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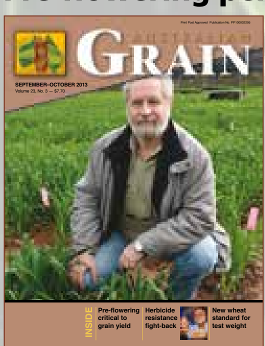
FRONT COVER

Pre-flowering period is critical



SARDI crop ecophysiologist Victor Sadras, says it's time for growers to focus more attention on the period leading up to – and just after flowering – for maximum wheat yields.
See article P 4.

Contents

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

NOTHING like a bit of travel to make you appreciate what you have at home. Having just returned from a farm study tour of Turkey and eastern Europe, this is a sentiment I'm sure I share with my 26 travelling companions – grain and cotton farmers from all corners of Australia.

Turkey is a country very much on the move, and by all appearances, that move is generally in the right direction. The nation's roads, and other pieces of nation-building infrastructure, are first class. Combine this with a well educated population which is keen to work and individually prosper, a favourable climate, plenty of natural resources and a strong agriculture, and you've got a country going places – as long as those pesky governments don't get in the way too much (sound familiar?).

But just across the Black Sea to the north, and into Ukraine, you get another impression entirely – and I'm not talking about the impressions left on your butt from the pot-holed roads. Ukraine is an intriguing mystery on all fronts, particularly agriculture. Boasting one of the most extensive areas of beautiful farming soil in the world and a reasonably reliable climate, this country's agriculture should be the engine room for economic and social progress for all Ukrainians. But tragically, this is not the case. Locals lament that the nation's political power (read here, wealth) is in the hands of a very small and very influential group who were first to capitalise on the chaos that followed the break up of the Soviet Union in 1991.

Our farm tour group then travelled west, into Poland and the European Union, and seemingly, another planet. This was a world of fantastic roads and infrastructure, comparative political and social order – and farm subsidies. And the more to the west we travelled into Europe, the more prosperous were the locals, particularly the highly subsidised farmers, and the more stable were the governments.

The strong link between national wealth being shared among all the citizens of that country, and the country's degree of political stability and integrity, was unmistakable. It's a great 'take home' message from any overseas travel you might do.

New chair at the GRDC

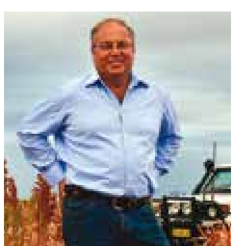
Back on more familiar shores, northern New South Wales grain grower and company director Richard Clark has been appointed as the new Chair of the Grains Research and Development Corporation (GRDC) Board.

Richard has replaced Keith Perrett who has held the Chair's position for the past six years.

In partnership with his wife Barbara, Richard runs an intensive 1340 hectare grain enterprise at Tulloona. He also has considerable experience as a chairman and director of companies in the agricultural sector, including a number involved in agricultural research.

Australian Grain congratulates Richard on his appointment and wishes Keith all the best in his future endeavours. Both men have been loyal and hard-working servants of the industry.

Here's hoping for a great finish to the season in your patch and a smooth harvest of plenty of grain.



Richard Clark, the new Chair of the GRDC.

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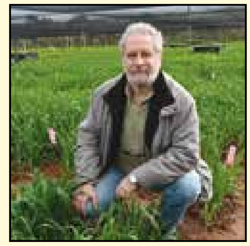
In this issue…

Pre-flowering critical for yield



A huge amount of attention is on managing wheat crops through grain fill to maximise yield. But Victor Sadras says growers should think more about the period of crop development in the lead-up to, and just after flowering, when grain number rather than size is determined. He says a plant's grain number and subsequently much of the crop's final yield, is defined during this period.

See article . . . . Page 4

Fighting back against glyphosate resistance

One key to addressing the threat posed by glyphosate resistance is early detection. Scientists can now determine whether a weed will resist glyphosate by measuring the amount of a compound known as "shikimate" in its tissues.

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Classic Tractors

The dark secret: The night was black as pitch and the lashing rain continued to bucket down. The driver of the old Albion rubbed his tired eyes as he strained to penetrate the feeble glow from the headlamps and endeavoured to avoid the worst of the potholes. The year was 1928, and it was four hours since the lorry, with its furtive load well hidden beneath a black tarpaulin, had been disembarked off the cross Channel ferry at Dover..

See article . . . . Page 16

Grain storage preparation

At this time of year, a pre-harvest inspection of storage mediums and grain quality testing equipment is critical to ensure that you are prepared for harvest and that you have a strategy to minimise pest problems in storage and to maximise grain quality.

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CLAAS
AXION

Pre-flowering critical to maximise grain yield

By Deanna Lush

A HUGE amount of attention is given to managing crops through grain fill to maximise yield but grain growers are encouraged to think more about the period of crop development in the lead-up – to and just after – flowering.

Speaking at a recent GRDC workshop on water use efficiency (WUE) in South Australia, SARDI Crop Ecophysiologist Victor Sadras said crop yield was more a function of grain number than grain size.

He said a plant's grain number was defined during the period either side of anthesis – from about 25 days before flowering, during stem elongation at growth stage 31 – to about 10 days post-flowering (see Figure 1).

Crop stress during this period could limit the number of heads, the number of grains per head and the accumulation of carbohydrate reserves in the plant.

"The question I would ask is are we focusing too much on grain filling and overlooking management to ensure good growth in the critical window for grain set?" Victor said.

Timing of stress

The degree of water stress experienced in the Australian wheatbelt during this critical window for grain number determination has been analysed in a study released this year by Dr Karine Chenu, DAFF Queensland.

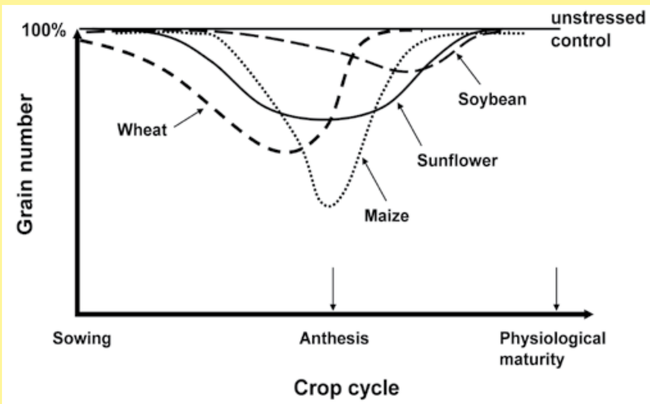
Presenting the data at the GRDC workshop, University of New England lecturer Dr Neil Fettell says the study used modelling to quantify seasonal drought patterns and their frequency. It found there were four major environment types across Australia (see Figure 2). These included:

Victor Sadras, SARDI.

- In 44 per cent of seasons, there was severe stress beginning before flowering. This includes 24 per cent of seasons where there was relief during grain fill (environment type 3) and 20 per cent of seasons where there was no relief during grain fill (environment type 4 – drought).
- In 33 per cent of seasons, there was stress mainly during grain fill (environment type 2).
- In 23 per cent of seasons, there was no substantial stress (environment type 1).

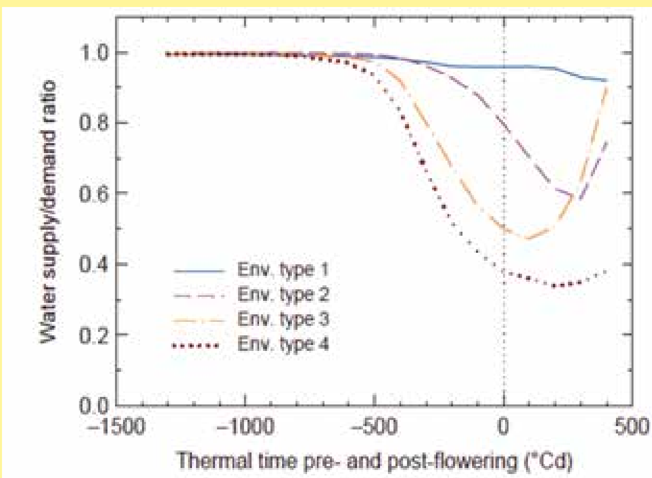
These results differed between each grain growing region with

FIGURE 1: Critical windows of stress vulnerability and how it impacts crop yield



Calviño PA, Monzon JP (2009) Farming systems of Argentina: yield constraints and risk management. In: Sadras VO, Calderini DF (eds) Crop physiology: applications for genetic improvement and agronomy. Academic Press, San Diego, pp 55-70

FIGURE 2: Modelling to quantify seasonal drought patterns across the Australian wheatbelt found that there were four major environment types and in types 3 and 4, crops experienced significant stress before flowering



Chenu K, Deihimfard R, Chapman SC (2013) Large-scale characterization of drought pattern: a continent-wide modelling approach applied to the Australian wheatbelt – spatial and temporal trends. New Phytologist 198:801-820

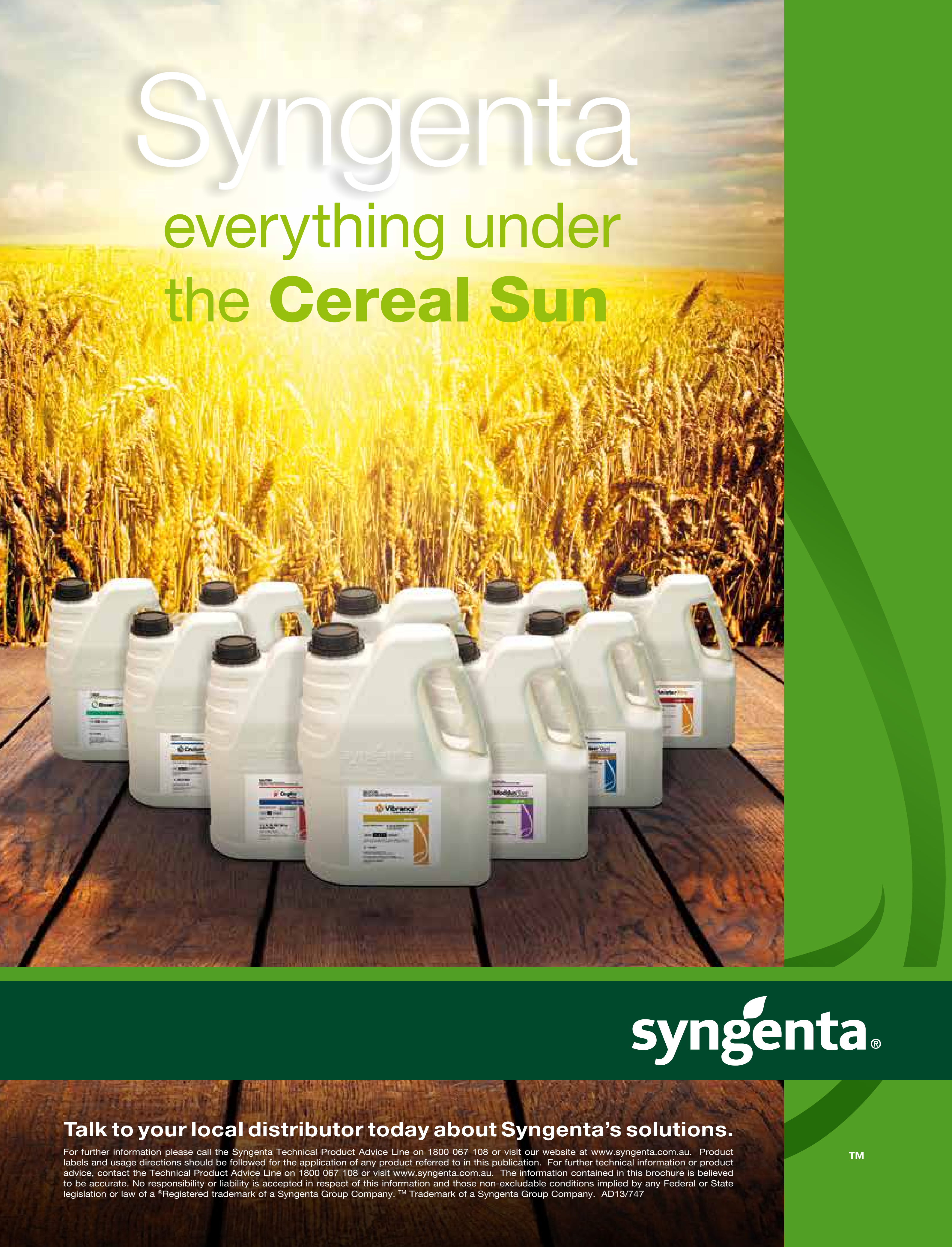

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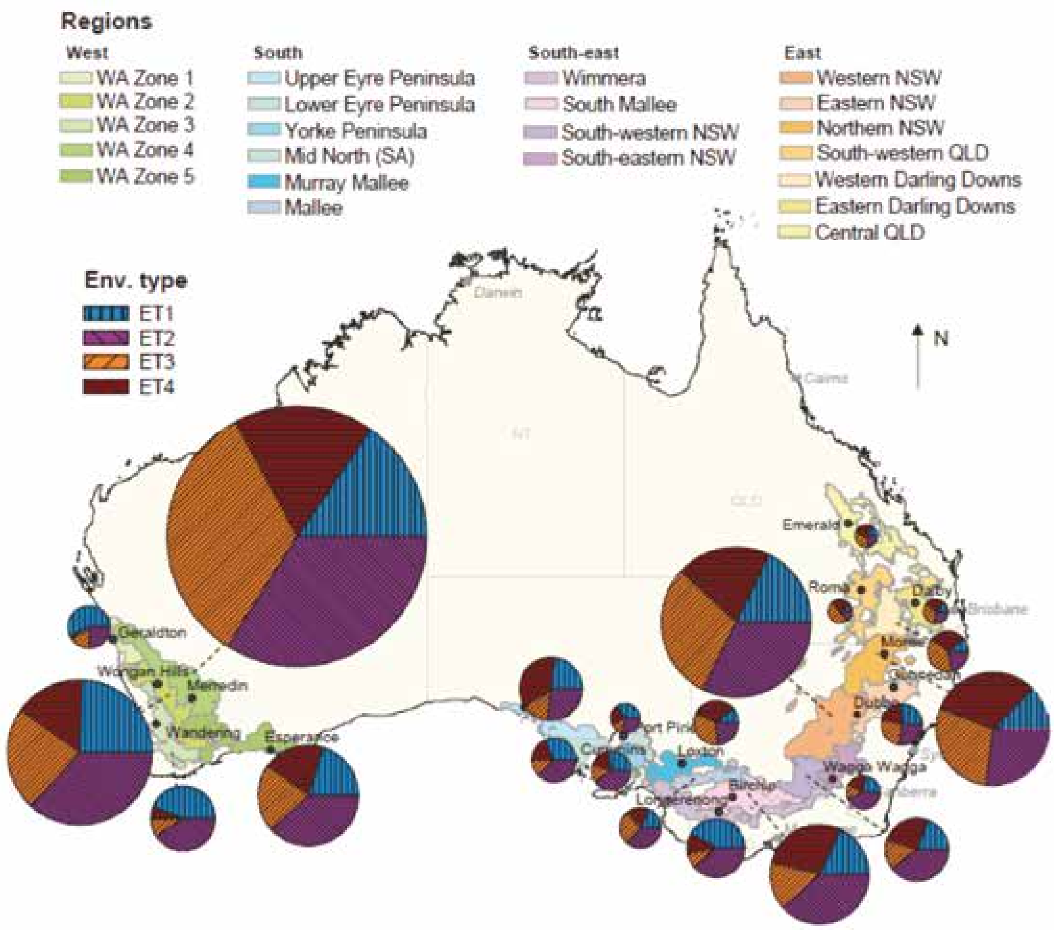
FIGURE 3: The frequency in which the four modelled seasonal conditions are experienced in the grain growing regions of Australia



Chenu K, Deihimfard R, Chapman SC (2013) Large-scale characterization of drought pattern: a continent-wide modelling approach applied to the Australian wheatbelt – spatial and temporal trends. New Phytologist 198:801-820

stress before flowering relatively infrequent in western Victoria and southern WA and much more frequent in northern NSW and Queensland (see Figure 3 for breakdown).

Neil said for southern Australia, much of the focus has been on drought during grainfill but the data showed the stress that affected grain yield was often occurring much earlier in the season, during flag leaf emergence, booting, flowering and the start of grain fill.

"These findings have implications for how variety choice and management decisions could be used to alter the pattern of seasonal water use," Neil said.

"Early sowing and greater stored water at sowing reduced the frequency of drought stress during this period in most regions."

Agronomy has a critical role

Neil says while soil moisture at grain fill has traditionally been the focus, it was important to use sowing time and rate, plant density and nitrogen rate and timing to ensure adequate moisture was available in the critical pre-flowering period. Use of fungicides for plant health was also vital.

"For years, we've been talking about green leaf for grain fill but it is earlier than that where we must be ensuring there is adequate water, nitrogen and healthy, green leaves," Neil said.

"In terms of management, for irrigation it means putting water on earlier but for dryland, it's managing the crop during the length of that period through variety choice, foliar disease control and nitrogen."

He says selecting varieties and sowing times to minimise stress from flag leaf emergence to the start of grain fill will reduce risk of a stress event impacting yield.

Nitrogen and WUE

Victor Sadras says trial work undertaken through the GRDC's WUE Initiative, which concluded last year, showed many growers were achieving 70 to 80 per cent of maximum water use efficiency.

One of the reasons was nitrogen management but while nitrogen is needed for high WUE, the more N that was applied, then nitrogen use efficiency (NUE) dropped (see Figure 4).

He said growers starting with a crop that was low in N, then applying nitrogen would increase WUE.

"To achieve maximum WUE, you may need 250 units of nitrogen in some soils and seasons but that's out of the question, it is too risky.

"That's why targeting the maximum WUE is not necessarily the best approach in terms of NUE management."

N use tools

THE GRDC has supported a series of projects to develop a yield and nitrogen estimation calculator for dryland cropping.

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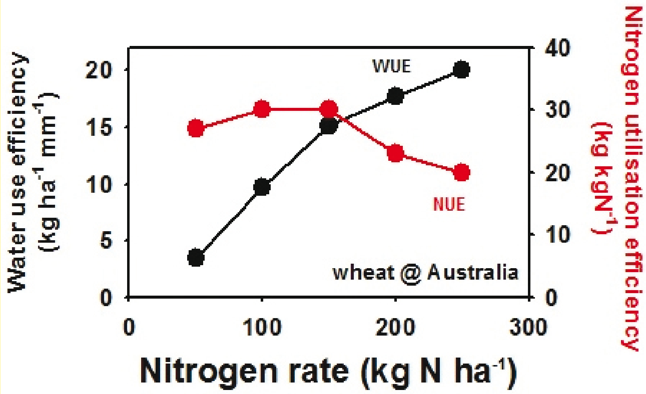
FIGURE 4: Nitrogen rate and its impact on water use efficiency



Sadras VO, Rodriguez D (2010) Modelling the nitrogen-driven trade-off between nitrogen utilisation efficiency and water use efficiency of wheat in eastern Australia. Field Crops Research 118:297–305

CSIRO researcher Jeff Baldock, based in Adelaide, says there are two Excel spreadsheet calculators that can calculate yield and nitrogen requirements for cereals and canola:

- *The Generic Yield and N Calculator* – a more general tool based on user inputs of growing season rainfall; and,
- *Your Soil's Potential Calculator* – a more automated calculator designed for farms with annual rainfall less than 500 millimetres. It estimates water limited potential grain yields and nitrogen fertiliser requirements.

Jeff says the spreadsheet is based on a series of calculations that automatically works out what amount of N a crop needs, based on raw data that growers collect. These calculations include:

- The amount of water available to crops.
- The demand of N by the crop based on potential yield and target grain protein at harvest.
- The N supply from the soil and previous crop and pasture residues.
- The N fertiliser requirement of the crop.

He says potential crop yield is defined by the amount of water made available to a crop.

"But actual yield is often constrained by factors such as inadequate nutrition, disease or subsoil constraints typical of dryland agriculture in southern Australia," he said.

"The balance between availability of water and nitrogen has been shown to impact significantly on yield, grain quality and efficient use of resources."

The calculators can also assess whether crops can take advantage of a post-sowing N application.

"The first requirement is to recalculate PAQ (the amount of potentially available water) based on actual rainfall data collected up to the present time.

"In this case, PAW is the sum of the available water present in the soil at sowing, the growing season rainfall received so far, and the rainfall expected for the last part of the growing season.

Revised values for potential grain yield and N demand are then calculated by the calculators, or by using the following formulas:

- Plant available water = available soil water + the amount of growing season rainfall.
- Potential yield (kg/ha) = (PAW-110mm) x 22 kg/mm/ha.
- N demand (kg/ha) = (grain yield (kg/ha) x grain protein (%)) / 208.

For more information:
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Neil Fettell, UNE, 02 6895 2099, nfettell@une.edu.au
Visit www.climatekelpie.com.au for a round-up of climate tools. ■

US researchers fighting back against glyphosate resistance

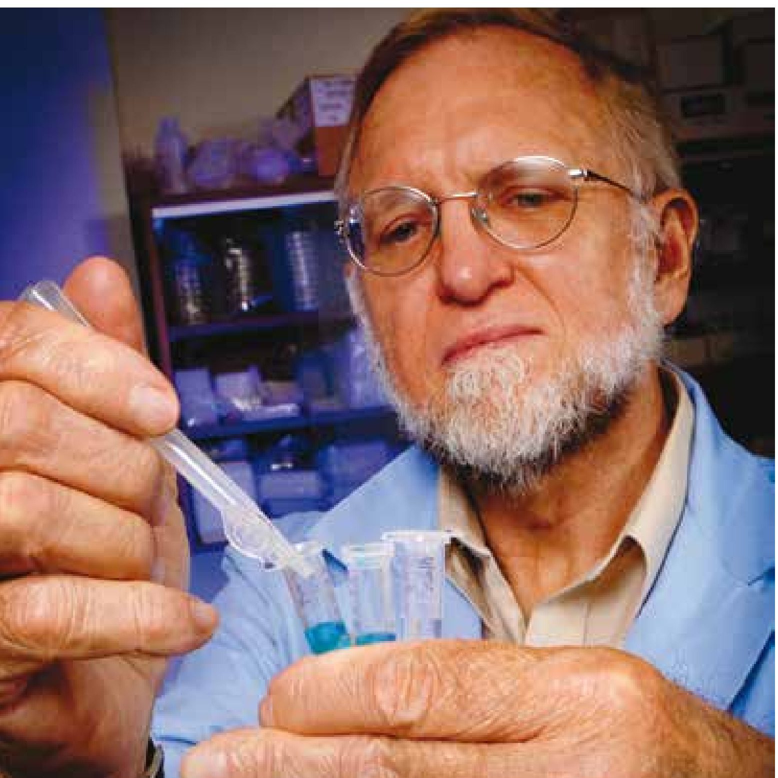
By Dennis O'Brien, USDA – Agricultural Research Service

THE herbicide glyphosate is highly effective at controlling a broad spectrum of weeds. It has been sold for many years in products known commercially as 'Roundup" and is used with conventional crops and in some countries with varieties of corn, cotton, soybeans, and canola that were developed specifically to withstand glyphosate.

Glyphosate use also has environmental benefits, such as simplifying weed control in reduced-tillage farming. It has allowed growers to switch from conventional tillage practices to no-till systems that reduce labour costs, improve soil quality, and help curb soil erosion. In the US, about 93 per cent of soybeans, 78 per cent of upland cotton, and 70 per cent of corn produced in 2010 were glyphosate-tolerant varieties.

Glyphosate's popularity, and the common practice in the US of using it with no other herbicides, has led to the emergence of a dozen glyphosate-resistant weeds. US growers who stop using glyphosate often go back to tilling their soil, reversing the improvements in soil quality seen over the past decade.

"Widespread use of glyphosate, often to the exclusion of other herbicides, ensured that weeds capable of surviving glyphosate would thrive. Now that we're seeing that happen, we need to address it," says Dale Shaner, a plant physiologist who recently retired from the Agricultural Research Service Water Management Research Unit, in Fort Collins, Colorado.



In Fort Collins, Colorado, plant physiologist Dale Shaner uses a dye test to detect the compound shikimate in plant leaves. Measuring this compound can determine whether a weed will resist glyphosate. (Photo: Rod Pentico)

Dale is working as a collaborator with Monsanto to develop a kit that growers could use to determine whether weeds in their fields are glyphosate resistant. Thomas Potter, an environmental chemist at the ARS Southeast Watershed Research Laboratory in Tifton, Georgia, is evaluating a herbicide that some cotton growers are using as an alternative.

Value of early detection

One key to addressing the threat posed by glyphosate resistance is early detection.

"If resistant weeds are detected early, you can minimise the problem by either using another herbicide or, in the case of Palmer amaranth – one of the most difficult weeds to control in the US – getting into the field to pull it out," Dale says.

Scientists can determine whether a weed will resist glyphosate by measuring the amount of a compound known as "shikimate" in its tissues. Glyphosate kills weeds by interfering with production of aromatic amino acids, and shikimate plays a key role in producing those amino acids. It is the "shikimate pathway" that glyphosate disrupts, causing shikimate to accumulate.

Plants susceptible to glyphosate will have high levels of shikimate, while resistant plants will not.

Existing methods for detecting shikimate in plants require sophisticated laboratory equipment, such as spectrophotometers that can measure ultraviolet light. Test results can take weeks.

Now, Monsanto has developed a method for detecting shikimate in just 24 hours, using a dye that changes colour. Dale plans to help Monsanto fine-tune the technology so that it's ready for use nationwide.

Weed management is a key part of the research conducted at the Water Management Research Unit.

"We study how best to ensure high yields with limited water, and critical to managing water is managing weeds. You want a weed-free field for your crop so there's less competition for available water," Dale says.

As part of his work with Monsanto, Dale is growing

Tubes with blue colour tested positive for shikimate, and the clear liquid was a negative result. (Photo: Rod Pentico)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In Tifton, Georgia, technician Sally Belflower loads soil sample extracts into an autosampler of a gas chromatograph-mass spectrometer to test for herbicide residues. (Photo: Peggy Greb)

glyphosate-resistant and glyphosate-susceptible crops and weeds in a greenhouse. He will spray some of those plants with glyphosate and place leaves from others in glyphosate solutions and then determine the levels and rates of shikimate accumulation.

The goal is to evaluate different methods for assessing shikimate levels and to determine the most effective way for growers to collect plant material for testing with Monsanto's system.

Looking at other alternatives

Soybean growers in Georgia have been using the herbicide fomesafen for years, and now with weeds developing glyphosate resistance, cotton growers have been using it as an alternative. It was approved for use on cotton in the US in 2008 after glyphosate-resistant forms of Palmer amaranth were discovered in the region. But concerns about potential adverse environmental impacts were noted at the time, particularly its effects on runoff into surface water. Growers also needed more information on how to use it when practicing conservation tillage.

Cotton growers in the region often rotate cotton with peanuts and either conventionally till the soil or use a common conservation practice, strip tillage. When they strip till, they typically use rye as a cover crop, spraying it with a herbicide in spring to kill it. The dead ryegrass provides a mulch cover for the fields.

In Tifton, Georgia, technician Margie Whittle extracts herbicide residues from soil with an organic solvent. (Photo: Peggy Greb)

When herbicides like fomesafen are sprayed, the mulch can intercept the chemical and prevent it from reaching the soil where it will be most effective. Herbicides intercepted by mulch can also damage cotton crops if they wash off after the cotton germinates.

Potter and colleagues evaluated how well a conservation practice known as 'irrigation incorporation' would wash the herbicide off the mulch and move it into the soil, reducing the potential for crop injury and excessive runoff. Irrigation incorporation involves irrigating a few days after applying a herbicide. The practice greatly enhances weed control by improving herbicide contact with germinating weeds.

They divided a field of cotton equally between strip tillage and conventional tillage. In the strip tillage section, they planted rye as a cover crop. Fomesafen was applied to the whole field, and irrigation incorporation was used on half of it. They then applied simulated rainfall and diverted runoff into troughs at the lower end of the fields for analysis. The rye crop residue was also collected and analyzed.

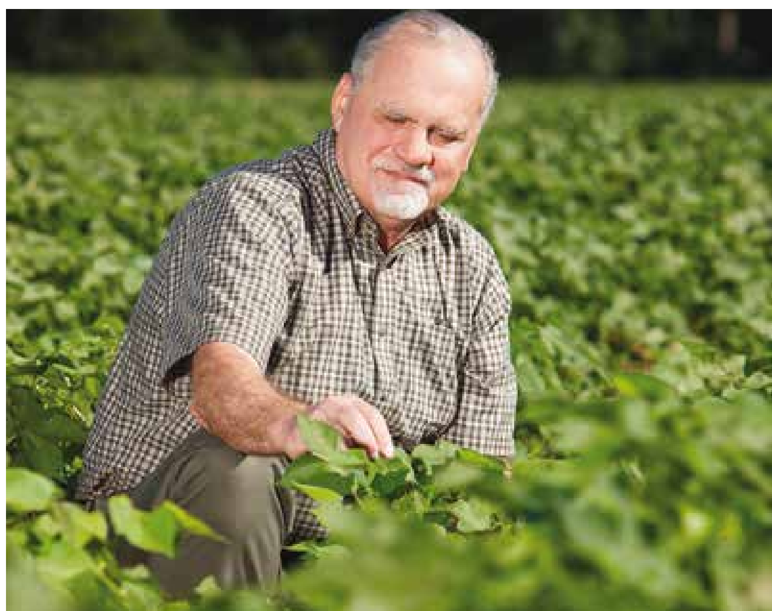
The results, published in the *Journal of Agricultural and Food Chemistry (2011)*, showed that fomesafen is more likely than other herbicides to wash off surface residue and penetrate into the soil as desired. Fomesafen's 'wash-off rate' was much higher than that of other herbicides studied.

The results demonstrated the benefits of using irrigation incorporation with fomesafen, particularly when conservation tillage is practiced. The product's high wash-off rate means that by applying a small amount of irrigation after the herbicide is applied, most of it will move into the soil, where it will not damage the cotton and will be most effective at controlling weeds.

The results also showed that irrigation incorporation substantially reduces runoff of fomesafen and minimises the potential for adverse water-quality impacts.

The results will help growers concerned about glyphosate resistance make better-informed decisions about herbicide alternatives.

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. ■



Environmental chemist Thomas Potter examines cotton plants in a herbicide-treated field in Tifton, Georgia. He is studying how different herbicides behave when used with conservation tillage to determine the best combination for cotton farmers. (Photo: Peggy Greb)

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Get smart about weed control

GRAIN and cotton growers can get on board the WeedSmart initiative to improve crop productivity and increase profitability despite the spreading scourge of herbicide resistance in the nation's weed populations.

Dr David Thornby, Department of Agriculture Fisheries and Forestry Queensland (DAFFQ) senior weed scientist, says glyphosate resistance in particular is a rapidly developing threat to profitability in Australian grain and cotton farming.

"Resistance causes an immediate reduction in the effectiveness of in-crop weed control in glyphosate resistant transgenic cotton and summer fallows," David said.

"Effective strategies to avoid, delay and manage resistance are of substantial value."

The WeedSmart initiative brings together industry organisations including the Grains Research and Development Corporation (GRDC), research providers and major crop input firms including Monsanto, Syngenta and Sinochem to deliver the message that herbicide resistance is a difficult but not insurmountable problem – if changes occur on-farm.

DAFFQ researchers used a model of glyphosate resistance dynamics to perform simulations of resistance evolution in *Sonchus oleraceus* (common sowthistle) and *Echinochloa colona* (awnless barnyard grass) under a range of resistance prevention, delaying, and management strategies.

David says several elements that could contribute to effective glyphosate resistance prevention and management strategies have been identified.

David Thornby, DAFFQ (pictured on right with Steve Walker) says effective strategies to avoid, delay and manage resistance are of substantial value to growers.

"Controlling glyphosate survivors is the most robust approach to delaying or preventing resistance," he said.

"High-efficacy, high-frequency survivor control almost doubled the useful lifespan of glyphosate from 13 to 25 years even with glyphosate alone used in summer fallows."

He says two non-glyphosate tactics in-crop plus two in summer fallows is the minimum intervention required for significant delays in resistance evolution.

"Pre-emergence herbicides are important, but should be backed up with non-glyphosate knockdowns and strategic tillage – replacing a late-season pre-emergence herbicide with inter-row tillage added four extra years before resistance evolved in awnless barnyard grass.

"Weed species' ecological characteristics, particularly seed bank dynamics, impact the effectiveness of herbicide resistance strategies."

David says sowthistle, because of its propensity to emerge year-round, was less exposed to selection with glyphosate than barnyard grass, resulting in five extra years of glyphosate usefulness (18 compared to 13) even in the most rapid cases of resistance evolution.

He says if glyphosate resistant cotton and grain cropping is to remain profitable in Australian farming systems, growers must adapt to the probability that they will have to deal with summer weeds that are resistant to glyphosate.

"Robust resistance management systems will need to include a diversity of weed control options, used appropriately," he said.

A link to the online Glyphosate Resistance Toolkit can be found at www.weedsmart.org.au/resources-training.

For more information on herbicide sustainability practices, visit www.weedsmart.org.au ■

How do weeds resist glyphosate?

IF you ever find yourself in the situation where you are catering for a group of people, and you are wondering how much food to prepare, the best thing to do is to prepare a little extra, just in case. The last thing that you want to do is run out.

Believe it or not, this is how some weeds resist glyphosate. They make an extra-large batch of the enzyme that glyphosate binds to – just in case. This way, if the weed is sprayed with glyphosate that inhibits some of the enzyme, there is still enough left for the plant to function and survive. This mechanism is known as 'Gene Amplification' and was discovered by Dr Todd Gaines along with a large team of scientists from around the world.

There are currently six known mechanisms of glyphosate resistance and several more are suspected (we will feature more about the others in future AHRI insights).

The table below lists the six known mechanisms of glyphosate resistance.

Mechanism	Weeds	Strength of resistance
Target site 106 mutations	Ryegrass	2 to 3 fold
Target site 102 + 106 mutations	**Goosegrass**	**>100 fold**
Gene amplification	**Amaranthus, ryegrass, kochia**	**6 to 40 fold**
Vacuole sequestration	Conyza (fleabane), ryegrass	7 to 11 fold
Reduced cell uptake	Amaranthus, Johnson grass	
Hypersensitive (source leaf)	Giant ragweed	

There are several other mechanisms of glyphosate resistance currently being researched but are yet to be confirmed.

Q. How many weed scientists does it take to identify a glyphosate resistance mechanism?

A. 18.

No, this is not a bad joke, it is reality. The research effort led by Dr Todd Gaines with Colorado State University, AHRI and Bayer CropScience Germany, involved collaborating with 17 other scientists around the world to identify a new glyphosate resistance mechanism. This gives some indication of how complex these new findings are. There is a considerable global effort to better understand glyphosate resistance.

The mechanism discovered in this research is called Gene Amplification because the plant produces many copies of the gene that codes for the EPSPS enzyme.

Glyphosate kills plants by inhibiting the enzyme EPSPS. This research discovered that America's biggest problem weed, pigweed (Palmer amaranth), developed resistance by producing a lot more of this enzyme. This research identified pigweed with five-fold to 160-fold more copies of the EPSPS gene. More copies of the gene resulted in more EPSPS enzyme activity.

The effect of additional EPSPS genes is additive, and additional copies of the gene infer higher levels of resistance.

Put simply, more copies of the EPSPS gene = more EPSPS activity = higher levels of resistance to glyphosate.

Glyphosate can still bind and inhibit some of the EPSPS enzyme produced by the plant, but the plant survives because there is enough EPSPS enzyme left over to do its job and keep the plant alive.

This resistance mechanism has now also been confirmed in ryegrass and kochia species. These weed species are the 'world champions' of developing resistance to herbicides. It comes as no surprise that these weed species are each able to develop several different mechanisms of resistance to our most precious herbicide, glyphosate. ■

Pigweed or Palmer amaranth, is now the biggest problem weed in the US.

The dark secret

A tractor tale of intrigue!

By Ian M. Johnston

The journey by night

The night was black as pitch and the lashing rain continued to bucket down. The driver of the old Albion rubbed his tired eyes as he strained to penetrate the feeble glow from the headlamps and endeavoured to avoid the worst of the potholes. His co-driver sitting alongside had dozed off into an uneasy sleep, miraculously, considering the continual jolting of the cabin.

The year was 1928, and it was four hours since the lorry, with its furtive load well hidden beneath a black tarpaulin, had been disembarked off the cross Channel ferry at Dover. And 14 hours since the journey had begun at Düsseldorf.

To stop for a cuppa was out of the question! The instructions were emphatically clear. The Albion with its cargo had to arrive at its destination under the cover of darkness. Then be securely locked away, well before the workers arrived at the plant and turned curious eyes in the direction of the laden factory transporter, wondering why the company logo had been crudely obliterated with black paint.

The first streaks of pink announced the dawn sky, as the Albion was finally navigated into the innards of the custom-built windowless construction, located deep in the interior of the factory complex. With the lorry safely inside, the single steel door was secured with a massive padlock. The drivers were weary and anxious to arrive home to a hearty breakfast and a warm fireside. A 50 pound note was handed to each and a reminder that the continuation of their employment with the Company was totally dependent upon their keeping their mouths tightly shut with regard to the clandestine operation.

In fact, their silence and loyalty were assured. The Great Depression was just getting into its vicious stride in 1928 and jobs were scarce. Further, at a time when two pounds ten shillings per week was considered a generous wage, neither of the men had even sighted a fifty pound note, far less received one. The dark secret would remain secure!

A 1914 Marshall Class F Colonial 70 hp tractor, with the optional Tropical fan cooled radiator, operating on the Darling Downs, Queensland. Owned by Nev Morris. (Photo IMJ)

The Marshall Colonials

In 1928 the distinguished Lincolnshire firm of William Marshall Sons & Company, the world's largest producer of steam engines and allied machinery, was in serious financial difficulties. The fact that a respected English organisation, able to trace its origins back to 1848 and with voluminous exports radiating to the four corners of the globe, was now teetering on the edge of bankruptcy, was indeed indicative of the perilous state of British heavy industry!

Marshall had made an effort to diversify from its steam heritage when in 1906 it unveiled a prototype farm tractor, powered by an internal combustion engine. The power unit was a two cylinder petrol engine designed by Herbert Bamber – a highly regarded engineer better known for his association with The Vauxhall Car Company. Bamber's tractor engine featured a hefty 7x7 inch bore and stroke.

By 1910 the Marshall factory (The Britannia Iron Works), had developed two tractor engines based on the Bamber prototype. A two cylinder version developed 35 brake hp and a four cylinder unit produced 70 brake hp.

Known as Colonials, the tractors were massive, indeed the Type G, the largest, weighed 13.25 tonnes. Even the two cylinder 'lightweights' weighed in at eight tonnes. Accordingly, British farmers were not enchanted with the Marshall Colonials as they were simply too heavy for the soft moist tilthy arable soils. A bogged Colonial presented a daunting problem as it could take a team of around 20 heavy draught horses to extricate the stricken machine.

As a consequence the majority of Colonials were sold overseas where they worked on shallow and often hard baked soils.

But there was a further problem! They were besieged by

This 1911 Marshall Class E Colonial 35 hp tractor, with the standard hopper cooling system, is leading a parade through the main street of Swan Hill, Victoria. The unit may be inspected at The Pioneer Settlement Village, Swan Hill. (Photo IMJ)


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A 1932 Marshall 18-30, restored and owned by Sandstone Estates, Centurian, South Africa. (Photo courtesy Sandstone Estates)

mechanical faults and the volume of sales required to establish an economy of scale did not eventuate.

By the mid 1920s, Marshall's fortunes declined alarmingly. The Colonials had been discontinued with only around 300 produced. The era of steam power was rapidly coming to an end. Farmers around the world were becoming attracted to more efficient lightweight tractors. Fordson, John Deere, International, Saunderson and other relatively inexpensive makes were enjoying rapidly expanding sales.

In Europe an odd-ball tractor known as the Bulldog with a horizontal single cylinder engine, was being manufactured at the giant Mannheim plant of Heinrich Lanz AG. Its low cost and simplicity of design encouraged non-mechanically inclined farmers, most of whom had grown up in the horse or mule era, to embrace the new tractor technology and purchase one of these somewhat idiosyncratic Lanz tractors. By 1930 the Lanz Bulldog had become Europe's top selling tractor, plus a thriving export market had flourished.

A view of the right side of the Marshall 12-20, showing the massive flywheel and cylinder head. A lit igniter is inserted through an orifice leading through the cylinder head into the combustion chamber, before the engine can be hand cranked into life. (Photo IMJ)

This 1936 Marshall M has been restored by the author and is one of only 212 produced. The single cylinder full compression diesel engine has a bore and stroke of 6.5 x 9 inches, and was to remain as such for all future single cylinder Marshall diesel tractors, including the Field Marshall Series, produced from 1945–1957. (Photo IMJ)

The clandestine plan

In 1927 the chairman of William Marshall Sons & Company, Herman Marshall, grandson of the founder, established a Committee of Investigation, the purpose of which was to produce an innovative plan, guaranteed to reverse the decline in revenue and return the firm to a position of profitability.

Several ideas were advanced by the Committee, but the one most favoured by Herman Marshall and his board was the concept of producing a copy of a Lanz Bulldog. It was considered the two stroke single cylinder Lanz would be easy to reproduce, with minor variations thus avoiding breaches of patents. Such a tractor it was believed would attract volume sales in Britain and in traditional Marshall export markets.

A plan was drawn up whereby a Lanz Bulldog would be acquired surreptitiously in Germany and stealthily transported to Gainsborough, where it could be dismantled and examined. The Committee stressed that absolute secrecy was essential in order to avoid alerting opposition manufacturers of the project.

In 1945 Marshall released the Field Marshall Series of tractors. This immaculately restored Series 2 is part of the Puls collection and is being driven by Barbara Puls. The method of starting the engine of this tractor is by the insertion of a shot gun style cartridge into the breech, which can be seen in front of the radiator cover. Once loaded, a tap with a hammer on the breech-pin explodes the cartridge and the resulting detonation starts the engine. (Photo N. Puls)


CLAAS

A special windowless warehouse was constructed to house the Lanz, enabling design engineer Samuel Dawson to proceed with his measurements and drawings unobserved.

Dawson was by nature an innovator and not entirely happy with the concept of merely creating a virtual copy of the Bulldog. He believed he could considerably improve the design of the single cylinder two stroke engine by increasing the compression ratio from 5 to 1 to 15.5 to 1. Thus instead of being a semi-diesel it would become a full compression diesel engine.

From one major aspect, this was a mistake. In actual fact a significant factor relating to the success of the Bulldog was its low compression ratio engine. Being a semi-diesel enabled it to be fuelled with a variety of cheap low cost products, including crude naphtha oil, sump oil drained from other vehicles, peanut oil, indeed just about any combustible fluid with a low octane rating.

An additional important factor of the Bulldog low compression engine was its inability to burn the total volume of fuel injected into the combustion chamber. Accordingly, there was always a degree of unburnt oil washing the inside of the cylinder wall, thus reducing the friction and therefore wear of the piston, rings and cylinder wall.

But even if some wear did take place, there would be virtually no noticeable fall-off in engine performance.

There was one other major advantage of the Lanz engine, when compared to the full compression ignition design proposed by Dawson. As the fuel was detonated within the combustion chamber of the Bulldog, owing to the low compression, the detonation explosion was not instantaneous. Instead, it 'leisurely' chased the piston to the bottom of its stroke in the manner of a steam engine, thus providing the Bulldog with a substantially higher torque characteristic than tractors with conventional either diesel or petrol engines. In other words – a farmer got a lot more pulling power per horse power with his Lanz Bulldog.

No doubt Dawson considered these factors, but contumaciously pushed ahead with his alternative design. Perhaps being persuaded by the fact that with the full diesel the tedious business of having to first pre-heat the cylinder prior to starting, as in the case of the semi-diesel, was eliminated.

The Marshall diesel tractors

Samuel Dawson worked secretly and diligently, pushing ahead with the design of his single cylinder diesel engined tractor.

In 1930, the tractor industry and farming community were taken by surprise, when Marshall announced, with considerable fanfare, the introduction of the Marshall 15-30 tractor. But sadly for the manufacturer, field tests were to prove the new Marshall in terms of performance was no match for its Lanz equivalent. Additionally the fuel injection equipment was unacceptably troublesome.

In 1931, the 15-30 was re-equipped with a German Bosch fuel pump and injector, but still its reliability and performance were considered unsatisfactory. Few were sold and those that had been exported to overseas dealers were returned to the factory at Marshall's expense!

A replacement model, the 18-30, was introduced in 1932. But despite the company outlaying capital (which it could ill afford) on the development of the new model, there was only a slight improvement with its reliability.

Astonishingly, there were only 72 Marshall single cylinder tractors sold between 1930 and 1934!

The Marshall 12-20 arrived on the scene in 1935, with a reduced nine inch cylinder bore and a new cooling system, with Lanz style radiator cells mounted crossways above the cylinder block.

The Marshall Board must have given a collective sigh of relief, for finally Samuel Dawson had got it right! The 12-20 was a creditable tractor, easily started by a hand crank, once the cigarette-like starting igniter had been inserted into the combustion chamber.

But alas the 12-20 had arrived too late to make a worthwhile impression on the British tractor market. A mere 212 were produced.

At the commencement of Word War 2, in 1939 tractor manufacturing at the Britannia Iron Works was switched to the production of war materials. That is apart from a small number of Marshall Model M tractors, ordered by The Ministry of Supply, aimed at assisting farmers to increase their yield of desperately needed farm produce. The model M was a stop-gap, basically a 12-20 with increased engine revs.

At the cessation of hostilities in 1945, Marshall announced a much improved new range of tractors, bearing the name of Field Marshall. But that is another story!

Appendix

The special secret warehouse, into which the Albion lorry transported the Lanz Bulldog that dark night in 1929, was considered so secure and impenetrable from prying eyes, that the British War Department acquisitioned it in 1940 for the purpose of developing the top secret midget submarines, designated X Craft.

German Intelligence remained unaware of the existence of these 60 feet long undersea stealth vessels until in 1943 the pride of the Germany navy, the 43,000 ton Tirpitz, was blown apart at her moorings in a heavily defended Norwegian Fiord. The crew of an X Craft had attached limpet mines to the underside of the battleship! ■

IAN'S MYSTERY TRACTOR QUIZ

Question: This tractor can be identified by its patented rear wheels. Can you name the tractor?

Clue: It is a British tractor, made under licence to an American firm, but has an Aussie name.

Degree of difficulty: A real challenge! You will have to know your onions (and tractors) to work out the answer.

Answer: Page 48.

Validation of soil moisture data collected via satellite

By Ann Perry, USDA – Agricultural Research Service

THE European Space Agency's Soil Moisture and Ocean Salinity (SMOS) mission includes the latest advance in using Earth-orbiting satellites for estimating soil moisture across the globe. The SMOS satellite was launched in 2009 and was designed to estimate soil moisture levels to within 4 per cent, which is like measuring a teaspoon of water in a handful of dry soil.

To capture this data, SMOS uses a new sensor technology that is the first passive L-band system – measuring microwave radiation emitted around the frequency of 1.4 gigahertz – in routine operation. But the accuracy of the information collected by this new technology still needs to be verified with actual soil moisture measurements – a task perfectly suited for a team of Agricultural Research Service scientists.

In 2002, ARS scientists established soil moisture monitoring networks in four of the agency's long-term experimental watersheds to verify the accuracy of soil moisture data collected by other Earth-orbiting satellites.

The researchers have been monitoring soil moisture levels in these networks – located in ARS watersheds at Walnut Gulch, Arizona; Little Washita, Oklahoma; Little River, Georgia; and Reynolds Creek, Idaho – hourly since 2002. So they had a vast

ARS hydrologist Tom Jackson and student Parmecia Jones use different methods to test soil moisture. The measurements will be compared to see which more accurately validates data obtained via satellites. (Photo: Stephen Ausmus)

ARS hydrologist Tom Jackson and collaborators collect an array of ground observations to verify the accuracy of satellite data. (Photo: Stephen Ausmus)

amount of data from a range of environments they could use to validate SMOS soil moisture measurements.

The research team was led by ARS hydrologist Tom Jackson of the Hydrology and Remote Sensing Laboratory in Beltsville, Maryland. The team compared a year's worth of soil moisture data collected by SMOS with data from the four ARS watersheds and from another satellite system.

The researchers determined that the SMOS soil moisture estimates approached a 95-per cent rate of accuracy, and they also identified conditions that reduced accuracy. For instance, SMOS records measurements in the early morning as the satellite ascends over the horizon and in the late afternoon as the satellite is descending.

Rain showers generated from heat and moisture that had accumulated in the atmosphere throughout the day would often saturate the upper soil levels in the afternoon. These strong downpours would result in an overestimation of soil moisture by the SMOS sensors. Tom's team devised a method for flagging and adjusting the data to improve the accuracy of the resulting soil moisture estimates.

Other ARS researchers contributing to this project include Michael Cosh, from the Beltsville lab; Patrick Starks, at the Grazinglands Research Laboratory in El Reno, Oklahoma; David Bosch, at the Southeast Watershed Research Laboratory in Tifton, Georgia; Mark Seyfried, at the Northwest Watershed Research Center in Boise, Idaho; and Susan Moran and David Goodrich, both from the Southwest Watershed Research Center in Tucson, Arizona.

The scientists published their findings in 2012 in *IEEE Transactions on Geoscience and Remote Sensing*.

To reach scientists in this story, contact Ann Perry, USDA-ARS Information Staff, 5601 Sunnyside Ave., Beltsville, MD 20705-5128; Ph: +1 301 504-1628. ■

USQ building a 'terminator' against Tasmanian pyrethrum

THE University of Southern Queensland's (USQ) Institute for Agriculture and the Environment (IAgE) is building a new 'terminator' to bolster the flourishing Tasmanian pyrethrum industry.

Tasmania produces 60 per cent of the world's crop of pyrethrum – a natural insecticide – but the state's mild coastal climate is also the ideal growing conditions for a whole range of weeds.

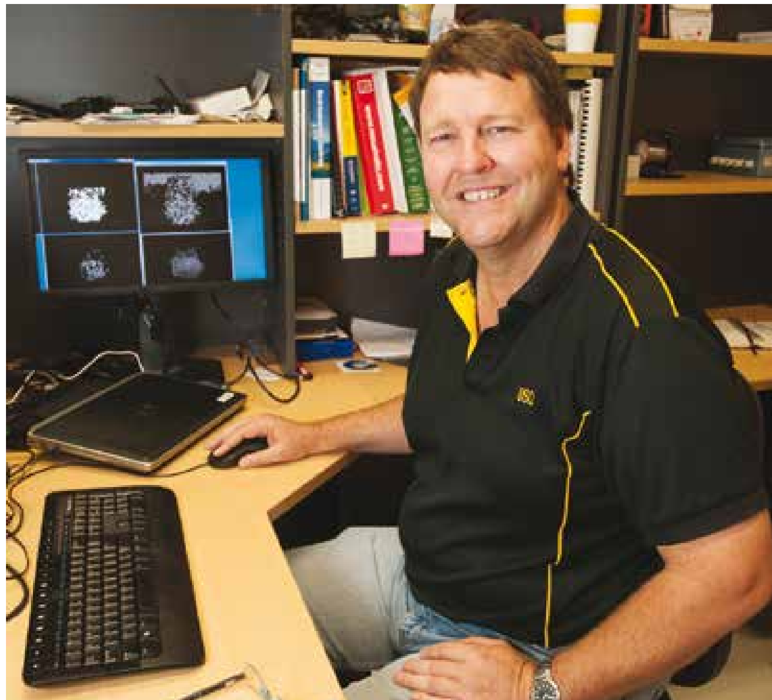
IAgE senior research engineer Steve Rees has been working with machine vision projects since 1995 and is excited about its application in the Tasmanian industry.

"Pyrethrum is a perennial crop and growers can farm the same crop for around four years so any weed incursion early on in the growth cycle can greatly affect its productivity in following years," Steve said.

"There is not enough margin in the crop to send people out with a hoe to clean up the fields, so the industry has asked us to design a precision spot spraying system that uses image analysis plant identification technology to improve herbicide application and spray the weed only, amongst the crop.

"We use colour cameras and depth cameras so that we get a 3D representation of the crop and basically any plant that doesn't resemble the crop gets sprayed."

Steve said USQ has been working on machine vision projects since 1994 and weed identification projects since 2007. The Institute has formed a reputation as a specialist in the field.



IAgE senior research engineer Steve Rees.

A Tasmanian pyrethrum crop in its dormant phase.

Tasmania produces 60 per cent of the world's pyrethrum.

"It is about the identification of weeds and looking to optimise the spraying apparatus to spray them with herbicide so that growers can improve their yields," he said.

"The idea is simple, but the process is quite complex as a spray application unit has to identify plants using colour, texture and shape and do it in real time.

"It then has to deliver the spray application to a defined spot at a speed of 10 to 15 kph."

Steve said the Tasmanian project was one of a number the Institutes Automation, Robotics and Machine vision (ARM) group was working on as the same technology was being applied in Queensland in sugarcane crops to fight the weed guinea grass.

"It is an exciting time for the Institute as we are constantly refining the process as new technology comes along," he said.

"I have been working on machine vision since the 1990s, but it is only the past five years that we have really hit an exponential curve in advancements in technology and their capabilities.

"In recent times we have seen computers double their memory every 18 months and halve in price … we are going faster and faster and I can see that in a very short time we will be identifying individual weeds in a crop and hitting them with their own very-specific brew of chemical for treatment.

"You can now buy a 3d colour camcorder for around $300 where five years ago you would order one and people wanted to know what you were going to do with such a specialist piece of equipment.

"I am not sure where technology is going to take us, but we are starting to look at all sorts of applications such as adding extra systems so that you can detect disease and pest damage in the crop as it passes over doing its herbicide spray.

"Advances in computing is allowing is to develop new processing techniques as well as customise our algorithms and the Institute is intent on making machine vision a specialist area of research for us."

A learning machine

Steve laughs when asked about a "terminator-style" machine wiping weeds out across the landscape, but said an integrated weed management system which "learnt" as it worked was definitely feasible.

"There are a lot of potential advantages that can be explored for all farming practices," he said.

"We talk a lot about machine vision, but in many ways it is just data collection and analysis. We then build algorithms to assess the information so a self-learning system is not totally out of the question."

Steve said he hoped to have the Tasmanian pyrethrum system on the ground and rolling within the next three years so that industry could continue to expand. ■

NORTHERN FOCUS
COVERING NORTHERN NSW AND QUEENSLAND

What's the latest on problem weed management in the north?

■ By Richard Daniel, Northern Grower Alliance

AT A GLANCE…

- Glyphosate resistant and tolerant weeds are a major threat to our reduced tillage cropping systems;
- Although residual herbicides will limit recropping options and will not provide complete control, they are a key part of successful fallow management;
- Double-knock herbicide strategies (sequential application of two different weed control tactics) are useful tools but the herbicide choices and optimal timings will vary by weed species;
- Incorporate other weed management tactics e.g. crop competition to assist herbicide control; and,
- Cultivation may need to be considered as a salvage option to avoid seed bank replenishment.

WEED management, particularly in reduced tillage fallows, has become an increasingly complex and expensive part of cropping in the northern grains region. Why? – Our heavy reliance on glyphosate has selected for species that were either naturally more glyphosate tolerant or selected for glyphosate resistant populations. The four key weeds that are causing major cropping headaches are:

- Awnless barnyard grass;
- Flaxleaf fleabane;
- Feathertop Rhodes grass *(Chloris virgata)*; and,
- Windmill grass *(Chloris truncata)*.

Although this article will focus on chemical management of these weeds, it is clear we need to better understand and employ other weed management tactics to successfully and economically control these significant threats to cropping.

Awnless barnyard grass (ABYG)

Barnyard grass has been a key summer grass issue for many years. It is a difficult weed to manage for at least three key reasons:

- Multiple emergence flushes (cohorts) each season;
- Easily moisture stressed, leading to inconsistent knockdown control; and,
- Glyphosate resistant barnyard grass populations are more frequently found.

Resistance levels

Prior to summer 2011–12, there were 21 cases of glyphosate

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.


Barnyard grass. (Photo: Michael Widderick)

resistant ABYG. Collaborative survey work was conducted by NSW DPI, DAFF Qld and NGA in summer 2011–12 with a targeted follow-up in 2012–13.

Agronomists from the Liverpool Plains to the Darling Downs and west to areas including Mungindi collected ABYG samples that were tested at the Tamworth Agricultural Institute with Glyphosate CT at 1.6 L/ha at a mid-tillering growth stage. Total application volume was 100 L/ha.

The key point from this survey work was that the number of 'confirmed' glyphosate resistant ABYG populations had nearly trebled. Selected populations were also evaluated in a separate glyphosate rate response trial. This experiment showed that some of these populations were still only suppressed when sprayed with 12.8 L/ha.

The days of relying on glyphosate alone for ABYG control are behind us.

Residual herbicides (fallow and in-crop)

There are a range of active ingredients registered in either summer crop, for example metolachlor (e.g. Dual Gold) and atrazine – or in fallow, for example imazapic (e.g. Flame) that provide useful management of ABYG.

The new fallow registration of isoxaflutole (Balance) can provide useful suppression of ABYG but has stronger activity against other problem weed species.

Few, if any, residuals give consistent complete control. But they are important tools that need to be considered to reduce the weed population exposed to knockdown herbicides as well as to alternate the herbicide chemistry being employed.

Use of residuals together with camera spray technology (for escapes) can be a very effective strategy in fallow.

Double-knock control

This approach uses two different tactics applied sequentially. In reduced tillage situations, it is frequently glyphosate first followed by a paraquat based spray as the second application or 'knock'. Trials to date have shown that glyphosate followed by paraquat has given effective control even on glyphosate resistant ABYG.

But note that the most effective results will be achieved from paraquat based sprays by using higher total application volumes (100 L/ha), finer spray quality and targeting seedling weeds.

A number of Gp A herbicides e.g. Verdict and Select are effective on ABYG but should be used in registered summer crops e.g. mung beans. Even on glyphosate resistant ABYG, a glyphosate followed by paraquat double knock is an effective tool. In the same situations there has been little benefit from a Gp A followed by paraquat application.

It would also appear that Gp A herbicides are more sensitive to ABYG moisture stress. Application on larger mature weeds can result in very poor efficacy.

Timing of the paraquat application for ABYG control has generally proven flexible. The most consistent control is obtained from a delay of around 3 to 5 days when lower rates of paraquat can also be used.

Longer delays may be warranted when the ABYG is still emerging at the first application timing. Shorter intervals are generally required when weed size is larger or moisture stress conditions are expected.

High levels of control can still be obtained with larger weeds but paraquat rates will need to be increased to 2.0 or 2.4 L/ha.

KEY POINTS ABOUT ABYG

- Glyphosate resistance is widespread. Tactics against this weed must change from glyphosate alone.
- Utilise residual chemistry wherever possible and aim to control 'escapes' with the aid of camera spray technology.
- Try to ensure a double-knock of glyphosate followed by paraquat is used on one of the larger early summer ABYG flushes.
- Restrict Gp A herbicides to ABYG management in crop and aim for strong crop competition.

Flaxleaf fleabane

For over a decade, fleabane has been the major weed management issue in the northern cropping region, particularly in reduced tillage systems. Fleabane is a wind-borne, surface germinating weed that thrives in situations of low competition. Germination flushes typically occur in autumn and spring when surface soil moisture levels stay high for a few days. But emergence can occur at nearly all times of the year.

One of the key issues with fleabane is that knock-down control of large plants in the summer fallow is variable and very expensive.

Resistance levels

Glyphosate resistance has been confirmed in fleabane. There is a large amount of variability in the response of fleabane to glyphosate with many samples from non-cropping areas still well controlled by glyphosate whilst increased levels of resistance are found in fleabane from reduced tillage cropping situations.

The most recent survey has focused on non-cropping situations with a large number of resistant populations found on roadsides and railway lines etc where glyphosate alone has been the principal weed management tool employed.


Flaxleaf fleabane. (Photo: Susan Maas)

Residual herbicides (fallow and in-crop)

One of the most effective strategies to manage fleabane is the use of residual herbicides in fallow or in-crop. Trials have consistently shown good levels of efficacy from a range of residual herbicides commonly used in sorghum, cotton, chickpeas and winter cereals. There are now at least two registrations for residual fleabane management in fallow:

- Residual (and knockdown) control: Tordon 75 D (2,4-D + picloram) at 0.7 L/ha plus glyphosate.
- Residual control only: Balance (isoxaflutole) at 100 g/ha.

Prior to 2012, diuron was the most consistent residual herbicide option for fleabane management but non-crop use has been halted by the APVMA.

Additional product registrations for in-crop knockdown and residual herbicide use, particularly in winter cereals, are still being sought. There are a range of commonly used winter cereal herbicides with useful knockdown and residual fleabane activity. Trial work to date has indicated that increasing water volumes from 50–100 L/ha may help the consistency of residual control with application timing to ensure good herbicide/ soil contact also important.

Knockdown herbicides (fallow and in-crop)

Gp I herbicides have been the key products for fallow management of fleabane with 2,4 D amine the most consistent herbicide evaluated.

Despite glyphosate alone generally giving poor control of fleabane, trial work has consistently shown a benefit from tank mixing 2,4 D amine and glyphosate in the first application.

Amicide Advance at 0.65–1.1 L/ha mixed with Roundup Attack at a minimum of 1.15 L/ha and then followed by Nuquat at 1.6–2.0 L/ha is a registered option for fleabane knockdown in fallow.

Sharpen is a product with Gp G mode of action. It is registered for fallow control when mixed with Roundup Attack at a minimum of 1.15 L/ha but only on fleabane up to a maximum of six leaves.

Currently the only in-crop knockdown registration is for Amicide Advance at 1.4 L/ha in either wheat or barley.

Double-knock control

The most consistent and effective double-knock control of fleabane has involved including 2,4-D in the first application followed by paraquat as the second.

Glyphosate alone followed by paraquat will result in high levels of leaf desiccation but plants will nearly always recover.

Timing of the second application in fleabane is generally aimed at about 7 to 14 days after the first application.

But the interval to the second knock appears quite flexible.

Increased efficacy is obtained when fleabane is actively growing or if rosette stages can be targeted. Although complete control can be obtained in some situations – for example in the summer of 2012-13, control levels will frequently only reach around 70 to 80 per cent, particularly when targeting large flowering fleabane under moisture stressed conditions.

The high cost of fallow double-knock approaches – and inconsistency in actual control level of large mature plants – is a key reason that proactive fleabane management should be focussed at other growth stages.

KEY POINTS ABOUT FLEABANE

- Utilise residual chemistry wherever possible and aim to control 'escapes' with camera spray technology (e.g. WeedSeeker).
- Thrives in situations of low competition; avoid wide row cropping unless effective residual herbicides are included.
- 2,4-D is a critical tool for consistent double-knock control.
- Successful growers have increased their focus on fleabane management in winter (crop or fallow) to avoid expensive and variable salvage control in the summer.

Feathertop Rhodes grass (FTR)

Since around 2008, FTR has emerged as an important weed management issue in southern Qld and northern NSW.

It is another small seeded weed species that germinates on, or close to, the soil surface. It has rapid early growth rates and can become moisture stressed quickly.

Although FTR is well established in central Qld, it is still largely an 'emerging' threat further south.

Try to aggressively treat the patches to avoid whole of paddock blow-outs.

Residual herbicides (fallow and in-crop)

FTR is generally poorly controlled by glyphosate alone even when sprayed under favourable conditions at the seedling stage.

Trial work has shown that residual herbicides generally provide the most effective control, a similar pattern to that seen with fleabane. A wide range of currently registered residual herbicides are being screened and offer promise in both fallow and in-crop situations.

The only product currently registered for FTR control is Balance (isoxaflutole) at 100 g/ha for fallow use.

Double-knock control

A glyphosate followed by paraquat double-knock is a very effective strategy on barnyard grass, but the same approach is variable and generally disappointing for FTR management. In contrast a small number of Gp A herbicides (all members of the 'fop' class) can be effective against FTR but need to be managed within a number of constraints.

- Although they can provide high levels of efficacy on fresh and seedling FTR, they need to be followed by a paraquat double-knock to get consistent high levels of final control.
- Gp A herbicides have a high risk for resistance selection, again requiring follow up with paraquat.
- Many Gp A herbicides have plantback restrictions to cereal crops.

Feathertop Rhodes grass. (Photo: Michael Widderick)

KEY POINTS ABOUT FTR

- Glyphosate alone or glyphosate followed by paraquat provides generally poor control.
- Utilise residual chemistry wherever possible and aim to control 'escapes' with camera spray technology.
- A double-knock of Verdict followed by paraquat can be used in Qld prior to planting mungbeans where large spring flushes of FTR occur.
- Treat patches aggressively, even with cultivation, to avoid paddock blow-outs.

- Gp A herbicides generally have narrower windows of weed growth stage for successful use than herbicides such as glyphosate. That is, Gp A herbicides will generally give unsatisfactory results on flowering and/or moisture stressed FTR.
- Not all Gp A herbicides are effective on FTR.

A permit (PER12941) has been issued, in Qld only, for the control of FTR in summer fallow situations prior to planting mungbeans. It is for Verdict at 150–300 mL/ha followed by paraquat at a minimum of 1.6 L/ha, within 7–14 days after the first application.

Timing of the second application for FTR is still being refined but application at about 7–14 days generally provides the most consistent control.

Application of paraquat at shorter intervals can be successful, when the Gp A herbicide is translocated rapidly through the plant, but has resulted in more variable control in field trials. Good control can often be obtained up to 21 days after the initial application.

Windmill grass (WG)

FTR has been a grass weed threat coming from Qld and heading south – windmill grass (WG) is more of an issue in central NSW but is spreading north.

WG is a perennial, native species found throughout northern NSW and southern Qld.

The key cropping threat appears to be from the selection of glyphosate resistant populations with control of the tussock stage providing most management challenges.

Resistance levels

Glyphosate resistance has been confirmed in WG with three documented cases in NSW, all located west of Dubbo. Glyphosate resistant populations of WG in other states have all been collected from roadsides but in Central West NSW, two were from fallow paddock situations.

Residual herbicides (fallow and in-crop)

Preliminary trial work has shown a range of residual herbicides with useful levels of efficacy against WG. These herbicides have potential for both fallow and in-crop situations. Currently there are no products registered for residual control of WG.

Double-knock control

Similar to FTR, a double-knock of a Gp A herbicide followed by paraquat has provided clear benefits compared to the disappointing results usually achieved by glyphosate followed by paraquat. Similar constraints apply to double-knock for WG control as they do for FTR.

- Although some Gp A products can provide high levels of efficacy on fresh and seedling WG, they need to be followed by a paraquat double-knock to get consistent high levels of final control.

KEY POINTS ABOUT WINDMILL GRASS

- Glyphosate alone or glyphosate followed by paraquat is generally poor.
- Preliminary data suggests that residual chemistry may provide some benefit.
- A double-knock of quizalofop-p-ethyl (e.g. Targa) followed by paraquat can be used in NSW.

- Gp A herbicides have a high risk for resistance selection, again requiring follow up with paraquat.
- Many Gp A herbicides have plantback restrictions to cereal crops.
- Gp A herbicides generally have narrower windows of weed growth stage for successful use than other herbicides such as glyphosate. That is, Gp A herbicides will generally give unsatisfactory results on flowering and/or moisture stressed WG.

A permit (PER13460) has been issued – in NSW only – for the control of WG in summer fallow situations. It is for quizalofop-p-ethyl (such as Targa 99.5 g ai/L) at 0.5–1.0 L/ha followed by paraquat at a minimum of 1.6 L/ha, within 7 days after the first application. Use of 200 g ai/L quiazalofop-p-ethyl formulations is also permitted at 0.25-0.5 L/ha.

First application should be at WG growth stages between 3 leaf and early tillering.

Timing of the second application for WG is still being refined but application at about 7–14 days generally provides the most consistent control. Application of paraquat at shorter intervals can be successful, when the Gp A herbicide is translocated rapidly through the plant, but has resulted in more variable control in field trials and has been clearly antagonistic when the interval is one day or less.

Good control can often be obtained up to 21 days after the initial application.

To sum up

Double-knock herbicide strategies are useful tools but there is 'no one size fits all treatment'. The interval between double-knock applications is a major management issue for growers and contractors.

Shorter intervals can be consistently used for weeds where herbicides appear to be translocated rapidly (e.g. ABYG) or when growing conditions are very favourable.

Longer intervals are needed for weeds where translocation appears slower (e.g. fleabane, feathertop Rhodes grass and windmill grass).

Critical factors for successful double-knock approaches are to apply the first application on small weeds and ensure good coverage and adequate water volumes particularly when using products containing paraquat.

Double-knock strategies are certainly NOT bullet-proof and rarely effective for salvage weed control situations unless environmental conditions are exceptionally favourable.

Thank you to Steve Walker (QAAFI), Tony Cook (NSW DPI and Maurie Street (GOA) for their input and provision of trial data. This research is supported by the GRDC.

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The original 2013 GRDC Updates paper was reviewed by John Cameron. ■

Bollgard III on the way

■ By Tony May[1] and Kristen Knight[2]

BT technology has provided excellent insect control for 17 years and has been crucial to the success of Australia's cotton industry. Growers and the wider industry can take much of the credit for this impressive record thanks to their efforts in preventing resistance from undermining the technology.

But if the industry is to continue to benefit from this technology we need to ensure we do not take it for granted. The threat of resistance can never be underestimated so it is crucial that we do not drop our guard now. This is why Monsanto is developing its third generation *Bacillus thuringiensis* (Bt) product – Bollgard III.

Monsanto is working to obtain approvals from the OGTR and APVMA and hope to achieve commercial release in 2015–16. With Bollgard III, Monsanto aims to provide a more sustainable insect control product for Australian growers to preserve the performance of current technology well into the future.

Monsanto is currently undertaking extensive scientific research into the performance of Bollgard III which will be launched in Australia before any other country in the world (subject to regulatory approval). And our partners CSIRO and CSD are working to introduce Bollgard III in to the best high performing varieties and ensure seed will be available.

As Bollgard III is still in the development phase, it is too early to determine what a final resistance management plan (RMP) might look like. There may be opportunities to create an RMP that can deliver productivity gains to growers but this will be dependent on the outcomes of our research which will continue this season.

Three proteins are stronger than two

Bollgard III contains a third protein, Vip3A, to reinforce the Bt proteins found in Bollgard II – Cry1Ac and Cry2Ab. Having three proteins will increase the longevity of the technology, each having a different mode of action – that is they kill larvae in a different way.

The addition of the third protein increases the sustainability of the technology as it becomes increasingly difficult for Helicoverpa to develop resistance to more than one of the Bt proteins. Early results indicate that Bollgard III is highly effective against Helicoverpa species, but it is too early to determine how the technology will affect any future RMPs.

Both Cry and Vip toxins are insecticidal proteins that were originally found in the bacterium *Bacillus thuringiensis* although they are produced during different stages of the Bt life cycle. Vip and Cry toxins have many similarities, including a narrow range of target pests and virtually no harmful effects on non-target organisms.

When a susceptible pest ingests Vip or Cry toxin, the food moves into the midgut where the toxins bind to midgut receptors. Both toxins cause the death of cells that line the insect's midgut, which in turn causes the lining of the gut to rupture. Rupturing of the midgut leads to the death of the insect.

Developing the Bollgard III RMP

Even armed with a third protein, it is still important that we have a robust RMP to manage the development of resistance. Along with Monsanto and CSIRO, CRDC has made a significant investment in a number of projects to develop a thorough understanding of the product, its benefits and the appropriate resistance management strategy.

The development of the Bollgard III RMP will be based on these principles:

- Providing a population of susceptible individuals that can mate with any resistant individuals, hence diluting any potential resistance;
- Minimising the exposure of Helicoverpa spp. to the Bt proteins Cry1Ac, Cry2Ab and Vip3A; and,
- Removing resistant individuals at the end of the cotton season the principle of providing a population of susceptible individuals that can mate with any resistant individuals.

These principles underpin the five key components of the current RMP:

- Refuge crops;
- Control of volunteers and ratoon cotton;
- Pupae busting;
- A planting window; and,
- Spray limitations.

Our research will provide us with the necessary product performance information to develop an RMP that protects the technology as well as offering growers greater flexibility. We are also working closely with the TIMs committee throughout the process to ensure there is understanding about what the research is telling us and what this may mean for the RMP.

RMP research is well underway

This season Monsanto will continue studies on three key components critical in developing the Bollgard III RMP. The components are:

- Baseline resistance monitoring;
- Refuge efficiency trials; and,
- Evaluation of the expression and efficacy profile of the Bt proteins in Bollgard III.

This research will continue this season as a thorough understanding of each of the elements is imperative to developing the Bollgard III RMP.

Resistance monitoring – trays of larvae being fed diet containing Bt toxin.

Seven day bioassay – placing susceptible strains of Helicoverpa larvae on leaf tissue collected from the field.

The large number of bioassays from the "Survivor trial" being undertaken at Monsanto's Toowoomba laboratory. Each container contains a larvae feeding on material collected from the field.

Resistance monitoring

Both Monsanto and CSIRO have conducted resistance monitoring programs for Cry1Ac and Cry2Ab over a number of years. These resistance monitoring programs are critical to the pre-emptive approach we have taken to resistance management in Australia and are capable of providing an important early detection of potential increasing resistance.

Recently, both laboratories have added baseline resistance monitoring for Vip3A to prepare for Bollgard III. Understanding the background resistance allele frequency of Helicoverpa spp. to the Bt proteins Cry1Ac, Cry2Ab and Vip3A is important in developing the Bollgard III RMP.

Refuge performance

Refuges are an important management technique to mitigate the risk of resistance developing. One of the key elements of the current Bollgard II RMP is the requirement to plant structured refuges.

Refuges produce moths that have not been exposed to the Bt proteins and are able to mate with any moth that may have survived Bollgard II. Larvae can survive Bollgard II for a number of reasons. The frequency of resistance genes in surviving larvae from Bollgard II crops is similar to the frequency of resistance genes in the random samples used by both resistance monitoring programs.

If an individual insect survives Bollgard II and is carrying a resistance gene, mating with a moth from the refuge will serve to dilute resistance genes.

The original research conducted by CSIRO and used in modelling indicated that the production of moths from a 10 per cent unsprayed cotton refuge should be the standard for refuge size calculations. Therefore as pigeon peas produce twice as many moths on average as unsprayed cotton, a pigeon pea refuge needs to be half the size of an unsprayed cotton refuge.

Our refuge trials (11 sites from the Darling Downs down to Hay) are re-evaluating the production of unsprayed cotton and pigeon pea refuges. The refuge trials are visited every three weeks and searches are conducted to find pupae. The pupae are then sent to the Monsanto laboratory in Toowoomba where we record the emergence of moths (species) and parasites.

Efficacy and expression

Monsanto is also evaluating the seasonal expression profile of the Bt proteins/toxins in Bollgard III. Although the Bollgard III plant will express all three Bt toxins, each toxin works independently.

In order to understand how each toxin is performing we need to evaluate plants that only express a single toxin: Cry1Ac alone; Cry2Ab alone; and Vip3A alone. In collaboration with CSIRO, eight trials with single toxin plants, Bollgard II, Bollgard III and Roundup Ready Flex plants will be conducted over two seasons.

We are evaluating the ability of larvae of both Helicoverpa spp. to survive at three points in the season, squaring, peak flowering, and approximate cut-out. We evaluate survival on each of the plant types, as well as understanding the expression level of each of the toxins.

What the early results tell us

Monsanto conducted nine trials over the 2010–12 Australian cotton seasons to determine the efficacy of Bollgard III. The in field trials assessed damage in terminals, squares and small bolls as well as measuring Helicoverpa spp. abundance across the treatments including; Bollgard III, Bollgard II and non–Bt Roundup Ready Flex. (Figure 1)

Leaf samples were collected from the sites and bioassays with Helicoverpa spp. were set up to check for mortality and the number of surviving larvae along with development stage and weights of the surviving larvae.

As expected both Bollgard II and Bollgard III provided very high levels of control of Helicoverpa spp in these trials. It will be unlikely that growers will see incremental differences in the field because of the already very high level of control experienced in Bollgard II crops.

But the key to Bollgard III is in delivering this high level of control long into the future. Adding an additional protein is expected to increase the length of time that the technology will provide this level of control.

Monsanto is using mathematical modelling as a tool to better understand the additional benefits Bollgard III can bring in terms of longevity compared to current practices with Bollgard II. It is also possible to simulate the effects in changes in the components of the RMP, for example reduction in refuge areas, pupae busting or planting windows.

Over the next year, Monsanto will work with the TIMS Committee and industry researchers to narrow the assumptions used in the modelling to determine the extent to which any changes in the RMP are possible while still protecting the technology.

Counting down to the 2015–16 season

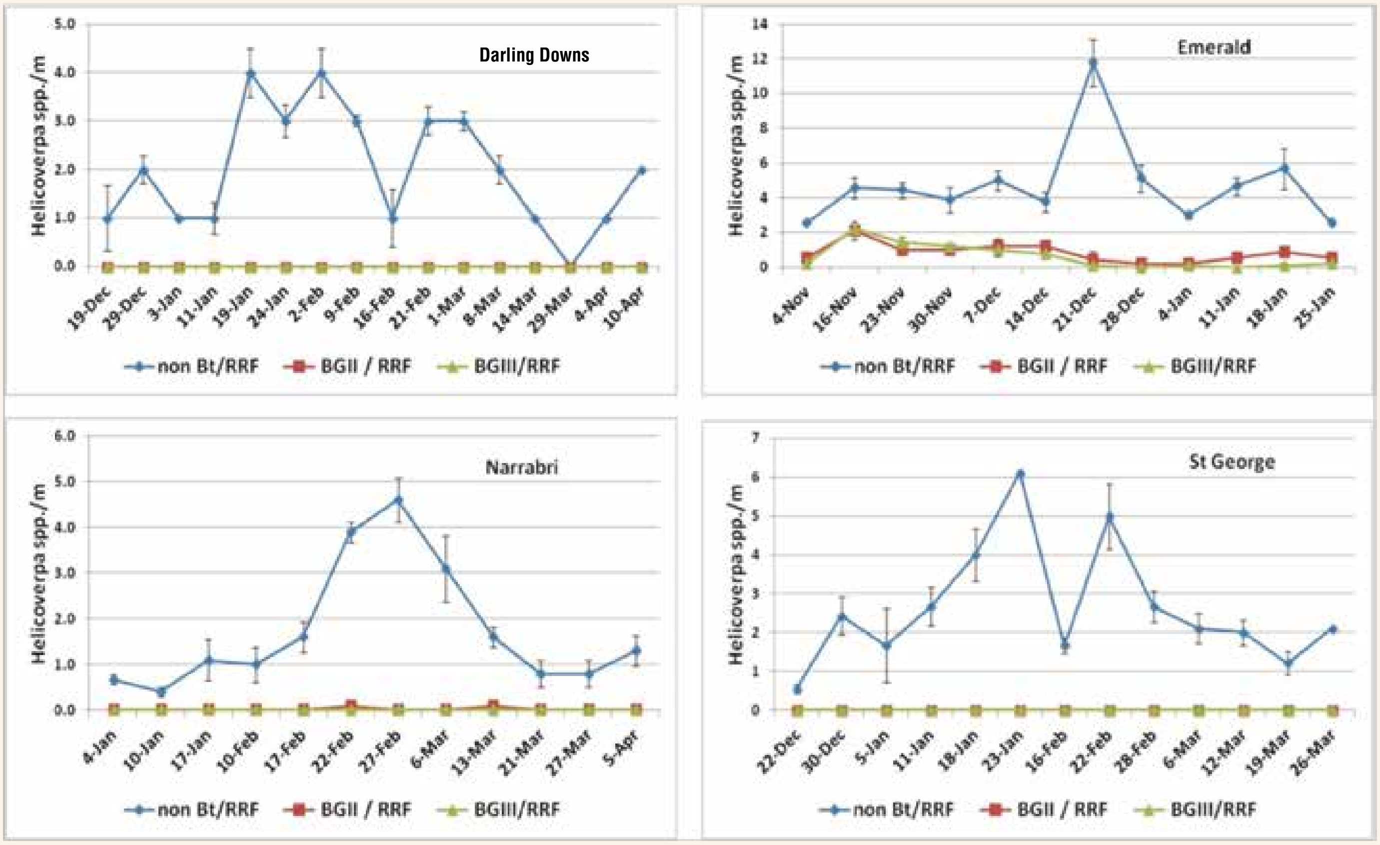
Monsanto, its partners and industry researchers have been working hard to understand how Bollgard III will perform and what this could mean for growers. Although we are only roughly half way through our research, the early results give us confidence that Bollgard III will perform as well as Bollgard II.

We also hope to be able to develop a less onerous RMP for growers, but it is essential we are guided by what the science tells us. Through our research and collaboration with TIMS we will have a much clearer picture of what scope there is to change the current RMP by the middle of next year, subject to the consideration of the APVMA.

Until then, we will continue our research into a product that will provide growers with the long term security they need and expect from Monsanto's Bt technology.

[1]Technology Development Lead, Monsanto.
[2]Entomologist & Manager of Monsanto's Cotton Research Laboratory.

FIGURE 1: Four field trials from 2011–12 assessing Helicoverpa spp. abundance across the treatments including Bollgard III, Bollgard II and non–Bt Roundup Ready Flex



Crop, chemical rotation the key to weed control at Edgeroi

THE emergence of hard to kill fallow weeds such as windmill grass as an increasing issue in the northern cropping region, is being combatted by Ian Gourley through the use of technology, rotation and timing.

By following a strict five-year rotation, Ian has been able to use different chemical groups and application methods to limit the weed seed bank on his property at Edgeroi, NSW.

Using a 30 per cent summer and 70 per cent winter crops production split on the 4000-hectare property, the rotation program also works against the risk of resistance developing.

"The rotation works pretty well in keeping down your seed bank levels so you're not getting escapes through different crops, and by changing your crops each year we're using the different chemistry of them to break up that resistance," Ian said.

"If you get on top of those resistant weeds it's a huge cost saver. If you've got to go to full cultivation every year and full blanket sprays, your fallow costs can just blow out and not much is profitable after that.

"Keeping good early control of weeds is allowing us to be much more profitable."

Ian grows both dryland cereals and cotton, with the farm receiving an annual average rainfall of 680 mm across the year, which makes weed control a constant priority.

Ian Gourley's very structured weed control strategy has evolved as a new weeds come along.

The rotation comprises cotton; then wheat into a pulse, faba bean or chickpea; back into wheat or canola; and then a return to cotton again.

"If we have enough moisture after the cotton we'll double crop into chickpeas," he said. "This isn't necessarily to harvest for profit but to use the chemistry base around growing chickpeas to give you the balance and simazine for the control of those weeds coming through.

"It's a lot easier if you've got residual control in your soil. If you're only getting a few escapes they're easy to pick up with the WeedSeeker camera and a lot cheaper to control."

WeedSeeker plays an important role

The summer fallow work is conducted using WeedSeeker technology, which allows Ian to try different tank mixes to see what works best.

"That also allows us to apply phenoxies safely, so we manage spraying around our own farm without a lot of drift," he said.

"We tend to put a phenoxy herbicide through the cameras and a mix of other chemicals at a lower cost, then come back in when we get a flush of weeds and knock it out with a paraquat broadacre spray. We also run over the crop once a month with a camera sprayer."

WeedSeeker technology uses a selective spot spray system to selectively apply herbicides, insecticides, fertilisers, and fungicides to plants only, not bare earth.

"WeedSeeker cuts your actual costs down a lot," Ian said. "There are higher application costs but we're using five per cent of a normal broadacre spray so we can use more expensive and effective tank mixes.

"It moves dominance away from the main chemical groups and allows us to use other groups. This is especially good for resistance, where you can use residuals in certain areas of paddock and not do a broadacre spray which can be very expensive."

Ian also employs cultivation in his weed management strategy, which came about through his Monsanto Technology Use aAgreement for his GM cotton crops.

"Since then we've integrated it into our system to reduce resistant weeds in the future by doing a full cultivation once or twice after cotton in areas that aren't being double cropped."

Ian said his weed management strategy has evolved as new weeds have become problems.

"You always keep an eye to the future," he said. "You can use your different rotations and put a strategic cultivation in which helps after the dryland cotton, but you don't know what will be the next issue weed until it hits you – you just have to work with it.

"We seem to get a new problem weed every five years. Previously we've battled fleabane in our fallow crops, but we seem to have controlled it to a point now.

"Windmill grass is coming into fallows now and it seems much harder to control than the fleabane. We have some black oat resistance over winter, and increasingly awnless barnyard grass resistance, which is going to hit soon.

"But a lot of the weeds we had 10 years ago just aren't an issue any more. We used to have a lot of trouble with pigweed, but it's very easy to control with WeedSeeker. We just need to keep on top of those new ones coming through." ■

THE RESEARCH VIEW

Achieving success with no-till into pasture ground

AT A GLANCE…

- Early grass control in pastures is best.
- Choose sown cereal pasture varieties with good disease resistance.
- Chemically control summer and autumn weeds well – don't just rely on grazing.
- Cultivation increases seeding nutrition rather than reduces disease inoculum.

RESEARCH undertaken in South Australia's Mallee region has underlined the key strategies needed for farmers to successfully no-till into pasture ground.

About 70 per cent of Mallee farmers operate mixed farming systems incorporating cropping, pastures and livestock, and many of these find it difficult to achieve successful results with no-till in pasture paddocks.

Chris McDonough (left) with workman Brian Pedler and trial site farmer Peter Blacket in the 2012 wheat crop at the *Grain & Graze II* Wynarka site, which showed a clear yield advantage for no-till over early working because all key management steps were taken. (Photo: Chris McDonough, Rural Solutions SA)

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.


Chris McDonough (second from left) discussing the *Grain & Graze II* project with farmers at the Wynarka site.
(Photo: Chris McDonough, Rural Solutions SA)

According to Chris McDonough from Rural Solutions SA, growers therefore resort to cultivation prior to sowing, increasing time and energy to get the crop in, decreasing soil moisture at seeding and increasing erosion potential, particularly when worked early in the year.

"Some farmers trying no-till into pasture ground have observed poorer crop establishment, less vigour and more root disease," Chris said.

"But other farmers have been able to consistently no-till into pastures with success, demonstrating that it can work in a variety of soil types and seasons."

Through the Grains Research and Development Corporation-funded *Grain & Graze II* initiative and a Caring for Our Country-funded Mallee Sustainable Farming Inc project, Rural Solutions SA has uncovered many factors influencing successful no-till into pasture systems.

Paddock-scale trials

Chris said numerous paddock-scale trials were established to better understand why many farmers with livestock find it difficult to no-till into pasture ground, and to give them practical management options for both the pasture and cropping phases that will help maximise outcomes, while reducing the risk of wind erosion.

Part A of the three-year *Grain & Graze II* project compared 2011 wheat crops that followed grass-free and spray-topped pastures in 2010. This clearly showed the advantages in early grass removal in reducing the build up of rhizoctonia, which carried through to grain yield advantages of between 12 per cent and 17 per cent at various sites.

This root disease was able to build up on the grass roots through both the spring period of the pasture phase, and on the early grass germination following late summer rains. Soil testing at seeding time showed low levels of rhizoctonia after grass removal, medium levels after spray topping, and very high levels where the autumn grass germination was not controlled.

But in last year's trial, the medium to high levels of rhizoctonia inoculum in the soil at both sites in December 2011 had reduced by over 80 per cent to very low levels by seeding time in 2012.

"This was thought to be mainly due to significant summer rainfall events in both December and February," Chris said. "But while seeding into these low levels, crop monitoring still showed an average of 30–35 per cent root loss at both sites."

These results highlight how seasonal factors can have a large impact on the threat posed by rhizoctonia, and how good management of grasses can help minimise yield loss even in problem years. This disease can still cause significant crop damage even when starting from a low base.

Part B of the project compared 2012 wheat crops that followed sown cereal pastures and volunteer pastures in both the southern (Wynarka) and northern (Wunkar) SA Mallee last season.

The farmer of the Wynarka paddock used cereal rye as the sown pasture which was very clean of other grassy or broadleaf weeds, while the Wunkar site had oats trashed in along with brome and barley grass, wild turnip and capeweed. In that dry season the volunteer pasture sections of both sites were fairly poor, consisting of capeweed, wild turnip and grass, leading to increased erosion risk from these sections. Chris said that the bulk of the paddock feed was obtained from the sown cereal sections (although areas were not separately fenced or measured).

Bipolaris (common root rot) inoculum levels at the Wynarka site after Bevy rye were shown to have built up significantly by seeding time of the following wheat crop. As the crop ripened in mid-October, white heads marked the cereal rye strips, resulting in a 33 per cent yield loss compared to the volunteer pasture.

Chris said it was also noted that the root loss measured from rhizoctonia averaged 39 per cent from these rye areas compared to 24 per cent from the volunteer pastures area, suggesting a link between the disease effects.

"Generally, cereal rye is used as an important break crop in the Mallee to improve soil health, and bipolaris is usually not a strong consideration when planning rotations, so it was quite unexpected when this problem arose. It suggests that Bevy rye – while yielding much higher – does not have the same disease resistance spectrum as the older SA commercial rye."

This result highlights the need for choosing sown cereal for pasture varieties carefully, so that they do not lead to a build up of potentially damaging crop diseases such as cereal cyst nematode, take-all, crown rot or common root rot (bipolaris).

Crop establishment treatments

In 2011 and 2012 there were four crop establishment treatments used across the original pasture treatments:

- Early worked (EW) after rains in late February and worked again one week prior to seeding;
- Late worked (LW) one week prior to sowing;
- No-till (NT).; and,
- No-till with higher inputs (NTH).

These tillage treatments were paddock scale using farmer equipment with all trials replicated and the main soil types monitored separately. Over the two years there were two clear messages that arose:

Firstly, the early tillage treatments had little impact on the levels of rhizoctonia inoculum in the soil by the time seeding occurred in May. In each site across the two years of trials the levels of rhizoctonia soil inoculum at seeding time were not significantly different.

Secondly, the biggest and most consistent difference at all sites was in the levels of mineralised nitrogen to 30 cm depth. Early worked areas last year had between 13–35 kg per hectare higher N available at seeding compared to the no-till areas, and 23–27 kg per hectare higher N at seeding in 2011.

These differences were generally higher in the loamy soil types,

Getting underway with no-till into pasture ground at the *Grain & Graze II* Wynarka site in May 2011.
(Photo: Chris McDonough, Rural Solutions SA)

and lower in the sandy areas due to their lower inherent fertility and ability to mineralise nutrients.

This higher soil nutrition (generally in the cultivated areas) initially led to slightly lower root disease symptoms when monitored in early stages of crop growth. But despite averaging 23 kg per hectare lower N at seeding at Wynarka in 2011, the no-till plots yielded 0.53 tonne per hectare above the early worked plots, meaning that they removed an extra 20 kg per hectare N in crop yield.

This suggests that the no-till areas mineralised far more nitrogen later in the growing season, aided by some useful early spring rains.

According to Chris, this extra N mineralisation from no-till farming systems (also measured in CSIRO Mallee research trials) is attributed to the higher microbial activity that occurs throughout the growing season as the crops need it, predominantly when the soil is moist and the temperatures are warmer.

"But in 2012, this extra N boost in no-till systems did not appear to kick in as well, possibly due to the cold winter and almost complete lack of rainfall after mid-August to the end of the season when increased microbial activity normally occurs. This was consistent with the generally low proteins from continuous cropping systems across the region."

Chris said the NTH plots were designed to try and account for the extra nutrient mineralisation at seeding resulting from cultivation. In three of the four trials over the two years, while the farmer applied an extra 25–50 kg per hectare of fertiliser, this only equated to an extra 4.5–9 kg per hectare N which generally showed no consistent advantage.

"But at Wynarka in 2012 the NTH plots received an extra 23 kg per hectare N, which averaged a 0.4 tonne per hectare yield increase over NT plots and 0.8 per cent higher protein across the loamy sand main trial area," he said.

"While I would like to see more work done in this area, I feel that farmers starting no-till from a more traditional base with pastures may benefit from applying extra N, unless coming off a good legume pasture. This will help account for the fact that the soil will not be receiving its usual nutritional mineralisation boost at seeding time from cultivation."

Secondly, the sites that proved to be most tillage responsive were those that had no chemical summer weed control. Results from Wunkar in 2012 (130 mm growing season rainfall) showed an average yield advantage for the early worked plots of 19 per cent over no-till across various soil types. In this case the farmer had just relied on grazing to control weeds that often did not kill them outright, resulting potentially in higher moisture loss, disease build up and nutrient tie up.

"Another no-till into pastures paddock trial at Parilla (southern Mallee) in 2012 showed a 60 per cent yield response to chemical summer weed control over just grazing," Chris said.

"Last year many Mallee farmers commented on the large difference in crops between those paddocks that had excellent summer weed control that conserved moisture, and those that didn't. Any no-till farmer knows that one of the keys to success is having good summer weed control.

Sheep for weed control

"My feeling is that many livestock farmers tend to use grazing for summer weed control more than chemical control. This is a logical compromise for getting some valuable feed as well as keeping summer growth down to a manageable size.

"But if you are not killing the plants, roots and all, then you will be compromising the potential of your following crop and certainly diminishing your chances of success with no-till seeding into this ground.

"In the trials where the farmers got the whole package right, with early grass removal in the pasture, good chemical summer and autumn weed control, and crop establishment with excellent no-till seeding machinery, the farmer achieved an 18 per cent gain yield advantage over early working," Chris concluded.

A closer look at the seeding operation at the *Grain & Graze II* site at Wynarka. (Photo: Chris McDonough, Rural Solutions SA)

Keys to successful no-till into pasture ground

Based on results from these two years of trials, other Mallee research and anecdotal observations, the following recommendations have been made:

- Early grass removal from pasture phase is better than just spray topping.
- If using sown cereal pastures, choose disease resistant varieties.
- Use chemical summer weed control that kills weeds and optimises moisture conservation, rather than just relying on grazing management.
- Keep autumn a weed-free zone, not allowing for disease build-up on volunteer growth.
- Use proven no-till seeding systems with good breakout pressure, deeper working narrow points, good seed and fertiliser placement and press wheels creating a water harvesting furrow.
- Sow early as practical before soil temperatures decline, with adequate N, P and Zn.
- Don't despair if no-till looks poor early, as generally nutrient mineralisation (as the crops require it) throughout the season will be advantageous.

"My observations are that farmers who have been successfully no-tilling in more intensive cropping systems with the right set ups and management generally have more success with no-till into pasture ground," Chris said.

"Farmers who are generally coming from a more traditional crop pasture situation will have bigger challenges in trying to move toward best practice no-till management after pasture, particularly if they compromise in one or more of these key areas. Some seasons can clearly expose any weaknesses in no-till seeding systems.

"But it is important to remember that no-till systems will help protect paddocks from erosion and will help increase biological activity in the soil which will improve crop nutrition in the long term.

"Mallee farmers can successfully no-till into pasture ground with sound planning and preparation that begins in the pasture phase."

A fact sheet produced by Rural Solutions SA details the keys to successful no-till into pasture. It is available via https://www.msfp.org.au/docs/media_343.pdf. A project powerpoint presentation is available via https://www.msfp.org.au/documents/Successwithno-tillpastures-ChrisMcDonough.pdf

Contact Chris McDonough, Rural Solutions SA, Loxton Research Centre, Phone (08) 85959136 or 0408085393, www.ruralsolutions.sa.gov.au Email chris.mcdonough@sa.gov.au

THE CONSULTANT'S VIEW

SUMMER AND AUTUMN WEED CONTROL

A critical component in achieving success with no-till into pasture ground is good weed control in summer and autumn, according to Mallee-based consultant Tanja Morgan.

Tanja, of Tanja Morgan Project Services, says chemical summer weed control is one of the most important factors in no-till yield benefit and can often be neglected when livestock are continually grazing weeds over summer.

"While grazing alone can be cheaper and provide convenient stock feed, growing weeds will always compromise the success of any no-till seeding," Tanja said.

She said poor weed control was one of the main reasons farmers experienced a lack of no-till success.

Through her involvement in the *"Increasing adoption of no-till technology following the pasture phase"* project funded by Caring for Our Country through Mallee Sustainable Farming Inc, as well as the Grains Research and Development Corporation-funded *Grain & Graze II* initiative, Tanja has witnessed the benefits to be gained through effective summer weed control.

Tanja said it was clearly demonstrated in numerous Mallee trials that to achieve benefits from summer weed control, weeds need to be sprayed until they are dead.

"Spraying summer weeds conserves moisture and nutrition and also reduces rhizoctonia disease build-up. In dry years, good summer weed control can be the difference in being able to sow, grow and harvest a profitable crop."

Tanja said summer weeds controlled early were easier to kill and this strategy also reduced the likelihood of trash build-up. Research in the Mallee has also shown that in the cropping year, early autumn weed control is just as important as summer spraying.

Tanja said she was seeing more and more farmers make adjustments in their management regimes to improve their yields from pasture ground.

"While some farmers are still choosing to cultivate pasture ground prior to sowing, especially as a perceived measure for reducing rhizoctonia after long periods of dry, hot weather, more growers are realising if they change their ways with other aspects of their farm practices – such as spraying grass out earlier in the pasture phase – cultivation is not necessarily required."

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Summer and autumn weed control are critical components in achieving success with no-till into pasture ground, according to Mallee-based consultant, Tanja Morgan.

Managing feathertop Rhodes grass

■ From GRDC Feathertop Rhodes Grass Fact Sheet

AT A GLANCE…

- Feathertop Rhodes grass (FTR) is well established in the northern grains region and is now emerging as a problem in the south.
- FTR can be relatively tolerant to glyphosate, especially after early tillering.
- The only way to control FTR effectively is to use an integrated weed management (IWM) approach.
- Focus on running down the weed seedbank and preventing seed set.
- Choose competitive cultivars and use planting densities to improve crop competition.
- Select crops that allow the in-crop use of grass-selective (Group A) herbicides and residual herbicides. If FTR is concentrated in a particular paddock, rotate away from crops with limited FTR control options (such as sorghum).
- Group A herbicides have a high risk of resistance developing, so only use them as part of a carefully considered IWM plan. If Group A is made redundant, all in-crop grass management options are lost.
- Always sow crops into weed-free conditions.
- Pre-emergent herbicides will be most effective when applied prior to sowing rain.
- The double-knock tactic can be effective, and there are a number of available options.
- The efficacy of herbicides against FTR drops rapidly when plants are larger than the early tillering stage or are moisture stressed, so spray as soon as possible after rain for best results.
- Delay sowing of summer crops on paddocks with a high density of FTR.

OVER the past two decades, feathertop Rhodes grass (*Chloris virgata Sw.*) has gone from being a minor cropping weed to a major problem for northern – and now some southern – region growers. But with an integrated weed management approach, effective control is possible.

FTR was once common only on roadsides and fencelines, but as with many emerging problem weeds in non-traditional areas, it has been favoured by the shift in cropping systems to minimum tillage so is now more widespread.

FTR is a tufted annual grass growing up to one metre tall. It has a distinctive seed head of between seven and 19 feathery spikes.

FTR prefers lighter textured soils but will survive in heavier clays. It is quick to mature. FTR can produce seed heads within four weeks if conditions are suitable.

Emergence, growth and seed set

Major flushes of FTR occur when good rain falls over consecutive days, particularly in spring, although FTR can emerge all year round in environments such as Central Queensland.

A single knock of glyphosate at full label rates has done very little to slow this mature infestation of feathertop Rhodes grass in a trial in Central Queensland. The greener plot on the left is the untreated control. (Photo: Darren Aisthorpe)

FTR germinates at temperatures of between 20°C and 30°C, with a preference for the warmer end of the scale.

FTR needs minimal surface soil in which to germinate. The majority of germinations will occur in the top two centimetres.

The majority of seeds lose viability after seven to 12 months. This means that although FTR is a difficult weed to manage, if you are able to limit seed production, effective weed control can be achieved.

Managing FTR

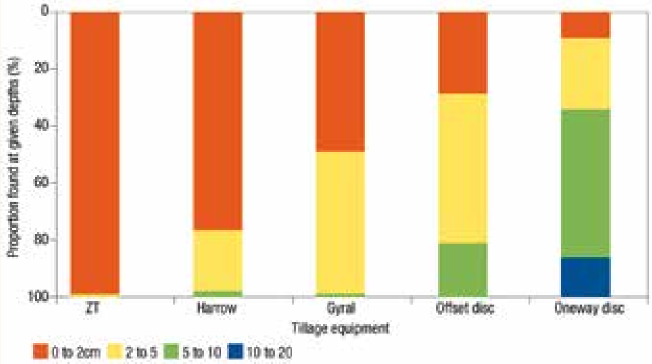
FTR management is a challenge. All phases of the weed's life cycle need to be considered, with an IWM strategy employed in both the fallow and in-crop phases.

When planning an IWM approach to control FTR, consider the following points:

- No single weed management application will provide 100 per cent control. Use a variety of tactics – both chemical and non-chemical.

The seed capacity of feathertop Rhodes grass is illustrated by this paddock in Central Queensland where the seed was 1 to 2 cm thick on the ground. Each plant can produce up to 6000 seeds, making it critical for the grower to focus on stopping the FTR life cycle. (Photo: Darren Aisthorpe)

FIGURE 1: Proportion of feathertop Rhodes grass seed buried by various tillage practices



Note: Data on burial of plastic beads that mimicked FTR seed. All tillage treatments gave 60 to 80 per cent reduction in emergence over the following summer.

- Aim to stop seed-set and run down the weed seedbank.
- Determine treatment type according to the density and distribution across paddocks.
- Use spot treatment for scattered or occasional FTR infestations.
- Target small, non-moisture-stressed and actively growing plants to improve the chances of good control. Spray small FTR seedlings immediately after rain.
- Adopt good herbicide application techniques to maximise coverage. This means using full label rates and appropriate nozzles, boom heights, water volumes and speed for the intended spray job.
- Closely monitor the results of all management applications, and spot treat survivors as soon as possible.

FTR well established in a chickpea crop. In this situation, rapid and aggressive control is needed to stop seed-set in crop. Most pulse rotations offer effective Group A knockdown herbicide solutions such as haloxyfop (Verdict) should your in-crop residual allow escapes. But in crops where there are no suitable in-crop knockdown options or crop stage prevents the use of them, seed management must be the first priority. The use of a double-knock knockdown option post-harvest, strategic tillage with a residual herbicide included or selective spot spraying or tillage are some of the key IWM practices that could be used. (Photo: Darren Aisthorpe)

- When using residual herbicides, apply to a clean soil surface. Ideally no weeds should be present.
- If using tillage to control existing plants, ensure the depth and type of tillage is sufficient to uproot the grass without transplanting it.
- If using tillage for seed burial, aim for good depth to prevent seed from germinating (Figure 1}.
- Manage outbreaks along roadsides, fencelines and around sheds as these will be a continuing seed source for paddocks.

Chemical control options

Balance (Group H) has recently gained a label extension for use as a residual herbicide in fallow in all states, and FTR is one of the specified weeds.

Paraquat (Group L) is registered for control of annual grasses generally, and imazapyr (Group B) is registered for non-crop land uses.

Several residual herbicides are effective at stopping seeds germinating and plants establishing in sequential flushes, and therefore can suppress the weed seedbank.

Ideally residual herbicides are applied to a clean paddock – so they make contact with the soil surface – and rain is received within two weeks of application. This allows the herbicide to move into the surface soil and minimises breakdown of the chemical from exposure to ultraviolet light.

The best time to apply is prior to sowing rain, as the herbicide will then control any FTR emerging with the crop. Keep application water volumes high – around 80 to 100 litres per hectare – for best results.

When using any herbicide with residual activity, follow label directions for re-cropping.

Double-knock

Glyphosate (Group M) alone may be ineffective on FTR regardless of the age of the weed. But if paraquat (Group L) is applied sequentially in a double-knock, control is improved, although 100 per cent control is rarely achieved.

The addition of a grass-selective residual herbicide, such as Balance, to the second knock can provide control of subsequent emergents.

Wait a minimum of seven days between knocks for best results, but no longer than 21 days, otherwise efficacy is likely to be reduced.

A permit initiated by the Northern Grower Alliance (PER 12941) allows the double-knock of a Group A herbicide followed by paraquat (Group L) but only in fallows that are to be planted to mungbeans.

This permit is effective until August 2016 and is restricted to Queensland growers only.

As Group A chemistries are susceptible to resistance developing in target weeds, PER 12941 limits Verdict 520 to one application per season in fallow, and this must be followed by a double-knock application of at least 1.6 L per hectare of a 250 grams per litre paraquat product.

This strategy can give up to 100 per cent control, but level of control is compromised when treating large and/or stressed weeds. Because of the issue of group A resistance, it is critical that any escapes are controlled.

With any herbicide applications, it is best to target the young actively growing weeds, and apply at full label rates to reduce the possibility of resistance developing.

Double-knock need not always refer to two applications of different herbicides. In some instances, the second knock may be a strategic tillage operation.

The difference that crop competition can make in control of FTR is illustrated in these two scenarios. The wheat on the left has been planted in tight row spacings and a residual herbicide applied, resulting in a very clean crop. On the right, the weeds have flourished in the wide rows and low plant densities, despite the application of the same residual herbicide. (Photo: Darren Aisthorpe)

WeedSeeker

A permit initiated by NSW DPI is in force until February 2015 (PER 11163) allowing the minor use of a range of chemical products in conjunction with a WeedSeeker.

The permit stipulates the use of 65-degree flat fan even nozzles (TP6503E or larger) and a minimum coarse spray. It also provides a list of active ingredients that are covered.

Soil disturbance

As FTR germinates at or very near the soil surface, burying the seed below 5 cm will prevent germination.

Strategic tillage has been shown to be effective in breaking the FTR life cycle.

Weed seedbanks can also be depleted in the soil by encouraging emergence.

A ‘tickle’ with harrows can facilitate peak flushes of FTR, exhausting the seedbank and presenting excellent opportunities for early post-emergent management.

Inter-row tillage can be an option for in-crop control of FTR, although this will depend on the crop rows being wide enough to allow the passage of machinery.

To avoid damage to the crop, this tactic should be used only when the crop is small.

When FTR plants are mature and clumped, offset discs and chisel ploughs are the best choice for uprooting and mulching the plant material.

In-crop

In-crop control of FTR will be limited by herbicides which are registered and can be safely used in that particular crop.

Group A grass-selective herbicides can be used in broadleaf crops such as mungbean and chickpea and there are other Group A herbicide options for wheat and barley.

Having these broadleaf crops in the rotation provides additional options for FTR control, such as residual herbicides, as well as being good practice for delaying or preventing herbicide resistance developing.

Crop competition

Increased crop competition can suppress FTR growth and weed seed production. Trials in Central Queensland showed FTR numbers were 30 per cent lower in wheat planted in 25 cm rows compared with 50 cm rows.

Select a competitive crop such as barley or wheat, sown under competitive configurations, and keep row spacings tight and plant densities high. Aim to establish the highest crop population for that cultivar and your region.

Good crop competition is also essential to maximise residual control with certain herbicides, especially chlorsulfuron (Glean) in wheat. Glean is an effective in-crop weed-control option, although not suitable in a fallow.

Sow into a clean seedbed and provide adequate nutrition and crop protection (insect and disease control).

Stopping seed production

FTR seed can be short-lived (around 12 months), so one or two seasons of attention and monitoring can bring it under control.

Manage the weed population when it is small in area, and don’t wait for large outbreaks before trying to control it.

Check the success of any weed management measure after treatment to identify survivors. Control them via spot tillage, spot spraying or manual removal.

An IWM approach requires diligence and persistence. Used together, the suite of tactics will result in reduced seedbanks and weed pressure.

IWM also reduces the likelihood of herbicide resistance developing, because it requires the grower to actively rotate crops, tactics and herbicide groups.

On-farm hygiene

FTR that grows in non-cropping areas such as roadsides, fencelines and around buildings can act as a seed source for cropping paddocks – so focus weed management efforts on these areas as well.

Seed can travel short distances via wind or water, but can also be transferred by vehicles, clothing, animals and other means.

Introducing a non-invasive ground cover is a good idea for non-cropping areas because FTR is less likely to establish on ground that is not bare.

For more information go to www.grdc.com.au ■

Australia-China canola research project secures key export market

AUSTRALIA has shipped more than 560,000 tonnes of canola, valued at about $350 million, to China since restriction on the trade of the oilseed was lifted during May, 2013.

The figures were released as a delegation of plant pathologists from China's Administration of Quality Supervision, Inspection, and Quarantine (AQSIQ) began a week-long research visit to the Department of Agriculture and Food, Western Australia (DAFWA).

The Australian Export Grains Innovation Centre (AEGIC), Australian Oilseeds Federation (AOF), DAFWA and representatives of the Commonwealth Department of Agriculture, Fisheries and Forestries (DAFF) held a welcome reception for the visiting delegates at DAFWA headquarters in July.

Australian Oilseeds Federation (AOF) vice president Jon Slee said the visit was Phase 1 of a research program which formed part of the conditions for the resumption of the trade.

"The export of Australian canola to China was suspended in 2009 when Chinese quarantine officials became aware of the risk of the seed-borne blackleg fungus entering the country," Jon said.

"Mr Bin Li and Ms Pinshan Wu's visit begins the joint Australia–China Research Program into managing blackleg fungus and represents the further strengthening of the relationship between our two nations."

Negotiations between DAFF and China's AQSIQ, during 2009 and May, 2013, lead by AOF, resulted in the resumption of the export of Australian canola from areas of low blackleg-prevalence. Eight Chinese ports are approved to receive the bulk shipments.

AEGIC Managing Director Richard Price said the research program would build capacity in the management of blackleg for both countries and play an important role in maintaining Australia's canola exports to China.

"Mr Li and Ms Wu will work with our industry in reviewing the methods used for testing for blackleg, comparing these to China's methods and learn about Australia's blackleg management practices," Richard said.

"They will also get an insight into our canola farming and logistic systems so that they have a better knowledge of and confidence in Australia's canola supply chain to China."

For more information go to www.aegic.org.au ■

(From left to right) Mr Bin Li ASQIQ; Dr Mahmood Nazir DAFF; Ms Roslyn Jettner AEGIC, Ms Pinshan Wu ASQIQ; Ms Dominie Wright DAFWA; Mr Jon Slee AOF; Mr Richard Price AEGIC; Mr Bill Magee DAFF; Mr Geoff Thomas DAFWA and Dr Ravjit Khangura DAFWA.

Recent rain a crop saver

By Malcolm Bartholomaeus, Bartholomaeus Consulting

Profarmer Grain AUSTRALIA
www.profarmer.com.au September 25, 2013

THE rains for the week ending September 22 have been a crop saver. All parts of the Australian wheat belt received rain, except for the parts of Queensland where harvest is already underway.

Some of the yield losses driven by the dry August and early September in NSW and parts of the Victorian and South Australian Mallee have not been recovered, but elsewhere the deterioration in the crop was stalled, leaving production projections much higher than they would have been without the strong rainfall events.

Even reports out of Western Australia are positive after a very dry June put a lot of their crop under pressure early in the growing season.

Basically it will leave the national crop much closer to the 24.5 million tonnes projected by ABARES in early September – rather than dipping down towards 22 mt as was being speculated by some forecasters.

A conversation being had with many growers now (late September) is whether their forward sales program is looking a bit light on, particularly in regions where production looks to be well above average, and a 'normal' forward sales program in tonnage terms is leaving their percentage of expected crop priced at lower than would be normal.

It is a fair question, because between now and our harvest we would expect to see further downside on all grain prices.

Canola is one crop being talked about because it is the first crop harvested for many, and is used to generate valuable early harvest cashflow. So, as the crop becomes more secure, should additional sales be added now?

Is it time to be selling?

At the moment canola seems to be in freefall, only held up as the market takes a breather, or as occasional support ripples through from US soybeans. The problem is that this was a year where canola prices were always likely to come under pressure from the North American oilseed harvest, and that is exactly what has happened. The best sales opportunities closed off at the end of August, and now may not be the time to be thinking about adding to sales.

If the current dip is related more to harvest pressure, then we might see a lift in prices as our own harvest gets underway, but what we don't know is how low prices will go in the meantime.

Wheat seems to be getting support for the time being and refuses to go below 638 USc/bu. We will be in danger of sharp downside if this strong level of support in the charts is broken. In the meantime, US corn will probably determine the fate of wheat, with barley heading wherever wheat goes.

What are the sale options?

When we cast our eye over all the potential sale options, wheat is still the one that comes to the fore. Relative to wheat, barley at up to a $68 per tonne discount to APW (Kwinana), and $48 per tonne to ASW, just looks too cheap to be selling right now.

The same applies to canola. If we use our rule of thumb that canola needs to be priced at double the APW wheat price, then at $475–$485 per tonne this week, versus wheat at $263–$272 per tonne, canola is too cheap by about $50–$60 per tonne.

And is now the right time to be adding to wheat sales? For growers with no sales to date and needing harvest cashflow, and are now looking at more yield certainty, and with potentially more downside on prices from here until harvest, it might still be something that needs considering.

What the dollar means for Aussie grain prices

To the point...

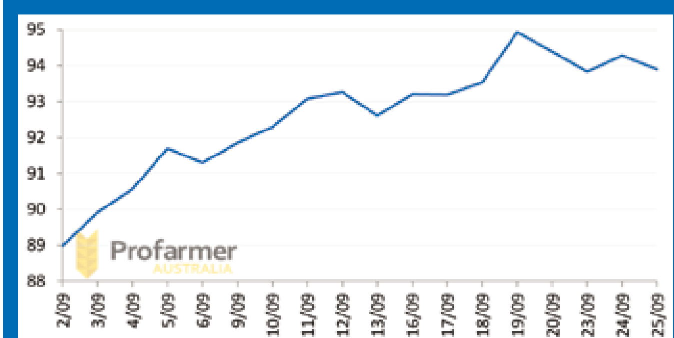
- When currency moves are based on changes in the USD, commodity prices will move to offset the gain/loss; and,
- Although the appreciating dollar is disappointing, we are still well in front of where we were at the start of the year.

We have had a recent period of rising currency, which has caused some disappointment with growers. But it is not all bad news. Since the start of January we have added about $25 per tonne to our prices as a result of the dollar falling. This gain is being held onto despite the apparent adverse currency move in the past couple of weeks.

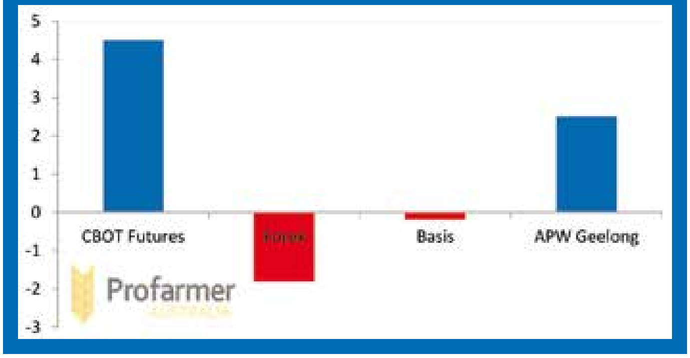
For most of the year we had a drop in our dollar against all currencies, including the US dollar. This has been very valuable for our export industries, including the grain industry.

It almost seems that a boost of $20 to $25 per tonne is about right for wheat. Periodically it gets above that. For example around September 2 we were clocking the gain from currency since January 3 at about $40 per tonne. That seems to have been too high, and we have seen it correct back to $25 per tonne, which is where it was mid August.

A$ for September 2013 (US cents)



Wheat price components



The current surge in the dollar is being driven by US monetary policy. The US Federal Reserve has been hinting at 'tapering' their 'quantitative easing'. In plain English it means that the massive money printing exercise to boost the US economy – which has pushed the US dollar down – is about to ease, allowing the US dollar to rise. In anticipation of this the US dollar went up, and our dollar went down, dipping below 90 US cents.

But there have been suggestions that this might not happen as quickly as people were speculating. So, the US dollar has fallen during September, pushing our dollar back up. It appears bad, and we have given up some of the benefit that was present in the market around the start of the month, but all that has happened is return us to a gain for the year from currency, back to around $25 per tonne.

If it is just the US dollar moving up and down against every currency, then on days we see a high US dollar, our dollar will be low, but commodity prices in US$ terms will be down. The impact on the A$ value of US wheat futures is close to zero. Likewise, on days that the US dollar falls, our dollar goes up but commodity prices in US$ terms will rise. The impact on the A$ value of US wheat futures is again close to zero.

US monetary policy the key

Basically, as long as we hold onto our $20 to $25 per tonne currency gain, up and down moves in the currency from here on will be negligible, meaning that there is little more to be gained from a drop in the dollar, and little to be lost if the dollar lifts, as long as those currency moves are driven purely by the US dollar going up and down in response to speculation about US monetary policy.

The big risk from currency is a lift in our dollar driven by factors just driving the Australian dollar, like a lift in the value of mineral exports to China, or a lift in our interest rates relative to overseas rates.

The chart above shows typical wheat price components. APW Wheat in Geelong gained $2.50 over the week to September 24. This was made up of a + $4.50 gain in CBOT Wheat, – $1.81 from stronger currency and – $0.19 from slightly weaker basis. ■

Grain market outlook

Wheat

New season wheat

Profarmer Grain AUSTRALIA
www.profarmer.com.au
September 25, 2013

While this is not the time to be making further sales of wheat, mainly because the opportunities for making sales at good values has passed (after staying open for much longer than normal this year, and right into late August), it is also fair to say that if anything is going to be sold right now, wheat looks like having the best value.

The recent blip up in the Australian dollar has pushed new season wheat prices down in all port zones in the past couple of weeks, as has a pull back in basis levels. But the underlying US$ futures price is firmly trading above support at around 640 USc/bu. As long as the market does not get forced below that level, we should see a new base put in place for the A$ value of US futures, and therefore in our own cash market as well.

To the point...

- Wheat futures in A$ terms have continued to fall, dragging down our new season cash market as well;
- Wheat is getting support from the near end to the northern hemisphere harvest, and export demand into Brazil, and expected into China; and,
- The threat to wheat is lower corn prices.

Supportive factors for wheat include:

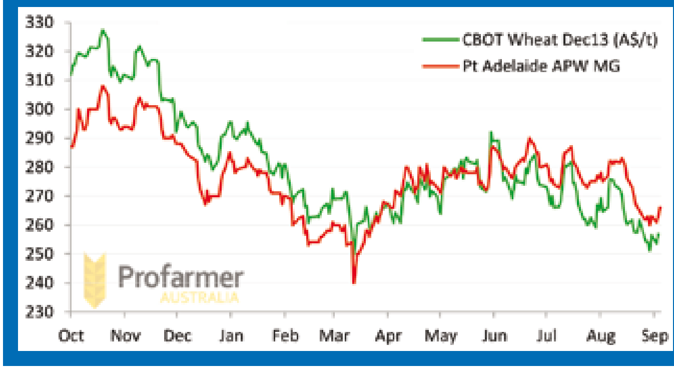
- The end of the US wheat harvest;
- Rapid progress about to be made on the Canadian harvest (really the last of the major northern hemisphere crops to come off);
- Ongoing demand into Brazil, which is expected to continue as the Argentine crop looks increasingly like falling short to be able to fill that market again this year; and,
- Potential for more wheat sales to China soon.

Working against wheat will be corn. The corn market needs to price itself at a level that will rebuild demand for corn in the feed market in the US and elsewhere. At the moment US corn has held above 450 USc/bu in recent times, but if it punches below that level it could head to the 350 USc/bu we saw in 2009. If that happens it will remove support for wheat and make it that much harder for the wheat fundamentals to be able to sustain a stronger market.

The latest information out of the US, reports a lower number of cattle on feed. One would expect lower corn prices will be needed to attract more feed demand from this sector of the livestock feed industry.

Right now, with the US corn harvest gathering pace, we are likely to see pressure come onto the feed grain markets. Not only

2013–14 wheat prices



will that take support away from the overall grain market, it will also begin to see the process of demand for feed grains shifting form wheat back to corn.

The Australian wheat harvest is now underway, with wheat being harvested in central Queensland, and being brought to market by some growers from that region as well.

Pulses

Peas

Stat Publishing report that pea exports from France are off to a strong start this year, but to other European destinations at this stage. It is expected that France will export more peas this year, but the limitation will be that overall supply will be lower in 2013–14 than it was for 2012–13.

The biggest issue will be if peas for feed consumption drops too far in France and elsewhere in Europe, as the availability of other feed sources (eg soymeal) improves. That could leave excess peas to be moved into human consumption markets in competition with Canadian and Australian peas.

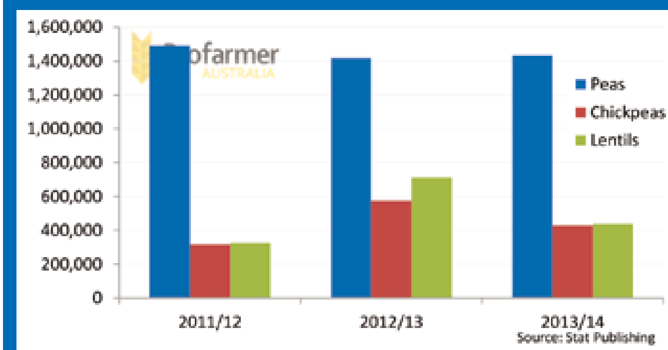
Indian kharif (or monsoon) crop

The Indian kharif pulse crop is expected to be slightly up on last year and above the recent average according to Stat Publishing this week.

That will leave 2013–14 pulse production from both their kharif and rabi crops at 18.53 million tonnes, up from 18.45 mt last year and 17.09 mt the year before.

Projected imports for peas are expected to be up on last year, but chickpeas will be down, as will lentils. The drop in chickpea imports will coincide with a smaller desi chickpea crop from Australia, but a drop in lentil imports will make it harder for Australian lentil prices to recover from low prices from the past couple of seasons.

Projected Indian pulse imports



Canola

To the point...

- Canola prices are under heavy pressure from the harvest in Canada and impending soybean harvest in the US;
- We may see prices recover from their Sept/Oct lows, possibly in our harvest period or shortly after; and,
- Current canola prices relative to wheat are getting down to about as low as they go making canola unattractive to sell compared to wheat.

Canola freefall

The drop in canola prices has been relentless, but very much in line with expectations as we transitioned from acute tightness in North American oilseed supplies, to relief from the harvest of a record canola crop, and a much larger US soybean crop.

The Canadian canola harvest is now well advanced, and yields are reported to be excellent, underpinning the projections for a record Canadian crop. It has now got to the point where Canadian farmers don't want to store any more on farm, and so are simply selling their surplus, regardless of where the market is.

That is classic harvest price pressure, which may end up being positive, in that once the harvest is finished, farmer selling should dry up.

That should happen for several reasons:

- Growers have made sales, particularly with their surplus production, and so will not feel the need to keep selling.
- With prices now well down on preharvest levels in Canada, growers will be reluctant to make more sales of stored canola until they see some sort of price recovery.

At some point the domestic crushers and exporters will need to come back to the market to buy, with growers being reluctant sellers. This is when prices should begin to make a recovery.

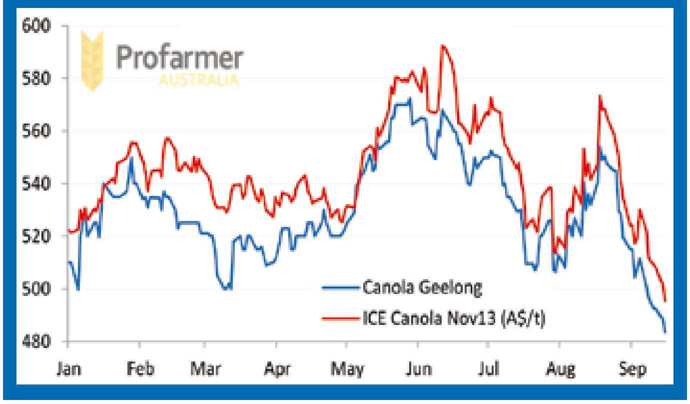
It is clear that our prices are being driven by Winnipeg prices at the moment, and that should continue. So anything that helps push Canadian prices back up, should flow over to our own market.

If the current downturn in canola prices is being driven by harvest pressure form Canada, then once that dissipates we should see a recovery in the price base, and a lift in our prices as well. That may begin to come into the market during our harvest.

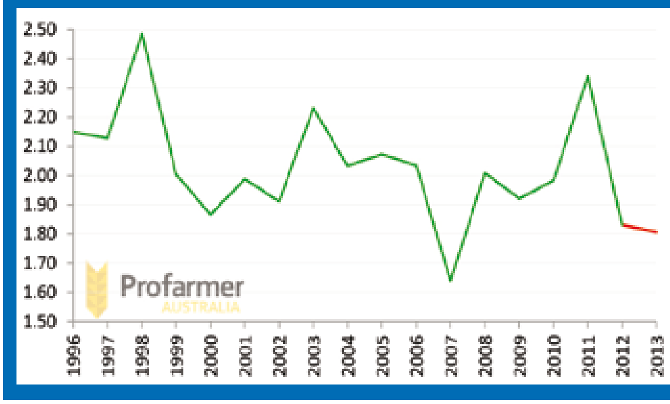
As well, as our harvest gets underway and as domestic crushers and endusers bid to get the tonnage they need, we might see a firming in basis levels, particularly in Victoria and NSW. That in turn will add a little more to the upside.

One issue right now is that canola prices have been driven too low relative to other grains to make selling canola attractive. If we benchmark off APW wheat prices, then current prices are close to as low as they go relative to wheat. ■

2013–14 canola prices

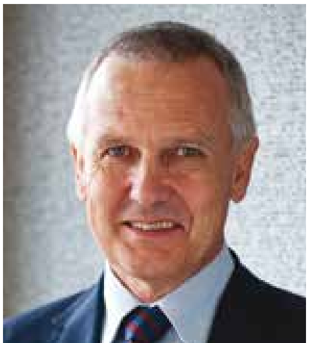


Ratio of canola to APW at harvest



Meeting customer demands – a top grain industry priority

By Geoff Honey, Grain Trade Australia


Geoff Honey.

THE challenge of meeting the demands of customers is well recognised across the grain industry. The Australian grain industry operates in a competitive environment and it is important that the industry, and growers, receive accurate market signals. It is important that trading standards are market based and reflect the quality of the grain that Australia produces – quality which is highly valued and recognised by our customers.

Typically a customer's requirements will be determined during negotiations with their supplier – that is, an Australian grain trader and then detailed in the grain trading standard that is attached to the contract. On behalf of the industry, GTA establishes these grain trading standards and these standards must reflect domestic and international industry conditions and benchmarks.

The Australian industry, including growers, fought hard to establish different standards or specifications for wheat, to segregate and reward higher quality grain. Test weight is one of the few specifications that was standard across all milling wheat grades.

In response to the demands of the customers of Australian wheat, in 2010, the Grain Trade Australia (GTA) Board approved a recommendation from the GTA Standards Committee to increase the test weight for milling grades of wheat from 74 kg per hectolitre to 76 kg/hl for the 2013-14 season.

Background to the grain trading standards

Up until 2008, industry used the AWB wheat standards as trading standards. In 2008 GTA developed wheat standards to ensure that standards would exist for wheat forward contracts then being written. The concern, which ultimately eventuated, was that AWB would cease publication of standards.

Importantly, the distinction must be made between 'receival' standards and 'trading' standards. GTA produces trading standards to reflect industry requirements via their contractual arrangements.

Industry is free to use the GTA trading standards at any point in the supply chain. This is frequently done at receival (point of delivery of grain from growers) and when grain is traded/marketed between various parties along the supply chain.

Grain storage operators/bulk handling companies reserve the right to adopt receival standards they will apply to grain delivered by growers in any given season. But having a different BHC receival standard to GTA's recommended trading standard creates the risk that market signals from Australia's grain buying customers are not being transmitted to Australian grain growers.

For this reason bulk handling companies have historically adopted GTA's trading standards (or the Grain Industry Association of Western Australia standards in WA) as their receival standards for each season.

The operation of the Australian market has changed from the Single Desk era. Under a free market environment, there is no single exporter or trader who can absorb the risk of receiving grain that does not meet buyers' requirements without reflecting that risk in lower prices to growers who cannot meet the market's requirements.

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What is test weight?

Test weight is a critical contractual parameter, listed in virtually all domestic and export sales contracts. It measures the density of grain and is calculated as kilograms per hectolitre. It is also used by the storage and transport sectors to determine how much grain will be able to be stored and transported in a given volume of space.

Test weight is one of five key physical measurements that regularly occur when grain is being graded at receival. They are:

- Test weight;
- Protein;
- Moisture;
- Screenings; and,
- Falling number.

GTA members sell the vast majority of Australia's grain to international and local flour millers and grain processors and critically none of our regular grain buying customers acquires milling grain with a test weight below 76 kg/hl, unless they are seeking to buy feed wheat.

How much wheat will be affected?

Historically, grain with a low test weight is likely to have other defects which would cause it to fail specifications for higher grades – so failing test weight will not be solely responsible for downgrading.

Based on data for the past five years supplied by bulk handling companies, the increase will affect 2-3 per cent of receivals into the major storage system across Australia at harvest.

Test weight and end product performance/quality

At the recent Australian Grain Industry Conference, JB Milling's John Bunn, explained to delegates that wheat grain with a test weight of less than 78 kg/hl compromises the extraction value for flour millers. This sentiment was backed up by the Managing Director of the Soon Soon Group (Malaysia) Dr Neoh Soon Bin.

A higher test weight provides a greater level of confidence for Allied Mills and our customers that the milling wheat being milled will meet their increasing expectations of flour quality, end product performance and consistency.

– Joshua Lawrence, Allied Mills

Another key characteristic that is indicated by low test weight is compromised dough and end product performance/quality. Low test weight indicates that the grain did not form properly or has not maintained its intended form.

Potential causes may include:

- Frost damage during protein deposition where the gluten-forming protein fractions were not laid down as normal within the endosperm – resulting in tough and possibly unusable doughs and poor end products.
- Lack of moisture during grain filling – indicating not only high screenings (which is a direct loss) but also unusually dry and hard grain. Often this is not able to be conditioned correctly prior to milling and –

  More mechanical starch damage occurs which leads to slack doughs which make bakers irate and can cause loss of sales; Higher ash levels result which reduce the value of the flour and require blending away as an extra process or require milling at lower extraction rates.
- Too much moisture after maturation leading to grain swelling and less density. Moisture-swelled grain, even if not sprung provides higher enzyme levels which may make the grain unsuitable for many end products, or make doughs difficult to handle and compromise normal production processes.

Any parcel of wheat grain that has a test weight of less than 78 has some basic defect.

– Mark Laucke, Managing Director, Laucke Flour Mills, SA

Test weight and the global market

On the world market, feed wheat generally trades at 72 to 74 kg/hl, while milling grades have a minimum test weight of 76 kg/hl everywhere except Australia.

Minor wheat exporters set their benchmark at 72 to 74 kg/hl, low quality, low price; not the target market for the high quality Australian wheat.

– Thomas Breitenmoser, Divisional Milling Excellence Manager, Weston Milling

A higher test weight for milling grades of wheat is being demanded by the domestic and export customers of Australian wheat, via the specifications listed in contracts.

For instance, international customer contracts require 76 kg/hl as a minimum test weight, as shown by the following aggregated data (Table 1) provided to GTA by grain exporters, although they do vary by grade and contract.

TABLE 1

Minimum test weight	Markets	Tonnage (5 year average)	% of total contracts
76	Vietnam, China, Malaysia, Yemen, Sudan, UAE, Bangladesh, other SE Asia, Oceania	5,924,000	36%
77	Thailand, Egypt, NZ, Saudi, Taiwan, EU, other SE Asia, other Africa	2,429,000	15%
78	Indonesia, South Korea, Philippines, Japan, Iraq, Iran, Kuwait, South Africa, other	7,884,000	49%
	Total	16,237,000	100%

Test weight of Australia's competitors?

The test weight specifications of Australian wheat competitors are all higher than the current Standard, although they do vary by grade and contract (Table 2).

The published minimum test weight limit is seen as an indicator to existing and potential customers of the standard of grain produced in that country. Australian wheat is poorly reflected to the market by having an official Standard of 74 kg/hl despite the current average test weight across all port zones for the past five years being 79-82 kg/hl.

The guarantee to the trade of 76 kg/hl on outturn will give the trade more confidence to participate in markets where the high hectolitre weight requirements exist.

– Sean Powell, Chair, Wheat Committee, Grain Industry Association of WA, Wheat Council

Implications of the increase for wheat growers

How will wheat that falls below 76 kg/hl be marketed?

In years when quality issues arise, competitive forces will ensure that 'fair value' for sub-standard grain will be found. If grain is delivered below, but not far below, 76 kg/hl and there is no other sub-standard quality defect impacting the sample, it is likely that buyers will apply small discounts to acquire this grain.

Many large bulk commercial storage providers currently offer dynamic binning services to grain growers to manage this risk.

TABLE 2

Supplier country#	Test weight minimum (kg/hl)
United Kingdom	76
South Africa	76/77
France, Germany	77/78
Argentina, Brazil (Hard wheat) Bulgaria, Kazakhstan, India (Hard wheat) Romania (Hard wheat), Russia, Ukraine (Group A, Grade No.1)	78
US	
• HRW, SRW, SWW	76
• HRS	75
Canada	
• CWAD No.1	79
• CWHWS No.1, CWRS No.1	75
• CPSW No.1 (No.2)	77 (75)

Not all grades are listed for some countries

Management of test weight by wheat growers

Wheat growers may consider the following strategies to minimise the risk of wheat falling below the new GTA trading standards test weight minimum of 76 kg/hl.

- Ensure you do not use wheat varieties that demonstrate susceptibility to low test weight in the likely expected range of seasonal outcomes in the relevant production region.
- Ensure screenings levels are minimised to maximise the volume of heavier grain in the hectolitre tests at the point of grain sampling for each load presented for sale or delivery.
- Consider on-farm or commercial storage blending programs that will address low test weight loads that might arise in the course of grain harvesting or marketing operations. ■

THE MAIN POINTS…

GTA produces Grain Trading Standards to:
Reflect customer contractual requirements; and,
Ensure Australian exports can compete with competitor grades and quality;

- Domestic flour millers and consumptive feed users strongly support a higher test weight;
- Test weight and end product performance/quality are related;
- 100 per cent of international contracts stipulate a higher minimum test weight;
- Internationally, 74 kg/hl is more aligned to feed grades than milling grades; and,
- The international competition for milling grades starts at 76 kg/hl.

GTA moved the test weight to 76 kg/hl to better reflect customer requirements and, as an additional benefit, to demonstrate to world markets the higher quality attribute for test weight than is currently promoted by the Grain Trading Standards.

Farming in Foreign Fields...

Just add water – guidance makes underground irrigation possible

TODD Boughner, manager of Judge Family Farms in Simcoe, Ontario, and Derek Hill – who oversees field operations – spend a fair amount of their time sharing "what if" scenarios. Todd is quick to run a cost/ benefit analysis, and if an idea passes that test, chances are they'll adopt it.

Todd Boughner and Derek Hill. "We farm, and we have fun doing it," says Todd. The fun part, a visitor soon learns, is finding ways to do things better.

"We do a lot of research and development work here," Todd explains. Judge Family Farms is a Canadian poultry, pork and grain business. It finishes out about 100,000 broilers annually and is a largescale hog producer with farrow-to-finish operations and a focus on breeding and selling breeding stock.

Farming operations of 1060 hectares include 650 hectares of corn, all of which is sent through a mill to feed the poultry and hogs.

About four years ago, several factors converged that set Todd on a path of looking for a new way to boost corn yields.

That's when they began irrigating some corn ground, using a traveling gun and drag hose system. With it, they saw yields approaching 300 bushels per acre (7.6 tonnes per hectare) on some sandy ground that typically produced corn yields in the low 100s (2.5 tonnes per hectare).

'Thought wheels' began to turn

That yield boost started their "thought wheels" turning. They saw land prices escalating and the outlook for higher crop prices beginning to strengthen. And, their local weather patterns were tending toward dry spells at critical yield-determining times, if not all-out drought.

If reliable water is all it takes to assure higher yields, they reasoned, they should find a way to bring it. "We're a progressive company," Todd says. "We're not going to be hampered by seasonal weather patterns."

A fair portion of Judges Farms' acreage lies on what's known as the Norfolk Sand Plain. The coarse-textured soil has limited water-holding capacity. There's ample groundwater for irrigation, but to Todd and Derek, the overhead water systems, either traveling guns or centre-pivots, have inherent shortcomings including high water and energy use, and lack of timeliness.

"We try not to be the old school of 'getting by,'" Todd says. "We started looking for a better way."

An underground irrigation system in a lawn, with zone control, caught their interest.

"We thought, 'Wouldn't that be nice to do on a farm scale?'" Todd recalls.

Applying tape to corn ground was unheard of

This concept of subsurface irrigation using buried tape has commonly been used for high-value crops such as orchards and vineyards where deep tillage isn't practiced and soils don't freeze. Applying it to Ontario corn ground was unheard of, as Todd and Derek learned as they looked for subsurface irrigation resources.

"We talked with people who did subsurface irrigation in Florida, but the tape is gathered up every year." Todd and Derek

Todd Boughner and Derek Hill in a completed field, with risers in place to take in water pumped from a nearby pond.

wanted a longer lasting solution. A friend and neighbouring producer, Dave Blake, provided additional insight and support.

Based on the potential for efficient water use, low energy cost and minimal labour requirements compared to overhead systems, Todd and Derek decided to install subsurface irrigation tape on a 75-acre (30 hectare) field with a nearby pond as the water source.

RTK guidance, with its sub-inch accuracy, is the technology that made this investment possible, Todd and Derek say, and they adopted it as part of the installation process. Their local Case IH dealer helped them during the installation by providing them with a Magnum tractor equipped with an AFS Pro 700 display receiving an RTK signal.

"We're in a learning mode with RTK," Todd says. "Our dealer helped us greatly in getting the maps set up and showing how the information can be transferred to our equipment."

Designed their own tape applicator

Using the resources of their farm's shop, Todd and Derek designed and fabricated their own drip tape applicator that's based on three Case IH ripper shanks.

They buried seven-eighths inch diameter (22 mm) irrigation tape 14 inches (35 cm) deep, and 44 inches (1.1 m) apart.

Why 44 inches? "We tried a plot with tape buried 60 inches (1.5 m) apart and it worked well. We figured we had one shot at this so we settled on 44 inches. We think this will work better. With more water going to it, we'll run the system less," Todd explains. Their tape is warranted for 15 years.

He says their goal is an "overall wetting of the field" rather than trying to place water under or beside rows.

The 44-inch spacings also allow ample clearance for subsoiling, if needed.

"Based on the map of the irrigation tape, we just move over 22 inches (55 cm) and go.

A 15-hp electric motor pumps water into the system at 16 psi. A sand filtration system protects the tape from sediment, and a flow meter is in place to monitor and measure water flow. They also have the ability to add nutrients into the water flow for fertigation.

The system is set up into six zones of approximately 12.5 acres (5 ha) each. "I can water two zones at one time, and put one-quarter inch (6 mm) of water into the root zone in six hours. So in 18 hours, I can water the whole field with one-quarter inch (6 mm) of water, which is huge," Derek says.

Benefits beyond higher yields

Todd and Derek see the benefits of this new irrigation system going far beyond simply having higher yields. For example, not only was last year's drought-affected crop short, the corn test weight and quality was reduced which in turn affected their feed quality and the productivity of their poultry and hogs.

The irrigation drip tape is buried 14 inches deep on 44-inch spacings. A Magnum tractor equipped with the AFS Pro 700 display provided the RTK autoguidance and mapping. The excavation photo shows the main line with rigid risers hooking to the dripper lines.

With predictable water, they will get full benefit from the fertilisers they apply.

In the broader environmental perspective, they note the benefits of minimal drawdown of groundwater, as they are relying on surface water. They will significantly increase yield from a fixed amount of ground, without breaking new soil or consuming more fuel and other resources.

They'll see higher returns from the cost of land, which is the farm's largest investment.

And, with water removed as a variable, they can work with other agronomic factors toward Todd's goal of more than doubling the yield on land that has averaged 100 bushels (2.5 t/ha). "I know we can gain way over 100 bushels," he says. "I want to see 250 (6.25 t/ha) or I won't be satisfied.

"We love fertility and corn science. Now, with water, we can put everything together," he adds.

Applying new technology

As an overall farm mission, Todd and Derek apply new technologies whenever possible. They use wireless cameras to monitor their multiple livestock locations, which they can view on their iPads wherever they have Internet access.

They're planning to add a camera focused on their newly irrigated field to view "real time" corn and anticipate adding wireless subsoil moisture monitors.

Case IH AFS Precision Farming systems fit well into their technology vision. "Most everything is red on this farm, and we're using AFS and the AFS Pro 700 display on our new Magnum tractors," Derek says.

"We get more new technology every time we get new equipment. AFS is definitely a system we can grow with." ■

Fast track way to market new malting barley

AUSTRALIA'S malting barley industry will be better placed to cater for the growing global thirst for high quality beer thanks to a unique project between the Australian Export Grains Innovation Centre (AEGIC) and Western Australia's Edith Cowan University (ECU).

The project – 'Pilot Malting Australia' sees the operation of Australia's first pilot malting plant at ECU's Joondalup campus.

It is proposed the new facility will assist breeders to better assess lines when making decisions about new Australian malting barley varieties.

AEGIC Chairman Robert Sewell said more accredited malting barley varieties would provide more sowing choices for producers; better results for barley breeders and a more diverse Australian barley crop for international maltsters.

"Pilot Malting Australia represents a new opportunity for the whole industry. Global beer consumption is increasing, particularly in South East Asia and Africa, and brewing is becoming increasingly sophisticated," Robert said.

"With these trends comes an increased demand for quality malting barley."

AEGIC and ECU recently signed a three-year funding agreement to support Pilot Malting Australia. The agreement provides funding for operational activities until 2016.

Pilot Malting Australia Operations Manager Jon Luff said the design of the plant would allow a broad range of activities to support the Australian malting and barley industry.

"It will match the requirements of international customers with Australian barley varieties and on the whole assist to promote Australian, high quality malting barley to the world," he said.

The facility is the only one of its kind in the southern hemisphere and one of only five of its type operating worldwide.

The Australian export trade for malt and malting barley is more than $1 billion annually. ■

AEGIC Chair Robert Sewell (left) and Pilot Malting Australia Operations Manager Jon Luff inspect the new facility at Perth's Edith Cowan University.

Australian grain product of choice

ENSURING Australia's export grains meet the requirements of international customers is the focus of a joint research program between the Australian Export Grains Innovation Centre (AEGIC) and Murdoch University.

The Grain Protein Chemistry Capacity Building (GPCCB) program was launched in Fremantle, WA in front of an international audience of grain research scientists attending the welcome reception of the International Cereal Chemistry Conference in August.

The program sees the appointment of Australia's first Professor of Grains Protein Chemistry and the support of three post-doctorate positions and 10 PhD students specialising in grain protein structure, function and genetics.

Understanding protein is critical

AEGIC Managing Director Richard Price said understanding the protein content and composition of wheat and other grain food crops was essential to increasing the international competitiveness of Australia's export grains.

"The end-uses of Australian grains in our major export markets such as China and South East Asia are changing from primarily noodles to also include baked products such as breads, sweet buns and cakes.

"Understanding the impact of protein on the functionality of Australian grains under a range of new baking processes deployed by our customers will enhance our capacity to provide for their needs.

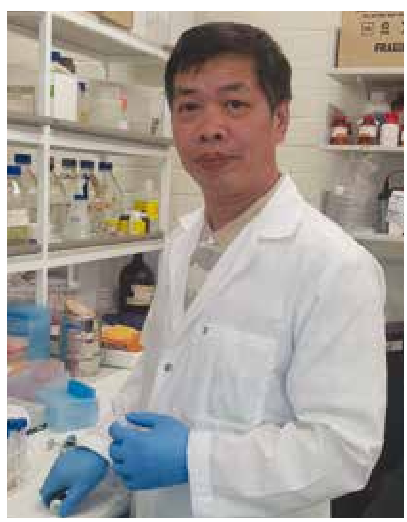
"The ultimate goal is to ensure Australian grain remains the product of choice for our existing and emerging export markets," Richard said.

Murdoch University Deputy Vice Chancellor (Research) Professor David Morrison said the initiative would build on the University's involvement in the Australia-China Centre for Wheat Improvement.

"Recognised as one of the top crop science universities we are pleased to partner with AEGIC to facilitate this important project," David said.

"Murdoch University has a long-term strategic commitment to wheat improvement and a mission to improve productivity in a process which maintains grain quality – this project will assist us in achieving this mission."

Accomplished wheat protein researcher Professor Wujun Ma has been appointed as the acting Professor of Grain Protein Chemistry. The program will focus particularly on baking quality but will expand to also include noodle quality, barley for malting and other grain foods with high value end uses. ■



Grain storage preparation – achieving profitable results

By Philip Burrill and Craig Moore

THE GRDC recently held a series of on-farm grain storage and quality testing workshops conducted by DAFF, GrainGrowers Ltd and Graintec Scientific. The workshops were well attended – highlighting the significant interest from grain growers in better understanding how to manage grain quality in storage.

The simple message of the workshops was "by better managing grain quality, growers can maximise their profits".

At this time of year, a pre-harvest inspection of storage mediums and grain quality testing equipment is critical to ensure that growers are prepared for harvest and that they have a strategy to minimise pest problems in storage.

The following strategies were recommended by the speakers to help maximise storage profitability and to maintain grain quality in storage.


Philip Burrill.


Craig Moore.

Maximise segregation opportunities through measurement

"You can't manage what you don't measure."

With the right equipment, growers can measure the quality of their grain on-farm and so maximise their profit through segregation.

Reliable and accurate protein and moisture meters, such as the FOSS Infratec Sofia, are now available for on-farm use and can be used to make important harvest decisions, such as which silo to store each truckload in, or which parcels of grain to blend in order to maximise the crop value.

Portable on-farm protein and moisture testers are generally light-weight and suitable to move around on-farm and can even be used on the back of a ute or in the cab of a header.

Grain of varying qualities can be blended to lift the overall grade. This can provide financial benefit if a small portion of higher-grade grain can be blended to lift the larger portion of lower-grade grain and the price difference for the grade is significant.

In addition to measuring protein and moisture, growers


Pre-harvest storage inspectioms are critical.
(Photo: Graintec Scientific)


A recent GRDC grain storage workshop at Dulacca, Qld.
(Photo: Graintec Scientific)

Accurate protein and moisture meters such as the FOSS Infratec Sofia grain tester can now be used on-farm.
(Photo: Graintec Scientific)

The Lesser Grain Borer – a serious pest of most stored grains. (Photo: DAFF)

need to focus on other quality parameters such as test weight, screenings and falling number. Using the right tools to measure these parameters is vital in managing grain profitability.

For example, the minimum test weight for wheat milling grades has now increased from 74 kg/hl to 76 kg/hl. It is now more critical than ever that growers use an industry approved chondrometer to ensure an accurate test weight measurement.

Talk to an experienced and reputable supplier of grain testing equipment (such as Graintec Scientific) to ensure you get the right equipment for your needs and, equally importantly, ask them to show you how to use and maintain the equipment correctly.

Eliminate insect resort sites

Are there grain stocks or residues left in your storages? Carryover planting seed, gradings or residues in headers and augers are all prime sites for insect infestation.

With spring temperatures upon us, the common grain pests are warming to the task of breeding and flying about. They are happy living in grain residues in those sheltered sites you may have forgotten about. Cleaning up any grain deposits significantly reduces the chances of early insect infestation problems occurring in your freshly harvested grain.

TOP LEFT: Insect probe trap. (Photo: Chris Warwick)
TOP RIGHT: Temperature probe. (Photo: Chris Warwick)
BOTTOM LEFT: Insect sieve. (Photo: Graintec Scientific)
BOTTOM RIGHT: Aeration control. (Photo: Custom-Vac)

Maintaining grain quality

Investing in storage monitoring tools, and having a monthly inspection plan will help prevent costly grain quality issues at outturn.

- Growers should be using a grain insect sieve (2 mm mesh) with a white base pan, to assist in performing monthly grain inspections.
- Insect probe traps help growers to monitor insect activity in the top section of stored grain.
- A grain temperature probe is a valuable tool for monitoring grain storage conditions. In summer, grain temperatures close to 20°C are ideal.
- Aeration fans and ducting: Cool grain temperatures reduce pest numbers, maintain grain quality and provide the option of short term storage of higher moisture grain prior to blending or drying.
- Automatic aeration controller: Reliability of achieving good results with aeration is much improved when fans are run at optimal times. Aeration controllers are also likely to offer energy savings.

Effective fumigation

There are a few simple checks and practices to ensure all insects are killed during fumigation and to prevent resistant insect strains surviving.

- Silos must be sealed and gas tight, particularly when fumigation is required. The Australian Standard AS 2628 describes a pressure test that silo manufacturers should meet when selling you a 'sealable silo'.
- It is advisable to pressure test your existing sealable silos now while empty, or better still when full of grain. This quick test shows up any small leaks or seals that require repairs. To hold the gas (eg. phosphine) at the right concentration for the required time (eg. 7 or 10 days), the silo does need to be gas-tight.

To sum up

Knowing the quality and value of grain on-farm provides growers with the power to make better on-farm decisions and profit from segregation and niche marketing opportunities. Once the segregated grain is in the bin, check it regularly to ensure that grain quality is not compromised by high moisture, adverse temperatures or insect activity.

More information:
Craig Moore (Graintec Scientific – grain testing equipment), 0411 654 254, craig@graintec.com.au, www.graintec.com.au
Philip Burrill (DAFF), 0427 696 500, philip.burrill@daff.qld.gov.au ■

Phil Burrill performing a silo pressure test. (Photo: DAFF)

From bad grubs to good bugs: Producing diesel on demand

IT sounds like science fiction but a team of scientists has developed a method to make bacteria produce diesel on demand.

While the technology still faces many significant commercialisation challenges, the diesel, produced by special strains of *E. coli* bacteria, is almost identical to conventional diesel fuel and so does not need to be blended with petroleum products as is often required by biodiesels derived from plant oils.

This also means that the diesel can be used with current supplies in existing infrastructure because engines, pipelines and tankers do not need to be modified. Biofuels with these characteristics are being termed 'drop-ins'.

Professor John Love from Biosciences at the University of Exeter said: "Producing a commercial biofuel that can be used without needing to modify vehicles has been the goal of this project from the outset. Replacing conventional diesel with a carbon neutral biofuel in commercial volumes would be a tremendous step towards meeting our target of an 80 per cent reduction in greenhouse gas emissions by 2050.

Global demand for energy is rising and a fuel that is independent of both global oil price fluctuations and political instability is an increasingly attractive prospect."

E. coli bacteria naturally turn sugars into fat to build their cell membranes.

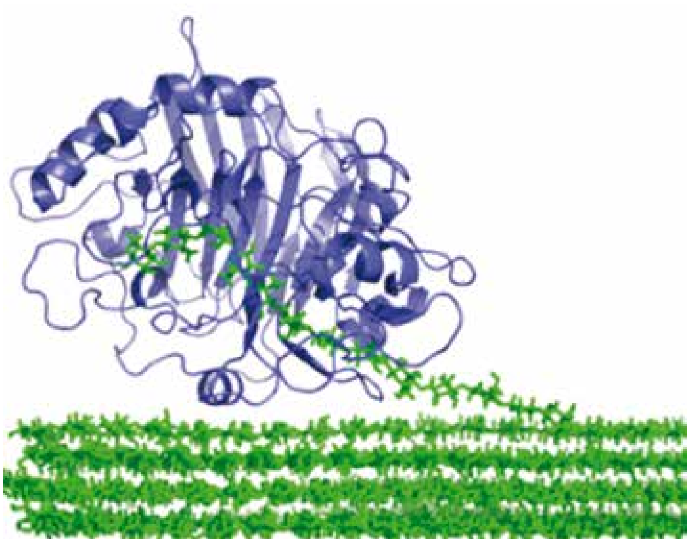
Synthetic fuel oil molecules can be created by harnessing this natural oil production process.

Large scale manufacturing using *E. coli* as the catalyst is already commonplace in the pharmaceutical industry and, although the biodiesel is currently produced in tiny quantities in the laboratory, work will continue to see if this may be a viable commercial pathway to 'drop in' fuels.

This work was supported by a grant from Shell Research Ltd and a Biotechnology and Biological Sciences Research Council (BBSRC) Industry Interchange Partnership Grant.

Rob Lee from Shell Projects & Technology said: "While the technology still faces several hurdles to commercialisation, by exploring this new method of creating biofuel, along with other

Fuel producing bacteria. (Image: Marian Littlejohn)



The 3D X-ray structure allows scientists to see inside the enzyme found in gribble and reveals how it binds and digests cellulose chains. (Image: John McGeehan, University of Portsmouth)

intelligent technologies, we hope they could help us to meet the challenges of limiting the rise in carbon dioxide emissions while responding to the growing global requirement for transport fuel."

Published: ***Agricultural Genomics*** **www.technologynetworks.com**

… and Gribbles that breakdown woody biomass

Limnoria – the wood-eating gribble. (Image: Laura Michie, University of Portsmouth)

Scientists have also discovered a new enzyme that could prove an important step in the quest to turn waste (such as paper, scrap wood and straw) into liquid fuel. To do this they turned to the destructive power of tiny marine wood-borers called 'gribble', which have been known to destroy seaside piers.

Using advanced biochemical analysis and X-ray imaging techniques, researchers from the University of York, University of Portsmouth and the National Renewable Energy Laboratory in the US have determined the structure and function of a key enzyme used by gribble to break down wood. The findings, published in PNAS, will help the researchers to reproduce the enzymes effects on an industrial scale in a bid to create sustainable liquid biofuels.

To create liquid fuel from woody biomass, such as wood and straw, the polysaccharides (sugar polymers) that make up the bulk of these materials have to be broken down into simple sugars. These are then fermented to produce liquid biofuels.

This is a difficult process and making biofuels in this way is currently too expensive.

To find more effective and cheaper ways of converting wood to liquid fuel, scientists are studying organisms that can break down wood in the hope of developing industrial processes to do the same.

Voracious consumers

Gribble are of interest as they are voracious consumers of wood and have all the enzymes needed for its digestion. The enzymes attach to a long chain of complex sugars and chop off small soluble molecules that can be easily digested or fermented.

The researchers identified a cellulase (an enzyme that converts cellulose into glucose) from gribble that has some unusual properties and used the latest imaging technology to understand more about it.

The research team leader, Professor Simon McQueen-Mason, from the Centre for Novel Agricultural Products at the University of York, explains: "Enzymes are proteins that serve as catalysts, in this case one that degrades cellulose. Their function is determined by their three-dimensional shape, but these are tiny entities that cannot be seen with high power microscopes. Instead, we make crystals of the proteins, where millions of copies of the protein are arrayed in the same orientation."

Dr John McGeehan, a structural biologist from the University of Portsmouth team, said: "Once we succeeded in the tricky task of making crystals of the enzyme, we transported them to the Diamond Light Source, the UK's national synchrotron science facility.

Rather than magnify the enzyme with a lens as in a standard microscope, we fired an intense beam of X-rays at the crystals to generate a series of images that can be transformed into a 3D model. The Diamond synchrotron produced such good data that we could visualise the position of every single atom in the enzyme.

Our US colleagues then used powerful supercomputers, called Kraken and Red Mesa, to model the enzyme in action. Together these results help to reveal how the cellulose chains are digested into glucose."

Gribble enzymes are different

This information will help the researchers to design more robust enzymes for industrial applications. While similar cellulases have been found in wood-degrading fungi, the enzyme from gribble shows some important differences. In particular, the gribble cellulase is extremely resistant to aggressive chemical environments and can work in conditions seven times saltier than sea water. Being robust in difficult environments means that the enzymes can last much longer when working under industrial conditions and so less enzyme will be needed.

Professor McQueen-Mason explained: "This is the first functionally characterised animal enzyme of this type and provides us with a previously undiscovered picture of how they work.

"While this enzyme looks superficially similar to equivalent ones from fungi, closer inspection highlights structural differences that give it special features, for example, the enzyme has an extremely acidic surface and we believe that this is one of the features that contribute to its robustness."

Aim is industrial scale

The ultimate aim is to reproduce the effect of this enzyme on an industrial scale. Rather than trying to get the cellulase from gribble, the team have transferred the genetic blueprint of this enzyme to an industrial microbe that can produce it in large quantities, in the same way that enzymes for biological washing detergents are made. By doing this they hope to cut the costs of turning woody materials into biofuels.

The work is part of the BBSRC Sustainable Bioenergy Centre (BSBEC), a £24M investment that brings together six world-class research programmes to develop the UK's bioenergy research capacity. Funding from a BBSRC US Partnering Award was instrumental in forming a highly synergistic collaboration with the US DOE funded research team at NREL.

The paper: 'Structural characterization of the first marine animal Family 7 cellobiohydrolase suggests a mechanism of cellulase salt tolerance' is available at: www.pnas.org/cgi/doi/10.1073/pnas.1301502110
For more information: www.bbsrc.ac.uk. ■

Western region

District Reports...

September–October 2013

NORTH

The season in WA's northern cropping region has had another turn. Cool wet conditions have prevailed over the past four weeks over most of the region. This is in stark contrast to the first three weeks of August which were dry and very hot on the 22nd and 23rd which severely stressed many crops.

But the rainfall totals are still well below long term averages in all areas and the lowest rainfall pockets are at decile 1. Most of the region is at decile 3 to 4 for rainfall.

Wheat crops are now at late grain fill and heading quickly towards maturity. Harvest is only a couple of weeks away and grain quality should be very good. Grain protein may be mixed with nitrogen applications being left off many crops due to dry conditions early in the season.

Crops are generally thin, particularly those early sown. Yields should be just below average in most areas and trending to above average in the southwest of the region.

Most canola crops are at maturity and starting to change colour. Aphids and diamond back moth (DBM) have been sprayed in many crops but insect pressure has caused yield losses in the west. The extreme cases have had severe yield reductions even with two insecticide applications. Budworms are around in very low numbers.

Lupin crops are now at the finished flowering through to maturity stage. Crop-topping will happen over the next couple of weeks. Lupins generally look good except in the driest areas where crops are very short and will have low yields. Budworm, anthracnose and brown leaf spot are issues in some crops. Lupins should yield close to average.

Late weeds are showing up in some crops and pre-harvest herbicides will be needed over a small percentage of the landscape.

Annual pastures are still growing with the recent rain and look good. Spray-topping has mostly been done but may need re-spraying with this latest rain. Perennial pastures are starting to

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 25yr Annual Average (mm)	Summer 2012–13	Autumn 25yr Annual Average (mm)	Autumn 2013	Winter 25yr Annual Average (mm)	Winter 2013	Spring 25yr Annual Average (mm)	Spring 2013 to date
Emerald Qld	537	307	239	178	110	136	66	34	114	0
Toowoomba Qld	646	916	261	657	135	205	86	94	170	17
Roma Qld	577	213	232	144	132	107	75	12	134	1
Goondiwindi Qld	607	530	235	337	135	182	101	49	137	19
Narrabri NSW	631	474	221	221	124	169	132	97	160	21
Gunnedah NSW	654	422	226	254	124	83	122	142	179	0
Dubbo NSW	596	437	192	97	129	108	124	155	152	83
West Wyalong NSW	435	381	109	95	88	93	113	153	124	59
Wagga Wagga NSW	530	398	129	67	115	99	146	181	142	33
Swan Hill Vic	324	181	72	25	67	30	88	90	96	46
Bendigo Vic	515	408	109	71	106	69	165	229	138	60
Horsham Vic	364	330	80	45	72	41	127	200	108	60
Lake Bolac Vic	555	346	121	36	98	71	155	215	151	46
Murray Bridge SA	352	318	62	47	71	56	120	202	99	28
Kadina SA	331	349	53	25	74	106	113	184	89	58
Cummins SA	377	443	47	13	81	100	166	269	82	64
Esperance WA	590	668	75	50	135	301	244	275	135	56
Wagin WA	394	376	43	96	92	163	174	116	84	67
Northam WA	389	360	41	48	82	132	186	131	79	73
Mingenew WA	356	345	31	11	91	170	174	119	61	53
Moora WA	379	312	40	36	89	110	180	140	69	39
Mullewa WA	320	189	49	21	93	85	134	69	44	25

Last rainfall reading September 27, 2013.

grow and will do well over the next couple of months with the replenished soil moisture.

Grain crops are finished and harvest is only a few weeks away. Hughie can now turn the tap off in our region and save it for May next year. Most growers should do OK out of what has been a tough season.

Everyone is looking forward to harvest but there is a question yet to be answered. How damaging to crop yield were the two prolonged dry periods? We will have an answer pretty soon.

Peter Norris
Agronomy For Profit and Synergy Consulting, Geraldton
September 23, 2013

SOUTH COAST

Seasonal conditions for the South Coast region during the past two months have been very good. All areas have received adequate spring rainfall to ensure good grain fill. There are some coastal areas, particularly to the east of Esperance, that are too wet and extensive water-logging and crop damage has occurred.

But the majority of the region is looking at some of the best crop yields in more than a decade.

There have been few agronomic problems during spring with the exception of aphids.

In just about every crop type we have aphid infestations. Some infestations have been difficult to control – especially green peach aphids in canola due to high levels of insecticide resistance.

Most growers have been busy in recent weeks planning their harvest logistics. The latest grain receival projection for the Esperance port zone by CBH is for around 2.4 million tonnes. Moving and storing this amount of grain from paddock to port is going to be a big task.

Many growers have increased harvest capacity and are looking at more temporary on-farm storage as truck capacity will not be adequate during the peak of harvest.

Condingup farmers Mark and Graham Darlow are all smiles with their Bass barley crop.

Many canola producers are presently swathing or desiccating canola crops with reports of one grower already attempting to harvest some March sown canola! But for the majority it looks like harvest will commence in earnest during the second week of October with canola and barley being the first cabs off the rank.

Growers are hopeful of good harvest weather to capitalise on a very good season to date.

Quenten Knight,
Agronomist, Precision Agronomics Australia
September 24, 2013

Southern region

SOUTH AUSTRALIA

Weather summary

Temperatures during July were slightly above average and near average during August. July rainfall was average to well above average. August rainfall for most of the cereal zone was also around the average but some southern regions received very good falls. The northern Mallee and Upper North tended to miss out on these better falls.

Minimum temperatures during July and August were milder than last year, with far fewer frosts. But some damaging frosts were recorded in inland districts in mid-August.

Winter crops

Early-sown crops have grown rapidly due to the milder conditions in late autumn and winter, with many of these crops two to three weeks ahead of normal. Yield prospects across the state are above average, with high levels of stored soil moisture providing the potential for excellent yields given a favourable spring.

Early-sown cereals in medium to high rainfall districts are beginning to develop thick, heavy canopies and are falling over (lodging), increasing the risk of disease.

Despite below average rainfall in the northern parts of the state during August, adequate stored soil moisture has allowed crops to grow and some moisture stress only became apparent in late August on some of the poorer soils.

In the high rainfall areas of Lower Eyre Peninsula, Kangaroo Island and the South East, waterlogging has significantly reduced yield potential in some areas and crop types.

In most areas of the state, significantly higher levels of post-sowing nitrogen have been applied. Nitrogen fertiliser supplies were limited in late July, before new supplies arrived in early August.

Additional nitrogen applications have been necessary to overcome effects of leaching, low soil mineralisation and to also take advantage of the higher yield potential.

Wet and waterlogged soils delayed the application of both herbicides and fertilisers (clayey soils, in particular, were un-trafficable for extended periods).

The frost in mid-August caused severe damage to cereal crops

in isolated parts of the Upper Eyre Peninsula with estimated grain yield losses of 10 to 25 per cent in affected areas.

Despite favourable conditions for disease development, leaf diseases are currently at relatively low levels across the state, due to a combination of the use of more resistant varieties and the proactive application of protectant fungicides to susceptible varieties.

Stripe rust is widespread across the state in susceptible varieties but close monitoring and the application of fungicides has kept levels low.

Spot form of net blotch has been severe in some barley crops in many areas of the state with some application of fungicide in an effort to control the disease. Net form of net blotch has started to develop on susceptible varieties and protectant fungicides are being applied to protect yield potential.

Canola crops have grown rapidly and have the potential to provide above average yields except on poorly drained soils in higher rainfall districts where waterlogging has affected crop growth.

Pastures

Pasture paddocks have a high amount of feed with a number of growers looking to cut pasture hay to capitalise on the dry matter grown. Cool to cold conditions in July slowed pasture growth but milder conditions during August have stimulated good growth.

Waterlogging has limited pasture growth on poorly drained soils on Lower Eyre Peninsula, Kangaroo Island and the South East.

With the generally very good pasture growth, livestock are in good condition across the state. But the limited pasture growth on Kangaroo Island and the South East has reduced the condition of some livestock over winter.

PIRSA Rural Solutions
September 6, 2013

VICTORIAN MALLEE

The 2013 season has been a roller coaster of highs and lows, and the window of possible outcomes is still wide open. Starting out with virtually no summer rain, most paddocks didn't even require a summer spray. At the time this was perceived as a saving, but the proof's in the pudding that there are associated issues. No stored moisture has been the obvious one, but the extra cost of selective weed control as opposed to pre-sowing knockdowns has been costly and, at times, stressful.

Volunteer weed numbers have been high. Canola in cereals, and cereals in cereals have been an ongoing concern and will affect classification at harvest. Winter weeds have also had the opportunity to dominate with radish, rye and brome grass being widespread.

Sowing was mostly into dry soil and a late rain in June didn't encourage everything to emerge. Canola was very patchy and while some shot and died, it is amazing to see how much came late.

Most crops were sprayed and top-dressed in June or early July when conditions looked good. There were only showers after that and with temperatures hitting 30 degrees in August – plus some hot winds – we were heading into some historically (and unfortunately) all too familiar territory.

Canola and legumes lost flowers and this will have capped some of the potential yields. Cereals stressed and heads emerged. Then, a very timely rainfall event dropped around 30 mm over most of the Mallee. This freshened up crops … as well as attitudes.

To the end of August there had been 177 mm of annual and 135 mm of growing season rainfall. Crops have suffered most on heavy dry flats and deep low-organic matter sands. It is fair to say they have done well on the amount of rain they have had, particularly where nutrition and weed control has been well managed. Below average yields are to be expected on below average rainfall.

Aphids made an appearance in vetch, cereal and canola crops when conditions were dry and tough. Disease management was only really targeted at susceptible varieties, with net blotch appearing in Scope barley. CCN has made an appearance due to the history of susceptible varieties and a large area of Scope barley plantings.

Late October is not far away and harvest will begin around that time.

Simon Severin
Dodgshun Medlin Agricultural Management, Swan Hill
September 26, 2013

MURRAY VALLEY RICE REPORT

Preparation is well underway for the coming rice season – there has been some rain delays, but nothing serious. I suspect that the bulk of the crop will be sown on time, which is quite important in these southern rice growing areas, particularly in the western Murray Valley.

There will probably be less area sown this year than last season for several reasons, primarily water related. At the time of writing, water allocations are at a relatively healthy 91 per cent, and most expect it will soon be 100 per cent. Last year started at 100 per cent, and there was also substantial quantities of carryover water and temporary water could be bought for about $20 to $25 per megalitre.

Urea is being drilled at 250 kg per hectare on this Murray Valley field prior to applying permanent water. If the current favourable conditions continue, there will then be an on-time aerial sowing of Opus rice.

District Reports…

September–October 2013

But this season there is virtually no carryover water and temporary water costs around $60.

Crop water use was also significantly higher than average last season, forcing many growers to purchase extra water (and extra delivery entitlements) to finish crops. Growers are keen to avoid this situation this coming season, which is another factor helping to moderate the area planted.

The other factor is the price outlook. Growers are mostly using a lower rice value in their budgets than they did last year. This means very few (if any) will purchase temporary water for rice as it is unlikely to give a $2 return for every $1 spent on extra water (the general rule for purchasing crop inputs).

In fact, this has led some growers to sell their water on the temporary market – they will probably earn less per megalitre for their water – but they will get their money now, with no risk and no work.

Most have elected not to sell their water but to grow a crop, knowing that there is plenty of opportunity for price improvement between now and when the crop is sold.

Variety wise, Opus is a popular choice with growers, so seed supplies have gone to ballot. It has yielded very well in recent years and the 20 per cent bonus has been attractive. Last season, most Opus growers in the western Murray Valley heeded the advice to mid-season drain their crops as an insurance against physiological straighthead. But the practice was not widely adopted in eastern areas around Finley.

Most growers seem to have also heeded the recommendations to increase basal nitrogen fertiliser rates now that legume pastures have disappeared from most rice rotations.

Now all we need is a warm October without strong winds and with low duck numbers – the type of starts we always hope for – but rarely experience.

John Fowler
Deniliquin District Agronomist
September 25, 2013

WESTERN MURRAY VALLEY

Growing season rainfall for winter cropping – after some good recent rainfall – is around 190 to 220 mm for the region. The early September rainfall, which many farmers described as "season saving", varied greatly ranging from 12 mm up to 56 mm with a probable average of about 20 mm.

With all of the in-crop rainfall the district's crops are looking towards at least average yields. The southern region of the WMV, around Mathoura and Moama, is looking at above average yields (2.8 to 3 tonnes per hectare for wheat and around 4.5 tonnes for barley).

Canola may be lower than expected (1.2 to 1.5 tonnes per hectare) due to late emergence in June and lack of vegetative cabbage growth. Canola also seemed to suffer more from the three week dry period in August when we experienced some 27 degree days.

Most winter crops have been topdressed with nitrogen due to the severe lack of soil N reserves. Any crop which missed out is (visually) suffering and massive yield penalties are likely to occur.

Nitrogen deficiency clearly shows up where the fertiliser spreader missed a headland when topdressing urea in wheat at Mathoura.

This has been a continuing issue since 2010 and with decent yields in the season since then, the soil nutrition hasn't recovered.

Most wheat crops have reached head emergence and some stripe rust pressure is now evident. But disease pressure is relatively low and major outbreaks of stripe rust haven't occurred. With the recent rainfall and warmer temperatures, growers have just applied a final foliar fungicide to protect crops from yield losses.

It's worth mentioning that any grower who used Intake (500g/L flutriafol) applied to their sowing fertiliser have had no stripe rust infection detected up to head emergence. This fertiliser treatment method is being used extensively by wheat producers across the Riverina and WMV as an economical stripe rust management strategy .

Most irrigators have applied one spring watering prior to head emergence in cereals and at early flowering of canola. Growers will assess the potential for a second watering in October if rainfall isn't imminent.

Irrigated pastures are looking excellent with Italian ryegrass

Jamie Mckindlay from the Barham district, inspects his crop of Mace wheat direct-drilled into rice stubble.

Leigh Hepner, agronomist from I.K.Caldwell assesses soil moisture levels in an irrigated canola paddock.

being cut for silage now or are being locked-up for a hay cut in October.

Summer cropping

At present, summer crop farmers are spraying fallow paddocks and are pre-drilling fertiliser for rice and corn plantings.

Currently the Murray Irrigation Limited (MIL) system is at 91 per cent allocation and many summer croppers are gearing up for a big year.

The only hesitation at present is the temporary water market trading at $60 per megalitre. Additionally, Sunrice have given rice producers an indicative price for the coming season of $260 per tonne (medium grain rice). Consequently gross margins with $60 per megalitre water and average yield (8.6 t/ha) forecasts, are pretty slim ($350 to $450/ha).

But even with the information at hand, rice planting will probably still be close to last year due to the consistency and frequency of success that rice offers in our region.

Corn production will be increased due to the current water price and the increase in demand for the end product by the dairy industry. Some new corn export opportunities are also adding to the crop's appeal. Last year's corn used substantially less water than rice (8 ML/ha for corn vs 14 to 16 ML/ha for rice) resulting in a better $ per ML return for corn.

Soybean plantings will be reduced due to poor prices last year and high water requirements (8 ML/ha) making margins slim.

In summary, the WMV is looking good. Dryland farmers have paddocks of sheep feed and winter crops look promising. The outlook for summer cropping is favourable with the high water allocation. We can only hope temporary water values drop to $25-40 per megalitre and allow for more profitable irrigation farms.

Fingers crossed for some big October rains!

Laurence Pearce
Agronomist, IK Caldwell, Deniliquin NSW
September 25, 2013

District Reports...

September–October 2013

Northern region

CENTRAL WEST

Greetings all from the now much happier and buoyant Central West region of NSW. Like many other regions we were graced on September 16 by some heaven sent wet stuff!

Most growers received 20 to 30 mm, with as high as 100 mm falling in parts of the Warren and Dubbo surrounds. For many, it was the first rain since a wet June. It was a saving rain for many – but not all.

North west of Coonamble and Walgett won't see many headers in the paddock this year.

Wheat crops are a mixed bag, depending on sowing date. Crops sown early look pretty good and some late crops still have a long way to go and have struggled to get secondary roots cranking in the dry conditions.

Nitrogen nutrition – and associated low protein and in some cases yield – will again be an issue this season. Few topdressing opportunities presented themselves and with such low moisture profiles at sowing, growers were understandably reluctant to make the economic commitment of applying N.

The variety mix is Gregory, some Sunguard, and a big push

Chickpeas on 'Summerlea' near Nyngan. The drier conditions have meant a generally disease-free season for chickpeas in the Central West.

District Reports…

September–October 2013

Bonnie Heuston in a paddock of very promising Maki fieldpeas on 'Quandong' near Collie.

Canola at 'Kinross' near Gulargambone. Due to a late start to the season, the canola and faba bean area this season is well down in the Central West.

towards the shorter options such as Spitfire and small areas of Dart where seed could be obtained.

The late planting also resulted in an increase in the area of barley sown, in particular the short season Hindmarsh.

Canola plantings and faba beans in the north are way down this season due to the lack of a sowing rain.

The chickpea area would be up and this crop has loved the above average winter temperatures we've received. Chickpeas have thrived in the dry conditions, resulting in some nice crops out there at the moment. As expected with the low rainfall, there have been very few reports of Ascochyta.

Small areas of field peas and lupins complete the cropping mix in the region.

Agronomic problems

Problems encountered to date include armyworm in cereals, some reports of cutworm and there are currently a lot of heliothis about giving the broadleaf crops a hard time.

One of the biggest problems in the region is the scary amount of grass weeds surviving grass sprays. Growers should be diligent in assessing paddocks for these survivors and should send any suspect seed away for resistance testing. To combat this issue – and coupled with the work down by Maurie Street and GOA (Grain Orana Alliance) – there will be an increased level of windrow burning post-harvest to try and run grass weed numbers down.

Penny Heuston, Warren
Delta Agribusiness
September 25, 2013

DARLING DOWNS

Winter crop

The winter crop was going well until the August 21-23 frosts which caused severe crop damage to chickpeas, wheat and barley, ranging from leaf burn to plant death. Most crops have had the subsoil moisture available to grow back, but maturity has

These chickpeas on the Darling Downs have bounced back from the late August frosts. But they are a smaller plant than should have been the case without the frost setback as the rows have not quite covered in.

District Reports…

September–October 2013

The June rain was welcomed by farmers on the Darling Downs … as well as black swans.

been delayed and the crops are now suffering from the lack of rain and the warm to hot spring temperatures.

Chickpeas were hit the hardest by the frosts and are now in the flowering to pod fill stages. There have been only isolated outbreaks of ascochyta but heliothis numbers are building rapidly with over 10 per square metre being found in the better growing and more attractive paddocks.

Wheat is coming into head and the grain fill stage with mice causing some problems on the Central Downs.

Barley is at grain fill with the earliest crops haying off. We are expecting harvest in mid October.

Canola suffered with the frosts and whilst aphids have not been too bad, heliothis have needed control.

Armyworms are not an issue at this stage.

Yield outlooks have come back to below average to fair, but anticipated mid to high 30s temperatures will not help. The rainfall event on September 16 only delivered 15 to 25 mm which was quickly used up by the crops. Quality may become an issue if the heat and dry conditions continue.

Summer crop outlook

The summer outlook is promising. Irrigators have good supplies of water and fallow ground has good stored moisture.

Some corn and sorghum planting is underway by irrigators and those growers lucky enough to be under the heavier parts of the recent storms. Soil temperatures are warm enough for planting but hot winds are drying back the soil moisture quickly.

Most growers will need 30 to 40 mm of good rainfall to be able to plant.

The cotton area is expected to drop a little from earlier expectations as dryland growers switch to sorghum after taking advantage of strong forward prices when the dollar was lower. Sorghum will be the Downs' main spring crop again, and there is interest in mungbeans and soybeans for the summer plant.

Hugh Reardon-Smith
Agronomist, Landmark Pittsworth
September 24, 2013

CENTRAL QUEENSLAND

The weather

Soil moisture for the winter crop in the Dawson and Callide Valley cropping districts was set up by above average summer rainfall, whereas on the Central Highlands, it was mainly rain during April and May.

All districts received sufficient rain to plant winter crop although almost all growers experienced at least one – and sometimes many – delays when planting due to small and frequent rainfall events.

Rainfall for June and July was well below average and no effective rain fell during August in any district. Many late planted crops received no rain post planting.

Temperatures during early winter were mild, but frost was common across large areas of CQ during mid to late August.

District Reports…

September–October 2013

Summer crops

Sorghum: About 100,000 hectares of sorghum were planted in CQ in the 2012–13 summer, much of it planted in late January or early February. As a result, the crop matured late and dry-down for harvest was frustratingly slow. Farmers were either forced to wait for the crop to dry or harvest high moisture grain and either dry on-farm or to line up at limited drying facilities at the few grain depots that do have drying capacity.

Ergot was present in many crops but presented few problems – probably as a result of mild dry weather.

Significant losses occurred on many farms from wild pig and bird damage.

Prices were generally good, with many gaining better than $270 per tonne on-farm but more commonly $240 per tonne. Yields were generally about average (3 tonnes per hectare) with a few reports of excellent crops (4-5 tonnes or greater).

In paddocks where grass weed control was poor or crop nutrition, especially nitrogen, was inadequate, yields are low (less than 1.5 tonnes per hectare).

Mungbeans: A larger area (more than 15,000 hectares) of mungbeans was planted – and most of it in the Callide. Yields were generally good. Puffy pod, which devastated the late summer mungbeans crop in 2012, was not an issue this summer.

Sunflower: A small area of sunflower was planted (around 10,000 hectares). Crops yields were moderate to good.

Winter crops

The area planted to winter crop – especially chickpea – in 2013 was larger then normal, due to a smaller summer crop. For many farmers the winter crop planting was later than normal and one of the most drawn out and protracted plantings for many years. One farmer at Capella said he had five major rain interruptions while planting his winter crop this year.

Early planted crops are yielding much better tha n later planted crops. Frost caused severe but patchy damage in many paddocks to both wheat and chickpea. But it is now difficult to separate the effect on yield of frost and drought.

Wheat: The planted area was around 180,000 to 200,000 hectares and the planting period extended from mid April to early July. Most farmers are pleasantly surprised at yields given some crops received no in-crop rain. Early planted and top end yields range from 2.5 to 3.5 tonnes per hectare but crops that were either double cropped, late planted or weedy are yielding from 0.7 to 1.7 tonnes.

Chickpeas: The planted area of chickpeas is estimated at 80,000 hectares. The planting period extended from early May to late June. Ascochyta blight was detected in some early crops and preventative sprays were used by some growers. Dry weather prevented this disease from becoming a major issue this season. Yield of chickpea crops ranges from 1.4 to 2 tonnes per hectare. Fires in headers harvesting chickpea are a serious concern with current high temperatures and extremely low humidity.

Livestock and pastures: Grass cover at the end of summer across much of the Central Highlands and the Dawson and Callide was good except for areas south of Springsure, west of Emerald and northwest of Clermont. There has been no effective rain since May. Some paddocks have dry grass but large areas are in drought due either to lack of grass or stock water or both. Poor cattle prices add to the crisis.

Maurie Conway
Principal Technical Officer
Grower Solutions for Central Queensland
Agri-Science, Emerald, Qld
September 25, 2013

ANSWER TO IAN'S MYSTERY TRACTOR QUIZ

The British tractor is a 1930 Vickers Aussie, made under a licencing arrangement with International Harvester Co. The patented 3 section rear wheels were designed to be self cleaning of mud, and so on.

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