market into the Middle East. Fortunately stocks are now somewhat depleted and feed millers are now using albus lupins in their mixes, but at feed prices.

### Lentils tight

Lentil prices have rallied since their relative low a season ago and yields have been very respectable. A significant downside has been the prevalence of header fires in lentils this year in both South Australia and Victoria. Adoption of the herbicide tolerant (XT) varieties has been high across the region. It is important not to produce only these small seeded types as oversupply could become an issue and there is market demand for the medium and large seeded types.

Ascochyta is a changing 'beast' in lentils, so it is important to

be aware of the revised disease resistance status of varieties and adjusting disease management in response.

Canada and Australia are continuing to producing very high quantities of lentils, mainly because the new lentil varieties and farming systems mean that lentils can be grown as a profitable pulse option at current prices in areas suited to the crop.

### Field peas hang in there

Field peas performed quite well despite the dry season except where frost or black spot impacted on yield. There is now a choice of several varieties that are short-season yet offering high yield potential. It has now also become clear that in areas regularly prone to bacterial blight, it is important to have the better resistance of PBA Percy. Variety choice, stubble management, crop sowing dates and seed hygiene are vital components of a disease minimisation strategy. Use the 'Black spot manager' to determine the optimum sowing dates in your area to minimise the risk of this disease limiting yield potential.

Pulse Australia encourages growers to attend Best Practice Management workshops for the pulse crops they grow to stay up to date with the latest research findings and agronomic advice. These workshops are popular with agronomists and consultants too so, if possible, engage advisors who have completed relevant BMP workshops.

For information and registration on future courses please contact the industry development manager in your region or visit the Pulse Australia website [www.pulseaus.com.au](http://www.pulseaus.com.au)

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Mary Raynes, Pulse Australia (Industry Development Manager – Southern) T: 0408 591 193 E: [mary@pulseaus.com.au](mailto:mary@pulseaus.com.au)

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# New Fathom barley out-performs Hindmarsh at Kellerberrin

**A** NEW feed barley variety that out-performed Hindmarsh by up to half a tonne per hectare in 2013 will feature in the Innes family's cropping program at Kellerberrin, WA, this coming season.

Phil Innes and his brother Eric put 75 hectares of Fathom barley to the test in tough conditions last season, and were so impressed with its performance that they plan to use Fathom across all 300 hectares of their feed barley program in 2014.

The third generation farmers run Innes & Co with their wives, Julie and Jan, at 'Wichatopping', Kellerberrin, cropping around 6500 hectares and running 4000 Merino sheep and cross-bred lambs.

Their cropping program includes wheat, barley, canola, lupins and chickpeas.

## First hand 'pre-release' experience

In their work as seed growers for the past eight years, the Innes brothers have enjoyed the opportunity to gain first-hand experience with new grain varieties before they are released.

Produced from a cross between a 'wild barley' derivative and a sister line to Fleet, Fathom has been bred as a dedicated feed barley variety with improved stress tolerance and water use efficiency over existing varieties like Hindmarsh.

Bred by the University of Adelaide with grower support through the Grains Research and Development Corporation, Fathom is an early maturing variety with good early vigour, broad adaptation and consistently high yields.

Fathom has a long coleoptile, good weed competitiveness and

straw strength, as well as strong disease resistance including CCN (cereal cyst nematode).

It is being commercialised by national seed business, Seednet, and is available in Western Australia for the 2014 season. Fathom seed has already sold out in the eastern states.

Just as the Innes brothers found in difficult conditions last season, Fathom is high yielding, with low screenings and good colour.

"Frankly, Fathom was sown later than we liked in less than ideal conditions in what turned out to be one of the most trying seasons in quite a while," Phil Innes said.

"Despite 210 mm of summer rainfall, the rain stopped in April and May last year, so we dry-sowed Fathom into good subsoil moisture in early June instead of early to mid-May."

The season then took a turn for the worse, with only 11 mm falling on the newly sown crops in the following six weeks, topped off by 10 frosts in 11 days in early July.

"At this stage, Eric and I were nervous about the whole 6500 hectare cropping program, but three days after that last frost on July 8, it started to rain and just kept on raining right through to the end of September," Phil said.

"As the season turned for the better, the Fathom barley stood up, the heads started forming and we knew it would perform really well."

## Comparing varieties

To provide a useful comparison, Hindmarsh barley was planted alongside Fathom and it showed more early vigour than Fathom, where the young plants seemed to crawl around the ground for more than a month before they took off.

"In those early stages, we think Fathom looks a bit like kikuyu as it covers the soil surface and chokes out any weeds, but this may well be a useful attribute for weed control too," Phil said.

As the season progressed, Phil said the Fathom heads were so long and heavy that the stems bent over but without the loss of any grain.

Harvested after Christmas, Fathom yielded 3.5 tonnes per hectare, out-performing Hindmarsh by 300–500 kgs per hectare even though it was sown three weeks earlier.

"We put Fathom to the test in the most trying start to the season in recent years, yet we are so confident of its future here that it will replace all 300 hectares of Hindmarsh this season," he said.

Typically, the Innes brothers sow around 1300 hectares of feed and malting barley, selling mainly through CBH.

Phil said Fathom's statistics from CBH's grain analysis were impressive.

The grain averaged 9.8 per cent protein and an excellent mean test weight of 71 kg per hectolitre – higher than the results recorded in the National Variety Trials in South Australia from 2010 to 2012.

Following its first season in Victoria and South Australia in 2013, Fathom will be released in Western Australia this season, through WA Seednet partners, Eastern Districts Seed Cleaning Operations (EDSCO), Kellerberrin, Australian Seed & Grain Ltd, Moora, and Multiseed Productions, Esperance.

For more information, call Seednet on 1300 799 246 or visit [www.seednet.com.au](http://www.seednet.com.au)



Inspecting one of WA's first crops of Fathom barley at harvest are (from left) Ian Doncon from EDSCO and Phil Innes who farms at Kellerberrin with his brother Eric, nephew Mitchell (in the header) and family. This crop out-performed an adjoining crop of Hindmarsh by 300 to 500 kgs per hectare.



# March USDA report benign but winter crop a worry

**T**HE March USDA report held no major changes for wheat – the 2013–14 US all-wheat supply and demand numbers were unchanged and US wheat ending stocks remained down more than 4 million tonnes year on year at 15.2 mt or 23 per cent stocks to use.

Global wheat stocks remain at more comfortable levels at 26 per cent stocks-to-use.



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March 13, 2014

premature break from dormancy which makes the crop susceptible to any freeze events.

But if good rains are received this coming spring the yield potential can turn around significantly. At this stage

the forecasts do not look particularly promising.

For Aussie growers, the current worsening trend of US crop conditions is better than conditions improving there in terms of price – especially with a tighter stocks-to-use situation in the US.

Soft red winter wheat seeded area fell 16 per cent year-on-year to 3.42 million hectares, reductions were seen in most states but especially Arkansas and Mississippi.

Hard red winter wheat area rose by 2 per cent overall to 12.2 million hectares, Kansas Oklahoma and South Dakota reduced area while North Dakota seeded a record area.

## Black Sea providing support

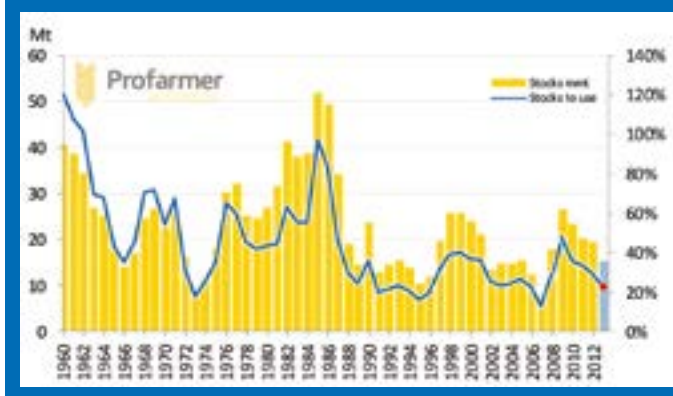
The political situation in the Ukraine continues to provide supportive white noise to wheat and feed grains. A heightening of tension in the Black Sea would result in further price support should there be a threat to broader Black Sea grain exports. If tensions are resolved the market should give up the risk premium.

As well as the Ukrainian political situation, the winter temperatures have been warmer and wheat has broken dormancy early. This could increase susceptibility to early frost damage, and it also remains dry across large areas of the Black Sea region.

## Impact on Aussie values

Australian prices may remain supported as we enter the US weather markets and volatility is to be expected. Ultimately price

US wheat stocks-to-use



## US wheat crop conditions

Winter wheat crop conditions across the US southern plains have become a significant focus of global wheat markets. The general theme is crop conditions are worsening in Kansas, Oklahoma and Texas due to dryness and a lack of snow cover in some parts. Some recent warmer temperature has also meant a

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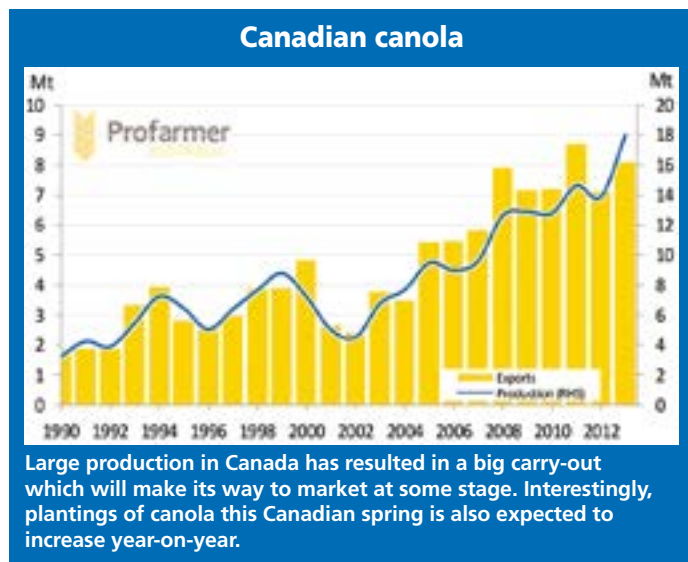
ALLC/A002/14

will be determined by the development of US crop conditions, potential adverse conditions across Europe and the Black Sea origins and how early planting conditions develop across Australia.

Over the next few months we will hear a bit about the 'fight for acres' as the northern hemisphere planting gets underway and we try to guess how the acres will be used.

## The oilseed market

What do we see as the major oilseed market drivers going forward on the international front?



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## Canada stocks

The big influence remains Canada and what is going to happen with their huge carry-out. Will thawing loosen logistics and see this crop hit the market? We think it will at some point and expect the spread between EU (and Australian) values and Canadian values will close to more normal levels.

This is potentially bullish ICE futures and bearish EU and Aussie new crop flat prices.

## Ukraine issues

Ukraine exports around 2 mt of rapeseed into the EU. Hence a risk premium was built into Matif rapeseed futures when pro-Russian militia turned up in Crimea. Again, fundamentally, the current situation has little impact on exports but speculators are happy to drive prices higher on what 'could' happen.

## EU crop size

The most recent production estimate by French analyst Strategy Grains put EU rapeseed production in 2014–15 at 21.4 mt. This is up from 20.85 mt last year as per USDA's estimate. Good conditions in France will probably see an increase in expected production which is harvested in June–July.

## Canadian planting intentions

One Canadian based analyst predicts canola (along with pulse crops) will gain acres back from wheat this coming spring. FarmLink suggests canola will gain 445,000 hectares year-on-year to 8.5 million hectares. The reason? Strong demand for oilseeds by domestic crushers and international buyers while wheat carryover will be large this year. With the logistics issues going on up there, canola has been an easier one to move.

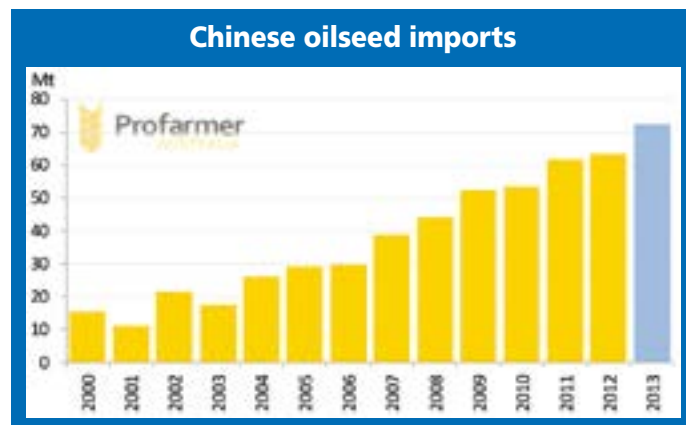
## US soybean production

Current price ratios with corn indicate soybeans may be an attractive option for US producers to plant this year. Mind you it is needed given the 'bin-bottom' stock levels there currently.

## Global oilseed demand

Generally oilseed demand continues to grow year after year led by China while EU use has also increased significantly since 2008 and maintained those levels in the past three years. At this stage we have no reason to believe this oilseed demand will not continue to track higher year-on-year.

If we look at the supply situation we can paint a bearish picture for global oilseeds. But there is a long way to go and demand from China is expected to remain relentless. This is on top of restoring some buffer stock in very tight areas such as Australia and the US.







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The CLAAS logo, consisting of the word 'CLAAS' in a bold, red, sans-serif font. To the right of the logo are several vertical green bars of varying heights, creating a decorative graphic element.

# Looking deeper into the world's wheat crop

■ By Shawn Campbell, US Wheat Associates

**A** QUICK glance at world wheat supply and demand might indicate that supplies are abundant and the world's importers can be somewhat relaxed about meeting their near-term needs. But well-informed buyers can see that the real picture of today's wheat market has more depth than the snapshot reveals – with potential impact on import strategies.

No doubt, the macro supply numbers are large and impressive. In its March WASDE report, USDA places global wheat supplies for the 2013–14 marketing year at 888.6 million tonnes (mt), including record total wheat production of 712.7 mt. Looking deeper, though, beginning stocks in the six traditional wheat-exporting regions are on a four-year trend down, from 84.0 mt in 2009–10 to 53.0 mt in 2013–14.

That is the lowest carry-in for major exporters since 2008–09, the year following the supply crisis of 2007–08.

World wheat use, on the other hand, is trending up. USDA estimated that the world will consume around 700 mt of wheat and world wheat trade will reach a record 162 mt. Not surprisingly, global stocks-to-use ratios are also falling, from 31 per cent in 2008–09 to 26 per cent projected for this marketing year.

## Major exporters supply and demand situation

Following is an overview of supply and demand situations in other major exporters that add detail to the supply and demand picture.

**Russian** wheat production bounced back from a drought in 2012–13, reaching 52.1 mt, up 38 per cent compared to last year and the fourth largest crop since the dissolution of the Soviet Union. But, heavy rainfall during harvest resulted in a crop with lower protein and weaker gluten than normal. Russian farmers responded by holding back their better quality supplies in anticipation of higher prices. In turn, higher prices later in the year affected Russian wheat's competitive position on the world market.

USDA's first estimate of Russian wheat exports in July was 17.0 mt. The estimate is currently at 17.5 mt.

**Ukraine's** wheat situation is similar. While estimated production of 22.3 mt is up from last year, quality suffered with harvest rains. In addition to quality issues, farmers are choosing to plant corn (maize) over wheat. High winterkill in winter wheat and the greater profit potential of corn is spurring the increase in corn planted area and production over the past three years. In fact, Ukraine has produced more corn than wheat for the past three

years and exported more corn than wheat for the past four years.

USDA estimates wheat production in the **European Union** (EU) at 142.9 mt, the third largest crop ever, and expects exports to reach a record 29 mt. What the numbers do not show is that a large part of the production increase is taking place in Eastern Europe, a region noted for growing lower quality wheat.

EU feed wheat usage has been declining, replaced by higher corn production and increasing corn imports from Ukraine. This forces countries like Romania to find other markets for their increasing wheat supplies, creating new competition for Russia and France in North Africa and the Middle East.

France itself is not immune to quality challenges. News outlets reported French farm groups are voicing concerns over wheat varieties bred more for yield than quality. In addition, a cold wet spring in 2013 resulted in a crop with below-average protein and above-average moisture; prices had to come down before that wheat would move to market.

Moreover, Egypt, the world's largest wheat importer, has recently lowered its moisture specification from 13.5 to 13.0 per cent. That new requirement will likely exclude higher-moisture French wheat from the Egyptian market.

Logistical issues have pushed availability of **Canadian** wheat well into the future in part because the 2013 spring wheat crop was so large.

There are similar, though less disruptive, logistical issues in the **United States**. US exporters are bidding and delivering wheat reliably, but farmers in the northern US have reacted to a very large basis by storing much of their wheat up country. This affects another issue – exportable supplies of high protein spring wheat.

The average protein levels for Canadian Western Red Spring (CWRS) and US Hard Red Spring (HRS) classes are an entire percentage point lower than last year. This has resulted in the highest premium for 14.0 per cent over 13.0 per cent protein since 2010–11. Large carry-over stocks of high protein HRS and record CWRS production have kept the premium in check.

If next year's HRS and CWRS protein levels are lower than average again, the looming shortage of high protein wheat could be a big challenge for the world's millers and bakers.

Moving to the Southern Hemisphere, **Argentina's** wheat farmers have little economic incentive to grow more wheat because of disruptive government policies. And, for the second year in a row, Argentina had a poor crop and Brazil will need to source much of its bread wheat from other sources.

**Australia** has also harvested its third largest crop ever at around 27 mt, but supplies of the higher protein wheat classes – Australian Hard and Australian Prime Hard – are likely to be limited. Farmers in Western Australia, South Australia and Victoria have generally harvested bumper crops, but a drought has restricted supplies in Queensland and New South Wales.

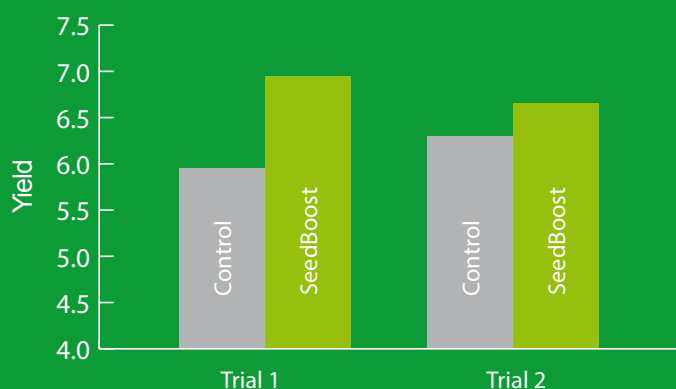
The drought did help raise wheat protein levels but also cut short supplies of grass and feed grains for the majority of Australia's cattle herd. The result has been high protein wheat moving away from the export market and into domestic feed channels. ■







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# The Farmall story

■ By Ian M. Johnston

I read with considerable interest, in a recent issue of *Australian Grain*, a well written article submitted by Case IH in which, following an absence of several decades, the recently re-introduced Farmall range is highlighted. Being a classic tractor addict and scribe, the mention of 'Farmall' brought with it a flood of memories and immediately activated my cerebral radar responses which saw me rushing in the direction of the computer keyboard. Here was material for my next epistle.

## The early days

The original agricultural tractors, which emerged in the early 1900s, were considered as being merely self propelled vehicles designed to largely replace the draught horse or oxen. They were vast in size, noisy, smelly and frequently dangerous. When there was no cultivating to be done, they were simply put away in the shed.

But the old steam traction engines, which the tractors with their internal combustion engines replaced, could also drive a variety of farm machines (such as a thresher) using an endless belt. So the design guys were put to work and soon belt pulleys became a common attachment on tractors.

But for most farmers of the era a tractor remained an expensive luxury with limited functions. Horses were still required and back-breaking manual labour persisted as a way of life.

Apart from the Henry Ford organisation, International Harvester was the world's largest producer of tractors during the second and third decades of the 20th century. Within its drawing office, International had a secret weapon! His name was Bert Benjamin.

In 1924 International Harvester introduced to the world's farmers the results of years of research by Benjamin. For the first time, here was essentially a rowcrop style tractor that could not only till the soil and power ancillary machinery with a belt, but could also perform the tedious menial tasks normally carried out by teams of manual labour (often children and women) – such as hoeing, weeding and planting. The new tractor was appropriately named the International Farmall.



A 1929 Farmall Regular, owned (and regularly worked) by Vern Anderson of Lincoln, Nebraska. (Photo IMJ)

The Farmall was an instant success. Farmers welcomed the tractor's versatility and saw value in investing in a tractor capable of being used throughout the year and taking much of the drudgery out of their lives.

## The Farmall evolution

The original production Farmall model in 1924 was designated the Regular. Priced at around \$500 it was not cheap, particularly when compared to the volume selling Fordson F, which sold for less than half the price. But the perceived savings in labour costs and the reliability of the Farmall, which was becoming evident, convinced 75,386 farmers to purchase a Farmall during its first five years of production. Indeed many Fordson owners were persuaded into trading-in their tractor against the more functional International Farmall.

The little 4-cylinder overhead valve removable sleeve engine was a magnificent example of a simple power plant that was the essence of reliability! With a displacement of a mere 220 cubic inches, it developed 18.03 belt hp at 1200 rpm, which was adequate for the many tasks of which it was capable. Three forward speeds were provided which represented a top speed of 4 mph (It should be noted that in the late 1920s, all tractors were equipped with steel wheels, restricting their top speeds to under 5 mph).

Over the years, continuing improvements were introduced into the Farmall, plus a wide range of matching implements.

In 1932 the first of the newly released Farmall F12s arrived in Australia. These were a lighter version of the original Regular model featuring a reduced size engine of 113 cubic inch displacement, and developing 16.2 belt hp at 1,400 rpm.

Modern farmers are frequently puzzled when they learn of the seemingly tiny horse powers produced by early tractor engines. They wonder how a 16.2 hp tractor, such as the Farmall F12, could ever have done a proper day's work. For after all, many of



A 1932 Farmall F12 restored by the author. Note the single front wheel – making this the pick configuration for rowcrop work. By slackening the retaining bolts, the rear wheels can be readily moved to any position along the axles to accommodate varying furrow widths. (Photo IMJ)





**This Farmall F14, owned by Queenslander Ross Sempf, is equipped with an optional full width front axle. (Photo IMJ)**



**Many Farmalls with full width front axles were used for non rowcrop work, such as this example of a Model M owned by Dave Dennis, photographed at a Victorian ploughing competition. (Photo IMJ)**

today's ride-on lawn mowers have an engine producing similar power ratings, and all they are required to achieve is a well groomed lawn!

One can talk about weight, torque, gearing, rear wheel dimension and so forth. But the proof of the pudding would be to back-up a lawn mower to an F12, hitch them back-to-back and see which one out pulled the other. Alternatively, try hitching a mouldboard plough to a lawnmower! There simply would be no competition.

A kerosene fuelled F12, subjected to various tests at the Nebraska Tractor Testing Authority in November 1933 (test no. 220) returned a drawbar pull of 1814 pounds at 2.44 mph over a sustained period. It is doubtful if a lawnmower could have even moved the test rig!

An interesting innovative feature of the F12 was a pair of rods which were ensconced within the tractor chassis and connected the steering mechanism to the brakes. While engaged in a full lock turn, perhaps at the end of a furrow, the turning of the steering wheel activated the relevant rear wheel brake, thus assisting with a tight turn.

But there was a down side to all of this. The two brakes were located inboard and were inadequate in the extreme for road use. Plus, the operator was obliged to lean forward to reach the two short hand levers with two hands (there was no foot pedal) which meant releasing control of the steering wheel!

I have vivid recollections of unloading a tricycle configured F12, which I used to own, off the back of a truck and down a steep ramp!

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**The Farmall H was a little brother to the model M. The photo was taken at a vintage tractor pull held at Warracknabeal, Victoria. (Photo IMJ)**

Another less endearing feature of the International Farmall F12, was the fact that mudguards (fenders in US parlance) were not offered as standard equipment. Accordingly a wise operator avoided wearing a loose fitting coat as the tall steel lugged wheels rotated worryingly close to the pan seating position. The wicked looking over hanging lugs extended beyond the wheel width and could easily drag a man to his death should a coat tail or sleeve be caught in their grasp – particularly if the variable wheel spacings were set to the narrow width setting! Also, an F12 operator would certainly not want to nod off!

The F12 was replaced in the latter half of 1938 by the F14. This was a near identical tractor but with the engine rpm increased to 1650, giving the tractor a slightly improved performance.

An extensive array of implements were offered by

International, specifically for attaching to each of the Farmall range. No less than 15 cultivators were available, plus hay rakes, a quick attachable mower, numerous ploughs, to mention just a few.

In 1939 International released the first of the Farmall A series, a lightweight 19 belt hp tractor. This proved to be the perfect unit for small acreage farmers. Numerous variations followed and indeed until the introduction of the Ferguson TE and TA series, the diminutive Farmall A became the world's top selling small tractor.

Also in 1939 the handsomely styled 27.9 belt hp Farmall H and the 36.7 belt hp Farmall M were introduced and, as with all Farmall models, became an instant success throughout the major farming countries of the world. The new row crop tractors surprised everyone by being decades ahead in styling, compared to the previous Regular, F12, F14 and the last of the original profile Farmalls, the F20.

The petrol/kero power plants installed in the H and M were undoubtedly the sweetest running tractor engines of the period. A diesel fuelled version of the M (the MD) became available in 1941 and although developing slightly less hp than the petrol/kero version, the extra torque of the engine increased the drawbar pull from 4233 at 2.17 mph to 4541 at 2.58 mph

Such was the popularity of the new big Farmalls, that, in order to ease the pressure at the parent Chicago plant, International's British implement factory at Doncaster commenced production of the H and M, which could be identified by the letter 'B' which preceded the model type – example BM.

In 1951 International's Australian state-of-the-art new factory at Geelong also pushed ahead with the manufacturing of Farmall tractors. Their model types were preceded with the letter 'A'.

Driving an AM (in particular) was a joy. The big slow revving petrol/kero engine was almost vibrationless throughout its power curve. The well spaced 5-speed gear box was operated through



**This photo, taken at a New Zealand tractor rally, graphically proves the ability of a diminutive Farmall A to pull a two furrow plough, despite having only an engine producing 19 brake hp. (Photo IMJ)**



a silky action clutch and a delight to use. An interesting feature was the well sprung seat, which could be tilted back enabling the operator to stand and stretch his legs, while continuing on with the job.

The Farmall saga extended for several decades with a bewildering range of model variations. Not all were available in every country. Regrettably, it would far exceed the confines of this epistle to detail the entire range.

But in view of the documented evidence of their past

outstanding integrity of design and their resulting reputation, it is not surprising that the present custodian of the name – Case IH – decided to once again introduce a catalogue of Farmall tractors to Australian farmers.

Bert Benjamin would have approved!

## IAN'S MYSTERY TRACTOR QUIZ

**Question:** Yes ok, the tractor is a Fordson N, but can you identify the well known personality, struggling with the controls?

**Clue:** He is a retired politician.

**Degree of difficulty:** Depends on your political persuasion!

**Answer:** Page 56.



The photo is of a Farmall M, restored by the author, and clearly illustrates the mounting positions along the side chassis for the location of front and mid mounted cultivating implements. (Photo IMJ)



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# New farm machinery sales mixed – large supply of second hand gear

**W**ITH final figures now in, the Tractor & Machinery Association (TMA) reports that 2013 produced what is best described as an 'average result' for farm machinery sales.

Tractor sales were down 7.5 per cent overall from 11,418 units in 2012 to 10,561 last year but the 100–200 hp sector, which holds 18 per cent of the market, rose by six per cent.

TMA Executive Director Richard Lewis feels that this was due to the uptick in dairy fortunes and improving hay and fodder markets during the latter half of the year.

"The aggregate decline in numbers caught most dealers and importers by surprise but it's important to note that this was still the fifth year in a row of more than 10,000 units," he said.

"It's looking like the new average. There's still solid underlying demand. The up to 40 hp sector accounts for around 30 per cent of the total market and it was only down five per cent.

"Because this is the lifestyle market largely driven by off-farm income, it's difficult to forecast. It bears little correlation to general agricultural indicators.

"At the upper end the 200 hp plus market increased one per cent to 2241 units. This was quite significant for importers and dealers because while this sector only holds 12 per cent of the total market in units, it represents a much larger proportion of the dollars."

Richard said he doubted the 10,000 benchmark would be achieved in 2014 but numbers would be very close.

"We're forecasting a five to seven per cent reduction this calendar year because dealers have a lot of trade-ins on hand that they need to move. Attractive pricing on second hand units is likely to replace some new sales."

Combine harvester numbers fell 30 per cent to 702 units down from 1012 the previous year. Richard said that although reduced sales had been predicted, the final result was slightly below expectations.

"We'd seen bumper sales of over 1000 units the previous two years. We knew it had to come down from there. I don't think we'll see much more than 650 sold this year. There will be a lot of used harvesters on the market."

Alan Kirsten, of industry analyst Agriview, expects combine harvester sales will settle around the 600 to 800 mark for the next five years.

"The re-equipping cycle for harvesters is quite long. The last time we had two years of 1000 plus sales was 14 years ago," Alan said.

## Balers finally turned the corner

Balers finally turned the corner in 2013 after five years in the doldrums with sales up 11 per cent to 621.

"It's been a long time between drinks for manufacturers and dealers and they were starting to worry if it would ever turnaround," Richard said.

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"We hear that most dealers were also able to clear out their inventory of used balers and hay tools.

"Rounds were up four per cent to 433 but the big improver was large squares with a massive 68 per cent jump from 78 units up to 131. Small squares were down 12 per cent but they account for only a minor part of the market.

Richard said there was plenty of new and used inventory on the ground both in dealer yards and with manufacturers and importers. This offered a mixed outlook for dealers and farmers.

### Good deals if no trade-in

"Dealers will have to be very careful with what they are prepared to offer on trade-ins, that's if they're prepared to trade at all. They have a lot of used stock to move and this will likely drive down the values of used machinery in the short term.

"That's good news for farmers if they are trying to buy used equipment, but not so good if they are selling. Farmers might also see some good deals on new gear that came into the country while the dollar was higher, especially if they don't have a trade.

"We don't specifically measure tillage and sprayer sales but there's no doubt that both have shown a vast improvement this last year. Tillage sales should continue to improve in 2014 but sprayer sales will drop – the market is again oversupplied with used equipment at the dealer level," Richard said.

Alan said tractor sales had declined in all states although the scale varied considerably.

"Queensland was only down 2.5 per cent compared with 14 per cent in Tasmania, although that was off a smaller base. New South Wales showed the next biggest fall with a 10 per cent reduction. The other states all ranged around the six to eight per cent mark."

Further information: Richard Lewis 0421 847 872.



**Richard Lewis, TMA Executive Director, reports a mixed bag of results for 2013 machinery sales.**



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# Modern Machinery Matters

## Protect your crop in all conditions



**Karl Suckling with his Patriot sprayer – precision, extensive coverage and low drift during chemical applications means maximum return on investment in both crop and chemicals for Karl.**

**N**O matter what or where you farm spray drift is a significant issue – not only for you and your crops but those of your neighbour as well. As indicated in this article, the short-term cost of spray drift may be wasted chemicals, but the bigger issue is crop loss because of poor protection on the intended target or damage from drift onto vulnerable off-target crops.

Karl Suckling manages a 6000 hectare wheat and canola property in Northampton, north of Geraldton WA, with his brother Craig and dad Eric. He says despite the 'nice wet spring' of the 2013 season the very dry winter made spray conditions challenging.

But now that he uses Case IH AIM Command spray technology he was able to get out into the paddocks – even during 50 km per hour winds – and still get great results.

This technology improves spraying efficiency with spray pressure control that ensures even application across various speeds and terrains. By controlling the chemical droplet size independent of flow control, you get better coverage and less drift.

Karl says AIM Command was his main reason for purchasing the Patriot Sprayer nearly two years ago. "It's tried and tested

on the Patriot and everyone I spoke to reported it worked really well."

He hasn't been disappointed. "The Pulse Width Modulation (PWM) is a standout feature – I'm a big fan."

PWM lets Karl maintain consistent spray quality without changing the nozzles. "The main thing I like is the system's adaptability. As conditions change, we can still get the best possible application control, and reduce the risk of spray drift. Otherwise, it's time-consuming to get out and change the nozzles."

### **Change droplet size on the go**

Karl can change droplet size on the go, and toggle between two pre-set application pressure values without varying the speed or rate, or stopping to manually make the change.

About half of Karl's property is wide-open, and he is able to get speeds up to 30 km per hour on four km-long runs. The rest is small, undulating paddocks, and that's where AIM Command lets him adjust speeds to spray more slowly into tight corners, then to a faster ground speed when possible.

"There's no other boomspray that is that flexible," he says, claiming it has given him a massive time saving.



Karl says it's imperative to get onto crop protection in a timely manner. "You've got to do the best you can in any conditions. With this gear, even if the wind is blowing 40 km an hour in the morning I can still go spraying, and if later that afternoon the conditions are perfect I can quickly adjust the settings for spray efficiency without changing the nozzles."

Geoff Rendell, Case IH Product Manager, believes that if you are lucky enough to have excellent growing conditions then crop protection is more important than ever. "You don't want to risk wasting a good season, so it's important to adequately protect what look to be lucrative crops," he says.

Managing the droplet size and pressure is the key to delivering improved pest control – and higher profits through higher crop yield.

"The ability to deliver consistent droplet size at varying speeds in irregular paddocks truly sets our technology apart. Precision, extensive coverage and low drift during chemical applications means maximum return of investment in both crop and chemicals. The short-term cost of spray drift may be wasted chemicals, but the bigger issue is loss of crop," says Geoff.

Karl says that with PWM, as long as he keeps the parameters set, he can spray the entire paddock knowing he won't miss anything.

"This is the future of spraying – I expect in 10 years time all models will use this sort of technology."

For more information contact your local Case IH dealer or visit [www.caseih.com](http://www.caseih.com)



**Patriot sprayers have a cab-forward, rear-engine configuration, so when the tank is full and booms are extended weight is still equally distributed.**

## SPRAYING TIPS TO MAXIMISE PRODUCTIVITY IN THE FIELD

Spraying plays an important role in Australian agriculture, but how do you know the perfect time to spray to achieve maximum yields? How do you minimise drift in less-than-ideal conditions?

To help farmers prepare for this growing season, Pete McCann, a Business Manager at Case IH, shares his insights.

"Many factors contribute to the decision of when – or when not – to spray," says Pete.

"Ideally, producers want any chemical application to take place at the right agronomic moment. That 'right moment' is when the chemical applied will preserve the yield potential for a particular field, providing the opportunity to maximise productivity."

"Environmental conditions such as wind and rain significantly impact the spraying window," he says. "Wet field conditions, for example, can cause equipment to leave ruts that will stay in the field all year long, and wind can cause off-target applications, or drift."

As well as potentially impacting sensitive areas, this can increase the amount of chemicals needed to do the same job – increasing input costs and affecting margins.

But it's important not to leave it too late. Competition for nutrients and moisture between plants and weeds increases every day during the growing season. Pest infestation also takes an increasing toll on a plant's ability to produce grain, seed, feed or fibre.

### Avoid wasting chemicals through drift

To minimise drift, McCann suggests producers consider:

- Tank additives to help reduce drift potential;
- Automatic boom height controls to maintain proper height above the target; and,
- Increasing droplet size with drift-reduction spray tips or air-induction tips.

"Advanced spray technology can also make a difference," he says. "For example, the AIM Command spray system on Patriot sprayers provides precise spraying capabilities with complete control."

And getting your tank mix right, including using the right additives, enables you to maximise productivity in the field while reducing costs and better safeguarding the environment."

### Smart equipment to access all conditions



**The Pulse Width Modulation (PWM) solenoid which is attached to the nozzle body allows the operator to maintain consistent spray quality without changing the nozzles**

"Sprayer configuration may impact your ability to access the paddock in certain conditions," says Pete.

"Better weight distribution between the axles will result in less soil compaction and fewer ruts. Our Patriot sprayers have a cab-forward, rear-engine configuration, so when the tank is full and booms are extended weight is still equally distributed."

"The most important factor is still the decision of the sprayer operator," he concludes.

"Regardless of what drift-reduction assistance you use, there are times when the only answer is to shut down the machine until weather conditions improve."

## ■ 'Up the competition' with Professor of Agricultural Innovation, Deirdre Lemerle

**E**XCELLENT establishment of all crops and the strategic use of highly competitive cultivars are powerful management practices that can limit the opportunities for herbicide resistant weeds to take hold.

Lead scientist and director of the Graham Centre for Agricultural Innovation at Charles Sturt University, Professor Deirdre Lemerle said the genetic control for competitiveness involves multiple genes and is too complex to easily select for in most crops.

"Breeding for competitive advantage has not generally been considered a key aspect of plant breeding programs in the past," she said. "We now know that it is an important agronomic trait and it is being considered in more breeding programs."

"When it comes to crop establishment, our studies have shown there is no yield penalty for planting at higher sowing rates, even in low rainfall environments."

The allelopathic effect of crops such as canola on weeds is a new area of research at the Graham Centre.

"The most competitive crops are still unlikely to prevent the spread of herbicide resistant weeds," said Deirdre. "Well established, competitive crops are known to restrict weed growth and so these strategies are included in the WeedSmart 10 Point Plan."

"If the crop is competitive, the herbicide applied to the crop is likely to be more reliable – managing to minimise herbicide resistance must be seen as a package because none of the weed control options are effective on their own."

### What are the most competitive crops?

**Short answer:** Triticale, barley and rye.

**Longer answer:** The competitive capacity of crops can be measured. Triticale, barley and rye are more competitive than



Screening for allelopathic potential in canola genotypes.

wheat and some wheats are more competitive than others. Pulses are less competitive than cereals and the competitiveness of brassicas is very dependent on sowing time. Choose varieties that have rapid early growth and early canopy closure.

### What is the best way to improve crop establishment?

**Short answer:** Aim for optimal crop density.

**Longer answer:** If weed pressure is a concern, choose a seeding rate at the higher end of the recommended range for your crop. Calibrate your equipment and use only clean, fresh, viable seed. In wheat, higher density planting causes fewer tillers per plant but larger grain, giving no yield penalty. Even though wider row spacing may be beneficial in conservation cropping systems for ease of planting and where stubble can reduce weed emergence, crops at wider rows are less competitive.

### How can allelopathy help?

**Short answer:** It can inhibit the emergence and growth of some weeds.

**Longer answer:** Current research is investigating the potential for crops like canola to inhibit the growth of annual ryegrass. There is a large difference in the allelopathic effect of different canola cultivars. A cultivar may be chosen specifically to inhibit the growth of a target weed as part of a three to five year weed management strategy.

## ■ 'Why change if a herbicide is working well' with AHRI Communication Leader, Peter Newman

Recently, the Kondinin Group conducted a survey of 200 farmers and found that the overwhelming majority were practising herbicide rotation in their cropping systems.

Peter Newman, Communication Leader with the Australian Herbicide Resistance Initiative says this confirms that most growers are implementing practices aimed at reducing the risk of herbicide resistance on their farms. "Rotating herbicide chemistry is essential," he says. "But it is not enough on its own. A diverse weed management program must include more tactics to help protect the chemistry that we have available to us for weed control."



Md Asaduzzaman, PhD student at Charles Sturt University, with supervisors Dr David Lockett (NSW DPI) left and Prof Deirdre Lemerle (CSU) is screening canola genotypes for differences in allelopathic potential to suppress the growth of annual ryegrass.





**Peter Newman, communication leader with the Australian Herbicide Resistance Initiative (AHRI) said a trusted herbicide can be used, and used often, provided there is a strategy in place to remove all survivors, including any seeds.**

"Glyphosate is by far the world's best herbicide," he says. "It is highly effective in so many situations and its widespread use is justified. What we need to start implementing are tactics that will protect the usefulness of glyphosate, and other herbicides, well into the future."

"We know that rotating chemical modes of action is useful as a broad tactic but when it comes to particular chemicals, like glyphosate, that are so widely used it is important that seeds from any weeds that survive a spray application do not enter the seed bank."

"So a trusted herbicide can be used, and used often, provided there is a strategy in place to remove all survivors, including any seeds," says Peter. "If possible this strategy should include non-chemical tactics to provide the double-knock effect."

### **Can I rely on herbicide rotation to avoid herbicide resistance?**

**Short answer:** No.

**Longer answer:** There are documented cases of herbicide resistance occurring on farms where herbicide rotation was conscientiously implemented. We even have cases where ryegrass has developed resistance to glyphosate and paraquat, despite rotation between these two herbicides.

### **Is it true that weeds can be resistant to herbicides I haven't ever used?**

**Short answer:** Yes.

**Longer answer:** Metabolic resistance is an alarming phenomenon that we are gaining a greater understanding of. In a laboratory experiment, annual ryegrass plants were treated with low doses of Sakura to see if they would become resistant to this herbicide. They did, and they also became resistant to Avadex and Boxer Gold, which had not been applied during the experiment. This meant that some individual plants had the ability to stop the action of, or metabolise, these herbicides with different modes of action, before they reached the various target sites.

### **Do non-herbicide weed controls really help avoid herbicide resistance?**

**Short answer:** Yes.

**Longer answer:** Managing herbicide resistant weeds is all about managing the weed seed bank. Farms where non-herbicide tactics are part of the system have less weeds and lower levels of herbicide resistance. The ideal second knock to follow a herbicide is a mechanical, non-herbicide option such as haymaking, cultivation or grazing. Effective weed management requires the implementation of as many tactics from the WeedSmart 10 Point Plan as possible. Using one or two of these tactics is not enough. ■

## **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.

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Knowledge grows

# Our Mystery Soup Mix garden

■ By the Year 3 students, Oberthur Primary School, southern Perth

**I**N 2013, in second term, our class, the Area 5, Year 3 students at Oberthur Primary, created a magnificent, Mystery Soup Mix.

One of the student's mother, Dr Sue Knights, who is a scientist specialising in plants wanted to share her general knowledge with the class, so she helped to develop this mystery garden.

We were learning about *Life and Living in Science* and as plants are living we wanted to become further educated in the life of plants.

Sue had some mystery packets with mystery seeds in it – but we didn't know what types of seeds were in these packets. We had to do a lucky dip. There were 25 packets of seeds to choose from and we each got one packet of seeds.

We all observed the seeds in the packets by tasting them, smelling them and feeling them. We talked about them and we

measured them. Some were big and wide while others were minute and skinny. Some were odd colours and shapes. Some of the seeds tasted bitter, some weak, some strong and some tasted delicious.

We put a lot of effort into researching the plants and seeds. We planted them in pots and some seeds grew really well but some took a very long time to grow because they weren't in their normal climate. Some turned out to be monocotyledon – which means they germinated with one leaf and others turned out to be dicotyledons – they had two leaves.

Later on we replanted the mystery plants in the garden and

## Q: SO WHAT'S IN A SOUP MIX? A: A LOT OF TASTY LEARNING

It appears if you are an 8 year old primary student in Year 3 at Oberthur Primary School in southern Perth it is a bottomless pot of learning opportunities!

Presented with their own mystery pack of seed simply identified as a 'plant species that can be found in soup' the students became plant detectives. Using a multi-sensory approach they had to identify their individual seed through visual observations, taste, and prior knowledge, ultimately germinating and growing the seed.

During the detective process the students learnt about plant classification, nutrition and, incidentally, responsibility! Each student was required to keep a visual plant diary; taking written and diagrammatic observations during the life of their plant, they were also given the responsibility for the initial care of their plants. Unfortunately the occasional pot was overturned and there was also some overzealous care, resulting in waterlogged seed and the production of mushrooms! Nevertheless an important learning outcome!

The children completed 'mind maps' of the soup mix grouping similar species into pulses, cereals, herbs and vegetables. During the course of the detective project the children learnt important aspects of nutrition. Whilst germinating their seeds they were able to view a clear demarcation in plant classification in the appearance of monocotyledons and dicotyledons as well as integrating some maths activity in the form of measuring the seeds and plant growth. They were then able to simulate a plant community in a large outdoor plot and examine the dynamics of plant adaptation and interdependence.

Through the shared experience of a 'PMI reflection' (Plus, Minus and Interesting fact) they observed that some plants were better adapted to the environment, some were dominant and some even relied on others for support!

Ultimately the growing soup mix was taken through to harvest and the children were able to partake in a cooking activity. The first species to mature were turnips and if you ever want to see 25 students enthusiastically devouring their own school grown and cooked turnips you are most welcome at Oberthur Primary School!

As part of their learning journey the children completed the accompanying collaborative recount writing exercise.



Year 3 student Beatrice Field with her dicotyledonous seedling black eyed pea.



we scattered some left over seeds anywhere we wanted without knowing where each seed landed in the garden.

One unexpected species called Bok Choy grew. But we didn't plant it and we surmised that some Bok Choy seeds had been left from the previous garden. Sue pulled it out as she said that anything that you didn't plant is a weed.

The barley plants, from our mystery mix, were the quickest at growing and became a dominant plant. As time passed, the snow peas became dependent on the barley by wrapping themselves around the barley in order to reach the sun.

As the mystery soup mix plants grew, some plants were bigger and dominant and some were small. Some of the small ones didn't grow well because the dominant plants were covering them but the ones with lots of sunlight did grow well. The ones that grew well were the ones best suited to the wintry conditions.

Over time we discovered what each of our plants were as they grew and were able to identify them from our observations and with the help of books on different types of herbs and vegetables.

### A magical learning journey

As a result of this experiment we learnt how to cook and grow vegetables properly. We made pumpkin soup and everyone thought it was delicious. We pulled up the ripe turnips in our garden and we made turnip and potato patties. We made a vegetable juice with carrots and beetroot and tricked our pre-primary buddies into thinking the juice was magic juice – which it was because it was made of healthy vegetables.

Some of the parents came and helped us make another batch of pumpkin soup which we sold at our school's *Learning Journey*, for \$1 a cup, and raised \$170 to go towards establishing an indigenous garden at the school.

We all enjoyed watching our garden grow and especially cooking with the ingredients that came from it!

#### PLANT SPECIES IN THE MYSTERY SOUP MIX

Barley	Red lentils	Navy bean	Pumpkin	Leek
Puy lentils	Adzuki beans	Lima bean	Celery	Onion
Green lentils	Black eyed peas	Red kidney bean	Carrot	Garlic
Kabuli chickpeas	Cannellini beans	Fennel	Spinach	Turnip
Broad beans	Peas	Parsley	Silverbeet	Swede



The Oberthur Primary School Year 3 Class 'plant detectives' with the living soup mix.

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# Drought tolerant wheat wins international recognition

**T**WO Australian researchers have become the latest recipients of the prestigious Rank Prize, only the second Australians to do so. Former high school classmates Dr Richard Richards from CSIRO Plant Industry and Australian National University's (ANU) Professor Graham Farquhar were presented with the Rank Prize in February at a grand affair held in London.

Richard and Graham were recognised by the Rank Prize Nutrition Fund for their dedication and outstanding contribution to agriculture through their pioneering development of Delta Carbon technology, which helps plant breeders more easily identify which varieties use water most efficiently.

"It's a great honour to receive and share this prize with Graham," Richard said. "A very notable and rare feature of our work is the coming together of both theoretical and applied research activities to provide improved varieties for farmers.

"While our discoveries date back to 1984, they are just as

relevant today, if not more so, as the world grapples with food security and water shortages."

The research received funding from the Grains Research and Development Corporation which recognised the significance of the breakthrough. "Drought is one of the major challenges facing Australian farmers. Richard and Graham's research provides hope for farmers to deal with future climate challenges," John Harvey, GRDC Managing Director, said. "It is really great to see some of our Australian scientists being acknowledged internationally."

Both scientists were surprised to be nominated by their peers for the prestigious Rank Prize for Human and Animal Nutrition and Crop Husbandry. Awarded every two years, the only other Australian to win the Prize was CSIRO's Hal Hatch in 1981, for identifying the C4 pathway of photosynthesis.

The Prize includes \$150,000 which Richard says he will use to support younger scientists to get into crop improvement. Graham has no plans as yet to how he will spend his share of the winnings, however, he hopes to encourage students to follow science.

"Students are starting to see that there is a real requirement for science to solve problems," Graham said. "People can make quite an intellectual contribution to feeding the world."

## Different – but similar – pathways

Parting ways after high school, Richard studied first at Melbourne University and then completed his doctorate at the University of Western Australia while Graham moved from Monash to the Australian National University, to the University of Queensland, and then back to the ANU, completing his doctorate in biophysics. The two scientists reconnected in Canberra where they found they were both working on water use efficiency.

"I ran into Richard. I'd known him from McKinnon High in Melbourne, and it turns out that we were both living in Canberra and both interested in water use efficiency," Graham said.

## Doing the hard research yards

Graham's theoretical biophysics approach revealed that plants discriminate between different forms of carbon dioxide in the



From left Richard Richards, Tony Condon, Graham Farquhar and Greg Rebetzke at the launch of Drysdale. Greg and Tony (both from CSIRO) have been essential collaborators during the journey to commercialisation.

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**This image captures the day that variety QT10187 formally became Rees in 2003. QLD farmers join Richard Richards in the field at the 2003 launch of Rees.**



**From left: Graham Farquhar, Richard Richards, Tony Condon and Greg Rebetzke in a glasshouse with Drysdale.**

atmosphere and this is linked to their water-use efficiency.

Plants breathe through small pores on their leaves called stomata. When they breathe in carbon dioxide they lose water molecules and the amount they lose depends on the limitation imposed by the stomata. The plants with greater stomatal limitation discriminate less between the stable, naturally occurring isotopes – C13 and C12 – of the carbon dioxide they breathe in. This can be detected by mass spectrometry of the carbon dioxide released when the leaves are burnt.

This requires only a tiny amount of leaf material, and so plants showing less discrimination can be chosen, early in their development, which use less water to achieve the same growth.

This understanding was then applied in the field to identify varieties which used water most efficiently.

"We were able to identify plants which grew more than others with the same amount of water by simply measuring the composition of carbon in their leaves. This not only gave us an objective measurement for drought tolerance but sped up the breeding process as well," Richard said.

### **Putting it into commercial, valuable practice**

Over a 10 year period the pair and their colleagues bred two drought tolerant varieties which were able to yield 10 per cent more in dry conditions. These varieties were commercially released as Drysdale and Rees in 2002 and 2004 respectively.

Although now susceptible to stripe rust Drysdale continues to perform well in south eastern Australia. The variety Scout, which is a closely related line to Drysdale and Rees and derived from the CSIRO pre-breeding program, is an outstanding current variety and a recent example of the application of the technology.

The carbon isotope discrimination technique has also been applied to rice, barley and chickpea crops in other nations where water is a significant limiting factor including India and Canada.

Importantly, two other major uses of the technology are identifying plants with less stomatal limitation which are higher yielding in favourable regions and identifying plants with deeper root systems.

Both of these applications of the technology developed by Graham and Richard have been extensively adopted in Australia and around the world. ■



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# Unprofitable, weedy paddocks making money again

**T**URNING unprofitable paddocks back into profitable production immediately is a big victory for any grower and is an achievement that overwhelmed the Smith family west of Mukinbudin, WA last year.

Paul Smith said a few paddocks comprising rocky country and plenty of annual ryegrass, including resistant populations, were so poor the family was considering selling the block.

"We were going to leave these paddocks out because we couldn't make money on them," Paul said. "But now the paddocks have become relatively profitable."

A strong cereal cropping rotation, long-term use of Group D and Group B herbicides and predominantly light, granite country that, ironically, was planted to annual ryegrass many years ago has been the recipe for weed control problems in a number of paddocks.

Paul and his wife, Serena, together with Blake, operate a continuous cropping program over their 4000 hectares 'Tourae' farm plus 1600 hectares of leased land.

Wheat-barley-wheat-barley forms the main rotation, with some oats grown for the export market and a few lupins. They have only cut hay in two of the past five years, but last season it achieved export quality with yields of around four tonnes per hectare.

"We use barley as the main break crop for the wheat," Paul said.

The Smiths have run into weed control issues in paddocks where Group D and B herbicides have been regularly applied and stubbles burned.

"We have been using trifluralin since the late 70s and it is not doing the job," Paul said.

Three years ago, this prompted them to trial a tank load of the new Group K pre-emergent herbicide, Sakura 850 WG, covering about 140 hectares in a paddock comprising the most resistant ryegrass.

"The difference (in control) was huge," Paul said.

"It didn't get 100 per cent (of the population), but in some areas with heavy ryegrass, it completely cleaned it out.

"Yield was better too by around 0.5 tonnes per hectare and up to 0.8 tonnes per hectare'."

Containing the active ingredient, pyroxasulfone, Sakura is a highly concentrated granule from Bayer and has a low use rate of 118 g per hectare. It controls annual ryegrass, barley grass, silver grass, annual phalaris and toad rush and provides suppression of wild oats and great brome in wheat (not durum wheat) and triticale crops.

## Good result in tough conditions

The Smiths used the herbicide for more than half of their wheat program last year and were extremely pleased with the results despite less than ideal conditions to ensure its optimum performance. Unsuitable conditions can impact the herbicide's efficacy for growers.

The family controlled mainly summer weeds with glyphosate before applying Sakura at the end of April in front of their knife point and press wheel sowing system set on 30 cm spacings and travelling at 10–11 km per hour, allowing some soil throw for good chemical incorporation.

"Early rain events were limited last year. From March 20 to June 15 we had 24 mm over 12 days," Paul said. "The only moisture we had (at seeding) was down 3–4 inches (7–10 cm). The crops basically germinated on that moisture.

"In May we had a couple of two mm and one mm (events), but nothing to get the weeds going. We then had 9 mm on June 15, but it wasn't enough to get down to germinate the (weed) seed.

"On July 12 we had 17.5 mm. The wheat had probably got to the 4-leaf stage. It also got weeds germinating, but when we pulled them out of the ground you could see the root pruning – and they only had one root strand. You could see it on the barley grass and wild oats too and we also had a little bit of brome.

"There was some ryegrass there, but it was limited. We had a good result on all the grasses and it (Sakura) did a 95 per cent job on the ryegrass.

"We had paddocks that were bad (for ryegrass) and we got a lot of wheat off them last year.

"Without Sakura, we knew we were going to be leaving some of these paddocks out.

"It is a significant cost, but you get the results. With two tonnes per hectare at \$280–\$300 per tonne (of wheat) and a \$36–\$37 per hectare per spray (for Sakura), there is still some good profit there.

"Last year was probably the worst seeding and it did a good job. We had quite a bit of trash too. To get a better result, we would burn the paddocks bare.

"We will probably do these paddocks twice (with Sakura) before rotating herbicides," he said.

Darren Marquis, Landmark Mukinbudin, said the early season conditions in the area allowed excellent grass control with Sakura, which was becoming increasingly adopted by growers throughout the region.

"We were fortunate, with the conditions, that Sakura performed to its maximum," Darren said.

"It's a particularly good dry sowing option out here. Growers going in early can utilise Sakura and be confident that they are going into the season with excellent grass control."



Mukinbudin farmers Paul and Blake (right) Smith with local Landmark Agronomist Darren Marquis pictured during spring in one of the Smith's previously unprofitable paddocks.



# Adding an edge to your farming business solutions

**F**ARM-EDGE is a partnership between Michael Burgis and Dawid van der Walt, an experienced team with skills in the Australian and overseas agriculture space and in supply chain management and finance – a team able to deliver creative agricultural business improvement solutions to all components in an extended supply chain.

A key guiding principle for Farm-Edge is to deliver measurable Return on Investment (ROI) improvement to our customers. Farm-Edge utilises best practice supply chain management principles to identify and deliver:

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Farm-Edge believes in ongoing measurement of the value it delivers to its clients. This enables a flexible engagement model, allowing Farm-Edge to offer a 'risk share' as well as a 'fee for service' approach for customer engagements.

Supply chain management not only reaches across business borders but also includes multiple time frames.

Between supply chain partners, Farm-Edge facilitates:

- Long term strategic planning;
- Medium term tactical planning; and,
- Short term operational planning.

The resulting plans allow for the active measurement and management of the short term activities necessary to achieve the longer term goals. This process also allows for the early identification and rectification of potential problem areas.

Farm-Edge services include all the aspects of supply chain management, from the purchasing of inputs or capital goods to the production, storage, logistics or sales. Agricultural margins continue to be squeezed and there is an increasing awareness amongst family businesses to find new ways of increasing productivity and returns. Farm-Edge partners our customers to find innovative solutions to these pressure points in farm business.

Farm-Edge services can be viewed at [www.farm-edge.com](http://www.farm-edge.com) or by calling 0490 142 408



Michael Burgis.



Dawid van der Walt.

# Resistance quick test revamped

**T**HE Syngenta Resistance In-Season Quick (RISQ) Test has been revamped with an advanced workflow to improve the turnaround of tests and provide fast information about weed resistance levels for growers and consultants.

The RISQ Test is an in season universal method for detecting herbicide resistance in weeds and resistance to a wide range of herbicide modes of action prior to field application. It is a fast and effective tool providing results in 14 to 21 days, enabling growers to make informed choices prior to application in the field.

David Bushell, Delta Agribusiness agronomist, Temora, said the RISQ test helped prevent significant yield losses to ryegrass for a client's crop last season. "It was hard seeded ryegrass that germinated with the wheat crop after a rain event, and we quickly needed to identify the best post-emergent herbicide choice to control the outbreak," said David.

"We collected the samples, sent them off for testing and quickly received the information outlining the most effective spray choice for that population of ryegrass. Control was quick and cost-effective, resulting in an excellent yield. We saved a lot of money – possibly as much as \$100,000."

The improvements to the RISQ test include set collection days to streamline testing and a new procedure for samples that arrive in poor condition. Syngenta Solutions Development Manager, Garth Wickson, said the changes will allow growers and consultants to better use what is already an effective tool.

"Because the RISQ Test has a fast turnaround, herbicide resistance can be managed in-season, which is a big advantage," said Garth.

"What we've worked on for 2014 is to make the workflow simpler and more effective. Set collection days will mean mailing of samples is better coordinated with growers and the chance of samples arriving in adequate condition is increased. We've also implemented a system that advises growers when samples are received and whether they are in a suitable condition or not, meaning a new sample for testing can be dispatched sooner."

Active ingredients tested this year will be the same as in 2013 and include pinoxaden (AXIAL), clodinafop (Topik), pyroxsulam (Crusader), clethodim (Select) and glyphosate.

Testing is suitable for weeds up to the 3-leaf stage and instructions on how to collect samples are available at [www.syngentacereals.com.au](http://www.syngentacereals.com.au)

Samples should come from high risk paddocks or firebreaks and be taken from areas where weeds have survived herbicide application in the previous season.



Testing is suitable for weeds up to the 3-leaf stage

## Sell-out workshop: Register early

**A** GRDC workshop conducted by C-Qual Agritelligence Pty Ltd in Perth late February was rated as “extremely valuable” according to participants. The KNOWLEDGE to ACTION workshop focuses on achieving action-based outcomes from research delivered to farmers.

The workshop highlights the importance of providing growers with a good technical package to make a convincing case for adoption. Along with that, however, the program stresses the critical role of effective marketing of research.

Too often there is the assumption that good data sells itself. But many growers who are not naturally inquisitive about new ideas need to see the significance of new research in the context of their personal values and aspirations. That’s where marketing comes in – it connects the data to their values, promoting an interest in the information available.

Following the workshop Janelle Smith from Planfarm Agricultural Consultancy commented, “The most I have ever got out of two days professional development.” John Paul Collins of DAFWA added, “I would rate this workshop highly in development of adoption strategies.”

**With the Perth workshop selling out prior to closing, it is recommended that those interested in ‘selling’ new technology to farmers register early for Swan Hill, April 8 and 9, and Adelaide, April 29 and 30. Go to [www.c-qual.com](http://www.c-qual.com) to register online.**

## Development of flumioxazin

**S**UMITOMO Chemical Australia Pty Ltd. (Sumitomo Chemical) and Nufarm Australia Limited (Nufarm) have announced that they will be working together to further develop the Group G herbicide, flumioxazin, in Australia.

Flumioxazin is currently marketed as Valor in Australia. The product has quickly established itself as an excellent mixture partner for glyphosate and other knockdown herbicides.

Future development activities will focus on new use patterns in winter and summer cropping, horticulture and fallow applications.

While Sumitomo Chemical Australia will continue to sell flumioxazin as Valor, Nufarm will launch its own product to be known as Terrain in time for the autumn knockdown market.

### Global alliance

The co-operation in Australia follows other strategic alliances between Nufarm and Sumitomo Chemical group around the globe.

Managing Director of Sumitomo Chemical Australia, Tony Brookes, said, “Nufarm’s presence and level of expertise in the Australian herbicide market makes them an excellent partner in the development of flumioxazin. The intention is to best utilise the expertise and resources of both organisations in a way that

will maximise speed for new applications of the product.”

General Manager of Nufarm Australia, Lachlan McKinnon, said, “Nufarm had built an important partnership globally with Sumitomo Chemical where flumioxazin represented a strategically important molecule to both organisations. The new collaboration on development of flumioxazin with Sumitomo Chemical Australia complemented Nufarm’s important chemistry and its glyphosate product development program.

“This includes our new Weedmaster Argo glyphosate formulation, which is a high load and fast acting Dual Salt Technology formulation. Developed in Australia and sold in a number of key global markets, Weedmaster Argo is the result of many years of research and development that brings together unique Nufarm chemistry with strong manufacturing and local knowledge.

“We see Terrain as having a key fit in the winter cropping market due to its efficacy on a range of broadleaf and grass weeds and its compatibility with our glyphosate range for the knockdown period.” ■

## The power of root protection

**C**HEMTURA Agrosolutions has added a new dimension to the Australian seed treatment market – Rancona Dimension.

Rancona Dimension, the next generation of the Rancona seed treatment family, offers enhanced benefits and features designed specifically for the Australian user.

Rancona Dimension contains the very active fungicides ipconazole and metalaxyl.

This unique combination provides superior disease control including the suppression of Rhizoctonia in wheat and barley. In addition, this revolutionary product adds protection against Pythium in wheat and barley as well as smut and bunt control in wheat, barley and oats.

### New formulation, more user friendly

Rancona Dimension utilises the superior micro-emulsion formulation technology found throughout the Rancona seed treatment family. The micro-emulsion formulation acts like a true liquid, increasing the adherence of the product to the seed compared to other seed treatment formulations, resulting in minimal dust off during application. This is a major benefit to seed treaters, making the product vastly more user friendly when compared to traditional seed treatment formulations says Clay Sutton, Technical Sales Support Manager for Chemtura Agrosolutions.

The micro-emulsion formulation also makes Rancona Dimension flow through machinery exceptionally well leaving minimal residue compared to traditional seed treatments. This is another benefit, as seed treating machinery is exceptionally easy to clean down after application, saving you time and effort.

Rancona Dimension is a new and exciting seed treatment for Australian seed treaters and farmers with its wider disease spectrum and unique formulation.

**For further information please contact your local seed treatment supplier.** ■



# Hasten preferred by crop protection partners

**W**ALK into any reseller outlet in rural Australia and ask for the premium spray adjuvant and you're likely to be sold Hasten, made by Victorian Chemicals (aka Vicchem).

According to the company's technical manager, Peter Jones, that's because Hasten has an enviable record of performance – not just for improving herbicide efficacy but also that of fungicides, insecticides and defoliantes.

"Hasten has become our flagship product since its Australian launch in 1996," said Peter from the company's manufacturing headquarters in Coolaroo, Victoria.

"Thanks to its robust performance in the paddock, Hasten is now cross-labelled on 25 leading crop protection products including those of Bayer, BASF, Sumitomo, Sipcam and Farnoz.

"These third party endorsements have really vindicated Hasten's technical reputation, helping it become a trusted brand among grain growers, agronomists and crop advisors around the country," he said.

Peter described Hasten as a third-generation oil-based spray adjuvant that was technically superior to anything else on the market when launched about 18 years ago.

"The first generation of adjuvants was based on emulsified petroleum oil products while the second generation was based on emulsified vegetable oils.

"Hasten was superior to these two product types because the active ingredient came from a different class of oil known as esterified vegetable oil. This superior oil base, coupled with our proprietary blend of non-ionic surfactants, makes Hasten unique in the market, even to this day."

Peter said Vicchem's commitment to research, development

and continuous improvement was another reason why Hasten had been well supported by growers and the wider farm chemical industry.

"We're committed to continuous development and improvement across every aspect of the business, all supported by an accredited quality system. This also ensures exceptional performance on the delivery side when the season is running full steam," he said.

For more details, go to [www.vicchem.com.au](http://www.vicchem.com.au)

## Unmanned helicopter demo

**Y**AMAHA'S Sky Division is constantly looking for new industries and applications for their unmanned helicopter, the RMAX. The latest opportunity for Australian farmers to access and witness the benefits of Unmanned Aerial Vehicle (UAV) technology was at the Rice Growers Association's annual rice industry field day on March 6 at Jerilderie, southern NSW.

The RMAX was first developed in Japan during the late 80s and early 90s, when the Ministry of Agriculture, Forestry and Fishery announced a policy promoting the use of unmanned helicopters for crop dusting in rice farming due to safety issues surrounding manned aerial spraying. After massive success and uptake in both Japan and Korea, Australia is the third market to be targeted by Yamaha.

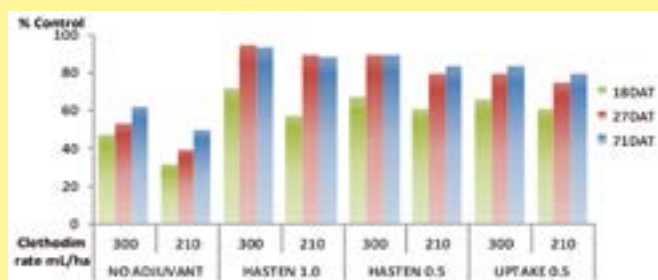
Today, the RMAX is used in around 60 per cent of Japan's rice paddies, with over 2400 units in operation across the country.

Ben Heaslip, Field Officer of Rice Research Australia is optimistic about the potential of UAV technology in the rice industry.

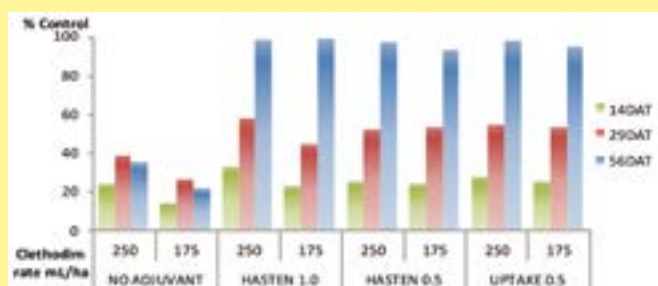
"This was an exciting demonstration for us because it represents a big step forward as far as innovation is concerned," Ben enthused. "From monitoring to crop maintenance, the RMAX could make life significantly easier for rice farmers in Australia."

For further information visit <http://rmax.yamaha-motor.com.au/>

### Control of annual ryegrass in canola



### Control of annual ryegrass in field peas



These trials show that Clethodim mixed with adjuvant Hasten @ 0.5L/100L gives at least equivalent weed control as Clethodim mixed with adjuvant UpTake at the same rate and almost the same control level as Hasten @ 1.0L/100L, hence a label change in January 2013.



# District Reports...

March–April 2014

## Western region



### NORTH

Not much to report across the northern agricultural region with only the odd scattered thunderstorm breaking the monotony of a long dry summer. Most storms have not given heavy enough rain to get weeds up and away. Those that have germinated are struggling. The odd grower in the west has a few melons that have been or are soon to be sprayed.

Growers are generally busy applying lime, getting seeding machinery ready and completing planning for the coming season.

The big hope is for a washed out cyclone system to wander across our region. Hopefully March might deliver.

**Peter Norris**

**Agronomy For Profit and Synergy Consulting, Geraldton**  
March 5, 2014

### SOUTH COAST

Seasonal conditions for the South Coast over the past two months have been dry with the exception of the northern fringes of the region that continually get the remnant rainfall of tropical lows.

The focus of most growers is planning for this season's crop – time is rapidly disappearing with the potential to seed only six weeks away!



Lime sand at Gibson awaiting the spreading contractor.

Lime and gypsum spreading has been a big focus with the local lime and gypsum pits experiencing their biggest years on record to the point where they are struggling to keep up with demand.

We are starting to see some puffs of smoke across the landscape as growers begin lighting up chaff dumps and windrows as part of their integrated weed management plans.

Surface and deep drainage works are underway on some farms to prevent some of the water logging issues experienced during the wet winter of 2013.

CBH is doing a great job of moving the record harvest to port. In February the Esperance Port recorded the largest shipment ever to leave WA with 78,636 tonnes of feed barley to Saudi Arabia.

**Quenten Knight,**

**Agronomist, Precision Agronomics Australia**  
March 3, 2014

## Southern region



### SOUTH AUSTRALIA

#### The 2013–14 season in review

Harvest was completed in the earlier districts by early December. Harvest on Kangaroo Island and in the south east was not completed until mid to late January.

Yields across the state were average to above average despite the dry spring and above average temperatures during spring.

Wheat yields were generally above average but significant yield losses occurred in barley crops from the strong winds in mid October.

Grain quality was variable with average protein levels in some areas and below average levels in others, despite higher than normal applications of nitrogen fertiliser.

Wheat screenings (small, pinched, underdeveloped grain) were higher than normal in many areas of the state, particularly on the heavier soil types.

Wheat test weights were lower than normal in some areas, particularly on Western and Lower Eyre Peninsula and the Mid North.

The frosts in October caused significant yield loss in isolated areas with actual losses higher than predicted prior to harvest.

Snails were generally at lower levels than normal but still caused problems during harvest in pea crops in a number of districts.

Mice are currently in low numbers in most districts but there is concern that they could build up rapidly in areas with high levels of grain on the ground.

Summer weeds have germinated in some districts, mainly on lighter soils. Growers have begun spraying to control them.

#### Pastures

Pastures have remained green in the higher rainfall districts of Kangaroo Island, Adelaide Hills and Lower South East.

Across most districts of the state, stubbles are providing a large amount of high quality feed for livestock and most livestock



producers have stored large feed reserves in the form of hay and grain on-farm.

Livestock are generally in good to excellent condition.

**PIRSA Rural Solutions**  
January, 2014

# District Reports...

**March–April 2014**

## VICTORIAN MALLEE

Summer has been hot and dry with January having prolonged periods of temperatures above 40 degrees. This had many seeking refuge indoors under the air conditioner – which wasn't a problem with few weed germinations and subsequently, not much summer spraying to do.

February and early March brought with it some summer rain but it came mainly in the form of patchy thunderstorms – so while some areas received good soakings others completely missed out. Sea Lake only recorded 55 mm for the summer months. This was enough to warrant summer weed sprays but because rainfall came through several small showers, it hasn't significantly impacted the soil profile with soil tests revealing not much stored soil moisture in this district.

The outlook for commencement of the 2014 cropping season is similar to last year and will pose the same issues. If there are no consistent rains prior to sowing, farmers will have to contend with volunteer weeds from last year's crop.

The other key management issue surrounds plant back

restrictions from residual herbicides used last season. Some farmers were caught out last year with sensitive crop types sown in paddocks with a herbicide history. The main concerns were caused by clopyralid and Clearfield herbicides, but Group B herbicides will also need to be considered.


With the 2014 cropping season fast approaching, planning this year's crops, varieties and rotations is a priority and according to farmers, weeds are 'calling the shots'.

At the recent Birchip Cropping Group (BCG) trials review, 34 per cent of surveyed farmers said they based their rotational decision on weed species or resistance problems, while 26 per cent said decisions were based on paddock history.

Other factors considered include seasonal outlook, stored soil moisture, economics and nutrition. These results clearly suggest that while sustainability is a top concern for farmers, weeds are dictating management options. In many instances the weed and resistance issues are limiting diversity.

Fortunately, growers are now more open minded about taking a broad approach to the issue. Many stubbles around the region were dumped into windrows last harvest ready for burning once

## Seasonal rainfall across the grain regions – 25 year averages and year to date

<div><div>Brought to you in association with</div><div></div><div>JOHN DEERE</div></div>			Summer		Autumn		Winter		Spring	
	25yr Annual Average (mm)	2014 rainfall to date (mm)	25yr Annual Average (mm)	2013–14	25yr Annual Average (mm)	2014 to date	25yr Annual Average (mm)	2013	25yr Annual Average (mm)	2013
Emerald Qld	554	110	250	125	118	1	61	34	120	141
Toowoomba Qld	673	29	281	64	134	5	82	94	179	140
Roma Qld	590	88	248	96	135	0	73	12	137	120
Goondiwindi Qld	619	63	251	83	133	1	97	49	139	135
Narrabri NSW	642	45	228	57	125	2	128	97	162	124
Gunnedah NSW	665	70	242	66	122	23	130	142	178	75
Dubbo NSW	611	166	200	148	136	65	127	155	153	91
West Wyalong NSW	446	86	117	66	90	38	117	153	126	104
Wagga Wagga NSW	545	77	133	80	121	19	152	181	144	52
Swan Hill Vic	327	38	73	70	66	6	92	90	96	64
Bendigo Vic	524	14	110	59	105	2	171	229	138	116
Horsham Vic	392	20	77	27	71	0	135	200	110	123
Lake Bolac Vic	537	30	119	51	101	1	163	215	153	147
Murray Bridge SA	370	99	64	109	77	9	130	202	101	54
Kadina SA	345	50	55	74	77	1	123	184	90	54
Cummins SA	394	78	46	93	86	2	177	269	84	94
Esperance WA	623	12	80	41	145	1	255	275	143	161
Wagin WA	405	0	49	2	96	0	171	116	89	103
Northam WA	402	4	45	7	84	0	190	131	84	100
Mingenew WA	368	11	32	12	92	0	176	119	65	75
Moora WA	389	0	45	0	89	0	183	140	73	39
Mullewa WA	320	13	50	28	90	1	134	69	47	41

Last rainfall reading March 13, 2014.

# District Reports...

**March–April 2014**

fire restrictions are lifted in autumn. It is a positive indication that growers are now embracing cultural weed control practices rather than relying solely on herbicide solutions.

In preparation for cropping, farmers are currently taking fertiliser deliveries and some are spreading gypsum, mainly on planned canola paddocks. Farmers with sheep are running out of stubbles and feed sources, so many would be now looking to off-load stock or move them into containment areas.

The key message for growers this season is to be prepared for anything. Review the plan and be prepared to implement a back-up plan. It does put pressure on seed supplies, but flexibility in an uncertain environment is essential.

**Simon Severin**  
March 12, 2014

## NEW SOUTH WALES

Dry conditions eased across much of NSW following good rainfall in mid to late February but more rain is needed to sustain summer crops and pastures and replenish soil moisture and water supplies.

About a third of the state received above average rainfall during February including the far north west, the south west and areas of the Central West, Central Tablelands, Hunter, South East, Riverina and Murray Local Land Services districts.

Average topsoil moisture improved but still remains low across 98 per cent of NSW and subsoil moisture levels declined slightly.

Early to mid February was hot with some areas receiving only patchy rain. Maximum average temperatures across the state in February were slightly above normal while the highest temperatures occurred in a belt through the west, south and north west where temperatures generally averaged 2 to 3 degrees above normal.

Total rainfall for February ranged widely but the majority of NSW received between 25 to 100 mm. Much of the drought-affected area in the north west around Bourke and Brewarrina received above average rainfall of 50 to 100 mm while the area around White Cliffs received only 10 mm or less.

Rainfall in other drought-affected areas of the north west ranged from 10 to 50 mm and, unfortunately, some areas such as Walgett and Pilliga did not receive the same falls as further west.

Subsoil moisture levels declined slightly between January and February, with the area of NSW in the 'low' category as modelled by NSW DPI, increasing from 55 to 59 per cent. Only one per cent of the state remained in the high subsoil moisture category during February.

Models suggest that 82 per cent of the Central West was in the low subsoil moisture category in February, 72 per cent of the Central Tablelands, 68 per cent of the Murray Valley and around 60 per cent of the Riverina and Northern Tablelands.

### Stock and pastures

Stock water supplies remain low over areas of the west, north west, north east and Tablelands. Stock condition and pasture production is dependent upon follow-up rainfall over the coming months.

Pasture growth improved during February across the

Tablelands, slopes and south west, and in the Hunter Valley.

Relative to historical records, pasture growth was average or better over almost two-thirds of NSW and below average in the north east, south east and parts of the north west.

**NSW DPI Climate Summary**  
March, 2014

## Northern region



## DARLING DOWNS

Early sorghum is being harvested with yields between 1.5 and 5.0 tonnes per hectare, depending mostly on soil type and the amount of fallow moisture available. This is well below our usual range, but with only 100 mm of rain, or less, falling in the last three months, rainfall is below 35 per cent of the average.

Fortunately most of this grain has been reasonable quality reaching Sorghum 1 classification, but on lighter soils, screenings have moved some down to Sorghum 2. Irrigated crops have yielded according to the number of irrigations, with the top yields around 7.0 tonnes per hectare.

Mice have been an issue across all grain crops and even cotton is being attacked, but it has been mainly sorghum that has needed control, with over 50 per cent of crops being baited.

Irrigated corn has yielded according to the irrigation available, with the best yields around 8.0 tonnes per hectare for grain and over 50 tonnes per hectare for silage. There have been more crops than usual cut for silage or hay, partly due to the demand and attractive prices and to make the best from a failing crop. Dryland corn crops are struggling but managing to form some grain.

The pulse planting was reduced by lack of rain, but the soybeans and mungbeans that established are holding on well and filling the pods. Yields will be back but there has been the benefit of few insect pests, except for the etiology. These branch and stem borers have caused some damage but in most cases were not heavy enough to warrant control in such a tough season, but have been significantly more numerous than last year.

Dryland cotton is being defoliated, whilst irrigated crops are shutting down quickly as they run short of water. Most crops needed four to five irrigations but could only receive two to three waterings. But the weather has favoured cotton and some fair irrigated yields are hoped for.

### Winter outlook

There will be a large winter crop planting, rainfall permitting. With much of the summer area not able to be planted, about 25 per cent of the winter area will be on long fallow ground which soil testing has shown does have good stored moisture. The rest will be planted on 'a wing and a prayer', as last season's winter crop ground has not had any significant rain to replace moisture.

There will be a significant increase in the barley area as



# District Reports...

March–April 2014



**These photos highlight the difference between sorghum grown on long fallow ground (top) versus short fallow ground (bottom) – good versus poor stored moisture.**

growers look to combat crown rot issues and take advantage of the crop's price outlook. There will be a reduction in the chickpea area, with no chance of double cropping and little good moisture ground designated for this crop.

On the Central Downs there is interest in faba beans to combat frost risk and phytophthora, but both these, and canola, will need significant rain to go ahead.

**Hugh Reardon-Smith**  
Agronomist, Landmark Pittsworth  
March 7, 2014

## WESTERN DOWNS

This summer crop season has proven to be particularly tough with planting opportunities few and far between, and minimal in-crop rainfall.

The only widespread sorghum planting opportunity was back in December with most of these crops still struggling to extend a head out if they have not already been sprayed out due to the dry. Even some small areas that received 100 mm of rain late in February in one hit still have sorghum crops that are looking ordinary, which are very uneven and head size not worth writing home about. Hopefully, tillers will add substantially to the yield.

Insect pests have been low in poor crops mainly due to unevenness but have been at thresholds in crops that look half decent. Midge will be one to keep an eye on in these uneven crops if deemed worthwhile to spend money on.

Some mungbeans were also planted but are either struggling or have been sprayed out. Cotton crops have battled with roots

struggling to tap into deep soil moisture as the moisture profile has never met up properly.

Areas around Roma and Meandarra received decent rainfall in February allowing for early oats to go in. It also set fallows up for winter cereal and pulse crops and potentially some canola.

In areas closer to Chinchilla, the story changes with a grim outlook for winter crop. Fallows remain quite dry, receiving minimal rainfall that mostly evaporated. Large cracks in the ground are apparent – you need to be careful not to drop your phone down them – due to a dry winter followed by a dry and hot summer.

Hefty rainfall figures are required to fill these profiles and have any chance of growing a winter crop.

**Nikolaus Fritz**  
Landmark, Chinchilla  
March 12, 2014

## SOUTH BURNETT

### Key issues

- No good news at all.
- Significant areas still not planted.
- Nearly all crops showing drought stress.
- Main crops planted are corn and peanuts.

The same description applies to the South Burnett as two months ago, except that conditions are much worse.

For December, January and February, Kingaroy has had 56 mm of rain. The biggest fall has been 11 mm and there have been 25 days when rain was recorded. Basically, no effective rain for the past three months on top of a dry previous six months.

By this time last year we had had 624 mm.

All of the South Burnett is suffering from the dry weather. Patchy storms have given some growers hope, but most have missed out and crops are really struggling. Most of the crops that picked up a storm are now stressing. In fact, even if we get rain now, most are beyond recovery.

There are plenty of bare paddocks that have not been planted and growers are grateful they did not have the expense of planting and then watch the crops die. Late planting options never eventuated and it is now too late for a summer crop.

Corn and sorghum crops have been silaged, despite a very low grain component.

A couple of peanut growers have said that it is the first time they have seen peanuts die. Growers are now trying to work out how they can cut and bale very small peanut plants.

Of the intended peanut plantings, about 90 per cent is in the ground. But the majority of crops are showing a lack of moisture and many are looking quite stressed. Peanut mites are starting to show up. This is a good sign of drought stressed crops.

Even irrigated crops are struggling as growers try to keep up with water demands. Gross margins will be lower than expected due to the high electricity tariffs.

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

**Ian Crosthwaite**  
Agronomist, BGA AgriServices, Kingaroy  
March 6, 2014

# District Reports...

March–April 2014

## CENTRAL QUEENSLAND

### The weather

To say the CQ locals were extremely disappointed to see two recent cyclones fail to deliver any rain is an understatement. Except for a relatively small area centred on Capella, stretching from north of Emerald to Clermont which is moderately wet, the CQ grain growing area is either dry or very dry. This includes most of the Dawson and Callide districts. November 2013 was the last month that any CQ district received above average monthly rain.

There were large scattered storms in the worst drought affected areas in the grazing district west of Emerald and Springsure. Alpha (255 mm) and Tambo (184 mm) received good falls but unfortunately many paddocks missed out. Intense rainfall in this area caused a minor flow into Fairbairn Dam which is currently at 55 per cent (or 712,000 ML).

### Summer crops

**Sorghum:** The area planted to sorghum in CQ is well down at around 80,000 hectares. The average planted area is 200,000 to 250,000 hectares. Some sorghum (30,000 hectares) was planted in mid January in parts of the Callide Valley (Jambin in particular), and a smallish area in the Dawson as well as an isolated part of the Central Highlands (Gindie to Clermont).

A slightly larger area (50,000 hectares) was planted later (end of January to late February) following patchy and variable rain. While a few paddocks had a good moisture profile and will

achieve good yields, a significant area was planted on a 'wing and a prayer' and some crops have already failed.

**Mungbeans:** The area planted to mungbeans (around 20,000 hectares) is down a bit. Crop yields have generally been low and some crops have failed but high prices have made most crops worth the effort.

**Sunflower:** The area planted to sunflower is low at less than 5000 hectares.

### Winter crop

Given the small area planted to summer crop the area available to plant winter crop is large – but the area with subsoil moisture is not very big. January and February are generally our wettest months and this is usually when the soil profile is filled for winter crop. Farmers then look for rain in April/May to re-wet the surface to plant.

A large area currently has little or no subsoil moisture and will not be planted without big rain. How much and when the rain falls will determine how much winter crop is planted

### Livestock and pastures

Given the low amount of summer rainfall, pastures from Clermont to south of Rolleston are surprisingly green, but short. Cattle, reflecting the stocking rate, are generally in good condition. The issue facing managers is that almost all pastures are effectively at the end of the growing season and feed on offer is short. Smart managers will be aware that it is a long time to Christmas (the next wet/growing season) and will adjust stocking rate to suit current pasture conditions.

**Maurice Conway**  
Department of Agriculture, Fisheries & Forestry  
Emerald, Queensland  
March 14, 20 2014

## ANSWER TO IAN'S MYSTERY TRACTOR QUIZ

The somewhat concerned driver is The Hon. Tim Fischer. The photo was taken in the main street of Yass, NSW, following the release of a video entitled *The Tractor Factor*. The magnificent example of a Fordson N was restored by Warren Kemp, who was watching anxiously as the Honourable gentleman wrestled with the unfamiliar and unforgiving controls of the 1936 Fordson. (Photo IMJ)



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4 Farmers .....	Insert
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Bourgault .....	5
Case IH .....	OBC
Chemtura .....	9
CNH Parts and Service .....	25
Croplands .....	18, Insert
C-Qual .....	5
Dinner Plain .....	22, N
Excel Agriculture .....	35
John Deere .....	11
Landpower Claas .....	7, 27, 31
Manutec .....	39
Monsanto .....	5
Neil's Parts .....	12
New Holland .....	21
Omnia Specialities .....	33
Profarmer .....	30
Seednet .....	26
Sinochem .....	23
Study Tours .....	IBC
Sumitomo .....	5
Syngenta .....	1
The Blast group .....	37
The-Gate .....	N, 46
Trimble .....	19
Valmont .....	45
Victorian Chemicals .....	17
Westfield .....	N, 5
Yarra Nipro .....	43