AUSTRALIAN GRAIN

www.ausgrain.com.au
July–August 2013

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Published by Berekua Pty. Ltd.,
40 Creek Street, Brisbane
Registered by Australia Post Publication No. PP100002295. ISSN 1449–2970.

Published bi–monthly.
Grain Yearbook published in April

FRONT COVER

Going 'soft' on aphids

If 'soft' insecticides are used to treat early aphid infestations, natural enemies such as ladybeetles can help suppress reinfestations. See articles Pi Northern and Southern Focus.

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Focus Sections

Southern Australia Focus

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

Northern Focus

Covering Northern NSW and Queensland

Editorial... Lloyd O'Connell

ONE of our marketing articles in this issue looks at the 'rollercoaster ride' of wheat production and exports from the Black Sea region (page 28). Swings of 30 to 40 per cent in year on year wheat production are not uncommon (sound familiar?) while wheat exports in lean production seasons are often subject to government imposed restrictions to ensure domestic needs are met. This year's Black Sea harvest is underway and most forecasts have total wheat production from Russia, Ukraine and Kazakhstan increasing almost 40 per cent on last season to around 88 million tonnes. The total wheat exports coming out of the region this year, after various government restrictions are applied – and implied – is pretty much anyone's guess but more than 30 mt is likely. Last year, Black Sea wheat exports were just over 20 mt.

When international wheat buyers are doing their sums, these erratic, and largely unpredictable, production and export numbers add up to 'unreliable supplier'. Despite Australia's own roller coaster ride when it comes to wheat production from year to year, we tend to be relatively reliable suppliers to our established international customers.

Being a reliable supplier is all well and good but the fact is the Black Sea wheat producing countries are now the preferred lower priced grain suppliers to the Middle East and Northern Africa – regions that are, or were, traditional Australian wheat export markets. The Black Sea countries might have erratic production, but over the past decade this variable production, thanks to better farming techniques and slowly improving infrastructure, bounces around a much higher level of production, and in turn, a much greater export capability. From 1990 to 2000, average wheat exports from the Black Sea region were just over 6 mt – in the past 10 years the average has been more than 21 mt.

The result is that Australia has been edged out of a large slice of the Middle Eastern and African wheat export market and we are now very much focussed on Asian destinations. In the 2000–08 period, Australian wheat exports into Asia ranged from around 5 mt (the '02 drought) to 9 mt (2003) which was roughly about half of our total wheat exports. But in more recent years, up to 90 per cent of our annual wheat exports have found a home in Asia. We are now supplying long-established and new Asian destinations where populations and economies are growing fast – as is the demand for high quality wheat and other commodities.

The very important task for our industry is to maintain and enhance our reputation as a reliable supplier of a high quality, accurately described commodity for an increasingly discerning Asian customer – with increasingly deeper pockets.

Here's hoping a very promising national winter crop enjoys some favourable growing conditions in the weeks ahead.

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In this issue...

Early sowing wheat benefits

If rain in summer and early autumn provide good subsoil moisture, how early is too early to start sowing wheat? CSIRO research is helping to answer this question for grain growers so they can get crops in, up and well established to take advantage of stored moisture and help adaptation to increased climate variability.

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Cereal disease control

Understanding foliar fungal diseases of cereals and how best to manage them with the agronomic and chemical tools available is in the interests of both individual farmers and the grains industry as a whole.

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What's new in grain storage?

Gaining a better understanding of grain storage insect pests – and fighting them using the right combination of management and equipment – not only gives you the upper hand in term of pest control but also in grain marketing. You strengthen your marketing position when your storage facilities allow flexibility with grain handling and timing of sales.

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Sourcing labour

The operating context of the farm workforce from 10–15 years ago isn't there today – the game has changed. Since 2001 there have been significant changes in Australian society that are also reflected in farming regions. Census information tells us that Australia has higher levels of employment, especially female participation, more part-time and casual work, an ageing population and higher levels of education.

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Early sowing adds yield to slow-maturing wheats

By Deanna Lush

AT A GLANCE...

- Slow-maturing varieties must be considered in the change to early sowing.
- Date of sowing and variety maturity can add an extra 0.8 tonnes per hectare to yields.
- Early sown crops yield more because they have deeper roots with more water and nutrient access.
- Other yield determinants include faster canopy development and longer stem elongation phase.

IF rain in summer and early autumn provide good subsoil moisture, how early is too early to start sowing wheat? CSIRO research is helping to answer this question for grain growers so they can get crops in, up and well established to take advantage of stored moisture and help adaptation to increased climate variability.

CSIRO's James Hunt says the key to successful early sowing is for growers to understand their region's optimal flowering window and how to achieve it with different varieties and sowing dates.

The CSIRO has partnered with FarmLink, Southern Farming Systems and NSW Department of Primary Industries, with funding from the GRDC, to test how slow-maturing, milling quality spring wheats sown early into stored soil water, yield in comparison to mid-fast varieties sown in the usual sowing window.

Data was collected from a range of maturing wheats – very slow, slow, mid, fast and very fast – at three locations – in the high rainfall zone at Lake Bolac and Westmere, Victoria; in the medium rainfall zone at Temora and Junee, NSW, and in the low rainfall zone at Condobolin, NSW.

Overall, the trial found that very slow or slow maturing wheat varieties sown in mid to late April averaged an extra 0.8 tonnes per hectare more than mid to fast varieties sown in mid-May (see Table 1).

There are two key risk factors in sowing crops early – the amount of rain that will be received in late autumn after the crop is sown and the chance that the crop will be flowering in the high-risk window for frost.

TABLE 1: Early sowing trial summary

High rainfall zone Lake Bolac & Westmere (Vic)	High density plantings of late April-sown Bolac at Lake Bolac yielded 7.0 t/ha, compared with a mid-maturing variety sown in early May at 6.6 t/ha and fast-maturing variety sown in late May at 6.0 t/ha. Bolac and mid-maturing variety Derrimut also performed well at Westmere when planted in early May.
Medium rainfall zone Temora & Junee (NSW)	EGA Eaglehawk sown in mid-April yielded more than mid-fast variety Lincoln sown in mid-May by 0.8 t/ha at Temora in 2011 and 2.1 t/ha at Junee in 2012.
Low rainfall zone Condoblin (NSW)	All varieties sown at their optimal time from mid-April to mid-May had similar yields because of a dry spell in late winter. Eaglehawk and Bolac yields were helped by low density plantings but fast-maturing wheats sown later were lower yielding. Eaglehawk sown in mid-April at 30 plants per square metre yielded more than Lincoln sown in mid-May at 90 plants/m² by 0.4 t/ha in 2011 and 0.6 t/ha in 2012.

SOWING RATE, VARIETY KEY TO LOW RAINFALL ZONE SUCCESS

THE saying 'sow early, sow light' applies when it comes to early-sown wheat in the low rainfall zone.

University of New England's Neil Fettell coordinated the Condobolin trial site in which data was generated for the CSIRO project.

Neil Fettell.

Neil, a GRDC Southern Panel member, said the trial demonstrated that sowing in late April gave at least the equivalent and sometimes higher yields than main season sowing in mid-May.

"If sowing earlier in April, it's important to keep seeding rates low at 30–40 plants per square metre to keep the harvest index high," he said.

But the key problem is the lack of variety options at present for early-sowing in the low rainfall zone. EGA Eaglehawk and EGA Wedgetail are most often used in southern NSW and in parts of Victoria but they can be too slow whereas Bolac must be sown early to avoid high screenings.

"Breeding companies are working on plugging that gap, particularly for southern Australia," he said.

Neil said it was important to use the appropriate variety for each sowing time and that longer season varieties had to be sown early.

"We are not pushing people into sowing quick varieties early and getting frosted," he said. "Realistically, early sown crops will be a portion of your area. It's about spreading risk and workload by spreading sowing times and taking advantage of opportunities.

"We are much better at weed control now, we don't have to work it up and back, so modern farming systems give more opportunities for early sowing because of the machinery and weed control advances."

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Managing frosts and other risks

In the past 17 years, rain in April and May has declined because of a southerly shift in the position of high pressure systems from central Australia, called the sub-tropical ridge. In recent years, this weather phenomenon has pushed the traditional Anzac Day autumn break back into May or June.

But in many areas, there is rain falling earlier in the summer fallow period, such as February and March. This means by conserving moisture from these falls, growers can use it to establish crops instead of waiting for the traditional autumn break.

The sub-tropical ridge change has caused an increase in the number of spring frosts in southern Australia in recent years and has changed the period of frost risk.

While the window of frost risk has widened over southern New South Wales, Victoria and eastern South Australia, it has become later over Western Australia and western parts of South Australia.

James says planting currently grown varieties in early autumn increases frost risk because of the earlier flowering time.

He says for growers to make the change to early sowing, they will need to consider slow-maturing varieties such as winter wheats, with their stronger vernalisation, or slow-maturing spring wheats.

"Such varieties do exist but they are currently undervalued and rarely used because they are sown too late for their yield and quality potential to be fully expressed," he said.

Despite these risks, James says yield penalties for sowing too late are generally higher than for sowing too early, even at sites where frosts are common.

Early sowing benefits

James says while growers may cringe at the prospect of keeping seed of multiple varieties on hand to sow an unknown area of crop each year, the yield benefits of early sowing are substantial.

Early sown crops are higher yielding because, when the soil

THE GROWER…

Charles Kingston, The Rock, NSW

Charles Kingston.

There are two 'must-haves' when early sowing wheat – clean paddocks and enough moisture to ensure the crop will germinate and emerge straight after it is sown.

That's the experience of Charles Kingston, who farms with wife Emma, parents John and Sue and brother David and his wife Rebecca.

The Kingstons planted long-season variety Bolac, a cultivar suited to southern NSW's medium and high rainfall zones, on April 23 last year. It was seven to 15 days before seeding would have traditionally started in the first week of May and was harvested in late November, when all wheat sown was ripe.

"It smashed everything else," Charles said. "The early-sown Bolac averaged 4.0 tonnes per hectare while the wheat in total averaged 3.2 tonnes per hectare, including the Bolac."

Bolac sown later in the program on May 2 did not finish properly and had high screenings.

There was no disease or frost in the early-sown Bolac and only a few broadleaf weeds which were easily controlled.

The trade-off

One of the challenges for the Kingstons in making the change was the trade-off between sowing times and different crops. While they were out sowing Bolac, it was traditionally their window of time for sowing canola, a crop they knew they were good at growing and would be profitable.

"We are still feeling our way with it. I don't think we'd have the whole farm sown to Bolac that early but it's definitely an option for a portion. A tight finish that was warm and dry would be an issue for the crop.

"Clean paddocks are needed because the effectiveness of your knockdown spray will be marginal. The key is to ensure it comes up in April when it is sown, because if it doesn't come up you're in a lot of trouble."

In 2013, the Kingstons have sown 2075 hectares mostly to wheat, canola and brown manure crops but also grazing wheat and lucerne and clover pastures undersown to barley and wheat. They also run 2700 merino breeding ewes, one-third mated back to merinos and two-thirds to Poll Dorsets.

While they were sowing into lots of moisture in 2012, they did not early sow Bolac this year because it started to get very dry and their cleanest paddocks were canola stubbles which lacked cover. Other paddocks were not as clean as they would have liked.

Charles says, in hindsight, this year they should have been aiming to early-sow Bolac into wheat stubbles rather than canola. And with good rain since the break to the season, some paddocks now have plenty of moisture.

Instead, canola was sown in April last year in moisture under wheat stubbles and on April 27, Charles started to sow Gregory wheat into marginal moisture.

The Kingstons put in 120 hectares of dual-purpose milling wheat EGA Wedgetail on April 1. Grazing started on June 5, with one 45 hectare paddock carrying 450 pregnant ewes, a carrying capacity of 20–25 DSE per hectare.

These paddocks will be locked-up again in spring, giving pastures a break over winter.

In future, the Kingstons hope to start sowing canola on April 15 then swap to early-sown wheat for a few days on clean paddocks before going back to canola.

Charles says they will keep enough seed to be flexible and change plans with seasonal conditions.

"If it was really wet in mid-April, we might have half the wheat sown to Bolac. If there's moisture in the soil, then we need to sow and not wait for the best timing of the variety we had originally planned to use."

profile fills with water, their roots grow deeper and use more moisture.

Wheat roots grow at about 12 millimetres a day from germination to flowering. Root depth is increased by early sowing slow-maturing wheats, which take longer to reach anthesis.

Canopy development is faster in early sown crops so less soil moisture is lost to evaporation, instead it is converted to dry matter more efficiently.

Early sown slow-maturing varieties have a longer stem elongation phase which means they intercept more radiation and grow more during this period, increasing grain number and yield.

Optimal flowering

James says CSIRO research has shown there are three basic strategies for achieving an optimal flowering time:

- Plant winter wheats from early-March to mid-April;
- Plant slow-maturing spring wheats from mid to late April; and,
- Plant mid-fast varieties from late April into May.

"The first two strategies require some stored soil water – about 25–30 millimetres of plant available water. Use a shovel to check if soil is wet to at least 30 cm on most soil types," James said.

"These crops must germinate and emerge when they are sown. Winter and slow maturing spring wheats will flower too late if they do not establish before the end of April.

"Choose paddocks that are relatively weed-free and therefore do not require a good knockdown for grass weed control. If sowing early into high soil N, reduce seeding rates."

He says one of the advantages is that including a slow-maturing wheat variety in a farm program increases the frequency of planting opportunities and allows more crop to be sown and flower on time, increasing average farm yield.

Full details of the trial are available in the 2013 Temora, NSW, Update proceedings www.grdc.com.au/UpdatesPapers
More information: Dr James Hunt, 02 6246 5066, james.hunt@csiro.au
Deanna is the GRDC Southern Region science writer. ■

THE FARM CONSULTANT…

Chris Minehan, Rural Management Strategies, Wagga Wagga

Early sowing a proportion of wheat area to long-season varieties can increase average yields and improve whole farm productivity, says Rural Management Strategies' Chris Minehan.

He has a number of clients early sowing long-season spring wheat varieties, based on the findings of CSIRO's time of sowing research.

He says using winter wheats and long-season spring wheats enables more wheat to flower at the ideal time for that area and the average wheat yield across the whole farm is increased. Starting earlier also spreads the workload and reduces stress, with less pressure to have everything sown by June.


Chris Minehan.

"Some clients finished their sowing program by the third week of May this year, by utilising available moisture when it was there and starting both canola and wheat earlier. Those with brown manure crops found it helped spread the workload," Chris said. "That means we didn't have many clients sowing past the end of May this year. This region has had around 100 mm in June, so that's in-crop rain for most."

Frost concern

One of the barriers to adoption has been concern about frost damage. But Chris says the risk of frost damage needs to be weighed up against the potential damage of heat stress at flowering.

"Frost seems to be more visual than heat stress," he said. "Yield loss from heat stress at flowering probably occurs every year but because it happens to the whole crop, it is less obvious. About 5–10 per cent frosting can look pretty bad, but may be a better yield outcome than no frosting and more heat stress."

Chris uses *Yield Prophet* to determine frost and heat risk for varieties when looking at a specific location and date.

"Another concern is that crops will use up the available moisture and will 'hay off' at grain fill, which is why stored moisture and canopy management are so important."

Grain growers need to consider the logistics of storing long-season wheat varieties in areas where an early sowing opportunity may only arise every three or four years.

Chris encourages growers considering the concept to sow one paddock as a test and compare with their normal practice.

In his experience, farmers with livestock are generally comfortable early-sowing winter wheats like EGA Wedgetail or Marombi because they provide a grazing option.

"This season around Wagga and Lockhart there was a planting opportunity in late March and early April, so Wedgetail was sown then. By the end of April surface moisture wasn't adequate to establish Bolac in many cases. Each year is going to be slightly different."

Chris says grain growers need to consider how any new technique or technology fits into their individual farming system.

RULES OF THUMB: EARLY SOWING

- There must be 30 mm of plant available water (PAW) stored in soil before sowing.
- There must be enough moisture in the top 5–10 cm to germinate wheat. While a paddock may have good moisture at depth, if it is dry at the surface the crop may not establish in the correct window and end up flowering far too late.
- Early-sown paddocks must have a low weed burden. It is especially important to have a low grass weed seed-bank. Canola stubbles are often the best choice after good grass weed control the previous year.
- Match the sowing time with the variety. For example, Bolac has to be sown in April, May is too late. Medium and high rainfall areas have more early-sowing variety options than low rainfall areas.
- Crop canopy must be managed by reducing sowing rate for earlier sown crops and avoiding oversupply of nitrogen in the vegetative phase by using paddock history and deep soil tests.

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Savvy seed sorter gains new fans

By Marcia Wood, Agricultural Research Service – USDA

SIMPLE, swift, and comparatively inexpensive, a colour-image-based seed sorter is helping plant breeders and others separate the seeds they want from those they don't – with an impressive degree of accuracy.

Agricultural Research Service agricultural engineer Thomas C. Pearson, based at the agency's Center for Grain and Animal Health Research in Manhattan, Kansas, developed the sorter in collaboration with National Manufacturing in Lincoln, Nebraska. The company has marketed the device to customers in the US and abroad since 2010.

In tests, the compact, portable sorter – a simpler and faster version of other machine-vision equipment that Thomas developed in 2009 – speedily differentiated kernels of hard red wheat from kernels of hard white winter wheat with 98.6 per cent accuracy.

"Breeders cross red and white varieties of these breadmaking wheats to transfer desirable traits from one to another. Test fields are planted with both hard red and hard white wheat. At harvest, the seeds have to be separated," Thomas says.

The sorter is also skilled at separating yellow from brown flax and barley from durum wheat.

Thomas explains that yellow flax is used somewhat like sesame seeds as a tasty, nut-flavoured garnish for breads and other baked goods, while brown flax is harvested for its oil. The sorter was accurate 94 per cent of the time in detecting yellow flax seeds from brown ones in Thomas's tests.

Biological science aide Anne Berry puts wheat in the hopper of a colour-image sorter. The ARS-developed camera behind her takes and processes a colour image of each kernel as it falls off the end of the chute. The kernels are then sorted based on visual features and deposited into either of two separate buckets at the base of the sorter. (Photo by Thomas Pearson)

Barley plants can sometimes turn up as unwanted 'rogues' or 'volunteers' in neighbouring test rows of candidate durum wheats. The sorter system detected durum kernels with 93 per cent accuracy, Thomas reports.

Other sorting jobs

The device is handling other important tasks, as well. For instance, seed from native grass plants, needed for revegetating publicly owned lands, is being sorted to rid it of seeds of unwanted plant species. A major breeder of peas and beans for vegetable farms uses the sorter to remove damaged seeds. Some university plant breeders rely on the machine to discern and discard spotty peas or to reject wheat kernels that show colouration associated with Fusarium head blight, a costly disease of wheat and barley.

The sorter assembly, which measures 91.5 cm by 30.5 cm by 91.5 cm, sits snugly on a wheeled base, making it easy to move from one worksite to another. Unsorted seeds are placed in a vibrating hopper and begin sliding down any of three adjacent chutes. After a seed falls off the end of its chute, a colour camera equipped with an image sensor (a complementary metal-oxide semiconductor) snaps an image and sends it, via a circuit board, to a chip for processing.

The chip (a field programmable gate array) uses preprogrammed data to determine whether the seed's surface texture and red, green, and blue colour values more closely match those of an 'accept' seed than those of a 'reject'. Seeds that appear similar to rejects are quickly directed, via a puff of air from an air valve, into the reject container, while the desirable seeds fall neatly into the 'accept' bucket.

Thomas's research is documented in peer-reviewed articles published in *Applied Engineering in Agriculture, Computers and Electronics in Agriculture,* and the *Journal of Food Measurement and Characterization.* ■

Oberon revisited

By Ian M. Johnston

1956

Back in the 1950s, Oberon was a jewel known only to a few. Certainly, travellers heading west to Bathurst from Sydney would have perhaps noticed the odd signboard pointing vaguely in the direction of some obscure place called Oberon. But only adventurous souls were prepared to negotiate the punishing gravel roads, liberally laced with worrying creek crossings, that led eventually to this small isolated township.

Accordingly, this oasis of tranquillity set high among the fertile hills and dales of the NSW Central Tablelands, remained relatively unknown, except of course to the locals, plus an annual small influx of Boy Scouts with tents, fly fishermen encapsulated in rubber waders and long haired artists arriving in battered VW Kombies.

My first encounter with Oberon occurred in 1956, during the halcyon years I was employed by Lanz Australia Pty. Ltd. as the NSW factory representative. A new range of small-farm Bulldog tractors had been added to complement their heavyweight broad-acre brothers. Retaining the single cylinder two stroke semi-diesel principle, the new lightweights quickly earned a reputation for frugal economy coupled to their ability to outpull any other make of tractor of similar dimensions. (My apologies to vintage Massey

A 1910 MacLaren steam traction engine quietly proceeding along Oberon's main street. (Photo IMJ)

A 1957 photo showing Ian, standing alongside a Lanz Bulldog Model H, discussing its features with a group of Oberon farmers. To the right of the photo is Johnny McCusker with his young son John. (Photo L. Simon)

Ferguson, Fiat, Fordson, etc enthusiasts – but such is the fact)!

Johnny McCusker, who was the proprietor of McCusker's Garage, Oberon, attended a Lanz Bulldog field day staged in a paddock near Bathurst. He immediately saw a potential market for the new tractors with his farmer customers. As a result he applied for and received the Lanz franchise for the expansive Oberon district.

Unlike some of my Lanz dealers, who were content to let me do the selling and then receive their unearned commission, Johnny McCusker became an inspired Lanz salesman. Within a short space of time, as a result of his efforts, the staccato note of the single cylinder Bulldogs became a familiar sound in the valleys and on the hillsides of the Oberon district.

A rare and technically interesting late 1950s Brockhouse President. 'Interesting' because of its design inadequacies. The Morris 10 hp engine rendered the little tractor under powered for any meaningful work and the 3 point linkage did not conform with any other tractor. The seating arrangement was hazardous and the throttle control protruded through the centre of the steering wheel. This could result in a sudden dangerous change of engine revolutions, whilst the operator negotiated a tight turn. (Photo IMJ)

A superbly restored Chamberlain Champion 9G. (Photo IMJ)

Each month I would telephone Johnny and arrange to pick him up in my car and off we would go calling on his prospects, invariably arriving back in town with a batch of completed order forms.

The closing of the 1950s coincided with the demise of the Bulldogs. The German Lanz organisation had been acquired by Deere and Co of Moline USA. The Mannheim factory now produced green and gold John Deere tractors. My close alliance with Johnny McCusker sadly drifted to an end.

An interval of 53 years would elapse before I was to resume my association with Oberon.

OBERON TODAY

Late in 2012 I received a phone call from a chap named Jim Hawkes, who introduced himself as being the chief organiser of The Highland Steam and Vintage Fair to be held in Oberon the following February (2013). His committee had requested he approach me to seek my services as commentator and guest speaker at the official dinner. Well – this did all sorts of things for my ego, which my wife Margery insists is not inconsiderable!

But truth to tell, I have been more inclined to adopt a lower profile over recent years (something to do with the calendar no

A view of a group of tractors on display at the 2013 Highland Steam and Vintage Fair. (Photo IMJ)

World War Three (firing blanks – of course). (Photo IMJ)

This excellent example of a Ford 6000 attracted a great deal of attention, as this model is fairly rare in Australia. (Photo IMJ)

doubt) following several decades of inflicting my commentary upon tolerant enthusiasts at tractor events around the country. But the lure of returning to Oberon after all these years, proved irresistible. So I said "Yes."

The excellent bitumen road from Bathurst to Oberon winds gracefully through the panoramic hills and valleys, passing flocks of impressive cross-breed sheep and quietly grazing beef cattle.

Not surprisingly the town has grown considerably since my Lanz days but, apart from the imposing and predictable presence of a large timber mill, the town has thankfully retained its delightful rustic rural character. The main street, with its historic structures, has little changed. Certainly there is now a small supermarket but the absence of a Coles or Woolies has protected the village-like ambience.

Upon entering the main street I pulled the car into the kerb,

The steam organ entertained the crowd, as it rendered typical fairground music. (Photo IMJ)

enabling Margery and me to just sit and absorb the harmony of the place. The official commencement of The Fair was not until the following day, but already the scene was being set.

A veteran steam traction engine unobtrusively meandered past the pub. Another squatted on the opposite side of the road to where we were parked, with the alluring aroma of wood-smoke gently coiling from its tall chimney. In front of the church a steam organ rendered typical old English fair-ground melodies. Two (no less) Rolls Royce Phantom One open roadsters unpretentiously glided past. Three old tractors, creating a seemingly unbecoming clatter to the scene, headed down the street in procession. It was manifestly apparent, that the morrow's Fair was going to be something special!

THE FAIR

Following a superb Chinese evening meal in the Big Trout Motel dining room with a couple of our haven't-seen-for-ages tractor friends, the next morning we drove round to the venue of The Fair.

We introduced ourselves to Jim Hawkes and some of the other volunteer officials. Jim informed me he had enlisted Pam as my official runner! Well, I was mightily impressed – I have never had a runner! I associated runners with young army types hastening with despatches between trenches in Flanders. And I visualised Pam as being a healthy sporty damsel attired in miniscule cross country gear. In actual fact Pam turned out to be a charming mature lady with an engaging smile. She was anxious to er run, but neither of us knew why or to where!

It was 10 am, spectators were in abundance and lines of old tractors plus vintage cars were arriving through the gate, following their parade through town. My microphone was thankfully of the wireless type and my utterances were bellowed forth from speakers strategically placed around the ground. Being left to my own devices (the way I like things) I decided it would be a good idea to give a brief technical run down of each vehicle as it proceeded towards the display area.

This went well and the paying public appeared to be interested in my rhetoric. I then paused the vehicles individually and invited the drivers to also offer a few comments. Again, this was well received, but after around 20 minutes an official came running up and breathlessly told me that the police had been on the phone complaining that the town was gridlocked by a procession of old vehicles that didn't appear to be going anywhere! Margery took the initiative and waved the cars and tractors to urgently get a move on and hasten to the display area.

Apart from the superb displays of classic cars, tractors and steamers, there was a sort of Dad's Army of military aficionados, attired in the uniforms of soldiers dating back two centuries. They also were equipped with the various weaponry of the periods. But they were somewhat glum of countenance as they were having difficulty in attracting the crowds to their display, away from the fascinations of the tractors and cars.

"Fear not," I said. "Just get your black powder into the breech or wherever it goes, and I guarantee you will be the centre of attraction!"

In order to broadcast my message loud and clear, I held the microphone right up to my mouth – any closer and I would have swallowed the thing resulting no doubt in an urgent enema at the local hospital.

"Ladies and gentlemen, this is an emergency announcement," I bellowed. "World War Three is about to commence. Make your way urgently to where the good guys are, up near the front gate. They are heavily armed and will protect you."

Obviously no one believed me, but curiosity drew them like a parade of reinforcements making their way to the front line, until they arrived at where the military guys awaited. In no time the alleged soldiers were doing their thing. Muzzle loaded long barrelled muskets were firing blanks, creating a crescendo of sound. One old guy with a flowing beard claimed to be a direct descendant of Ned Kelly and gleefully banged away with a dangerous blunderbuss.

A police car slowed as it passed the gate and with Margery egging me on I stepped in front of it with my palm raised, indicating it should stop. I poked the microphone through the police car window and requested the constable's name. He gave me a withering look and eased the seat belt off his shoulder to reveal three stripes. I gulped and apologised and explained what was going on in relation to the gunfire. Thankfully he exhibited a good sense of humour, and made some comical remarks into the mike – and sped off. No – I was not arrested.

On returning to the World War Three battlefield, by a sneaky prior arrangement one of the Redcoats pointed his musket at me and pulled the trigger. Also by a sneaky prior arrangement, I collapsed in a heap on the ground. The crowd laughed at our antics. But one old lady had to sit down and was quite overcome. Unfortunately smelling salts, used to revive swooning ladies, disappeared at around the same time as crinoline and high wing collars. The dear old thing quickly regained her composure, but I regretted the foolishness of my prank.

THE TRACTOR PULL

After lunch I took up my allotted place, under the shade of a small marquee alongside the tractor pull track. Old tractors of various types lined up ready to be put to the test.

A tractor pull sled, to which each tractor is hitched, has a type of grader blade at the front which scrapes the surface of the allotted track. But as the sled is pulled by the tractor along the track, a heavy weight (usually blocks of concrete) is automatically winched forward along the chassis of the sled. This has the effect of increasing the draught required, as the sled is pulled forward. The tractor which hauls the sled the greatest distance is declared the winner.

The Oberon tractor pull departed from convention. This was to be merely a friendly informal affair, with no prizes or accolades. So instead of the tractors being segregated into horse power classes, it was a case of whichever unit was next in line. Thus a grey Fergy might be preceded by a Chamberlain Champion, and then perhaps followed by an International B250.

I delivered my commentary, describing each tractor and explaining what was taking place. I remarked that a deal of skill is required by the operator to coax the maximum effort from his mount. The gear selected, the location of any counterweights, the water ballasting of tyres and the pressure in the tyres, all contributed to achieving the maximum drawbar pull.

Then I heard it! The thumping of a Bulldog! But not just any Bulldog. This was my old mate Young Steve Muskat, a legend at tractor pull competitions. I had no idea he was in the ground. He came careering round the corner and attached his belching Bulldog to the end of the tractor line.

I should explain that Steve's single cylinder 2 stroke semi-diesel Bulldog is one of the earlier types, which has to be started with the aid of a fearsome blow lamp that is attached to the cylinder head. The tractor has no electrics, no valves and only three moving parts.

Once the cylinder head is heated, the steering wheel and column is removed from its rightful place and the column is inserted into the end of the crankshaft. The steering wheel is gripped and the flywheel rotated back and forth in a pendulum manner. With luck there will be an almighty explosion and the big engine will burst into life. With even more luck it will run in a forward direction, for there is nothing to stop it running in reverse. If it starts in reverse cycle then it has to be stopped, by cutting off the fuel supply and restarted.

Steve's 40 hp Bulldog out-pulled tractors of double its horsepower rating. And the crowd loved it! The spectacle of the flames belching from its vast exhaust stack, was both spectacular and a trifle scary. Plus, the massive thumping and vibrations from its 11 litre single cylinder engine (fuelled with sump oil drained from a 'lesser' tractor) tended to send hearing aids into meltdown.

A vintage steam traction engine attached to the tractor-pull sled. The viewing crowd could not help but be impressed with the tremendous torque exhibited by the steamer, which had a nominal rating of 8 hp. (Photo IMJ)

In my opinion the Highland Steam Fair was one of the best and most lay-back events of its type I have experienced for many a year. Full marks to the organisers.

There was no hesitation on my behalf to accept an invitation to return for the 2014 event, being held on Saturday, February 8.

I invite my readers to – as we used to say – paste it in your hat. ■

IAN'S MYSTERY TRACTOR QUIZ

Question: Can you identify this strange looking little tricycle tractor?

Clue: It is not a grey Fergy!

Degree of difficulty: Damn hard!

Answer: Page 48.

Cereal disease and tips for best fungicide management

AT A GLANCE...

- Fungicides are only one component of a good management strategy.
- Cultivar resistance is the best protection against fungal diseases. Ideally, when agronomically suitable varieties are available, opt for moderately resistant (MR) to resistant (R) varieties in disease-prone environments.
- Disease control using fungicides is an economic decision.
- Understand the role of the season and have a plan in place, and if growing susceptible varieties have the right chemicals on hand.
- For cereal rusts and mildew, remove the green bridge between crops.
- Spray if disease threatens key plant parts (flag to flag-2) of varieties that are moderately susceptible (MS) or susceptible (S).
- Fungicides do not increase yield; they protect yield potential and cannot retrieve lost yield if applied after infection is established.
- Fungicide resistance is a major emerging issue particularly for powdery mildew control. (In WA it is now recomended not to use tebuconazole-based products on barley if there is any chance of powdery mildew occurring, and to select varieties that are resistant to powdery mildew.)

UNDERSTANDING foliar fungal diseases of cereals and how best to manage them with the agronomic and chemical tools available is in the interests of both individual farmers and the grains industry as a whole.

Most diseases that affect cereals are caused by fungi. A fungal species that causes disease is called a pathogen.

Fungal pathogens feed off living plants, diverting carbohydrates that are required for grain fill to their own growth and reproduction.

They also reduce the green area of the plant that is required for carbohydrate production and so reduce growth and grain fill of infected plants.

Where fungi infect the stems of plants, further damage is caused by blockage of the transport tissues that feed carbohydrates to the grain.

It is this stem damage that often causes the most severe yield losses.

Many plant symptoms are confused with disease, and this may lead to wasteful disease control decisions. Nitrogen deficiency, for example, may be mistaken for yellow spot, and some symptoms of herbicide phytotoxicity can be mistaken for fungal lesions.

Barley responds to a range of stresses by developing spots – it may not be disease.

Different fungi have different life cycles and have specific environmental requirements and so to manage cereal diseases it is important that the correct fungal species is identified. The most effective control strategy can then be followed.

Aim of fungicide use

Fungicides reduce the growth of pathogens so the plant tissues that provide carbohydrates to the grain are protected from damage.

They can be applied to seed, in the furrow or directly onto the leaves and stems as foliar sprays.

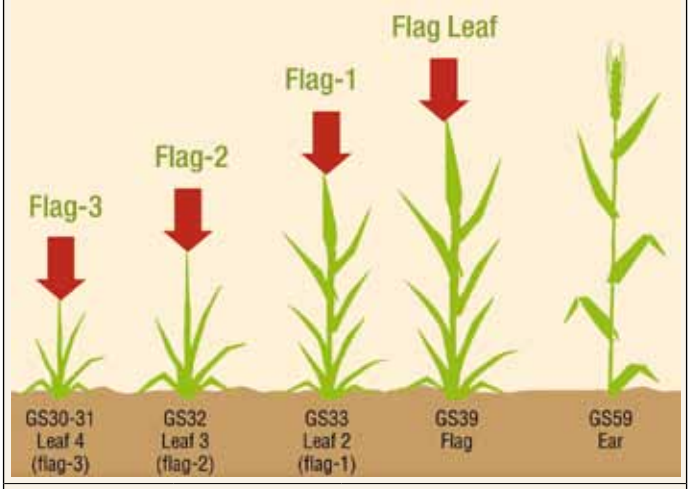
The most important plant parts for grain fill are the final three leaves, stems and heads. But the best way to protect these tissues is often by applying seed or soil treatments or sprays during stem elongation. This will reduce the growth and reproduction of the fungus in the weeks leading up to their appearance because:

- Fungicides are better at protecting than eradicating disease;
- Early treatments can reduce the amount of airborne pathogens spreading through a district from one crop to another;
- Some pathogens appear very rapidly and can multiply and cause extensive damage before a grower is able to apply a foliar fungicide; and,
- Where a pathogen can cause stem or head infection, it is critical that inoculum is kept at a low level in the canopy, as fungicides are far more difficult to use effectively on diseases in later growth stages.

It is important to be able to correctly identify the growth stages of plants so the top three leaves, leaf sheaths or head can be sprayed before they are infected (see Table 1).

TABLE 1: Growth stage and leaf emergence

Development phase	Zadoks growth stage	Approximate leaf emergence stage
Stem elongation (GS30-39)	GS32 (second node)	Leaf 3 (F-2, the second leaf underneath the flag) emerges on main stem.
	GS33 (third node)	Leaf 2 (F-1, the leaf underneath the flag) emerges on main stem.
	GS37	Flag leaf just visible on main stem.
	GS39	Flag leaf fully emerged on main stem.



Courtesy: Nick Poole, FAR Australia

Fungicide modes of action

There are two modes of action available in foliar fungicides used in Australian cereals:

- Group 3 – Demethylation inhibitors (DMIs), including triazoles;
- Group 11 – Quinone outside inhibitors (QoI), or strobilurins.

Fungicides work differently on different diseases. Some are more mobile in the leaves than others.

Flutriafol is an active ingredient that is highly mobile in the plant. When applied with fertiliser it enters the root system and moves up the developing plant, providing protection.

Products that combine different active ingredients, particularly if one is a Group 3 and one a Group 11 fungicide, may provide more complete protection for a plant.

Disease management

Measures to employ at sowing include:

- Fungicide seed dressings;
- Fungicide applied on fertiliser; and
- Liquid in-furrow application at sowing.

If a variety is susceptible to stripe rust, chemical control at seeding will provide initial protection. A further foliar application is also likely to be required, particularly in higher rainfall regions with longer seasons. Often GS37 to GS39 is a good time for this spray.

Depending on the treatment used at seeding, protection can be effective from eight weeks to early to mid-stem elongation.

Protection against rust with a fungicide applied at seeding is less effective on the top two leaves of the crop canopy, as the fungicide is diluted by plant growth during stem elongation.

Seed and in-furrow treatments are also effective on powdery mildew (sensitive strains) and to a lesser degree on scald in barley. They are not effective against yellow leaf spot or the net blotches.

Foliar fungicide timing

Factors that influence spray timing recommendations include:

- Growth stage;
- Level of disease;
- Length of the grain fill period;
- Crop yield expectations;
- Whether the region/season is high or low rainfall and if an early seasonal cut-off is expected;
- The resistance rating of the variety; and,
- The likelihood of disease.

With rust-susceptible wheat varieties – and where in-furrow treatments or fluquinconazole seed treatments have been used – the first foliar fungicide can usually be delayed until the emergence of the flag leaf (GS37 to GS39). This should provide season-long protection.

At this time, apply fungicide directly to the top three leaves of the canopy.

If pre-seeding treatments have not been used, the strategy with susceptible cultivars should assume that two foliar fungicides may be required.

The first spray is applied at the start of stem elongation, first to second node (GS31 to GS32) to protect flag-2 (F-2); the second at flag leaf fully emerged on the main stem (GS39) to protect the flag leaf and flag-1 (F-1).

Where wheat varieties have a useful level of adult plant resistance (APR), there will be less need to apply two foliar fungicides.

Only a single fungicide may be required between GS32 and GS39, depending on the variety, seasonal conditions and disease presence on the top three leaves.

Where a longer-lasting fungicide has been applied at seeding to varieties with APR, there may be no need to apply any follow-up fungicide, particularly in drier environments.

In high-rainfall situations more conducive to disease, a follow-up fungicide can achieve greater returns.

Sprays applied with the herbicides during tillering when no rust is evident are often included for logistical reasons – to save an operational pass or as a risk reduction strategy.

Depending on when rust appears in the district, these sprays may provide a critical delay in any epidemic build-up and reduce the need for later sprays.

KEY CEREAL GROWTH STAGES

Development in cereals can essentially be broken down into two stages, pre-flowering (anthesis) and post-flowering growth.

Pre-flowering

Pre-flowering growth develops the leaves, roots and stems and sets the plant's yield potential. Eventual yield is linked to the amount of light the plant can intercept through the crop canopy, so it is important to protect the top three (final) leaves from fungal disease as they emerge – the flag, flag-1 (F-1) and flag-2 (F-2).

Zadoks growth stages provide a guide to a crop's development. Table 1 outlines how growth stages can be used as an approximate guide to the emergence of the top three leaves.

Post-flowering

Post-flowering growth is mostly dedicated to grain fill. The longevity of the crop canopy depends on nitrogen (N) and water.

The longer the crop canopy stays green after flowering, the greater the eventual yield. If neither N nor water is limiting, protecting against fungal disease will help to maintain the photosynthetic area and yield potential.

But they will not protect the top three leaves (flag, F-1, F-2), as they will not have emerged.

If **stripe rust** infection is observed during tillering, spraying will reduce inoculum pressure, but it will not protect the key top leaves or be as effective as the best seed or in-furrow treatments.

Spraying during tillering may therefore need to be followed by further sprays at both the start of stem elongation (GS31 to GS32) and again at flag leaf emergence (GS39) where cultivars are susceptible.

Stem rust is a disease that does not appear in crops until later in the season when the weather is warmer, but it can move rapidly once established.

Spraying for stem rust can be economical at much later growth stages than with other diseases.

Sprays at GS45 to GS51 (booting to early ear emergence) are more effective on stem rust on the flag leaf sheath. Later sprays, GS55 to GS75, are more effective on disease on the ear and the peduncle.

The optimal single spray timing is around GS55 to GS59, with timing dependent on the onset of infection.

Foliar fungicides are more effective in controlling rusts and mildews than they are in controlling necrotrophic diseases such as yellow leaf spot and the net blotches.

Sprays for **net blotch** control are usually only effective for two to three weeks or until a new leaf emerges, as the fungicide does not effectively suppress infection on the lower dying leaves.

Sprays for **yellow leaf spot** control during tillering are usually uneconomical. In the south, the disease rarely progresses up the plant to any damaging degree, and if it does, fungicide will not control the source of inoculum in stubbles or on dead lower leaves.

Control of any disease is highly dependent on the timing of application, with product choice, rate and method of application also important. Higher rates of recommended product will give longer protection and are usually more effective on harder-to-control diseases.

Barley disease management slightly different

In barley, the flag leaf contributes less to yield than it does in wheat: F-1 and F-2 leaves are more important. But the flag leaf sheath in barley is also a major contributor to yield and it is not exposed until awn emergence (GS49).

Protection of these leaves in barley is centred on two principal fungicide timings – at the start of stem elongation (GS30 to GS32) and from flag leaf to first awn emergence (GS39 to GS49).

The first spray is particularly effective against the earlier disease infections, such as scald and net blotch, as well as powdery mildew and early leaf rust infection.

HOW EPIDEMICS OCCUR

Disease epidemics occur when three variables combine:

- Environment: Wet conditions are more conducive to fungal diseases, and each disease has an optimal temperature range where it develops most rapidly. Net blotches and yellow spot require free moisture for infection, but high humidity is sufficient for powdery mildew;
- Host: Susceptible cultivars are more easily infected than resistant cultivars and produce more inoculum for the next disease cycle; and,
- Pathogen: Source of pathogen inoculum is present (for example, green bridge or infected stubble). The pathotype present is virulent on resistant genes in a variety, allowing disease to establish.

In susceptible barley varieties, the second spray is critical.

The second timing more fully protects the upper crop canopy, particularly F-1 and the flag sheath from the same diseases, particularly leaf rust. The second spray is more important in disease-susceptible cultivars and in seasons with a softer finish.

Applying the fungicide

Foliar fungicides need to cover a much larger plant area than herbicides. Unlike herbicides, they are translocated in only one direction (from the point of contact towards the leaf tip) so fungicides will protect only the portion of the leaf that is visible at the time of spraying. When applying fungicides, a higher carrier volume (around 70 to 80 litres) is needed.

New emerging leaf material is unprotected, although the earlier spray will mean inoculum levels are lower.

Medium to medium-coarse droplets provide the best coverage. Fine droplets have poorer penetration of the crop canopy and present a greater risk of spray drift.

Coarse droplets are not always retained on a waxy leaf surface as they can bounce off.

Tips for optimal fungicide efficacy

- Ensure thorough boom decontamination.
- Understand most fungicides have limited translocation. Hence coverage is required where control or protection is needed.
- Use a minimum of 70 to 80 litres carrier volume and medium to medium-coarse droplets. In denser canopies, more volume may be required if the product needs to reach the lower parts of the canopy.
- Limit speed to less than 20 km per hour. Higher speeds risk spray coverage being concentrated on only one side of the plant.
- Consider a narrower nozzle spacing (for example, 25 cm), with one angled forwards and one backwards, or twin jets. If using this option, limit speed to 16 km per hour.
- Use the correct surfactant, if advised, as per label recommendation.
- Use minimum controller hold settings to avoid pressure loss and under-dosing at the ends of runs where seed and pressure are normally reduced.

Aerial application (in non-controlled traffic systems) is another option for most foliar fungicides and is generally less damaging to the crop because there are no wheel tracks.

Aerial application works well with much lower carrier volumes (around 30 to 40 litres) for products designed to protect the flag leaf or upper parts of the foliage. But higher application volumes may be required where deposition is needed in lower parts of large canopies.

However, barriers to aerial application (trees, power lines, proximity to roads/waterways) can be an issue and may leave parts of a paddock unsprayed that would otherwise have been covered with an application using a ground rig. This can cause issues with more rapid reinfection of a paddock once the fungicide protection wanes.

Economics

The decision to apply a fungicide for disease control is usually based on economics. That is, will the fungicide application give an economic return greater than the cost of application? Factors to consider are:

- The presence of disease;
- Yield potential;
- Potential loss of yield and quality;
- Commodity prices; and,
- Cost of fungicide plus application.

A break-even return suggests that the application is not warranted. Many growers consider a 100 per cent return on the cost of spraying justifies application of a fungicide.

A decision to spray a crop may also be made on the economic protection that that spray will provide to surrounding crops where spores will travel from one crop to another.

If there's no threat, don't use fungicides

In the absence of diseases or any threat of diseases, it is uneconomical and unnecessary to apply fungicides.

Good management practices such as controlling the green bridge for cereal rusts, attention to potential risk of stubble-borne leaf disease when deciding on crop rotations, and choosing the most resistant variety for the conditions will reduce the reliance on fungicides and disease pressure overall.

More information and acknowledgments
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Adapted from GRDC *Cereal Fungicides* Fact Sheets May 2013 (Northern, Southern and Western Regions) see www.grdc.com.au ■

FUNGICIDE RESISTANCE

Resistance to several fungicides has recently been confirmed in the barley powdery mildew population in WA with losses estimated at $100 million. The resistance is associated with two mutations, one of which has been detected in other states and sends a warning to use fungicides responsibly.

For these reasons, barley growers should limit the use of tebuconazole (Folicur, Impact Topguard), flutriafol (for example, Impact), triadimefon (Triad) or triadimenol (Baytan) alone where powdery mildew is the target disease.

This WA resistance affects the older triazole fungicides tebuconazole, flutriafol and triadimenol. The only remaining seed treatment effective against barley powdery mildew in WA is fluquinconazole.

The resistance to fungicides has been attributed to the widespread growing in WA of the very susceptible (VS) variety Baudin, low use of seed treatments on barley and conducive environments for infection.

Large amounts of fungal inoculum and the repeated use of similar fungicides has led to the selection of resistant mutants of the fungus.

Growers can help reduce the threat of fungicide resistance by avoiding the use of VS varieties, treating all barley seed with seed treatments and, where sprays are required, rotating with the fungicides that remain effective in WA.

These are the triazoles (propiconazole, cyproconazole, prothioconazole and epoxiconazole) and the strobilurins (azoxystrobin and pyraclostrobin). See Table 2.

Growers should instead consider rotating with fungicides from alternative modes of action (for example Amistar Xtra, Opera) and the remaining triazole fungicides (for example Tilt, Tilt Xtra, Prosaro, Opus). Refer to Table 2 for active ingredients.

The GRDC is investing in research into new modes of action to manage these risks.

TABLE 2: Modes of action registered for control of foliar diseases in Australian cereals

Group	Active ingredient	Example product name	Foliar (F), seed (S) or in-furrow (IF)
3 – DMI	Triadimefon	Triad	F and IF
	Propiconazole	Tilt	F
	Propiconazole + cyproconazole	Tilt Xtra	F
	Tebuconazole	Folicur	F and S
	Flutriafol	Impact	F and IF
	Tebuconazole + flutriafol	Impact Topguard	F
	Tebuconazole + prothioconazole	Prosaro	F
	Propiconazole + tebuconazole	Cogito	F
	Epoxiconazole	Opus	F
	Triadimenol	Baytan	S
	Fluquinconazole	Jockey	S
3 + 11 (Strobilurins)	Azoxystrobin + cyproconazole	Amistar Xtra	F
	Pyraclostrobin + epoxiconazole	Opera	F
5 (Amines)	**Spiroxamine***	**Prosper**	**F**

*APVMA permit (PER14012) issued for WA only and expires March 2016.
Courtesy: Richard Oliver, Curtin University

What's new in grain storage?

By Philip Burrill, DAFF Qld, Hermitage Research Facility, Warwick

AT A GLANCE…

- Combining good hygiene, well managed aeration cooling along with regular grain inspections provides the best foundation for successful grain storage.
- Recent ecology research reinforces the value of cleaning up grain residues in storages and equipment.
- Lesser grain borer's (*Rhyzopertha dominica*) widespread resistance to grain protectants is ending with the availability of new and soon to be registered products.
- New easy to use automatic controllers improve aeration cooling.
- Producers should aim to achieve grain temperatures in storage of 20° to 23°C during summer storage and less than 15°C in winter.
- Recirculation and ground level applications have a role to play in effective, safe fumigations.

GAINING a better understanding of grain storage insect pests – and fighting them using the right combination of management and equipment – not only gives you the upper hand in term of pest control but also in grain marketing. You strengthen your marketing position when your storage facilities allow flexibility with grain handling and timing of sales.

As a bonus, many of the strategies used to minimise pest problems also significantly improve storage conditions for maintaining grain and planting seed quality.

There is an increasing number of growers who are reaping rewards by placing extra emphasis on the management of their grain storage facilities. And it is the combination of good practices and strategies that provides the real strength to successful storage. These include:

- High standard of hygiene for storages and grain handling equipment to minimise insect pest breeding sites;
- Monthly checks of grain in storage, including planting seed – sieving for insects and checking quality;
- Aeration fans fitted to storages, operated by an automatic controller;
- Grain temperatures – checked and achieving 20°–23°C in summer and less than 15°C in winter. Aeration helps achieve cool, uniform moisture conditions in storages which is particularly important in the first few weeks after harvest. These cool conditions need to be monitored and maintained;
- Fumigations, when required. These are carried out in sealable silos pressure tested at least once a year (see the GRDC fact sheet – *Pressure testing sealable silos*); and,
- A simple storage record-keeping system to record details such as grain variety, moisture content, grain temperature, treatments, inspection dates and insects found etc.

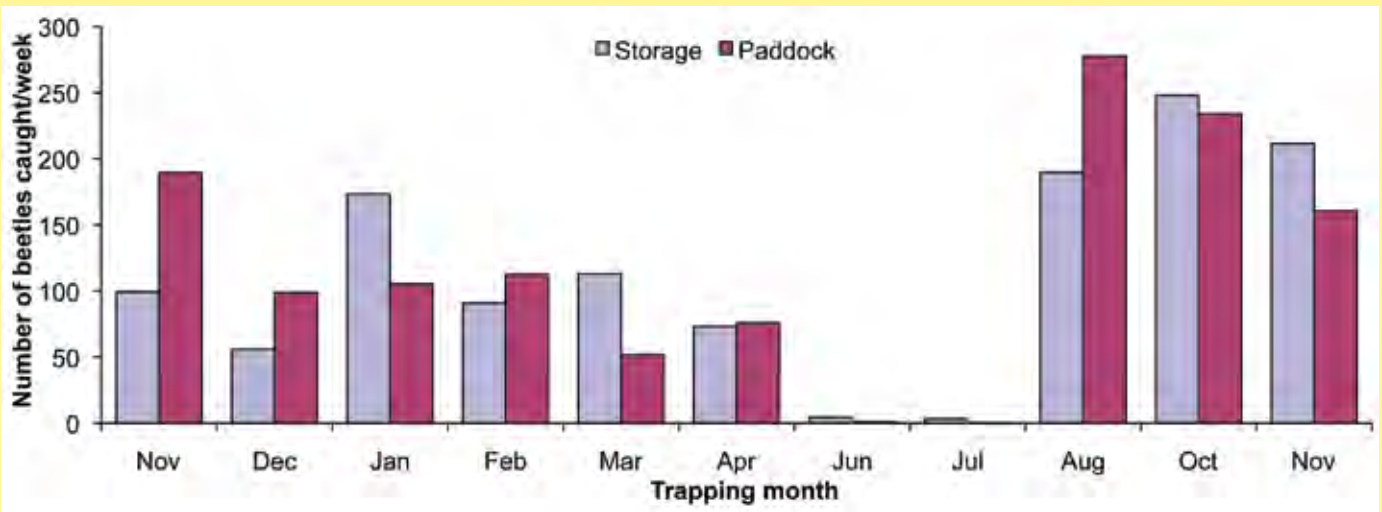
Maintaining grain quality in storage

The two most common and serious threats to grain quality in Australia's storages are insect pest infestations and grain moisture problems causing mould / fungal growth. Key initial strategies include thorough hygiene for storages and equipment plus aiming for cool, dry grain in the storage.

Recent research (Figure 1) shows that high numbers of storage pests can fly out from distant on-farm sources of infested grain looking for newly harvested clean grain to infest. This underlines the value of regular hygiene activities.

Lesser grain borer (*Rhyzopertha dominica*).

FIGURE 1: Lesser grain borers (*Rhyzopertha dominica*) trapped in warm and cooler months at farm storages and at least one km away in paddocks



(Greg Daglish DAFF Qld)

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The recommended air flow rate for cooling grain is 2 to 3 litres of air, per second, per tonne of grain in the storage.

Grain temperatures below 15°C stop the breeding life cycle for all of our common storage pests. During summer, achieving grain temperature close to 20°C is also valuable as it either stops or significantly slows insect population increase.

Grain fungal growth in storage is kept in check with appropriate grain moisture contents – for wheat less than 12.5 per cent, sorghum less than 13.5 etc. Lower grain temperatures also assist to some extent in reducing fungal growth.

Aeration cooling – achieving reliable results

- Fan operations – do not rely on manual switching or time clocks to operate fans. Auto controllers provide reliable, consistent cool grain temperatures.
- Maintenance – manually test individual silo fans to check there are no electrical faults. For auto controllers, check that the temperature / humidity sensor is clean. Also compare its readings, with a reliable hand held thermometer and relative humidity (RH) reader.
- Fan operations – ensure fans are stepped through the three important stages of aeration cooling – continuous; purge; and, protected. The most recent auto controller models now automate this procedure over the first two weeks for storage.
- Fan performance – An Australian research group has developed a simple, accurate method for testing the air flow performance of aeration fans while they are operating. The recommended air flow rate for cooling grain is 2 to 3 litres of air, per second, per tonne of grain in the storage. Field tests on farm storages have shown some fans are not delivering these required air flow rates. (See GRDC Fact sheet: *Performance testing aeration systems*, August 2012.)
- No aeration fans fitted to storages? Some growers may not be convinced aeration of grain is worthwhile in their location. A well managed aeration system will typically reduce grain temperatures by at least 10°C over the summer months compared to non-aerated storages. This has a significant impact on reducing insect pest problems and maintaining grain quality. For safe storage of wheat over summer, growers should be targeting grain temperatures of 20–23°C. An aerated system will deliver these temperatures while wheat in a non-aerated silo over summer, will constantly be above 30°C.

Fumigation in silo bags

In some situations growers may find it difficult to gain access to a sealable, gas-tight silo in which to carry out an effective fumigation of infested grain. Recent trials have shown a silo bag can be used successfully for fumigation with phosphine when using the correct procedure.

The key steps are:

- A gas-tight seal – inspect the silo bag and repair any minor holes;
- Correct phosphine tablet dose – apply in multiple grain spears evenly placed 7 metres apart;
- Allow a 14 day fumigation period; and,
- Vent the gas safely using a standard F650 aeration fan.

Fumigating in silos

Terms such as 'recirculation', 'thermo siphons' and 'ground level application of phosphine' are often bandied about when fumigation is the topic. What are they and when should they be used?

The standard recommended practice for phosphine application has been to place tablets in trays in the sealed silo headspace. For small and medium size silos of less then 150 tonnes capacity this is an effective application method. The phosphine gas only takes approx 24 hours to diffuse from the top to the bottom, through the 5 to 7 metre depth of grain to the base of the silo.

But for larger, taller silos (more than 150 tonnes) it can take two or more days for phosphine gas to reach the grain in the base of the silo. This can be a problem for a standard seven or 10 day fumigation, because some infested grain at the silo base does not have enough exposure time at high gas concentrations to kill all stages of the insects.

Recirculation is simply a system of adding plumbing / pipes to the silo to connect the silo base with the top of the silo to speed up the movement of gas through all grain in the silo. Recirculation should provide a faster, more uniform gas distribution.

We now see a number of silo manufacturers offering silos fitted with PVC tubes running down the outside of silos from top to bottom. The complete system, including the silo itself, still needs to be well sealed and gas-tight. Otherwise gas simply leaks out and the fumigation will fail to kill all the pests.

Recirculation usually involves using a small aeration fan connected into the plumbing system to force the phosphine gas distribution around the silo. The critical time to have this operating is during the first three or four days while tablets are liberating gas.

Thermo siphons have the same silo roof to silo base plumbing arrangement aiming to achieve gas movement (recirculation) around the silos without the use of an electric fan. The heating and cooling of the silo head space and the black coloured piping down side of the silo, helps generate air currents which distribute the phosphine gas.

To assist with safety and reduce the amount of time climbing silos to place tablets, phosphine tablets or bag chains can be placed in appropriate **ground level** structures or containers at the silo base. These are often part of a recirculation system and connect to the internal aeration ducting.

It is very important to ensure the system's design has ample space for tablets with free gas flow to prevent the phosphine gas concentrations building up above the flammable threshold (explosive) of 17,000 ppm. Do not restrict gas movement with small containers for tablets or small diameter pipe plumbing while gas is liberated in the first three to four days. Seek advice to ensure only safe designs are used.

More information: Philip Burrill, Department of Agriculture Fisheries & Forestry Qld. Email: philip.burrill@daff.qld.gov.au; Ph: 07 4660 3620 ■

NEW GRAIN STORAGE PRODUCTS AND EQUIPMENT

High flow grain cleaner

One of benefits of having on farm storages is the ability to segregate various quality grades at harvest time. If you are just missing a premium grade due to a few extra per cent screenings in wheat, or you are facing downgrades in pulses due to splits or weed seed contamination, grading is an option that can quickly add value.

Cleaning grain into storage helps to eliminate the environment which cultivates insect growth and saves storage space by removing a good percentage of the addmix adding significant value to your grain.

Storage safety is also improved by, for example, grading out impurities and fines from oilseeds and products such as sorghum while filling the silo.

A new grain cleaner (pictured) has multiple screen tubes designed for flow rates that will keep up with most harvesting operations. A range of screen sizes and slot designs suit most cleaning requirements (more information – CustomVac Aust. Toowoomba).

K-Obiol Combi® (50g/L deltamethrin, 400g/L Piperonyl Butoxide) from Bayer CropScience

This grain protectant insecticide formulation registered by Bayer was restricted for use by the bulk handling companies such as Graincorp for a number of years. After lengthy negotiations it has now been released for use by grain growers who meet two key requirements: the grower undertakes a training course in its correct use and has a recognised QA system on their property.

For growers it is currently the only protectant registered in Australia with acceptable efficacy against the common storage pest, lesser grain borer (*Rhyzopertha dominica*), which has developed widespread resistance to current insecticides.

But note that insect resistance surveys have consistently detected low levels of deltamethrin resistance. This is a warning that resistant populations could increase quickly if there was widespread excessive use of one product.

Conserve™ (Spinosad) – Dow AgroSciences

Conserve™ Grain Protector was registered in February 2013 for exclusive use by approved bulk handling companies. It is hoped that Conserve™ On-Farm grain protector will be registered for use by growers before the end of 2013.

Spinosad – one of three active ingredients in Conserve On-Farm – will provide up to nine months control of the lesser grain borer (*Rhyzopertha dominica*). It will be sold as a twin pack combination, with the partner product, Reldan Plus, to control all the other key stored grain insect pests.

There will be a stewardship program to be followed for the sale and use of Conserve On-Farm. It will be registered for use on all cereal grains excluding maize, malt barley and rice.

Automatic aeration controllers

Reliability of achieving good results with aeration cooling is significantly increased with automatic controllers turning on silo fans when the best ambient temperature and humidity conditions are available. Two companies based in Toowoomba (southern Qld) – CustomVac Aust. and Agridry International – have recently incorporated new functions in their automatic aeration controllers.

An example is the ability to have fans automatically step through the three important stages of aeration cooling – continuous; purge; and, protected. An additional auto function can also exclude high humidity air (more than 85% RH) in all three of these stages.

These new practical functions are another good reason to no longer use the less reliable methods of trying to remember to manually switch fans on and off, or using power point time clocks.

ProFume® (998g/kg Sulfuryl Fluoride)

Is a relatively new fumigant for grains in Australia, registered by Dow AgroSciences. It comes in gas cylinders and may only be applied by licensed fumigators to cereal grains (not for pulses or oilseeds). Like phosphine, it still requires a well sealed and gas-tight storage to hold the gas concentration for the required four to six day fumigation period.

Cost of treatment ranges from $3 to $7 per tonne depending on tonnage, storage type, and distance the licensed fumigator needs to travel. When compared to $0.35 $0.40 per tonne for a standard on-farm phosphine treatment, it is expensive.

But sulfuryl flouride currently has a very important role in Australia's grain industry as a 'phosphine resistance breaker' especially targeting strongly resistant rusty grain beetle *Cryptolestes ferrugineus*, currently a problem in bulk handling facilities and on a few farms.

Sulfuryl fluoride is an important fumigant as a 'phosphine resistance' breaker on rusty grain beetles (*Cryptolestes ferrugineus*).

SOUTHERN AUSTRALIA FOCUS

COVERING CROPPING SYSTEMS OF SOUTHERN NSW, VICTORIA, TASMANIA, SOUTH AUSTRALIA & WESTERN AUSTRALIA

THE RESEARCH VIEW

How landscape features affect pest populations

AT A GLANCE...

- Both pests and natural enemies can be found in a range of habitat types in grain cropping landscapes throughout the year;
- Pastures play a key role in providing habitat for pest populations;
- Pests are commonly found on exotic weeds and rarely found on native plants;
- Native vegetation remnants – that are well managed, not over-grazed and have an intact under and middle storey – have fewer weeds and are likely to support more natural enemies and fewer pests.

A NATIONAL project funded by the Grains Research and Development Corporation (GRDC) has found that 'good quality' native vegetation may help reduce pest pressure in grain crops.

The 'pest suppressive landscapes project', which focused on

A canola plant infested by aphids. (Photo: CSIRO)

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.

pest and beneficial insects relevant to wheat and canola, also found that pasture management in agricultural landscapes may be important in controlling pests.

Led nationally by CSIRO, the project aimed to understand which landscape features contribute to the control of pest populations in crops.

It involved field work in Western Australia's Great Southern region, Dalby in Queensland and Cootamundra in New South Wales.

Ideally, pest suppressive landscapes would have the right mix of habitats that support natural enemy populations and allow them to move into crop paddocks, but discourage the build-up of pests throughout the year.

Source habitats identified

Sarina Macfadyen, a CSIRO researcher involved in the project, said the work found that both pests and natural enemies could be found in a range of habitat types throughout the year.

"Pastures play a key role across the year in providing habitat for pest populations, while native vegetation remnants provide much better habitat for beneficial such as predators and parasitic wasps," she said.

"The types of plants in native vegetation patches influenced the density of pests and predators found and we are currently working on compiling an 'important plant list' for each region that will highlight low and high risk plants.

"Within the native vegetation remnants we found that, in most cases, broadleaf weeds host more pests, native shrubs and trees more predators, and grasses host both pests and predators.

"Native vegetation remnants – that are well managed, not over-grazed and have an intact under and middle storey – have fewer weeds and are likely to support more natural enemies and fewer pests."

Sarina said implications of the findings included that weed management in pastures may be important for suppressing pests, as could weed management in native vegetation patches.

"Native vegetation containing few weeds doesn't support pests, but does support beneficials," she said.

"There are many 'low risk' native plants suitable for revegetation, such as Eucalyptus, that don't generally harbour pests but do host adult and immature natural enemies."

The parasitic wasp *Trioxys complanatus* is a biological control agent introduced to combat the spotted alfalfa aphid.
(Photo: CSIRO)

Sarina said the findings also suggested that farmers could take stock of areas on their farms likely to host insect pests or beneficials, and take this information into account when making management decisions.

"The results also suggest that growers can help manage insect populations by actively managing weeds in pastures, or planting native vegetation on 'that weedy patch along the laneway'.

Movement between habitats

Sarina said the research found that insect pests and beneficials moved frequently between cropping paddocks and remnants of native vegetation early in the crop growing season.

"Regardless of where they come from, the relative timing of the arrival of pests and their natural enemies may be crucial for pest suppression throughout the season," she said.

"If natural enemies arrive late, the pest populations have had time to build up in a paddock and may be harder to control.

Sarina said data from interception traps showed that native vegetation patches in cropping landscapes were important for the recruitment of beneficials into crop paddocks early in the season.

"Native vegetation patches were also associated with crop colonisation by pests – this is most likely due to weeds in the patches," she said.

"Therefore a remnant patch offers both opportunities and risks for pest management," she said.

"The development of targeted management strategies in native vegetation patches – perhaps targeting weeds that support pest species – may reduce the risk of early season crop colonisation by pests, but not hinder movement by natural enemies."

Sarina said field trials in New South Wales and Queensland, which aimed to find out if pest and beneficials were equally likely to move from native vegetation patches at the start of the cropping season, focused on the period from crop planting through to stem elongation.

"Overall, the patterns of movement between habitats were similar between New South Wales and Queensland, but there were some exceptions," she said.

"The brown lacewing – a predator of aphids – is a highly mobile species that occurs in many different habitat patches in these landscapes.

"This species had significantly greater activity in New South Wales than in Queensland and we think this difference may be related to the relatively large amount of fallow land in Queensland at this time of the year.

"In another example, *Aphidiinae parasitoids* (wasps that attack and kill aphids) showed high numbers moving out of native vegetation and into cereal crops early in the season at the New South Wales site, but not in Queensland.

"Parasitoids – which can be quite specific predators of certain pest species and can lay eggs into multiple hosts – can be very effective in reducing pest numbers in-crop."

Aphid research in WA

In WA, the field research component of the national project was led by the Department of Agriculture and Food (DAFWA) and researcher Svetlana Micic.

Svetlana and her colleagues investigated the activity of aphid pests and their beneficial near and far from native remnant vegetation, in southern cropping areas of WA.

"Aphids can vector viruses that lead to yield loss in crops – for example, barley yellow dwarf virus in cereals can reduce crop yields by 50 per cent if plants are infected prior to tillering.

A patch of native vegetation (planted) surrounded by canola.
(Photo: CSIRO)

"They can also cause direct feeding damage which can reduce yields by up to 10 per cent in cereals.

"Aphids are known to use predominantly short range flights to colonise crops, rather than long migratory flights.

"Consequently, plant hosts of aphids need to be present in the landscape to allow colonisation of crops."

Svetlana and her colleagues found that the number of beneficials that attack aphids caught near native vegetation were not different from the number caught in the middle of the grain paddocks.

But more brassica aphids were found in traps near to native vegetation, whereas traps that were far from native vegetation had higher numbers of legume aphids and aphids from unknown vegetation hosts.

To sum up

Sarina said researchers involved in the 'pest suppressive landscapes' project welcomed feedback from growers and consultants about positive or negative results relating to pest management in cropping paddocks.

They also welcomed input on ways in which they saw the surrounding landscape influencing pest problems in their paddocks.

Sarina can be contacted at Sarina.Macfadyen@csiro.au
Sarina said there were still many questions left to answer about how pest risks could be reduced by focusing on landscape features in agricultural landscapes.
More information about the pest suppressive landscapes project is available at www.nipi.com.au/research/pest-suppressive-landscapes ■

THE CONSULTANT'S VIEW
HOW LANDSCAPE FEATURES AFFECT PEST POPULATIONS

■ **By Brent Pritchard, Farmanco**

The national 'pest suppressive landscapes' research tells us that if there are weeds (which are host plants for pests) around a cropped paddock, there is a greater chance of invertebrate pest incursions into the paddock.

These incursions of pests such as aphids, redlegged earth mites (RLEM) and diamondback moths can be from weeds in remnant vegetations, on roadsides or in pastures.

GRDC supported trials conducted by the Department of Agriculture and Food (DAFWA) in southern cropping areas of WA show that the abundance of aphid predators is related to pest presence and not necessarily related to remnant vegetation.

The condition of Western Australian remnant vegetation can vary from that which is in very good condition (good understorey and few or no weeds) to poor.

Where radish and other brassica weeds are common, there will be a rapid build up of aphid populations in adjacent crops, especially as remnant vegetation can provide shelter from environmental conditions adverse to aphids such as rain and wind.

Where possible, growers should manage weedy areas to prevent pest build ups.

Weedy areas and pastures can provide a good food source and great breeding grounds for RLEM.

A bare fire break at the start of the season provides a good 'fence' for RLEM, but unfortunately winged pests don't respect these 'fences'.

If weeds have invaded remnant vegetation it may be very difficult to remove the weeds in a timely and cost efficient manner.

Brent Pritchard (left) and Bill Ryan.

Canola disease pioneer recognised with GRDC award

Steve Marcroft (left) receives his *Seed of Light* award from GRDC Southern Regional Panel deputy chair Peter Schwarz.

A PIONEERING authority on canola diseases has been officially recognised for his efforts and achievements in communicating the outcomes of research.

Dr Steve Marcroft has been named the recipient of the 2013 Grains Research and Development Corporation (GRDC) Southern Region *Seed of Light* award.

This award acknowledges Steve's outstanding commitment and contribution to the Australian grains industry.

Steve, who is based at Horsham in Victoria where he owns and operates Marcroft Grains Pathology, is highly respected and regarded around the nation and the globe for his leading research role into the occurrence and management of the damaging blackleg disease.

GRDC Southern Regional Panel deputy chair Peter Schwarz, who presented the award to Steve at the National Canola Pathology Workshop in Melbourne, said Steve continued to perform a vital function in providing growers and advisers with important information relating to blackleg disease in canola.

"Blackleg is the major disease of canola in the southern region, which grows more than half of the nation's canola crop," Peter said.

"A recent GRDC-commissioned report into oilseed disease losses shows that the magnitude of potential losses caused by blackleg in canola alone – without current control measures in place – would be $287 per hectare or more than $330 million nationally.

"So the value of the work that Steve undertakes cannot be ignored. Without his ongoing contribution, and that of his colleagues, it would be very difficult for growers to continue to successfully produce canola crops which have become such an important element of farming systems in the southern and western regions.

"Effective blackleg prevention and management strategies are critical – and we have Steve to thank for the development and implementation of these."

Broad-based research

Steve is the chair of the Australian Blackleg Review Committee and chair of the Australian National Canola Pathology Working Group. He has previously been president of the Canola Association of Australia and was project leader of the *Better Oilseeds* extension-based project aimed at promoting oilseed production.

Since 1998, Steve (a former canola pathologist and agronomist with the Victorian Department of Primary Industries) has led and collaborated on a number of key GRDC-funded research projects focused on the monitoring and management of blackleg, as well as the identification of alternative blackleg resistance genes and increased blackleg resistance in Australian canola cultivars.

He has also been responsible for the development of blackleg phenotyping techniques which are now used routinely for identifying blackleg molecular markers, as well as the development of differential blackleg isolates to identify canola major seedling resistance genes.

Steve devised a screening method to assess adult plant resistance, and this method is now used commercially to classify all canola cultivars into different adult plant resistance groups.

In 2000, he created the National Blackleg Resistance Ratings which are updated annually to provide growers and advisers with standardised and independent ranking of cultivars for blackleg resistance.

Steve's groundbreaking research – much of it done in collaboration with Professor Barbara Howlett and Associate Professor Philip Salisbury at the University of Melbourne – has resulted in the establishment of industry-endorsed best practices for durable blackleg management, including choosing resistant cultivars, separating new canola crops from last year's stubble, and using either a fungicide seed dressing or fungicide-amended fertiliser.

Aspects of the *Australian Blackleg Management Guide*, produced by Steve last year, are now being adopted by the Canola Council of Canada.

Dual purpose canola

In collaboration with Dr John Kirkegaard from CSIRO Plant Industry, Steve also developed the concept of dual purpose canola, for grazing and seed production, and provided recommendations on how to graze canola without increasing susceptibility to blackleg.

He was the first person in Australia to show that under certain conditions canola could be successfully grown in the low rainfall zone, and that canola can reduce disease-related yield losses in subsequent cereal crops. This remains the key reason for canola production in areas of less than 300 mm growing season rainfall. ■

Mapping the way to even healthier rice

By Jan Suszkiw, Agricultural Research Service – USDA

WITH the aid of high-tech tools, USDA Agricultural Research Service and collaborating scientists are closing in on the genes in rice that regulate the uptake and storage of important minerals – a pursuit that could bolster the nutritional value of this cereal grain crop as a staple food for roughly half the world's population.

Ultimately, the team envisions biofortifying rice using traditional plant breeding methods to develop new varieties whose kernels (grain) boast exceptionally high concentrations of essential minerals, including zinc, iron, and calcium.

Rice is a mainstay of the human diet for good reason. It is a rich source of energy, free of gluten (which causes allergic reactions in some individuals), easy to digest, low in fat, and packed with vitamins, minerals, and other nutrients. But some key elements, like iron, are lost when the bran on brown rice is stripped off during milling to produce so-called white rice, notes Shannon Pinson, a plant geneticist with the ARS Dale Bumpers National Rice Research Center in Stuttgart, Arkansas.

"More than 70 per cent of the white rice eaten in the US is 'enriched,' meaning that thiamine, niacin, iron, and folic acid have been added to the outside surface of the uncooked white kernels to bring the overall nutritional level up to or higher than that of the whole grain (brown rice) for these vitamins," writes Shannon and coauthors in an article describing their work in the October 2010 issue of the newsletter *Texas Rice*.

But in developing countries where rice is a mainstay, fortifying the grain after milling may not be a viable option. Additionally, the soils in which the crop is grown may be lacking in certain essential minerals. For populations that rely on rice as a staple food, low levels of iron, zinc, or other minerals can lead to nutritional deficiencies that manifest as fatigue, poor immune system function, and other symptoms. Indeed, more than three billion people worldwide suffer from iron or zinc deficiencies in their diets.

Accessions from around the world

To address these concerns, Shannon and her ARS and university colleagues focused their studies on three different groups, or 'populations', of rice – with the most diverse represented by 1643 lines (called 'accessions') collected from 114 countries around the world. In this diverse group, the researchers encountered rice accessions whose grains contained up to nine times the amount of minerals normally observed in standard US varieties.

"We've crossed these accessions with the US cultivar Lemont and are now evaluating the seed of second-generation plants for extreme grain concentrations of these minerals," says Shannon.

Her chief collaborators are David Salt of the University of Aberdeen, United Kingdom (and adjunct professor at Purdue University); Mary Lou Guerinot of Dartmouth College; Lee Tarpley of Texas A&M AgriLife Research, and Ratnaprabha Chittoori, a graduate student being co-mentored by Shannon and Tarpley.

Rice growing in a flooded field at the Texas A&M AgriLife Research Center, in Beaumont, Texas. Scientists are studying the rice under both flooded and unflooded field conditions to see how differences in soil chemistry caused by flooding affect mineral accumulation in rice grains. Here, ARS geneticist Shannon Pinson (left) and AgriLife technician Yao Zhou inspect rice plants in a flooded rice field at the research centre. (Photo by Stephen Ausmus)

Shannon Pinson and AgriLife plant physiologist Lee Tarpley (foreground), and technicians Richard Chase and Jerri Daniel (background) examine diverse rice lines found to have high concentrations of specific minerals in their grain. (Photo by Stephen Ausmus)

The group began the project in 2007. The National Science Foundation is supporting the effort, which includes mapping the approximate locale of the genes on rice's 12 chromosomes and developing marker data to easily detect them during future breeding efforts.

The collection they're working with, the USDA Core Collection, was developed by Wengui Yan at the USDA-ARS Dale Bumpers National Rice Research Center in Stuttgart, Arkansas, in collaboration with the National Plant Germplasm System's National Small Grains Collection, which is maintained in Aberdeen, Idaho, by ARS and includes more than 17,000 total rice accessions.

In search of traits that might influence plant uptake of certain minerals, ARS plant geneticist Shannon Pinson (right) and graduate student Ratnaprabha Chittoori examine roots from a rice plant removed from a field study in Beaumont, Texas. (Photo by Stephen Ausmus)

Minerals of interest

Based on data from side-by-side comparisons conducted under controlled field conditions in Beaumont, Texas, the team identified 40 rice accessions whose grain contained high levels of minerals important not only to human health, but also to that of the rice plant. Take, for example, calcium.

"Calcium strengthens the plant cell wall and decreases permeability of cell membranes, which, in turn, can lead to increased resistance to diseases and environmental stresses," explains Shannon.

Also of interest are rice accessions with low grain levels of certain elements that are toxic to plants and people, such as arsenic and cadmium. Rice with low levels of arsenic or cadmium may have genes that sequester or bind these toxic minerals in leaves instead of grain or that curtail their absorption from contaminated soils or irrigation water – a concern, for example, in parts of Bangladesh where rice is grown as a staple crop and high arsenic levels in water are indigenous.

In the Beaumont studies, the team compared mineral uptake in rice plants grown in flooded and nonflooded fields. Flooding, Shannon explains, changes the soil chemistry and converts some elements into forms more available for mineral uptake and others into less available forms. By studying plants grown in both soil conditions, the team was able to identify even more genes and to gain knowledge about how the genes function in the plant to affect element uptake and accumulation.

To date, the team has identified 127 genes clustered in 40 different chromosome regions that correlate to high concentrations of particular minerals. They have also identified genes affecting other grain features, including shape, and found that grain element accumulation is largely independent of these other grain quality attributes.

Other findings are that:

- There is a wide range of mineral concentrations among rice accessions from around the world.
- Mineral levels fluctuated more when rice was grown in nonflooded fields than in flooded ones.
- Rice with the highest grain levels of certain minerals, like molybdenum (important for plant nitrogen nutrition; high levels help rice cope with acidic soils), sometimes originated from the same geographic region of the world.
- Natural gene variation may be responsible for some of the highest mineral levels in grain.
- Plant maturity influences the amount of mineral absorbed and where it is stored – in leaves, bran, or grain, for example.

Molecular markers for early identification

The team is also developing molecular marker data to quickly identify high-mineral rice plants without growing them to maturity during breeding operations. There is early evidence that high mineral levels (calcium, for example) in the leaves of seedlings of some rice varieties may correlate with high mineral levels in the grain at maturity.

The team is investigating whether root architectural or physiological traits, which are expected to affect rates of mineral uptake from the soil, are causing differences that carry through to differences in grain concentrations. These seedling assays could offer a way for rice breeders to save time and money in selecting top-performing plants for use in developing elite commercial varieties. Much work has yet to be done toward that end, but the stage is set.

The approach could also serve as a useful model for biofortifying other important grains that feed the world.

This research is part of Plant Genetic Resources, Genomics, and Genetic Improvement, an ARS national program (#301) described at www.nps.ars.usda.gov ■

Mapping molecules to solve soil mysteries

AT A GLANCE...

Groundbreaking research is identifying key soil biological functions for disease suppression, organic matter breakdown and nutrient supply.

WESTERN Australian scientists are using new high definition DNA-based sequencing to help unravel the mysteries of the nation's soil biology and how it affects crop production and yield.

This molecular research is being conducted at the University of Western Australia (UWA) as part of the GRDC Soil Biology Initiative II, which is due to wrap up a five-year program in 2014.

UWA Faculty of Science Dean and Winthrop Professor, Tony O'Donnell. (Photo: Cox Inall Communications)

Although DNA-based sequencing technology has been available globally for many years, recent advances in increasing resolution and reducing costs has enabled Australian researchers to incorporate it into a soil quality testing program.

It allows them to study the microorganisms present in the soil, population sizes, activities and how interactions affect agricultural production.

This world-first research is already attracting strong overseas interest – especially from China – according to UWA Faculty of Science Dean and Winthrop Professor, Tony O'Donnell.

"With a trend to more drying climates across the globe, Australia is seen as almost an 'end point' example of what might happen in soils in other countries in years to come," he said.

"It is estimated that 35 per cent of the world's population live on dry lands, so the work we are doing and the data generated has global significance.

"Hopefully we can help keep Australian growers ahead of the game as markets and farming practices adapt to climate change."

Tony said by 2014, UWA researchers aimed to have identified and quantified – using state-of-the-art molecular approaches – the key microbial genes present in the major soil types and land use combinations across all GRDC cropping regions.

"We can use this information, combined with soil quality monitoring data, to see how on-farm management practices – such as till, no-till and compost additions – impact on microorganisms, soil biology, crop productivity and longer term farming sustainability," he said.

The molecular approach to soil monitoring

A single gram of soil can contain thousands of millions of diverse individual organisms that have a vast complexity of interactions.

DNA-based tests allow these soil communities to be assessed at once – quickly and cost effectively.

Researchers are using this sophisticated molecular technology to describe the 'nano-scale' soil engine and detect changes in its 'performance' – as influenced by management and land use.

It is allowing them to measure the impacts of farming practices against factors such as the size of particular fungal or bacterial communities, which in turn can be assessed for their importance in maintaining soil properties such as nutrient availability or disease suppression.

Understanding the molecular signatures

Tony said UWA scientists were using powerful, high resolution and next-generation sequencing to produce billions of 'bar codes' of the organisms present in a one gram soil sample.

He said these 'bar codes' were like bacterial fingerprints and were being used to identify individual microbial species based on sequence variation in their DNA.

"Just as our understanding of the human genome has provided new insights and potential treatments for disease, knowing these 'microbial fingerprints', the soil genome, its changes and interactions will allow us to compare the genome of one paddock with that of another.

"This is in much the same way as we do when studying genetic disorders in humans."

Tony said the challenge was to farm these microbes to deliver functions that maintain soil quality, suppress disease and enhance crop yields.

But currently, Australian soil testing laboratories have limited capacity to offer farmers commercial DNA-based sequencing tests for their soils.

To address this gap, researchers from the GRDC Soil Biology Initiative II in Western Australia (UWA), Victoria (Department of Environment and Primary Industries) and South Australia (South Australian Research and Development Institute) are collaborating on the evaluation of a range of genetic fingerprinting approaches to identify both microbial and nematode species and functional differences between soils.

Finding these quality indicators involves the extraction and sharing of nucleic acids by these three laboratories across Australia. The laboratories are using different analytical and fingerprinting methods to detect the presence and abundance of groups of microorganisms, including bacteria, fungi, mycorrhizae and actinomycetes.

"From this testing we are starting to build what will be a very valuable dataset that links what's happening below the ground to the farming practices used on the ground," Tony said.

The initial molecular/farming systems research was being developed on WA sites where zero-tillage, tillage and organic matter additions had been used for more than 10 years.

"Eventually we hope growers will be able to use these approaches – available through routine soil testing – to indicate yield potential or protein content for a range of cropping practices," he said.

"This research is a vital part of the aim of the Soil Biology Initiative II to equip grain growers with tools and resources to:

- Better manage nutrient input;
- Suppress soil borne diseases without chemicals or with minimum chemical input; and,
- Understand what makes a quality soil able to sustain yields and productivity."

Contact: Tony O'Donnell, 08 6488 1776, email: tony.odonnell@uwa.edu.au ■

Farm efficiencies the key to a profitable future

WITHOUT changing his farming practices to a lower cost system, Ryan Smart couldn't see a sustainable future in agriculture. It was with this in mind that the Keith, South Australia, farmer applied for a Nuffield Scholarship and the rest, as they say, is history.

With increasing costs a fact of life in agriculture, Ryan hoped to investigate efficiencies he could bring to his family's diversified farming system in south-east South Australia.

With such a broad topic, everything from new technologies to practical applications in day-to-day work was on the table.

"Our costs were ever-increasing and I guess I just didn't see a sustainable future in agriculture with our current farming practices – I thought that we needed to really focus on our energy efficiencies and try and capitalise on that," Ryan said.

As is the case for many Nuffield scholars, Ryan's research itinerary started by calling on the organisation's wide-ranging network of scholars and contacts around the world.

"As you get to meet Nuffield Scholars and find out their experiences and their contacts in the industry, all of a sudden you have a whole range of people around the world you need to visit to seek the right information. Initially, that Nuffield worldwide directory was just amazing, and when you eventually meet those people the network becomes even more extended," he says.

Nuffield scholar, Ryan Smart, sees a huge role for state of the art, applied technology in Australia's farming future.

Ryan met many farmers around the world who were using new technology to make farmwork more efficient and ultimately produce a more cost-effective system.

"I met farmers in Canada who were doing fantastic things with their soils and were using state of the art technology to run their farms. It had changed the whole way they were farming, by getting more precise and better information about what they were growing.

"A lot of the technology behind these advancements had come from The Netherlands. Many Dutch farmers had been selling land at home for large sums of money and buying very productive land in Canada. They are now doing some incredible things with the latest farming technology," Ryan says.

Keeping research focussed

With Ryan's family running such a diversified business, there was a whole range of things he could have investigated, making it a challenge to keep the research focussed.

While soil health management and livestock efficiencies were of interest, it was broadacre cropping technology Ryan was keen to focus on.

"I came across Pixel Intelligent (PI) Mapping and emissions technology. This is producing huge amounts of information on growing crops that we've never had before and the technology has the ability to change the way we farm. It was these sorts of technologies being adopted into agriculture that really got me ticking," Ryan enthused.

How will the farm be operating in 10 years?

With technology changing so quickly, if we could fast forward 10 years, what sort of systems would Ryan like to see on his South Australian farm?

Ryan hopes the technology he has seen on his Nuffield travels will not only be in use on his property, but also be much improved by 2023.

"Current emissions technology has produced positive and successful rates of improvement, so I will hopefully be using systems that are well advanced from what they are now, and that they are working at zero emissions and in fact will actually be a food for soils.

I also see a great future with PI mapping using satellite imagery and a whole range of other information – such as evaporation and precipitation – to make an intelligent pixel of the specific crop that you're growing.

I hope I can adopt systems like that as soon as possible in our farming operations to do what we now do better," Ryan said.

While he believes it's too hard to put a dollar figure on the potential benefits from adopting these new technologies until they are tried and tested in Australian-specific conditions, he is confident there are huge efficiencies to be gained.

The Grains Research and Development Corporation supported Ryan's scholarship.

Nuffield Australia is an organisation which provides opportunities to Australian farmers between the ages of 28 and 40 to travel the globe investigating a research topic important to them and Australian agriculture.

To keep up to date with the very latest from the Nuffield organisation, stay connected at www.nuffield.com.au, on twitter @nuffieldaust or on Nuffield Australia's Facebook page. ■

NORTHERN FOCUS
COVERING NORTHERN NSW AND QUEENSLAND

THE RESEARCH VIEW

Managing aphids in canola – what the research tells us

By Melina Miles, Principal Entomologist, Field Crops Entomology, DAFF Queensland, Toowoomba

THERE is a lack of clarity around thresholds for aphids in canola. With variation in the recommendations and difficulties with monitoring aphids effectively in the field, growers and agronomists are finding making decisions about control challenging.

The majority of research on aphid impact on canola has been undertaken in Western Australia by entomologists with DAFWA. The most comprehensive work was undertaken by Francoise Berlandier through the mid 1990s and early 2000s.

The result of this work showed that yield loss was uncommon,

Cabbage aphid infestation on canola. The aphid/crop interaction changes with varieties and the environment.

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.

If 'soft' insecticides are used to treat early aphid infestations, natural enemies such as ladybeetles can help suppress reinfestations.

with 16 of the 17 field trials showing no yield loss even with severe infestations (40–80 per cent of stems infested).

The variety used in the trials was Karoo – an indeterminate variety with the potential to compensate. Francoise concludes that compensation was a major factor in the absence of impact on yield (GRDC final report for DAW489).

Revised recommendation

Resulting from this research was a recommendation to control aphids in canola only when 100 per cent of plants were infested with aphids and there was some additional stress on the crop (water, other insect pests, disease) which would limit compensation. But DAFWA has since revised this recommendation to 'control if more than 20 per cent of plants are infested with aphids'.

The NSW DPI recommendation is to control aphids when more than 50 per cent of plants have clusters 25 mm long on stems or four to five stems per square metre have clusters 50 mm long on stems (*Insect and Mite control in field crops, 2011*). The origin of the NSW threshold is unknown.

Changed aphid/crop interactions

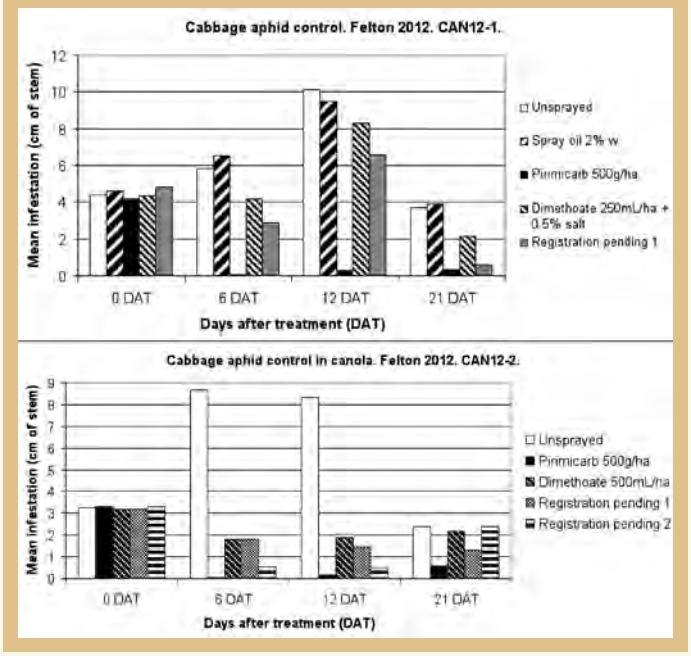
There has been no recent threshold research in the western, southern or northern region. Clearly the availability of varieties with a range of maturities and expansion of canola production into different environments will change the interaction between aphids and the crop. Investigation of these interactions and the conditions under which yield loss may occur is warranted. This is an area DAFF Queensland entomologists plan to research in the current season.

In 2012 DAFF entomologists conducted two trials to evaluate the effectiveness of a range of insecticides. In these two trials we evaluated impact by tagging individual infested stems and revisiting these same stems at each sampling date to look at the change in the infestations.

Trial results (Figure 1)

The results of these trials show that pirimicarb (Pirimor) is very effective in controlling aphid infestations. As a relatively selective

FIGURE 1: Insecticide impact on cabbage aphid populations in canola



product it also has the benefit of preserving natural enemies that then suppress the population growth of surviving aphids.

The spray oil treatment had no impact on the cabbage aphid populations. The addition of salt to the reduced rate dimethoate did not offer an increased efficacy as we have seen with other sucking insects (green mirids for example). This is probably because aphids are generally less mobile than mirids and will insert their proboscis and continue to feed for long periods.

Additional data (not presented here) examined whether there was any difference in the efficacy of the product between heavy infestations (more than five cm stem infested) and lighter infestations (less than two cm stem infested) – there was no difference for the products tested.

The first trial (CAN12-1) shows resurgence in aphid numbers at 12 days after treatment (DAT). The exception to this is the pirimicarb treatment which suppresses the population to such a low rate that the population does not re-establish quickly. Both trials show a natural decline in aphid numbers in the unsprayed plots between 12 DAT and 21 DAT.

This natural decline is often seen in fields once natural enemy numbers (ladybeetles, hoverflies, lacewings, parasitoids wasps) build up, and/or the crop becomes less suitable for aphids as it matures.

The capacity of aphids that survive an insecticide treatment to continue to reproduce and build up in number is one of the main reasons to take care with control decisions – both in terms of the timing and product selection. Broadspectrum insecticides (e.g. organophosphates, synthetic pyrethroids) will reduce aphid numbers, but also kill natural enemies, which means that aphids surviving the insecticide application are less likely to be controlled by predators or parasitoids.

If an aphid infestation is treated early, for example during flowering, there is more time for the population to re-establish and impact on developing and filling pods. But reinfestation may not occur if a 'soft' insecticide (such as pirimicarb) is used and there are good natural enemy populations present to suppress further aphid activity. ■

THE CONSULTANT'S VIEW
CANOLA PESTS IN THE CENTRAL WEST

■ **By Maurie Street, Grain Orana Alliance chief executive officer**

Many growers are recognising the rotational benefits of growing canola in their crop rotations and, with current grain pricing, the profitability of canola is also a strong motivation.

These growers are now becoming comfortable with their management of this once 'unreliable' and 'risky" crop but questions remain unanswered – particularly in relation to some insect pests.

Insecticide seed dressings such as Gaucho are now common place which has removed the need for traditional bare earth sprays for mites or early season sprays for some of the more sporadic early season insect pest that have plagued canola establishment in the past. But increased retention of crop residues has also been blamed for hampered establishment by harbouring of less traditional pests such as slugs, weevils and even slaters.

Later in the season critical in the north

For canola growers in the northern grains region, it is at the other end of the season where some of the burning questions lie. **Aphid** infestations around late flowering and podding are becoming more common place. Dry springs and moisture stress appear to support these epidemics and current industry thresholds seem to be hard to believe.

Recommendations in NSW suggest that more than 50 per cent of plants need to be infected with aphid colonies before spraying is warranted. For many growers and agronomists this level of infestation is quite alarming to see in the paddock. It is often thought that canola is tremendously compensatory and able to cope with such an attack but many would like to see these thresholds reviewed.

Diamond back moth has been a much less common pest but its occurrence is increasing. It is more common in the tougher springs just when the crop needs nothing more to drag it down. The identification and control of DBM infections sometimes misses the mark. The small larvae can often be confused with that of heliothis and the pest's resistance to many common insecticides used for heliothis control can catch some off guard. Even with correct identification advisors need to shift up a gear in their insecticide control options but with some new products entering the market more effective options may soon be available.

Heliothis are still a common pest of podding canola and are often easily controlled with synthetic pyrethroids. But increasing industry stewardship for insecticide resistance has seen some advisors take a more long term approach to product choice for control. Part of this change in approach has also been greater consideration to integrated pest management strategies as advocated by GRDC.

Greater consideration of the presence of predatory or beneficial insects, seasonal conditions and the use of insect thresholds when deciding to, or not to, spray is becoming more common place. But many would agree our confidence in such approaches and our knowledge of beneficial insects and population dynamics needs much improvement.

Unfortunately for many advisors the common comment is that "I can't decide to not spray a paddock in case I get this wrong – the grower will feed me to the insects!"

Canola is losing its 'risky' or 'unreliable' reputation in the north.

Tailoring nutrition to variety

IT'S mid-season and depending on the season, people may be considering in-crop nitrogen (N) application. Research by NSW DPI research agronomists, Matthew Gardner and Rohan Brill under the variety specific agronomy package (VSAP) project (GRDC DAN00169) has shown that there is some variation in how varieties respond to N.

"We have received a lot of feedback over the last two years about EGA Gregory being a difficult variety to achieve good protein," said Matthew.

"Most varieties fit the linear relationship between yield and protein (Figure 1) – where not surprisingly, the higher the yield, the lower the protein for a given amount of N.

Previous VSAP trials throughout the Northern grains region have shown that EGA Gregory and Suntop behave similarly – where both varieties generally achieve high yields and consequently lower protein. EGA Gregory had the lowest grain protein in all trials in 2012 compared to LongReach Spitfire, Livingston and Sunvale. Suntop appears to behave similarly to EGA Gregory in terms of both yield and grain protein accumulation, which means that the N removal on a per hectare basis is equivalent to other varieties.

In the north, nitrogen applied around stem elongation (Z31) tends to help both yield and protein.

LongReach Spitfire appears unique

LongReach Spitfire appears unique in the fact that, unlike EGA Gregory, even when it achieves higher yields it is still able to maintain protein concentration, giving it the potential to have a higher protein yield.

In the northern regions, Longreach Spitfire stands out for protein, generally speaking being one to two per cent higher protein at a given yield point compared to EGA Gregory, particularly where Longreach Spitfire achieves high grain yield.

"This has implications for in-crop nitrogen management. If you are chasing prime hard, and growing Longreach Spitfire you are less likely to have a reliance on in-crop N to achieve protein targets than if you are growing EGA Gregory", said Matthew.

"From a risk management perspective, I would be advising growers to pick a target yield at the start of the year based on soil water and planting time.

Match your fertiliser application at the beginning of the season to meet this target yield. If when you get to stem elongation the season is better than expected, there is an opportunity to take advantage of the season by applying in-crop nitrogen. A reliance on supplying N in-crop is particularly risky in the northern region given the high variability of winter rainfall.

"Research has found that N applied pre-stem elongation contributes to yield response. N applied after flag emergence tends to drive protein and N applied around Z31 (stem elongation) can contribute to both yield and protein," said Matthew.

But what happens if it ends up being a dry finish and you've applied the N?

"We have just gone out to measure the nitrogen in plots from our trials last year and found that 60–80 per cent of the topdressed nitrogen applied in 2012 is still in the system.

But the areas where the trials were conducted have been dry over summer. If you have significant rainfall, there is the potential for denitrification to occur," said Matthew.

Further information: Matt Gardner, matthew.gardner@dpi.nsw.gov.au, 0400 153 556.

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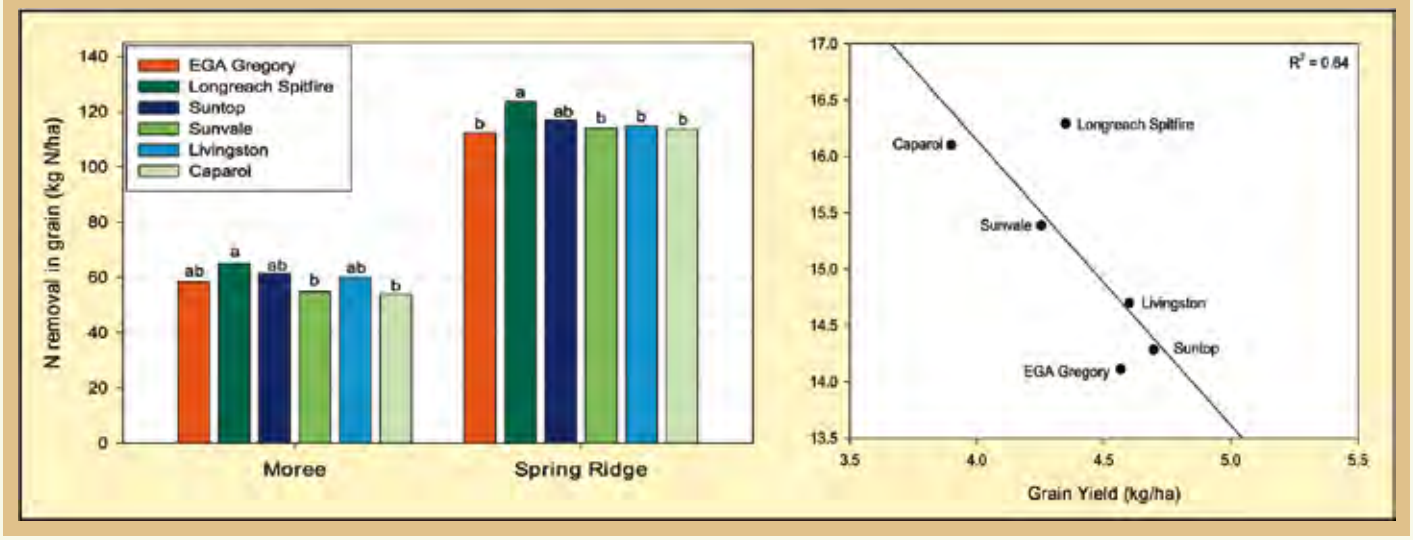
FIGURE 1: a) Grain N removal of six wheat varieties at Moree and Spring Ridge when averaged across six N treatments; and, b) the linear relationship between grain yield and grain protein at Spring Ridge for six wheat varieties in 2012



Two approaches for optimising water productivity

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

AGRICULTURAL Research Service researchers in Bushland, Texas, are helping farmers make the most of their water supplies in a region where they depend on the Ogallala Aquifer, a massive underground reservoir under constant threat of overuse.

Steve Evett, Susan O'Shaughnessy, and their colleagues at the Conservation and Production Research Laboratory are developing and testing soil-water and plant-stress sensors and automated irrigation systems that will irrigate fields only as necessary. Automated systems are considered key to sustainable use of the aquifer and to helping growers reduce water and labor costs.

"As water becomes more precious and the costs to pump it continue to rise, we need to tap the potential of every drop used in agriculture. To do that, we need to develop the best systems possible for accurately scheduling and controlling irrigation," Steve says. The researchers are developing automated irrigation and sensor systems based on two approaches that complement each other, Susan says.

One system applies water based on levels of crop water stress detected by wireless sensors mounted on aboveground moving pipelines of commercial irrigation systems.

In the other system, the researchers are adapting sensor technology designed for urban sites so that it will work in agriculture. It triggers irrigation based on soil water content detected by sensors in fixed locations in the soil.

"Each system has advantages and disadvantages. But the combination of these two networked systems in a single field would be ideal, providing the temporal frequency and spatial coverage needed for monitoring crop water stress and robust control of irrigation," Susan says.

Agricultural engineer Susan O'Shaughnessy views an irrigation prescription map constructed from data collected by an ARS wireless sensor system. The map shows variable crop water needs. Next to her, agricultural engineer Joaquin Casanova tests his prototype TDR (time domain reflectometry) probe. (Photo by Stephen Ausmus)

Sensing water needs from above

Steve, Susan, and their colleagues have filed for a patent on the automated irrigation system. They verified its effectiveness in numerous field studies that compared it with manual irrigation control based on soil water monitoring with a neutron probe. The probe is a research standard for irrigation scheduling, but US growers avoid it due to expense and regulatory burdens.

In one study, the researchers cultivated early and late-maturing sorghum for two years. They used 16 prototype wireless sensors on a centre-pivot irrigation system to monitor crop canopy temperatures. They chose sorghum because of its importance as

A variable-rate centre-pivot irrigation system at Bushland, Texas. Technician Luke Britten (left) and agricultural engineer Susan O'Shaughnessy (right) adjust wireless infrared thermometers in the field while technician Brice Ruthardt (centre) uses a neutron gauge for soil water measurements. (Photo by Stephen Ausmus)

a cash crop in the Southern High Plains and because it withstands water stress. Even so, irrigation plays a significant role in sorghum production in the region, tripling its yields.

Crop canopy temperature was monitored during the growing season as the pivot system moved across the field. Other instruments recorded weather data. The information was processed daily by a computer at the pivot point, which automatically scheduled and delivered irrigations when and where necessary.

"The sensor network was mounted on a six-span centre pivot, but the technology could be adapted to other types of moving or static irrigation systems," Susan says.

An earlier system used to trigger irrigation manually was the Crop Water Stress Index. It calculated water stress based on canopy temperatures and weather factors measured at midday. Because cloud cover and other weather changes could make once-a-day measurements irrelevant to daily water use, the researchers developed a system using continuous measurements over the course of a day and calculated an Integrated Crop Water Stress Index (iCWSI). Irrigations were delivered automatically when and where iCWSI values exceeded a threshold established from previous data.

Besides comparing crop yields and water-use efficiency between automatic and manual control methods, the study also evaluated yields at 'deficit irrigation' levels. This was important since growers in the region sometimes increase profits by irrigating less, which saves on water and pumping costs.

The study results, published in 2012 in *Agricultural Water Management*, showed that the automated method of irrigation scheduling was just as effective as the manual method at both the full and deficit irrigation levels, producing similar grain yields and water-use efficiency levels.

Through a cooperative research and development agreement (CRADA), Steve and his colleagues are modifying Nebraska-based Valmont Industries' commercial irrigation systems in ways that will make them more useful to growers. The research team is integrating the ARS-developed sensor networks and irrigation-control system with the company's variable-rate and centre-pivot irrigation systems.

ARS researchers in Florence, South Carolina; Maricopa, Arizona; Portageville, Missouri; and Stoneville, Mississippi are working with Steve and Valmont on the CRADA as part of an ARS multi-location research plan. The scientists are also developing sensor technology that will allow irrigation levels to be set based on site-specific data, which can be updated based on changing weather conditions.

In a sorghum field, ARS technician Jourdan Bell (left) collects soil water content data from TDR (time-domain reflectometry) probes that measure crop water use. In the background, soil scientist Robert Schwartz observes grain fill in plants grown under deficit irrigation. (Photo by Stephen Ausmus)

Sensing water status below the soil surface

For the automated irrigation system using underground sensors, Steve and his colleagues established a CRADA with Acclima, Inc., of Meridian, Idaho, to create a soil-water sensor designed to measure deeply and accurately. Steve and Bushland researchers Robert Schwartz and Joaquin Casanova are coinventors of the system.

Acclima makes sensor-based irrigation control systems with probes that use time-domain transmission technology, which measures the time required for an electromagnetic pulse to travel along an electrode embedded in the soil. Water slows the signal's travel, and the recorded speed is an accurate representation of the amount of water in the soil. A computer automatically activates water pumps and/or valves at predetermined soil water content levels.

Because Acclima's sensors are designed to control irrigation on tracts of grass, shrubs, and ornamentals, they only need to monitor water content to depths of about 10 to 15 cm. For use in agriculture, the probes need to be installed at depths of 1.2 metres or more and take readings at multiple depths.

Steve and his Acclima partners are developing new technology that uses time-domain reflectometry. They are using hollow, nonconductive, plastic tubes that can be drilled deeper into the soil. The tubes are divided into segments that attach to each other so they can be drilled down to any desired depth.

Prototype designs tested in water and test fluids, in clay and loam soils, and in the field have shown the feasibility of the approach, Steve says. ARS and Acclima have filed for a patent on the technology, which also includes the ability to assess soil salinity.

A new generation of relatively inexpensive wireless sensors is likely to make sensor network systems affordable in the near future, Susan says. Combining these sensor systems and improving and testing control algorithms based on years of data will increase the robustness and effectiveness of the irrigation automation solution.

"This is the future of irrigation, getting water where it is needed when it is needed, and limiting water use to the exact amount that is needed," Steve says.

To reach scientists mentioned in this article, contact Dennis O'Brien, USDA–ARS Information Staff, 5601 Sunnyside Ave., Beltsville, MD 20705-5128; Ph: +1(301) 504-1624.

■

All Ears in the Northern Region

■ Sharon O'Keeffe – Regional Grower Services

There has finally been some soaking rain over much of the Northern Region – it's now time to start planning your weed control and in-crop scouting for disease and pests.

In this article of *All Ears* we have a snapshot of some significant research being carried out in the Northern Region.

I look forward to your feedback and suggestions. I can be contacted at sharon.okeeffe@grdc.com.au or 0409 279 328.

Strategic tillage: Threat to no-till benefits?

Dr Yash Dang, Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA) senior scientist (soil and nutrient management) says balancing soil moisture and weed control has been a dilemma for growers choosing to use strategic tillage to manage difficult-control-weeds within an established no-till farming system.

"Tillage reduced soil moisture at most sites during a 2012 research trial, but this decrease in soil moisture did not adversely affect productivity.

"This could be due to good rainfall received between tillage and prior to seeding and during the crop this year.

"The occurrence of rain between the tillage and sowing or immediately post-sowing is necessary to replenish soil water lost from the seed zone."

This suggests timing of tillage and taking seasonal forecast into consideration is important, Yash said.

Dr Rohan Rainbow, GRDC manager crop protection says GRDC is funding the research in its bid to help growers manage the growing issue of herbicide resistance.

"Conserving soil moisture is the key to maximising yields in the northern grains region from Dubbo in NSW to Emerald in Central Queensland. We certainly don't want to jeopardise the benefits gained from no-till," Rohan said.

"However some weeds, particularly in fallows, can be effectively controlled by a well-timed strategic tillage.

"We are looking forward to more results emerging from the research but the key seems to be timing the tillage with imminent rainfall events where possible."

Five sites

Five fields at sites including Biloela, Condamine, Moonie and Warwick, Queensland and Wee Waa, NSW were selected for the trials.

Yash said grain yields showed little response to tillage and one-time tillage using either chisel or offset disc tended to increase grain yields at all the sites but only significantly at the Condamine site.

A second tillage pass did not further improve the grain yield either at Biloela or Condamine sites and the Kelly chain had no effect on grain yield, he said.

"Net returns per hectare from one-time tillage using either chisel or offset disc in long-term no-till systems were estimated to range from $2.50 to $35.80.

"The highest net return was seen at the Condamine site, which could be the result of higher chickpea prices.

"A second tillage pass at Biloela and Condamine did not further increase net returns.

"Among tillage implements, chisel tillage resulted in higher net returns than offset disc at the Moonie site, and similarly chisel tillage gave better returns than Kelly chain at Wee Waa."

Yash said tillage treatment generally slightly lowered bulk density, soil moisture prior to seeding, soil carbon and available phosphorus in the surface 0–10 cm soil depth.

"Significant negative effect of one-time tillage on soil organic carbon and available phosphorus at the Moonie and Wee Waa sites, and total soil microbial activity at the Warwick site, did not result in adverse effects on productivity and profitability.

"One potential negative effect from tillage is the reduced soil moisture at most sites. But in the 2012 season this decrease in soil moisture did not adversely affect productivity.

"This could be due to good rainfall received between tillage and prior to seeding and again in-crop this year and suggests the importance of timing of tillage and taking seasonal forecast into consideration."

He says it is also important to note that at all sites in the 2012 season, all tillage operations were carried out later in the summer fallow period, after March 3.

Tillage earlier in the fallow period could have had a far greater impact on fallow efficiency and water storage for the following crop, he said.

Benefits widely recognised

The benefits of no-till systems have been widely recognised for many years – with significant benefits in yield and crop

Recent research shows 'one time' tillage may improve yields without losing no-till benefits.

AT A GLANCE…

- Strategic tillage and moisture conservation remain a balancing act for no-till farmers.
- Strategic tillage may offer benefits in controlling resistant or hard-to-control weeds.
- Single tillage events can reduce moisture but may boost yields and profitability in the presence of a high weed burden.
- Future trial work is scheduled to determine the best timing for strategic tillage.
- Early research results show one-time tillage may be able to improve grain yields and profitability without losing the benefits of no-till.

performance especially in lower rainfall environments, erosion control and improved soil health.

Despite these tangible benefits, a recent survey of 55 growers and advisers in the northern grains region indicated that diseases such as crown rot and yellow leaf spot and hard-to-kill weeds such as fleabane, feathertop Rhodes, windmill grass and glyphosate resistant barnyard and liverseed grass, tend to be bigger problems in no-till systems than in systems where tillage is regularly used.

"Recent wet seasons have favoured disease and weed development in no-till farming systems and have put pressure on growers' management strategies to combat heavy infestations of weeds and diseases," Yash said.

"Issues with cost effective management of glyphosate tolerant or resistant weeds has led to an increasing number of growers and their advisors to seriously consider the merits of re-introducing the plough in certain situations."

He said many growers are concerned that even a single tillage operation may be enough to send their soil conditions back to the start of conservation farming systems.

"Many growers are keen to know what would be the level of impact of occasional tillage in no-till arming systems on their soil health and production system."

For more information: Dr Yash Dang, Ph: 07 4529 1245
E: Yash.Dang@science.dsitia.qld.gov.au

Watch for chickpea viruses near canola

Larger canola plantings may have been responsible for unusually severe outbreaks of viruses in the northern region's chickpea crops last year. Joop van Leur, NSW Department of Primary Industries (NSW DPI) plant pathologist says the link is as yet unproven but it is likely canola crops hosted viruses including beet western yellows virus (BWYV) which then spread to chickpeas.

"Canola and turnip weed close to surveyed chickpea paddocks showed high infections of BWYV and turnip mosaic virus (TuMV) and have likely played an important role in the BWYV epidemic in chickpeas," Joop said.

He warns growers that the outbreak of BWYV was especially severe on the Liverpool Plains, NSW last year and was costly as it wiped out several chickpea crops completely.

"Last year the area sown to canola was about five times the long term average because of better prices for canola and poor prices for other crops," Joop said.

"It is likely that virus inoculum builds up in canola over winter and spreads to chickpeas in spring where it can cause severe yield losses."

He says growers need to pay attention to the whole farming system and growing environment of their crops to ensure plants are healthy enough to fight incursions.

"Viruses are more severe in poor growing paddocks," he said.

"A good growing plant seems to have the ability to withstand the virus, so it is well worth following recommended agronomic practices to reduce the chance of virus infection and to increase the ability of the plant to resist the virus."

This includes sowing in standing stubble because virus-spreading aphids tend to be more attracted to plants that are in poor growing paddocks or growing in bare ground, he said.

"We try to identify resistance as part of the breeding program so we can deliver varieties with improved resistance." ■

Grain market outlook

Wheat

Profarmer Grain AUSTRALIA
www.profarmer.com.au July 10, 2013

New Crop

New crop wheat prices rose across all Australian port zones last week to Tuesday the 9th of July. This was due to a weaker A$, CBOT futures ending the week slightly higher and basis firming.

New crop basis is firming as we perceive there has been less grower selling more recently and up till Tuesday night CBOT futures had been coming off. Australian basis is now back near levels seen in late April/May when many parts of south eastern Australia remained dry before the sweeping rains were received at the end of May, which corresponded with basis weakening.

WA – East Coast price spread

The premium new crop WA wheat prices relative to eastern Australia have increased by more then $10 per tonne from the lows reached at the end of May. This is reflecting the drying conditions in parts of the WA wheatbelt warranting a premium to be built into WA prices.

The natural premium that WA should trade over eastern Australia – assuming they were both trading at export parity – is roughly $18 per tonne reflecting the adjustment for FIS in WA vs a track price in the eastern states ($10.50 per tonne) and the freight advantage WA has relative to eastern Australia to key export markets ($5 to $10 per tonne).

Premiums for high protein wheat

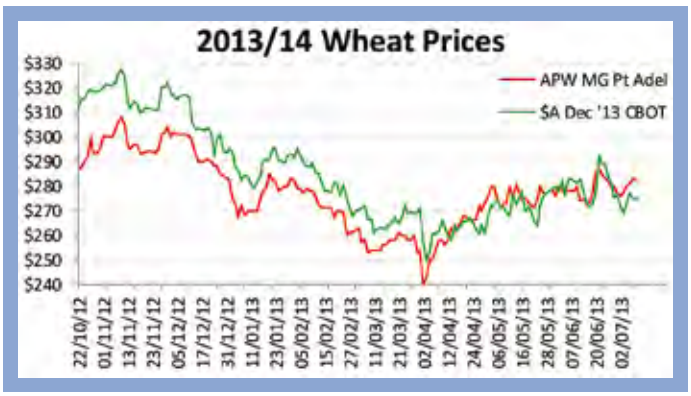
Good production prospects in a number of countries that produce high protein wheat may keep a lid on high protein wheat spreads this year.

Currently production prospects for high protein spring crops through Canada and the US remain good. These are traditional competitors of Australian wheat into Asian markets. There are some question marks over spring wheat in parts of Russia and effective segregation is often a burden to trade. Although high protein wheat produced in Germany looks set for reasonable production.

How the Australian season pans out will have a significant bearing, but the signs at this stage look set for higher protein grade spreads to come in at the lower end of historical premiums. Over the past two years, H1 premiums over APW has ranged from $30 to $4 per tonne.

Forward pricing in July

July is when the northern hemisphere winter wheat harvest is in full swing. Due to this, traditionally it has seldom been the preferred time to forward price the coming year's crop. Northern hemisphere supply hitting the market often sees wheat prices come under pressure. This year is no exception. Risk premium has come out of US$ wheat values pushing price lower. But thankfully for Australian growers this has corresponded with a significant depreciation in the A$/US$ which has helped to maintain forward prices on offer to growers. The chart below plots the A$ value of CBOT futures vs the Port Adelaide APW1 cash price.



It is fraught with danger trying to pick the future direction of the A$, just as it is with trying to pick a future value of international wheat prices.

Any forward sales decision should be made on the basis of mitigating risk. That is, assess whether the price on offer is profitable for your business and assess your production risk. If both boxes are ticked then work out how to sell by using a transparent pricing service such as *Profarmer Price Discovery*.

At this stage, fundamentals are indicating international wheat prices could be lower by the end of the year, and many analysts suggest the A$ could be weaker. But if anyone knew this for sure they would be sitting in Hawaii and working 2 hours a week picking the tops and bottoms of markets.

Barley

Malting barley

The Australia malting barley industry is awash with malt varieties, to the point where some growers are saying it is all too hard. The problem is that each variety seems to need to be segregated because of differences in malting performance. That means there are very few delivery points available.

The list of varieties is seven to eight in most states and covers Baudin, Flagship, Gairdner, Schooner, Sloop, Commander, Buloke, Stirling, Scope, Bass and Vlamingh.

The industry has become too fragmented, which in turn makes it hard for growers to select the optimal variety that also matches where delivery can be made. Then there is the issue of who might stand up to buy any particular variety.

Add to that the probability of actually getting malt grade, and the recent low premiums for malt, and it is no wonder that a lot of growers are turning away from growing malt barley as a specialist crop.

Some growers will grow a malting variety, simply because it yields well and performs well for them in the feed grade. If it happens to go malt it is either a bonus or becomes a nightmare to "claim" the prize if segregations are not easy to find.

In the old regulated days there were often only one or two varieties that could be received as malt, and there were many segregations across the silo network. Today there may be the same number of malt cells, but a very limited number of sites a grower might actually be able to deliver to.

One suggestion is that every time a new variety is released, an old one gets struck off the list. But in a deregulated market, with private ownership of varieties, it is very difficult to force sensible rationalisation.

Even if a variety is not classified as malt standard, it can still

sneak into the international malt barley market – as we have seen with Hindmarsh.

That variety is classified as 'food' grade, and seems to get a small premium, but also seems to find its way into some markets for use as a malt variety.

EU update

The early winter barley harvest in France is underway with excellent yields, underpinning what looks like being a very strong cereal year this year. Yields are coming in above expectations and above those of last year. The quality is good as well.

This follows on from good harvests in Spain and southern Austria. Across the board yields are seen as being 1.5 – 2 tonnes per hectare above average.

The French crop is particularly important because they are a large producer and are a source of malting barley for export. The proportion making malt grade is still unknown, but with a dry 10 days in the forecast in southern France, it looks good for the start of the spring barley harvest as well.

Canada

A large barley crop in Canada is also seen as putting pressure on premiums for malt this year. Crops seem to have survived a very wet period in the third week of June, although some patches will be lost to waterlogging. Around 80 per cent of the crop is rated good or excellent in Saskatchewan.

Pulses

Chickpeas

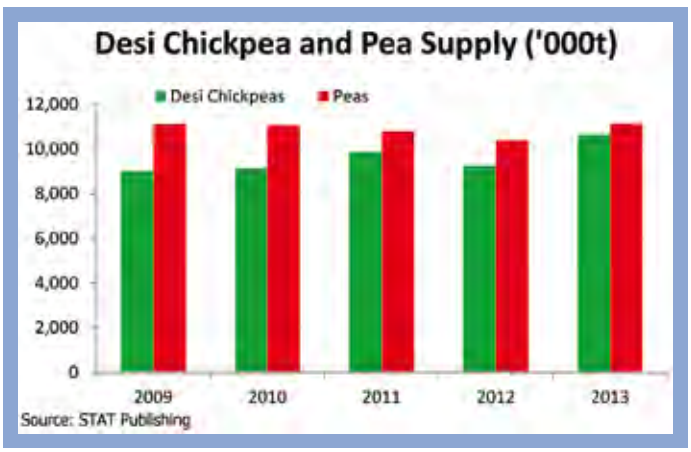
Harvest pressure from India has impacted on Kabuli types in recent weeks, but Desi types have held steady against low supplies now available from Australia. In the October to January period we cleared 78 per cent of our available crop, and we should be sold out by harvest.

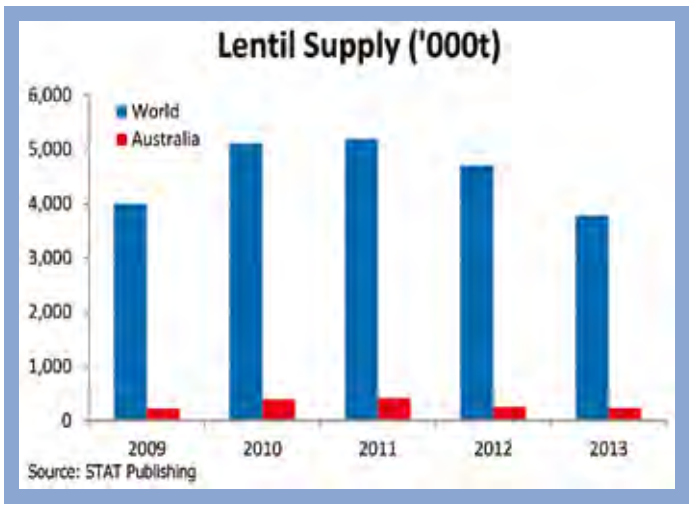
Global production of all types should hit a new record this year, but demand should be able to absorb this. But as consumers respond to price on chickpeas, consumption will only lift if prices ease a little.

The global supply of Desi chickpeas is projected to hit 1.0629 million tonnes in 2013–14. This is up 1.399 mt from last year. Supply from Australia is expected to slip from 792,400 tonnes in 2012–13 to 713,300 t in 2013–14, but this won't help hold prices against the overall increase in output, particularly in India.

Peas

A complicating factor for Desi chickpeas is an expected lift in field pea production and supply in 2013–14. With some





substitution between Desi and field peas, the two prices will be linked. Although consumption of peas is expected to lift against the larger supply (as we expect to see in Desi chickpeas as well), it will be driven by lower prices for the 2013–14 crop.

Lentils

The oversupply of lentils seen in global markets in 2010 and 2011 has passed. Supply this year will dip to a five year low. Recent strong demand for red lentils from India has cleared stocks in Australia and Canada.

Production of lentils is falling because other grain and oilseed crops have become more attractive in most countries. This is important, as consumption of lentils does not respond to price, so the only way a surplus is fixed is by production falling.

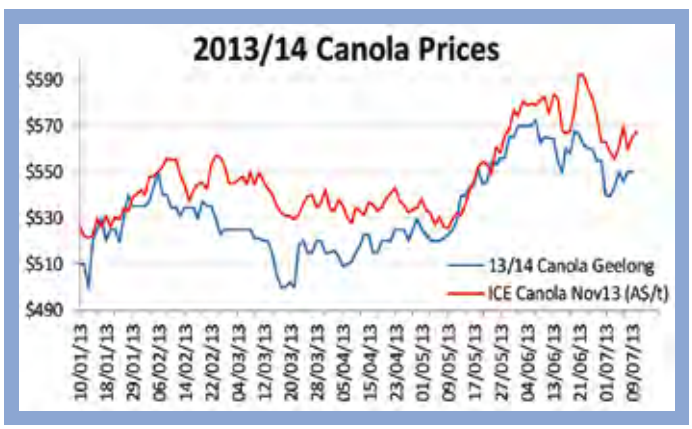
That seems to have happened, and it should underpin lentil prices at more reasonable levels for the 2013–14 season. But those higher prices may attract more land back to lentils, particularly if oilseed prices pull back against a lift in global output this year.

Canola

Australian canola

New crop prices are up $10-15 per tonne across Australian port zones following ICE canola futures higher and a weaker A$ against the Canadian dollar.

Unlike wheat, often prices for canola through July and August provide an opportunity to make a start on forward sales. This is because northern hemisphere oilseed crops are generally in the critical spring period when yields are largely determined and so often risk premiums are building in price during this time. ■



International grain market

■ **International Grains Council Report – July 1, 2013**

PROSPECTS for bumper crops in 2013–14 have pressured grains and oilseeds prices during June. But tightening old crop supplies have provided some support to spot export quotations and near-term futures. The IGC Grains and Oilseeds Index (GOI) of prices fell by 2 per cent month on month, as a 7 per cent decline for wheat and a 3 per cent fall for rice were more than offset by small increases in maize and soybeans.

Total grains (wheat and coarse grains, excluding rice) output is set to rise by 8 per cent in 2013–14, and end-season stocks are expected to increase by 11 per cent – just exceeding 2011–12 levels.

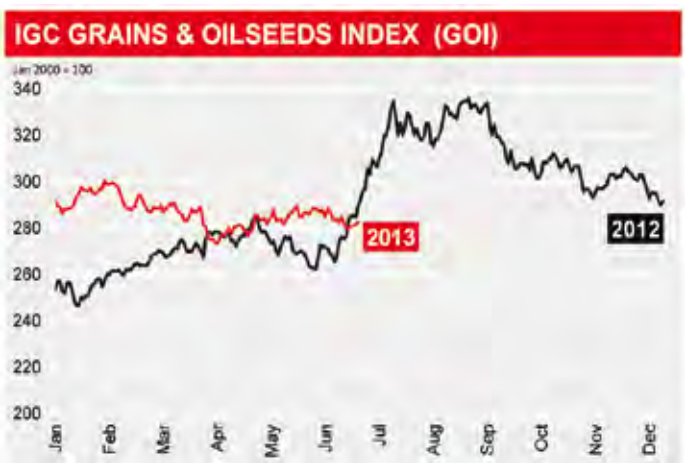
The forecast for world 2013–14 wheat production was raised slightly in June, by 1 million tonnes to 683 mt, but the 4 per cent increase is still expected to be largely absorbed by demand. End-year stocks are forecast up by just 2 mt.

Projected maize output for 2013–14 has also been raised by 1 mt since the last IGC report, on higher expected output in the Black Sea region. Despite strong demand growth, stocks are likely to rise sharply, by an estimated 25 per cent to a 13-year high.

World rice production is expected to expand slightly, to 476 mt, underpinned by increases in Asia. Aggregate end-season stocks are set to rise for the ninth consecutive year, led by 8 per cent growth in major exporters' inventories to a fresh record, mainly reflecting expectations for further increases in Thailand. At around 44 mt they would again exceed annual traded volumes.

Global soybean production is expected to rise to a new record of 284 mt in 2013–14, up 6 per cent on bumper crops in leading producer countries. Aggregate end-season inventories are consequently set to increase by 28 per cent to a three-year high, while global trade could expand by as much as 8 per cent on larger deliveries to Far East Asia, predominately China.

In contrast, the rapeseed/canola market is likely to remain extremely tight in 2013–14, with world carryovers seen declining marginally, including a fall in stocks in key exporter countries.



Wheat

- The IGC GOI wheat sub-Index fell by 7 per cent m/m on prospects for a large world wheat harvest, and a large maize harvest that could potentially limit feed demand for wheat in some countries.
- The forecast for world wheat production in 2013–14 was lifted by 1 mt in June, to 683 mt, up 4 per cent.
- Higher than previously forecast feed and industrial use boosts world consumption and only a modest 2 mt rise in end 2013–14 carryover stocks is expected.
- World trade is forecast to show little change, at 137.7 mt. Import forecasts for China and Iran are raised, while India's projected exports are cut.

Oilseeds

- The IGC GOI soybeans sub-Index rose by 1 per cent month on month as gains in the US, on tight old crop availabilities, and Brazil, more than offset declines in Argentina.
- World output in 2013–14 is tentatively projected to expand by 6 per cent to 284 mt, led by the major producers.
- 2013–14 world carryovers are tentatively expected to increase by 28 per cent to a three-year high, with much of the rise in the major exporters, while trade is expected to rise by 8 per cent.
- The global rapeseed/canola market is set to remain extremely tight in 2013–14 with a further marginal fall in end-season stocks, following a forecast 22 per cent decline in 2012–13. ■

The Black Sea wheat roller coaster continues

■ By Casey Chumrau, US Wheat Associates, Market Analyst

FOLLOWING the Black Sea wheat market over the past few years has felt a little like riding a roller coaster. Large swings in wheat production in Russia, Ukraine and Kazakhstan have led to inconsistent export availability, sending some customers for a loop.

For all three Black Sea countries – Russia, Ukraine and Kazakhstan – USDA expects total wheat production to reach 88.0 million tonnes (mt) in 2013–14, which is just 3 per cent above the five-year average. But the proximity of this projection to the five-year average doesn't provide the whole story. In the past four years, Black Sea production has alternated between reductions of 33 per cent and increases of 35 per cent or more.

If realised, 88 mt in the current marketing year would be a 39 per cent increase from 2012–13.

To further complicate the effect of these large production swings on the world market, in years with lower production, the Black Sea countries often implement or threaten export limitations in order to secure the domestic supply. The threat of a supply restriction often distorts the market as much as an actual export ban or prohibitively high tariff.

Most recently, in October 2012, the agriculture minister announced that Ukrainian wheat exports would be capped at 4.0 million tonnes. The next month, under intense international pressure, he modified the policy to allow shipment of the 5.5 mt already committed. In the following months, the government continued adjusting the maximum-allowed export number. In doing so, exporters rushed to make sales early, potentially distorting the world market. USDA estimates Ukraine's total 2012–13 wheat exports reached 7.0 mt, the number predicted prior to the ban.

In August 2010, Russia implemented a 10-month export ban due to a small harvest and tight domestic supplies. Total exports for marketing year 2010–11 plunged 79 per cent to 3.98 mt, the lowest since 2003-04, and one of the first years Russia started to become a major export competitor.

Sales soared the next year to a record 21.6 mt, only to fall 49 per cent again in 2012–13 to 11.1 mt. Russia threatened export limitations in 2012–13 after a fast start to exports diminished supplies, again pressing domestic wheat prices higher. But prices rose, exports slowed and an official ban was avoided.

In 2013–14, USDA expects Russian exports to rebound 54 per cent to 17.0 mt thanks to higher production.

Production this year hard to forecast

While Russian production certainly will be better than last year, persistent dry weather throughout the spring and into the summer harvest season has again resulted in lower than expected yields of new crop wheat. The last official production estimate released by Russia's agriculture ministry was 54.0 mt. However, the minister recently signaled a probable reduction in that forecast, saying Russia will "harvest no less than 50.0 mt" of wheat in 2013–14.

Two leading Russian analytical firms have also lowered their forecasts for 2013–14 Russian wheat production. Analytical firm SovEcon lowered its forecast range by 1.0 mt to 49.5 mt to 51.5 mt and Russia's Institute for Agricultural Market Studies (IKAR) cut its forecast by 3 per cent to 52.4 mt.

FIGURE 1: Black Sea production and exports

In Ukraine, the wheat crop faces an outlook similar to Russia. It will certainly be larger than last year but has suffered from extremely hot and dry conditions. Analytical firm Agritel termed the early Ukraine harvest as 'disappointing'. In June, USDA lowered its 2013–14 production estimate for Ukraine from 22.0 mt to the current 19.5 mt. If realised, it would be 24 per cent higher than 2012–13 but 4 per cent below the five-year average of 20.3 mt. But in early July, the Ukrainian agricultural minister adjusted his estimated production range 1.0 mt higher to 20.0 to 21.0 mt.

USDA expects Ukrainian exports to reach 8.0 mt, up 14 per cent from last year and slightly higher than the five-year average of 7.82 mt.

The largest 2013–14 wheat production increase of the Black Sea countries by percentage will be Kazakhstan. According to USDA's estimate, Kazak wheat production will reach 14.5 mt, up 47 per cent from the prior year and slightly greater than the five-year average of 14.4 mt. The additional supplies will allow for a 8 per cent increase in exports to 7.0 mt, which would be below the five-year average of 7.52 mt.

Inconsistency means an unreliable supplier

The Black Sea region has emerged as a major competitor in the world wheat market in the past decade. But inconsistent production, unpredictable export supply and the use of export policy restrictions has prevented the region from becoming a reliable supplier year to year.

The outlook is good for 2013–14 so far, but the world will continue watching closely for the next loop of the rollercoaster. ■

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Developing and retaining the farm industry workforce

By Ruth Nettle

AT A GLANCE…

An overview of some key findings from a CRDC research project into addressing farm workforce issues was presented at the recent Australian Cotton Trade Show by Ruth Nettle.

Ruth's main message was that agricultural sectors can't replicate the past ways workforce issues have been addressed to meet today's workforce needs.

Ruth Nettle.

THE operating context of the farm workforce from 10–15 years ago isn't there today – the game has changed. Since 2001 there have been significant changes in Australian society that are also reflected in farming regions. Census information tells us that Australia has higher levels of employment, especially female participation, more part-time and casual work, an ageing population and higher levels of education.

Agriculture relies on people willing to work and/or invest in agriculture and with concentration of land ownership and increased reliance on employed labour, a necessary focus for sustainability in agriculture becomes the relative attractiveness of farms as workplaces. Increasingly, factoring in the people for farm business success – including family members, employees, contractors and farm services mean we need farming systems to fit the people.

Attracting a workforce is difficult in rural and regional Australia, particularly in mine-impacted communities, and with the significant increase in grain production post-drought placing additional burden on the current workforce. Our research found severe shortages, particularly of skills and experience across the value chain with a large number of casual and inexperienced people and fewer senior people, often burnt out from long hours of work and the burden of keeping the system going.

The 'hollowing out' of capacity at the middle-experience level is of concern, and also the impact on productivity across the value chain from high turnover, mistakes and production losses/costs – and managers' time diverted to recruiting/inducting/on-job training. In a survey of cotton growers in the Gwydir Valley of northern NSW (24 farms and a total staff number of 255), half the farms reported vacancies with a total number of jobs available at 50, with about half (22) at the senior/experienced level and half (25) at the entry-level and casual or part time positions.

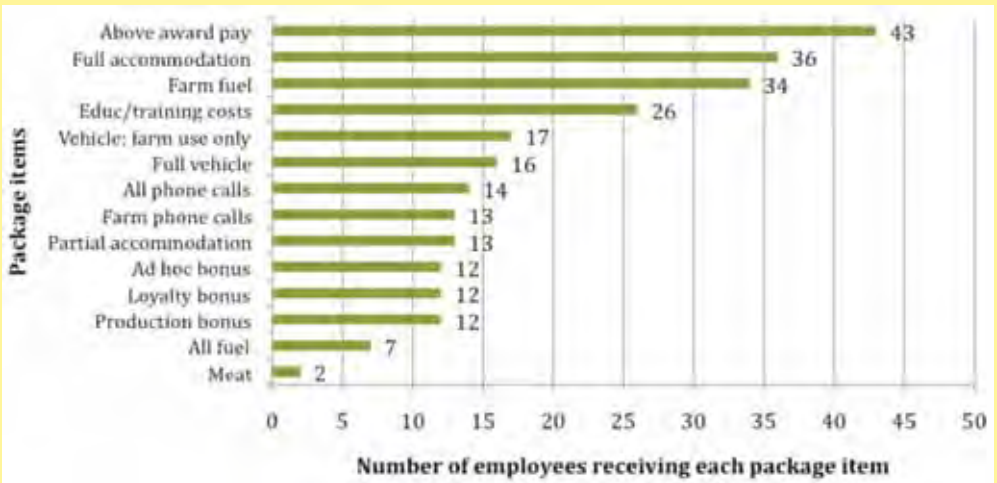
In addition, the use of contractors was extensive and 90 per cent of farms had utilised casual staff, predominantly back-packers to fill workforce gaps. Being able to communicate workforce needs collectively like this is important – particularly to engage with service providers who can help address workforce needs. Expanding the networks for attracting people is part of the new game, particularly as many businesses specialise in workforce recruitment.

There is a sense of hopelessness amongst many that attracting a workforce is impossible because of the inability of the sector to 'compete' with the pay of mining. But our research shows that the reasons people are in farming are different from the reasons pulling people to mining, and the sector can gain advantage in promoting these aspects.

For instance, in the Gwydir when we asked employees what attracted them to cotton they mentioned factors like:

- Being part of a dynamic industry;
- The profitability of the sector and the higher wages cotton provides over other agricultural jobs;

FIGURE 1: Package contents – all employees



- Their employer's reputation;
- The ability to have their own land;
- The lifestyle – that is, variety of work, fresh air; and,
- Being offered a job when they had not intended to work in the industry.

We also found many growers were putting together a 'work package' mixing monetary and non-monetary benefits to meet employee needs. Common packages included well-above award pay, full accommodation, use of farm fuel for private use, full education and training costs, and phone-packages. Finally, the synergy in some skill sets between mining and agriculture could provide future benefits for the farming industry.

Retaining the workforce

Increasingly, retaining a workforce is a key area of competition in rural and regional areas. There is a need to create new career pathways reflecting how the game has changed in the workforce and with increasing use of contractors and new technologies replacing some skill sets.

Retaining staff is not just about reducing turnover costs, and lost farm productivity – even though these are important and costly. More important is the impact that turnover has on the skills and experience available in the sector, but also the career profile and image of the sector. Retaining people is therefore important for industry sustainability.

But there are challenges in retaining staff in the farming industry. Our survey in the Gwydir found that in peak periods two-thirds of cotton industry employees worked a seven-day week, and almost all of the remainder worked a six-day week, and in off-peak periods four out of 10 employees continued to work either a six or seven-day week, particularly managers. Long seasons have exacerbated workloads, but the sustainability of these work patterns needs to be more closely considered.

Clearly, many growers are considering retentions strategies and many reported common strategies like ensuring flexibility in work times and patterns, providing varied work, paying above award, and matching working on effective working relationships with staff and matching work with skill and interests of employees. Fewer growers were deploying more innovative retention strategies such as non-monetary rewards, time-off, mentoring, and career support including equity arrangements (see Figure 2).

These latter strategies reflect commonly used targeted retention strategies in other agricultural industries and corporate organiations. They align with research that suggests the intrinsic motivation of employees is a more important determinant of workplace productivity and innovation than pay.

Providing employees with a degree of autonomy suited to their role, an ability to express mastery of a particular area and to provide strong meaning and purpose to their role are critical for productivity, retention and development. Providing career development and mentoring grows employee commitment – ensuring any promises or obligations of employers and employees are met are all part of the new game for agriculture's workforce.

In summary, cotton regions have a number of strengths for addressing workforce issues and these could be harnessed for longer-term workforce development:

There are opportunities for cotton and the wider farming community to address and grow a workforce for the future. For example:

- Small groups of employers could work together on collective strategies to recruit and group train;
- Develop consistent induction for new and casual entrants – that gives a great experience – it is worth thinking about what reference current backpackers would give to the farming sector?
- Relook at career pathways actually available;
- Work with groups whose job it is to understand and address workforce needs over time;
- Be proactive and form a workforce planning and action group – to oversee work on workforce issues over time – not just for short-term needs.

The farming sector's reputation for innovation is enviable and innovation in farming workforce development is a logical extension for the sector.

***This article builds from research results from the CRDC project: innovative work – cotton workforce development for sustained competitive advantage. This work is being conducted by A/Prof Ruth Nettle and Dr Jennifer Moffatt (University of Melbourne) and the University of Sydney (Workplace Research Centre). For information about the project or for copies of reports, please contact Dr Jennifer Moffatt: jennifer.moffatt@unimelb.edu.au** ■

FIGURE 2: Most effective retention strategies

Sourcing labour through the visa application process

By Matthew Gentle, Legal Practitioner and Principal Migration Consultant

SOURCING labour from overseas is becoming increasingly popular among a range of employers, including those in the farming industry. While the 457 visa has attracted a lot of publicity in recent months, it is just one of the ways that workers can be employed from overseas. Following is a summary of the types of visas available for overseas workers.

Working Holiday Class TZ Subclass 417 visa

- Available to persons from Belgium, Canada, Republic of Cyprus, Denmark, Estonia, Finland, France, Germany, Hong Kong, Ireland, Italy, Japan, South Korea, Malta, Netherlands, Norway, Sweden, Taiwan and United Kingdom;
- 12 month initial visa grant period plus 12 months additional visa grant period ('2nd year') if they undertake 88 days of specified regional work during the initial 12 month visa grant period;
- Main source of seasonal labour for farming businesses and agribusiness in Australia;
- Visa application numbers from countries listed above are 'uncapped'.

Working Holiday Class TZ Subclass 462 visa

- Available to persons from Argentina, Bangladesh, Chile, Indonesia, Iran, Malaysia, Thailand, Turkey, USA and Uruguay;
- 12 month initial visa grant period ONLY – no second year available;
- Visa application numbers are 'capped' (per country 'quota') for countries listed above.

Common criteria/requirements for Subclass 417 and 462 visas

- Purpose of the visa is holiday and undertake work to supplement holiday travels;
- Only available to persons aged between 18–30 years of age;
- Both the Subclass 417 and 462 visas have a six month employer work limitation condition (Condition 8547). That is, they can only work for an employer for six calendar months. For the Subclass 417, the visa holder can return to the previous first year employer for another six months on their second year visa;
- Always check work rights before engaging a working holiday visa holder;
- Employer can use the free Department of Immigration & Citizenship Visa Entitlement Verification Online (VEVO) system or Visa Entitlement Verification Faxback Service 1800 505 550 (toll free);
- Obtain a copy of visa holders' passport bio-data page to enter details into VEVO and check work rights. Visa holders can access VEVO themselves and check and confirm their work rights and provide employers with a printed copy of their VEVO check/extract.

New penalties for employers employing persons that do not have the right to work in Australia

Effective from 1 June 2013, new regulations and penalties apply to employing persons without the right to work. The onus is now on the employer to check and validate work rights regardless of whether the worker(s) are provided by a contractor, labour hire provider or referral business.

To check that a person has legal right to work, use the DIAC free Visa Entitlement Verification Online (VEVO) system or Visa Entitlement Verification Faxback Service 1800 505 550 (toll free). The maximum fine for employing an illegal worker is $3060 for an individual and $15,300 for a company – per illegal worker.

Substantial civil penalties can also apply as well as criminal and aggravated criminal offences.

Transition of Working Holiday makers to 457 Work visas

A subclass 457 visa is the easiest and most efficient way to secure a working holiday visa holder in your business as a skilled employee for the medium term. A 457 visa duration can be between one day and four years. A 457 visa gives temporary resident status with multiple entry in and out of Australia.

There is a three stage application process – on paper or on-line.

Stage 1 – Business applies to be approved as a Standard Business Sponsor (SBS) (application fee is $420). The business must be lawfully operating and meet the training requirement. As to the training requirement, the business must show expenditure equal to one per cent of 'payroll' (wages plus super) on Australian employees for the 12 month period immediately before lodging the SBS application. For example: if the business payroll for the 12 month period before the SBS application is $365,000, then training expenditure must equal $3650. SBS approval is valid for three years and the business must continue to spend one per cent of 'payroll' on training of Australians for each of the three years.

Stage 2 – The business lodges a 457 Nomination application (application fee is $85). You must nominate the most suitable occupation as listed on the 'CSOL' – no tractor/machinery drivers or unskilled farm labour. The current minimum salary level is $51,400 plus super and the salary must be in line with the market salary for the occupation. If Australians employed in the business are doing the same work, the salary for the nominated 457 visa applicant must be the same or very similar and the general terms and conditions of employment (holidays, leave etc) offered must be the same as those available to Australians. An employment agreement or letter of offer is required.

Stage 3 – Potential employee/visa applicant lodges a 457 visa application (application fee is $455). The employee must have the qualifications, skills and experience to perform the role. Character and health requirements must be met. The 457 visa employee must have the genuine intention to perform in the occupation/

position and can only work for the sponsoring employer. English language proficiency is required as well as evidence of health insurance. Adult family members included in the 457 visa application have unrestricted work rights. School age children must attend school and pay temporary resident school fees (depending on state/territory government requirements).

There is monitoring by DIAC of the sponsoring employer regarding sponsorship obligations, visa holders employment in actual occupation, ongoing training expenditure, entitlements paid to employee (wage, super, leave etc).

After two years working on the 457 visa, the 457 visa holder and family members may apply for Employer Sponsored Australian residence sponsored by the same 457 employer.

The Seasonal Worker Program

The Seasonal Worker Program commenced on July 1, 2012 and will operate as part of the Department of Immigration & Citizenship (DIAC) Special Program Subclass 416 visa category through to June 30, 2016. The Department of Education, Employment and Workplace Relations (DEEWR) administers the Seasonal Worker program and is the lead agency.

The Seasonal Worker Program allows employers to sponsor and employ people aged between 21–45 years from East Timor, Kiribati, Nauru, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu to work in their business.

Accessing the seasonal worker program

Only 'Approved Employers' can recruit and sponsor seasonal workers. Approved Employers enter into agreements with the Australian Government and also enter into a sponsorship arrangement with the Department of Immigration and Citizenship. Farmers with unmet demand for labour can either contact an Approved Employer who can manage the recruitment of seasonal workers and take care of all the administrative arrangements; or apply themselves to become an 'Approved Employer'.

'Approved Employers' have a number of responsibilities when participating in the program including responsibility for:

- Organising flights, transport and accommodation for workers;
- Ensuring seasonal workers have access to a minimum average of 30 hours of work per week; and,
- Pastoral care responsibilities, as well as ensuring that the wellbeing of seasonal workers is managed.

Further, Approved Employers have reporting obligations to the Australian Government summarising the work, activities and wellbeing of seasonal workers they employ and providing evidence that workers have been employed and paid in accordance with the program and Australian workplace entitlements.

What work can a seasonal worker undertake?

Seasonal workers are able to work in the farming industry and can undertake the following work in the approved trial locations:

- General farm work;
- Ground preparation, planting, irrigating, harvesting etc of crops;
- Loading trucks, clean, store, operate and maintain equipment (including tractors);
- Weeding, fencing, trenching, draining or otherwise preparing land;
- General farm maintenance; and,
- Tractor operations.

What are the visa conditions and obligations of seasonal workers under the program?

Seasonal workers apply for the Subclass 416 visa and once the visa is granted, they are

- Able to work in Australia for 14 weeks to six months;
- Permitted multiple travel to Australia during this period;
- Permitted to return to work in future years, if they comply with visa conditions;
- Limited to working with the Special Program Sponsor/ Approved Employer;
- Required to maintain private health insurance during their stay;
- Not permitted to apply for another visa while in Australia;
- Required to pay for their own living expenses, other incidentals and part of their international and domestic travel; and,
- Not able to bring dependants with them. ■

The human asset

By John Moloney, Labour Solutions Australia

TO ensure modern agricultural technology is applied correctly, operators must be highly trained and skilled. Apart from the need for highly trained personnel, there is also a need for good, competent workers with the right attitude to doing the more menial tasks.

The supply of labour to the agriculture sector is currently affected by employee perceptions of the career opportunities within agriculture as well as direct competition from sectors requiring similar skills. This is particularly apparent when competent plant operators are being lured by high paying jobs in such industries as mining.

As of 2010–11, there were 307,000 people employed in Australian agriculture. The complete agricultural supply chain, including the affiliated food and fibre industries, provide over 1.6 million jobs to the Australian economy.

But production in the agricultural sector is at risk of being severely inhibited by an undersupply of appropriately skilled labour over the next 10 years if no action is taken.

There are no easy fixes to the labour shortage in agriculture but what is obvious is that agriculture needs to be positioned as an attractive career option. What is also required at the employer level is to create better career prospects with a greater emphasis on human resource needs and skills training.

Current and future scenarios

A research paper published by the Australian Farm Institute in 2010 found that the agriculture sector had a labour shortfall of 96,000 full time and 10,000 part time workers in 2007–08. It also suggested that the shortfall is going to further increase by 2018.

An AgForce survey found that the broadacre beef, sheep and wool, grains and cotton industries in Queensland would need an additional 23,000 full and part time workers over the next two years.

The shortage of agricultural graduates, labour and young farmers is the biggest challenge facing Australian farming. Without the qualified personnel to guide and implement new technology the race to be 'worlds best' is only going to get harder!

In 2012 only 700 agricultural scientists graduated nationally – well shy of the demand for in excess of two thousand graduates. Experienced agronomists are able to command higher salaries than ever before due to the demand and the skill shortage. A number of the larger supply companies are now training their own agronomists in-house.

Trends in employment

According to a survey conducted by the Kondinin Group, almost two thirds (65 per cent) of the farmers surveyed found sourcing reliable and high quality permanent farm labour difficult. This has resulted in an increase in the employment of part time/casual labour.

One of the findings of the report was that 25 per cent of farmers did not interview prospective permanent employees and that 75 per cent of casual employees were also not interviewed. Of more concern was the finding that only about 55 per cent of employers carry out reference checking.

The key challenge for the agricultural industry is to increase its professionalism in its approach to employing staff, whether they be family or non-family members, permanent or casual staff.

Why people leave

There are numerous reasons why people leave agriculture. Employers being more aware of the human resource needs of the employees can address many of these issues.

Key issues identified by the North Australian Rural Careers Network as reasons people leave rural employment are:

- Uncompetitive wages;
- Variations in the handling and payment of overtime;
- Farmers failing to explain clearly the additional non-cash components of their employees' salary package (for example, cooked meals and free or subsidised accommodation);
- Lack of understanding of workers' expectations and needs;
- Poor people management skills;
- Workers not being treated with respect and dignity;
- Lack of professional standards and attitudes as employers;
- Failure to consider the needs of off-farm family members of their employees;
- Poor career development opportunities;
- Lack of recognition and incentives;
- Isolation and the lack of social contact;
- Poor housing conditions and an emphasis on community living; and,
- Lack of emotional support, especially for young people living away from their families.

Possible solutions

Labour Solutions Australia has developed a number of solutions that attempt to address many of the issues raised in the various research documents (see Table 1).

TABLE 1:

Situation	Remedy
Shortfall of seasonal workers	• Utilise travellers
Travellers generally unskilled	• Develop skills training program at a local level
Utilise refugees for certain industries	• Canvas government to make access to funding to assist in resettlement easier for those companies placing personnel
Second tier management shortage	• Source trained personnel from overseas using 457 visas
General lack of HR skills by owners/managers	• Offer short courses in management techniques • Raise awareness of skills needed to retain staff

Accommodation

Lack of suitable accommodation was an area of concern for both permanent and casual employees. The candidates that we are now dealing with have options re employment and often a lack of suitable accommodation can be a deal breaker. There are numerous options today for relocatable accommodation that can be both comfortable and create a sense of community. Candidates are comfortable in paying for accommodation if it is to a standard.

Unfortunately farming and coal or gas go together in a number of regions and rent can be exorbitant.

Workplace standards

Workplace standards need to be adhered to, as the safety of the employee is paramount in today's litigious society. Employers need to offer turnkey implementation of workplace standards. It is highly recommended that employers conduct a bi-annual review of the workplace to ensure compliance with OH&S.

It is imperative that all employees receive an in-depth induction prior to every assignment. This service includes the legislative requirements of OH&S and administrative standards of timesheets and payment, Health and Safety at Work and OHS Policy to include a Code of Conduct, incorporating the expectations of the employer.

It is also a requirement to supply appropriate safety apparel and ensure that appropriate signage is displayed in areas of potential danger. An incident report book is a must and needs to be displayed in an appropriate and easily accessible location.

Overseas options

Labour Solutions Australia has developed a number of key markets using overseas candidates for either permanent or part time/casual positions. Candidates visiting Australia under a 417 working holiday visa are able to apply for a second year visa if they have completed 88 days of specified work in a regional area. Specified work is work that is undertaken in a 'specified' field or industry in a designated regional area.

What this equates to is that a host employer can utilise a second year visa holder for two seasons. This negates the problem often associated with having inexperienced candidates turning up year after year. Labour Solutions Australia has an extensive network of agents and Regional Account Managers spread from northern Australia to southern Australia. This network allows candidates to be moved from one cropping regime to another with relative ease.

Many of these candidates are looking to stay in Australia, as the option of finding work back home is not guaranteed. If these 417 visa holders meet the ANZIC code for skilled occupations they maybe considered for sponsorship.

Our company together with our migration lawyer of choice, Matthew Gentle, has had success in converting 417 visa holders to 457 visa candidates.

The Temporary Work (Skilled) (subclass 457) visa allows eligible employers to address skills shortages that cannot be filled from the local labour market.

The subclass 457 visa program is the most commonly used Australian visa program to sponsor overseas skilled workers on a temporary basis (see Matthew's article P32).

There are well-trained candidates in many overseas markets.

For example, the Philippines is a good source of candidates for trades – Filipinos are generally trained on US equipment.

Ireland/UK and northern Europeans are potential for agricultural trained farmers/industry personnel. It is interesting to note that on a visit to the UK in December 2012 it was apparent that all placements in agricultural courses were fully committed. It is however, still relatively difficult to find a good career in Europe.

There is no easy fix to the farm labour shortage problem but the obvious starting point is to make agriculture an attractive employment option.

In March of this year our company entered into a MOU with an Irish based company involved in agribusiness recruitment. The European marketplace has proven very successful for permanent recruitment. In April of this year we were successful in placing the following candidates:

- An agronomist from Saudi Arabia into an irrigation supply company;
- A farm manager from the UK into an irrigation enterprise in the central west of NSW;
- A diesel mechanic from South Africa into a north west NSW dealership; and,
- A foreman for a farm machinery dealership in south west Queensland.

Refugees

Refugees are another source of potential long-term employees. These people are in Australia and hold appropriate passports and visas to work in Australia. These candidates are keen to be part of our society and to be employed legally. Our company has had great success with refugees working in the meat industry.

One of the bugbears of employers is staff turnover. Staff turnover equals increased costs and loss of revenue:

There is a high turnover of entry level participants in agriculture primary processing. This adds significant recruitment, pre-employment and training costs to a business.

Our company runs a targeted focus on turnover reduction. For example, a typical meat industry business can have a turnover of from 60 to 200 per cent per year on 'new starters'. By utilising refugees, we have been able to achieve levels as low as 20 per cent.

More information Labour Solutions www.laboursolutions.com.au ■

How we stack up in the productivity stakes

PRODUCTIVITY growth has been a key factor driving agricultural output in Australia. More than two-thirds of the current real value of Australian agricultural output can be attributed to productivity growth that has taken place over the past 50 years. With limited land, water and labour available for agriculture, future growth in food production depends on increases in productivity.

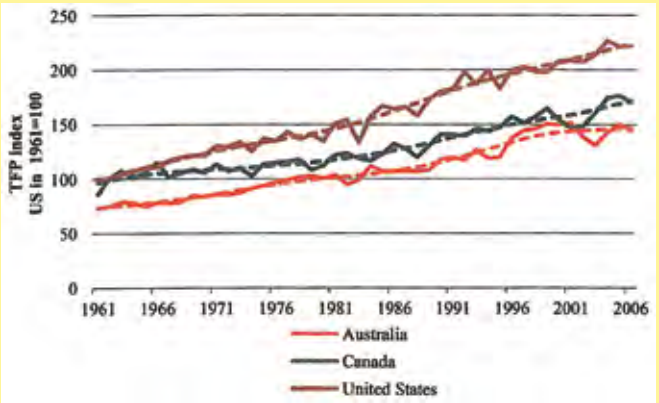
But there are concerns that agricultural productivity growth in Australia and other developing countries such as Canada and the US has been slowing.

A recently released Rural Industries Research and Development Corporation report titled *Cross-country comparisons of agricultural productivity* evaluates how Australian agriculture has performed over the past five decades and considers implications for maintaining competitiveness on global food markets and for contributing to global food security.

The report prepared by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) compares Australian agricultural productivity against two key competitors on global agricultural markets – Canada and the US.

The study found that Australia's agricultural productivity has been maintained relative to the US and improved relative to Canada, despite inherent challenges such as higher climate variability, remoteness from global markets and a smaller capacity for rural R&D (Figure 1).

FIGURE 1: International comparison of agricultural productivity 1961–2006



The comparisons drew on new comparable agricultural productivity data developed as part of an international initiative.

Key findings

The productivity level of Australian agriculture has been below that in Canada and the US over the past five decades. Lower productivity suggests that, in aggregate, Australian agriculture has faced relatively higher production costs and has been less competitive on world markets.

In spite of this, Australian agriculture has maintained its relative productivity at around 70 per cent of the US, which is seen as a global leader in agriculture. Notwithstanding international factors that have also influenced competitiveness on world markets (such as exchange rate fluctuations and shifts in global demand), these results suggest that the competitiveness of Australian agriculture has been maintained relative to these two key competitors.

Long-term productivity growth in Australian agriculture has averaged 1.6 per cent a year, behind the US (1.8 per cent a year) but above Canadian agriculture (1.2 per cent a year) for 1961 to 2006. This growth has accounted for most of the increase in agricultural output, which has tripled over the period in Australia and Canada, and doubled in the US. Less than 25 per cent of Australian output growth has been driven by additional use of market inputs.

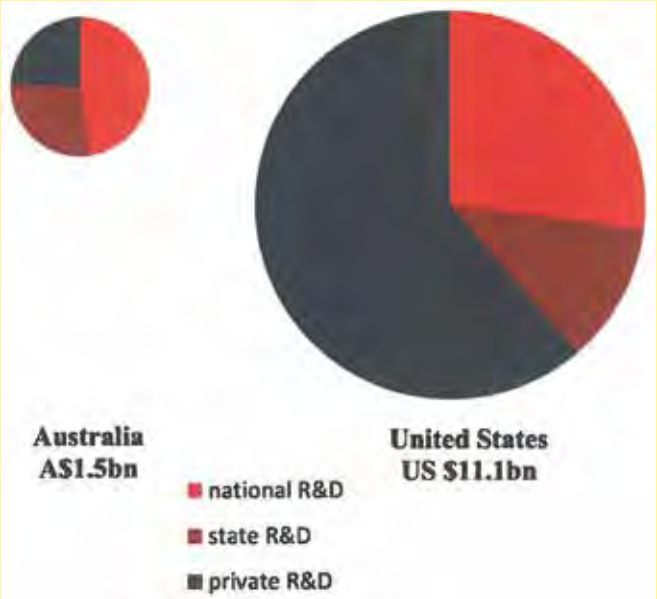
There are many similarities between Australian agriculture and that in other developed countries.

Australia, Canada and the US each export a significant share of their agricultural production and have experienced, over time, a trend towards fewer, larger and more capital intensive farms. Key drivers of productivity growth are also common, including:

- Continued investment in research, development and extension (Figure 2);
- Increased adoption of advanced technologies and practice innovations;
- Improvements in human capital;
- Reallocation of resources and enhanced specialisation; and,
- Greater trade openness and market competition.

But there are also country-specific factors that have

FIGURE 2: Public and private R&D expenditure



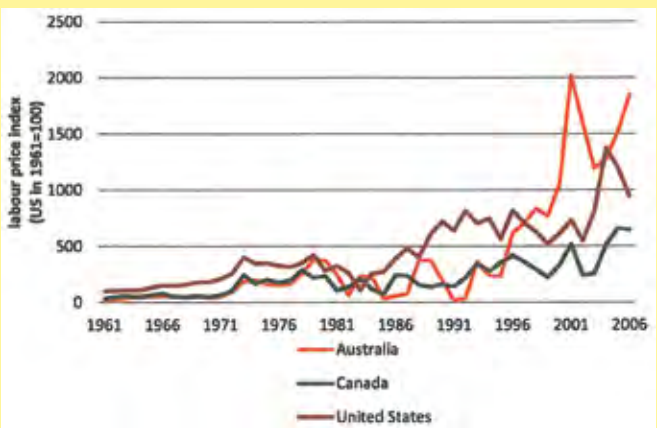
influenced productivity levels and growth rates. Physical, climatic, geographic, economic and policy factors have shaped industry composition and inherent comparative advantages in agricultural production. For example, Australian agriculture has faced challenges associated with a small, remote sector with a highly variable climate.

Many of these factors are beyond the control of industry or governments. Others, such as the removal of distorting price supports and marketing schemes, have improved Australian agricultural productivity, but their payoffs have already been realised.

Nonetheless, there are some areas where further reform could assist in maintaining and enhancing agricultural productivity and competitiveness in Australian agriculture. Two such areas identified in this study include:

- Increasing agricultural innovation spillovers to overcome Australia's small domestic capacity for agricultural R&D and to better leverage international technological advances; and,
- Reducing policy and regulatory constraints that inhibit structural adjustment and efficient resource allocation towards more productive farm enterprises. In particular, improvements in labour market flexibility could yield productivity improvements for many rural businesses. The cost of Australian farm labour inputs have become relatively more costly than those in Canada and the US (Figure 3). In addition, improving access to skilled labour could serve to improve productivity.

FIGURE 3: Agricultural labour price index, 1961–2006



Implications

Increasing agricultural productivity is a critical challenge for Australian agriculture. It is the main mechanism for the sector to maintain and improve its international competitiveness and to contribute to global food supplies.

Australian agriculture's productivity improvements – at 1.6 per cent a year – have continued to increase Australian food production. Given Australia's small domestic population, increases in agricultural production generally increase the surplus available for agricultural export.

But this is only a small part of Australia's food security role. Mostly, it is through providing technical assistance to food-deficient countries – including advice and training to improve their productivity growth – that Australia is likely to make its largest contribution.

Monitoring and evaluating trends in agricultural productivity, including through cross-country comparisons, provides relevant insights into how Australian agriculture has performed over the longterm.

The analysis presented here serves to assist rural R&D managers, policy-makers and other stakeholders in understanding the issues and opportunities for improving agricultural productivity and competitiveness in Australia in order to make strategic investment and policy decisions.

For a copy of the complete RIRDC report – *Cross-country comparisons of agricultural productivity* – written by Yu Sheng and Alistair Davidson of ABARES, go to www.rirdc.gov.au ■

Farming in Foreign Fields...

Family-run with Swiss precision – under the sign of the eagle

TRADITIONALLY, this Swiss farming business – Römerhof – has been run by two brothers from each generation, each with his own area of responsibility – one for agricultural technology, the other for farming.

Jakob Widmer and his brother Roland have stuck to this tradition and intend to hand over the business to their sons too. The oldest son, Jakob Andreas, is already involved since completing his agricultural studies and the other two will follow over the next few years. Jakob Widmer's wife Ruth is also fully integrated into the management team. She is responsible for all office and organisational tasks.

Pilot farm for integrated production

Since 1991 Römerhof has been one of several pilot farms involved in a project covering the whole of Switzerland concerning Integrated Production (IP). Integrated production stands for a method of farming that combines elements of conventional and ecological farming. They apply methods that enable production of everyday food that are friendly to both the environment and animals. The pilot phase of the project was successfully completed in 1995 – since then around 95 per cent of Swiss farmers operate their farms effectively according to the IP Suisse model.

Beef cattle on straw

At Römerhof they have 380 beef cattle: Limousin, Charolais, Belgian Blue and German Holstein black and white as well as red and white. Under the meat label Agri Natura (Terra Swiss), known for natural and especially animal-friendly conditions, the cattle are kept in groups in a large, well-ventilated free running shed. Almost 70 per cent of the covered area is spread with straw – only the feeding area is on a solid floor. They are fed mainly silo maize, grain maize, lucerne and hay.

The Widmers buy in the animals, which arrive aged three to four weeks and remain on the farm for around a year. With a live weight of around 530 kg they are then sent for slaughter.

No problems with western corn root worm

The Römerhof farm has around 70 hectares of land. In addition to the forage required for the beef cattle, they grow 21 hectares of wheat and 14 hectares of sugar beet for market. Then there is around eight hectares of ecological compensation area, which is required to fulfil the requirements of the IP project.

Another special feature stemming from this project is the upkeep of a four-crop rotation for planting maize to maintain a balanced nutrient household. As a result, it is not possible to plant maize on top of maize. Widmer immediately points out a major advantage of this system: "The western corn root worm is unheard of here."

Big on sustainability

Family-run, traditional, environment and animal friendly – these are the things that make the Römerhof what it is. But that is not everything by a long way. That is because the Widmers believe in sustainability in terms of technical equipment as well.

"All the tractors that have arrived on our farm over the years are still here. They have pointed our business in a direction that has enabled us to give our customers continuity and reliability. That is why, even when they get old, they have earned a place on the farm," explains Jakob Widmer.

He runs through his workshop and the adjoining sheds – wherever you look there are gleaming vintage tractors. Even the farm's very first tractor is still there – a black Fordson from 1937 – and an impressive selection of Farmalls from the sixties. "Even back then this tractor showed impressive flexibility," says Jakob.

Mechanisation in the sixties

Jakob Widmer tells how his father faced the challenges of mechanising maize growing in the 1960s. Not much was known about the Central American plant at that time, so his father was entering new territory. He needed flexible machinery and decided on IHC since the company could provide everything necessary for planting and harvesting maize.

The IHC 806, with a – at that time – spectacular 120 hp, was successfully put to work in the maize fields. Widmer shows a photo from 1969: "In this photo you can see the tractor is fitted with a maize picker. The tractor could be converted into a maize picking machine within an hour using the maize header. IHC made everything possible."

These tractors impressed the family so much that the Widmers remained faithful customers of the International Harvester Company (IHC) as they still are today with its successor Case IH.

Symbol for contractor business

In addition to the typical bright red Case IH colours, there is another detail that catches the eye when you see the machinery fleet.

On the engine hood of each vehicle there is a red eagle swooping in a downwards dive.

Jakob Widmer says that this emblem is from the Swiss air force. It is the official emblem of 17 Squadron in Payerne. Widmer, who is a recreational pilot, is good friends with the professionals at the squadron and has been given permission to use the emblem for his contractor business.

"We are recognisable from further away with our mascot. At first glance people can see whose tractor it is. The eagle tells our customers what our business can supply them with: Precision, reliability and uniqueness," says Widmer proudly. ■

UK RESEARCH HIGHLIGHTS TRACKS' BENEFITS IN REDUCING SOIL COMPACTION

Research looking at the effect of tracked and wheeled tractors on soil compaction could benefit farms throughout the UK according to the farmer's son from Hertfordshire who carried out the work. Edward Watson conducted the investigation last year as part of a BSc (Honours) Degree in Agriculture with Mechanisation at Harper Adams University College.

"The dreadful weather in 2012 has caused many farmers to re-evaluate the relative merits of tracked and wheeled high-horsepower tractors, but the lack of data involving current technologies has made it virtually impossible to make accurate assessments," Edward states.

Significant differences exist between the different types of tractor, as well as the different track systems.

Compaction can treble production costs

Soil compaction costs UK agriculture £400–£500 million ($670–$840 million) annually and rectifying the damage can increase the energy, time and costs involved in producing a crop by up to 300 per cent.

The significant soil compaction caused by large tractors can mean that up to 90 per cent of the energy used in cultivations goes to repair damage infl icted by machinery in the first place. Other large equipment such as combines can add significantly to the level of soil damage.

"Last year on our own farm we were looking to change our existing twin-track tractor for a 500 hp-plus wheeled tractor. I was keen to find out more about the implications in terms of ground pressure and soil compaction, but the only research I could find dated back to the 1970s–80s and had been done with small steel-tracked 'crawlers' or wheeled tractors.

These were so different that I decided to carry out scientifically-accurate research." Edward said.

He assessed three different tractors with similar horsepower: a 507hp STS Steiger 500 articulated tractor with four equal-sized wheels was compared with a 491hp twin-track machine and a 535 hp Case IH Quadtrac STX 535 with four independent track units.

Each was driven over sensors placed 50 mm, 250 mm and 450 mm deep across an area of known uniform soil structure at a constant 5 km per hour, first without an implement and then pulling a 7 metre Vaderstad Topdown minimal tillage cultivator, replicated three times.

While the twin-track and wheeled tractors caused similarly

high mean pressures near the surface, the Quadtrac created substantially the lowest, making it least likely to cause detrimental compaction. It caused significantly lower peak pressures (3.88 bar) at 50 mm deep, compared to the twin-track (5.12 bar) and large wheeled machine (4.87 bar). The mean pressure was also significantly lower under the Quadtrac (1.38 bar) than the twin-track (1.94 bar) and wheeled (1.98 bar) tractors.

Big changes in tracked tractors

Commenting on the research Paul Freeman, Product Specialist with Case IH, states: "Tracked tractors have changed beyond all recognition in recent years. The Quadtrac's four independent tracks have obvious benefits over wheeled tractors and avoid the significant drawbacks of twin-track machines which, amongst others, can suffer from power loss and inefficiencies, scuff the soil when turning and are less accurate to steer.

"The Quadtrac transmits its power with virtually no slip, compared with 10 to 12 per cent slip for a wheeled machine of the same power. That greatly reduces soil damage and compaction, makes the most efficient use of fuel and provides higher outputs under a wide range of operating conditions.

"The 'tracks v tyres' debate is also increasingly relevant to combines, which are becoming larger, heavier and more powerful. In addition to improving traction and reducing compaction, tracks provide significantly greater stability, reduce the swaying motion caused by wide headers, result in a more even cut height and enable smoother operation. The number of Case IH Axial Flow combines being ordered with tracks has been increasing each season and we see this trend continuing."

Ancient crop could help safeguard world's wheat

USING a crop popular in the Bronze Age but almost unknown today, University of Sydney scientists have helped pave the way to creating wheat resistant to the fungal disease stem rust.

"Wheat crops worldwide are vulnerable to this fungal disease and it has ruined entire harvests in Africa and the Middle East. The promise of creating wheat with greater resistance to stem rust is of major importance to the agricultural industry," said Professor Harbans Bariana, from the University's Faculty of Agriculture and Environment.

Harbans's student, Dr Sambavisam Periyannan, conducted research in a collaboration with the Faculty's academics, CSIRO and scientists from the US and China on the molecular cloning of stem rust resistance gene Sr33. The results were recently published in the journal *Science*.

The researchers' goal was to understand the molecular structure of a gene that exhibits resistance to the most important stem rust strain, Ug99. An estimated 90 per cent of the world's wheat harvest is vulnerable to Ug99.

The international research team used a gene from goat grass, a plant related to wheat. Goat grass was common over 5000 years ago but is rarely grown today and is a prohibited plant – considered a weed – in Australia.

"Colleagues at the CSIRO confirmed the cloning of Sr33 by inserting it in a modern wheat variety then testing it for stem rust," Harbans said.

Australia ahead of the game

"Australia has been more aware of the risk of stem rust than many other countries because of an epidemic in south-eastern Australia in 1973, which led to the creation of the National Wheat Rust Control Program."

While Australian researchers continued to work on creating resistant strains, the rest of the world's wheat community experienced a wake-up call in 1999 with the detection of the highly virulent Ug99 race of stem rust in Uganda.

The latest edition of *Science* which reported the University's collaborative research, also describes an American study identifying a different gene – Sr35 – in a plant related to wheat and able to provide good levels of stem rust resistance.

"It is in the long-term interest of wheat breeders to develop varieties with broad-spectrum resistance through combinations of different genes, but to do that we need to understand the nature of resistance genes," Harbans said. These studies have delivered robust markers to combine Sr33 and Sr35 in future wheat varieties.

"This latest research marks significant progress towards that long-term goal."

Dr Sambavisam Periyannan is lead author of the *Science* paper. Contributing authors from the Faculty of Agriculture and Environment are Professor Harbans Bariana, Professor Robert McIntosh and Dr Urmil Bansal. ■

Professor Robert McIntosh, Plant Breeding Institute and Professor Hans Bariana, in a wheat field n Kenya, inspecting a Ug99 trial.

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***** *Department of Agriculture, Fisheries and Forestry: DAFF*

MAERSK LINE

Investigating wheat... from an early age

By Nixon, Oberthur Primary School, WA

THE OUTDOOR CLASSROOM

The Outdoor Classroom is an exciting initiative funded by the Parents and Community Group at Oberthur Primary School in the southern suburbs of Perth. Further funding has been provided by local businesses including Bunnings Willetton, RichGro and Willetton Rotary. Seed has been provided by The University of Western Australia, the Department of Agriculture and Food Western Australia, Intergrain Pty Ltd, Canola Breeders Western Australia Pty Ltd and the former Australian Temperate Field Crops Collection.

The establishment of an *Outdoor Classroom* within the Oberthur PS environs has created a resource which facilitates interdisciplinary learning and cross curriculum links. This incorporates science, literacy, numeracy, personal and social development, society and environment and arts and crafts.

The incorporation of the use of the *Outdoor Classroom* into the teaching curricula at Oberthur PS caters for the different learning styles of children and compliments other technology used within the teaching program.

The article provided here is written by Nixon, a Year 6 student, as part of an exercise investigating a collection of wheat varieties representing over 100 years of plant breeding science in Australia.

Watch for more articles from adventures in the *Outdoor Classroom*. The next one will be the unraveling of Miss Roper's Mysterious Soup Mix with a Year 3 class.

THE world's population is estimated to be nine billion in the year 2050. How are we to feed all these people? Wheat is one of our main foods and we have been using it for hundreds of years. Better types of wheat can be made, and there are companies all around the world trying to make them. We need to make new types of wheat that are resistant to diseases and provide more yield.

To appreciate the challenge of feeding this growing population a Year 6 class at Oberthur Primary School, located in Bull Creek just 15 minutes south of Perth, conducted a wheat experiment in 2012. The students grew a historic selection of wheat varieties for an experiment to see how much yield (grains) we could get. More yield additionally means more money for the grower.

In the beginning...

We started in Term 1 by learning about plant biology. We learnt about plant life cycles, capillary action, the pH scale and did an experiment to find out where photosynthesis occurred on the leaf.

In Term 2 we had a visit from Dr Sue Knights, who has a PhD in plant development and growth and specialised in wheat. She helped us understand more about wheat. She gave us a presentation and we learned where in Australia we grow wheat, the history of wheat and where Australia exports it. We learned about three different types of wheat – Federation, Olympic and Emu Rock used by farmers over the history of grain production in Australia. Federation was released around the time of the Australian Federation (1901), Olympic during the Melbourne Olympics in 1956 and Emu Rock is a recent release.

Nixon sitting on the edge of the *Outdoor Classroom* with a hand full of Emu Rock, one of the three wheat varieties tested by the students.

Which one has more yield?

These were the types of wheat we tested. We wanted to see which one had more yield. As I said before, more yield means more money. We planted them three centimeters deep and one handspan away from each other. Twelve seeds of each variety were planted. Each plant had the same amount of water and sunlight. In my opinion, I thought this part of the experiment was the most fun and really enjoyable.

We found it quite a challenge growing the wheat varieties! Our leaves appeared to have mildew on them. They were also very droopy. We thought about it and decided that our soil may be too salty, may have too much acid or alkaline, or too little nutrients in it.

Students with Chris Moore from InterGrain and Oberthur Primary School teacher, Mrs Helen Taylor.

Mr Jones who is a grandparent and a grain grower, heard about our problem at our school sports carnival. He has a big farm in WA, and he has been a farmer for more than 50 years. He took a look at our wheat and suggested that the wheat had too much shade. I would have to agree with Mr Jones' theory, because the wheat would be in shade for a few hours a day, because of the position of the sun.

One week later, we had a visit from Dr Chris Moore, a wheat breeder with InterGrain Pty Ltd based in Perth. He took a look at our wheat and suggested that the soil had too little nitrogen, and we had to apply more. He gave our whole class a presentation. We learned that only 20 per cent of our wheat is used in Australia, the rest is exported to other countries.

Where Chris works, at InterGrain, they make different kinds of wheat that have higher yields and are less affected by diseases. Chris helped in making Emu Rock, the latest breed of wheat the company released in 2011. This presentation was very informative and helped us know about the history of wheat improvement, where Australia grows wheat, where Australia exports wheat, what wheat is used for and the appropriate environment in which to grow wheat.

Sue put more nitrogen in our soil, hoping that this would alleviate the problem. In Term 4 we harvested the wheat. We took the wheat out of the soil and separated the heads and threshed the grain from the heads. We counted the number of ears and determined the final grain yield. The results can be seen in the following table.

	Federation	Olympic	Emu Rock
Total weight of straw+grain (g)	870	900	910
Weight of ears (g)	150	120	256
Number of ears	104	90	168
Final weight of grain (g)	15	25	100

I learnt that Emu rock did very well in our experiment and it shows that we are really improving our wheat as this is one of the most recent varieties developed. ■

Chris Moore with keen onlookers from *The Outdoor Classroom.*

District Reports…

July–August 2013

Western region

NORTH

What a difference a few weeks can make. It was raining last time I wrote and it did for a week afterwards but we are now into our fifth week without significant rain. It is very dry in the landscape and crops are going backward. June rainfall in Geraldton was the second driest recorded. Many parts of the region had under 5 mm for the month of June.

Wheat is mostly at the tillering stage with some pushed along to stem elongation and starting to boot. Some have gone backward and are browning off.

Canola and lupin crops are starting to flower.

Annual pastures have vanished and stock farmers are hand feeding again. Perennial pastures are faring better but still desperately need rain.

A couple of strips in the landscape had double digit rain in late June and these areas look good. Rain is forecast for later this week and again next week. I hope there is a good drop in it for the region.

Peter Norris
Agronomy For Profit and Synergy Consulting, Geraldton
July 8, 2013

SOUTH COAST

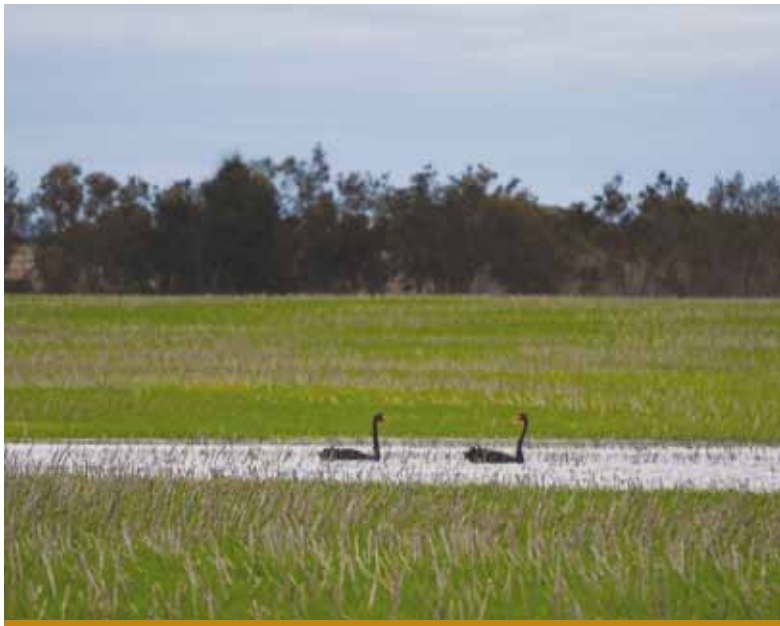
Seasonal conditions on the South Coast have been mixed over the past two months. Good rainfall continued during May following on from very good March and April rainfall. For some, the May rainfall has continued to set up a very good season – this is especially evident in the Mallee where crops are looking extremely good.

On the other hand areas within 30–40 km of the coast are having to contend with some waterlogging and re-seeding due to seed burst. Fortunately June was quite dry and sunny, allowing waterlogged crops to recover.

Most crops are quite advanced. Early sown canola is at 50 per cent flower, barley at 1st to 2nd node and early sown wheat at 1st node. Most post emergent weed control is now complete apart from later May and early June sown crops.

Top-up nitrogen is continuing to be applied with growers trying to assess how much to apply to take advantage of such a good start and a full profile of stored soil moisture.

Insects are providing some problems. Green peach and turnip aphids have been troublesome in canola, in addition most canola



Black swans in a lake that has formed in a paddock sown to Hindmarsh barley into a 2012 canola stubble. This is a common scene in the wet areas of the South Coast.

crops have low levels of diamondback moth caterpillars which could be a potential problem as temperatures start to rise.

Aphids are also widespread in cereal crops and pulse crops.

In general the South Coast is looking very good apart from some waterlogging. Most growers are feeling very optimistic about this season and are already starting to plan for a big harvest and all the logistical problems this may cause in moving grain from paddock to port.

Quenten Knight,
Agronomist, Precision Agronomics Australia
July 4, 2013

Southern region

SOUTH AUSTRALIA

Weather

- Temperatures during May were above average across the state with average to slightly below average temperatures during June.
- There have been widespread frequent frosts in the south east since mid June, but very few in the rest of the state.
- Rainfall during May was average to slightly above average with above to well above average rainfall in June.
- Several centres in the Upper North received record falls for June.
- Despite a dry summer and early autumn, rainfall for May and June is well above that received last year.
- Temperatures during May and June have also been milder than last year, with far fewer frosts.

District Reports...

July–August 2013

Crops

- Conditions during seeding were ideal in most areas of the state with adequate moisture enabling the crop to be sown earlier than normal.
- An increased area of crop was sown dry in April and this has emerged well and grown rapidly with the mild conditions in May.
- Dry sowing has generally been successful in most parts of the state, although some crops have moderate to high levels of grass weeds where pre-emergent herbicides have not worked effectively.
- Warm to mild conditions during May and early June have enabled crops to grow rapidly and most are further advanced than normal for this time of the year.
- There has been a slight increase in the area sown to wheat with a reduction in the area sown to barley and canola compared to last season.
- Soil moisture levels are now good to excellent across the state and most districts have average to above average yield potential.
- With the well above average June rainfall, some crops have become waterlogged, particularly on Kangaroo Island.
- There has been an increase in the area sown to Clearfield varieties to achieve grass weed control when sowing early.
- Disease levels are generally very low across the state, although in high rainfall areas growers are applying fungicides to bean crops to slow disease build-up.
- There has been far less damage to emerging crops from insects and other pests this season, particularly snails, slugs and millipedes.
- Following above average rainfall in June and good soil moisture reserves, some growers have commenced applying addition nitrogen fertiliser to canola and cereal crops.
- Early indications are that there will be significantly more nitrogen fertiliser applied than normal.
- Early-sown cereal crops which have not received adequate nitrogen are beginning to show signs of nitrogen deficiency, particularly on light sandy soils.
- Post-emergent weed control has commenced in early-sown crops.

Pastures

- Rain in late April and mild conditions during May enabled pastures to grow rapidly in most areas of the state.
- In mid June, cool to cold conditions slowed pasture growth and red legged earth mite and lucerne flea began to cause damage to pastures, particularly in the south east.
- Livestock are in average to good condition throughout the state.

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

Brought to you in association with JOHN DEERE

	25yr Annual Average (mm)	2013 rainfall to date (mm)	Summer		Autumn		Winter		Spring	
			25yr Annual Average (mm)	2012–13	25yr Annual Average (mm)	2013	25yr Annual Average (mm)	2013 to date	25yr Annual Average (mm)	2012
Emerald Qld	537	275	239	178	110	136	66	2	120	62
Toowoomba Qld	646	877	261	657	135	205	86	71	176	132
Roma Qld	577	208	232	144	132	107	75	8	139	61
Goondiwindi Qld	607	489	235	337	135	182	101	26	141	46
Narrabri NSW	631	427	221	221	124	169	132	71	163	26
Gunnedah NSW	654	280	226	254	124	83	128	0	184	58
Dubbo NSW	596	326	192	97	129	108	129	126	157	79
West Wyalong NSW	435	252	109	95	88	93	118	83	127	73
Wagga Wagga NSW	530	234	129	67	115	99	154	90	146	97
Swan Hill Vic	324	108	72	25	67	30	94	63	98	53
Bendigo Vic	515	191	109	71	106	69	176	72	142	57
Horsham Vic	364	160	80	45	72	41	133	90	110	58
Lake Bolac Vic	555	170	121	36	98	71	160	85	154	112
Murray Bridge SA	352	221	62	47	71	56	124	134	102	49
Kadina SA	331	208	53	25	74	106	117	81	91	29
Cummins SA	377	231	47	13	81	100	173	120	83	48
Esperance WA	590	428	75	50	135	301	254	91	140	138
Wagin WA	394	215	43	96	92	163	180	23	86	92
Northam WA	389	168	41	48	82	132	195	11	81	101
Mingenew WA	356	178	31	11	91	170	181	4	63	77
Moora WA	379	151	40	36	89	110	187	18	71	115
Mullewa WA	320	100	49	21	93	85	138	5	46	54

Last rainfall reading July 10, 2013.

District Reports...

July–August 2013

- There have been issues with pregnancy toxemia in lactating ewes in a number of districts.
- Marking percentages have been lower than normal in areas with low pasture feed supplies resulting in high death rates of young lambs.

PIRSA Rural Solutions
June 28, 2013

VICTORIAN MALLEE

'Cautiously optimistic' is the cliché term I would use to define attitudes in the Victorian Mallee farming environment at the moment.

Leading up to sowing this year's crop, we endured the driest summer in a long time. This meant very little summer weed control was needed, but left many feeling anxious about stored moisture. Crops were sown dry and timely follow-up rain saw a staggered, but generally satisfactory emergence.

Canola ran out of vigour on some heavy soils where it shot and couldn't penetrate the press wheel furrow where rain had run and sealed the surface. These flats have slowly emerged now.

The greatest implication has been the high numbers of winter weeds, particularly volunteers, from last year's crop. Volunteer canola in cereals, and cereals in cereal crops have proven to be the most challenging and costly problems endured. Crop competition has been an impediment and herbicide options and timings have been chosen carefully for the best outcome.

We were lucky to receive 50 mm of rain in June which promoted early growth and provided good conditions for spraying weeds.

July started with typical cold temperatures, some frosts and a short dry period. Crops steadied their growth and showed symptoms of nitrogen deficiency. The majority of growers' topdressing urea strategy was applied ahead of a mid-July rain forecast. Some had urea out earlier and were lucky to receive five to seven mm on top of that.

Most weed spraying was finished by mid July allowing time to spread urea. The nitrogen decision raised some good discussion with growers. We started with dry soils, received good follow-up rain, and forecasts are optimistic for the coming months. But certain soil types are quite dry and risk and cost had to be weighed up.

Many have topdressed reliable soil types and crops demanding nitrogen, such as canola and Hindmarsh barley, leaving lower yield potential wheat for the next rainfall event.

Some crops will require a follow up herbicide to control volunteers. Due to the dry start there were also some insects in crops. Lucerne flea and some bryobia and balaustium mites infested canola, vetch and cereals. The use of imadacloprid as a seed treatment has proven to be a good integrated pest management strategy this year.

We can now expect a typical cold Mallee winter and look to the spring for moisture and sunshine to finish the season off. Having saved dollars on summer spraying, an ideal finish, linked with good grain prices can make this a profitable season for many growers.

Simon Severin
Dodgshun Medlin Agricultural Management, Swan Hill
July 11, 2013

EASTERN MURRAY VALLEY

Following a very dry autumn two inches of rain on June 1 was a brilliant start to winter. A further inch of rain (or more in places) on the June long weekend really saturated the region and made for some wet paddocks. A three week dry run of weather since means paddocks currently have about 50 mm stored moisture.

Canola development is running two to four weeks behind normal due to late emergence and slow early growth with dry May conditions. Increased mite numbers in recent years and isolated slug infested paddocks has meant regular monitoring and quick action when necessary.

The majority of wheat is early tillering – paddocks sown early May into moisture are mid-tillering. Yellow leaf spot infection has been spotted this week in paddocks with retained one to two year old stubble.

Fingers crossed the rain front this weekend delivers as the region urgently requires some follow-up rain to incorporate urea with generally low soil nitrogen reserves again. Nitrogen

deficiency symptoms are starting to show up in the more advanced crops.

Rosie Dye
Agronomist, I.K. Caldwell, Corowa NSW
July 9, 2013

Northern region

DARLING DOWNS

Winter crop

What a start to the winter season! We have seen some very good establishment with plant populations close to the desired levels, and strong growth as the crops make use firstly of good June rainfall and then of the recent warm and mostly sunny weather.

The wheat and barley areas are well up on last season by 50 per cent and 30 per cent respectively, due to the strong prices and good moisture reserves. The chickpea area is similar to last winter's large planting.

There has been more than usual double cropping into summer ground, following the above average rain over the past four months, with up to 30 per cent of the cereal crop and 70 per cent of the chickpea crop double cropped.

Earlier planted oats are well into the grazing phase, with more varieties taking rust this year, but the grain cereals are generally disease free. There has only been the odd net blotch in barley and yellow spot in wheat. These cereals are approaching the in-crop weed control stage.

Chickpeas are ranging from the emergence phase to 12 nodes, but some ascochyta has been detected on the Eastern Downs, probably accentuated by stress from the cool wet conditions in June. One side-effect of the recent warm temperatures has been an increase in tillering in the cereals, whilst the rainfall events have allowed good secondary root development.

Summer outlook

The high prices for last season's sorghum is expected to encourage another strong plant of sorghum this summer, but there is renewed interest in cotton especially after such good dryland yields this year and the fall in the dollar improving forward prices.

Irrigated cotton will have another big year due to full water storages and could be 20 per cent up on last season. The dryland area will depend on rainfall. The stored moisture levels are better than normal for this stage of the seasonal cycle.

All in all, a large summer crop plant is expected.

Hugh Reardon-Smith
Agronomist, Landmark Pittsworth
July 11, 2013

CENTRAL QUEENSLAND

Weather

Most growers experienced at least one – and sometimes many delays – planting their winter crop due to rain during May with small (5–15 mm), frequent (almost weekly for some) rainfall events across the whole grain growing area of CQ.

All of the district received below average rainfall for June. While CQ farmers don't want rain on high moisture grain sorghum crops awaiting harvest, winter crops would certainly benefit from 25–50 mm of rain. Frost prone areas have experienced 6–12 frosts during June.

Summer crop

Sorghum: About 100,000 hectares of sorghum was planted in CQ this summer, much of it in late January or early February. This has resulted in a late finish to the crop and very slow dry down for harvest. Currently, sorghum crops have either been sprayed out or frosted. Some farmers are harvesting high moisture crops and drying the grain to capture the current high prices on offer (over $300 per tonne port).

Yields have generally been about average (3.0 tonnes per hectare) with a few reports of excellent crops (four to five tonnes per hectare or greater). In paddocks where grass weed control was poor or crop nutrition – especially nitrogen – was inadequate, yields are low (1.5 tonnes per hectare). Ergot is present in some crops and losses due to wild pig and bird damage an issue for many growers.

Mungbeans: A larger area (more than 15,000 hectares) of mungbeans was planted especially in the Callide and to a lesser extent the Dawson and Central Highlands. Yields are generally good. Most crops have been harvested. Puffy pod – a disease which devastated the summer mungbeans crop in 2012 – was not an issue this summer – thank heavens!

Sunflower: A small area of sunflower was planted (over

Sorghum being harvested on Ross Armstrong's property 'Coolibah Plains' Comet.

District Reports…

July–August 2013

10,000 hectares) with all crops currently post flowering and drying down. Crops yields are expected to be moderate to good.

Winter crop

The area planted to winter crop was larger then normal, due to a smaller summer crop and an increase in the area planted to chickpeas. For many farmers, winter crop planting was later then normal and one of the most drawn-out and protracted plantings for many years.

Frequent small rainfall events interrupted planting for many. It was too dry for some to start at the normal time (north of Clermont) and too wet for others to keep planting (Clermont to Capella). Expect winter crop yield to be moderate or less if good in-crop rainfall is not received.

Wheat planting (expected area of 180,000–200,000 hectares) was not completed until mid June.

Chickpea planting (80,000–100,000 hectares) also finished late on many farms. Ascochyta blight has been recorded in some crops. In the past, CQ chickpea growers have been vigilant and used best practice to maintain an Ascochyta blight free status in the CQ chickpea crop by planting only CQ grown seed and using appropriate rotations.

The best and worst of chickpea disease management is currently on display with some growers applying a number of sprays to protect their crop prior to rain and prevent an AB disease outbreak – while near neighbours have planted back to back chickpeas, increasing the opportunity for disease spread.

Livestock and pastures

In many districts of the Central Highlands and the Dawson and Callide the grass cover during late summer and autumn was excellent. The exceptions were south of Springsure and most areas west of Emerald. There has been no substantial rain to grow grass so these areas are dry, either short on grass and /or stock water. Recent frost and high stock numbers have substantially reduced pasture cover in many paddocks. Cattle prices remain low.

Water

Flooding within many river and creek systems restored stock water in most of CQ but is a major issue for some properties south and southwest of Springsure and west of Emerald and north of Clermont. There are a couple of properties SW of Springsure with adequate grass but have had to destock due to lack of stock water.

Maurie Conway
Principal Technical Officer
Grower Solutions for Central Queensland
Agri-Science, Emerald, Qld
July 5, 2013

Gregory wheat planted early May on Shane and Cassye Eden, 'Kilmore' Gindie.

ANSWER TO IAN'S MYSTERY TRACTOR QUIZ

The wee tractor is a 1948 Gunsmith, manufactured by Farm Facilities Ltd. of Twickenham, UK and sold in New South Wales by Norton Tootill and Co, of King Street, Sydney. Designed for market gardens, the unit was powered by a J.A. Prestwick (JAP) single cylinder air cooled four stroke engine of 395 cc capacity which developed 5 hp. Drive to the gearbox was by a 4 inch diameter leather belt. This example restored by IMJ.

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