AUSTRALIAN GRAIN

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FRONT COVER

Heavy stubble – more water:
WA researcher Catherine Borger (pictured) says that in heavy stubble situations, increased water rates improves the effectiveness of trifluralin at commercial spraying speeds. See article Page 16.

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Covering Northern NSW and Queensland

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Editorial... Lloyd O'Connell

IT took its time, but late May delivered some very welcome rain to most cropping regions in the eastern half of the country. In a turnaround from the 2011 season, Western Australia has been a bit slow out of the blocks – but millions of hectares have been dry-sown and will bounce away quickly when the winter showers start rolling in. With limited knockdown opportunities leading up to sowing, diligent in-crop weed control will be high on the management list this season – particularly in WA. And higher still on that management list is ensuring that we use our farm chemicals very wisely to stave off, for as long as possible, the development of resistance. Prolonging the effective life of relatively low cost and benign chemicals – such as glyphosate – is essential for the commercial success of Australian minimum and zero-till farming systems.

Speaking of commercial success, late May also brought with it an encouraging turnaround in international grain prices – and helped along by a weakening Aussie dollar – domestic wheat prices kicked $30 or more in the space of a week. This sharp market movement illustrates just how sensitive farm commodity (and particularly grains and oilseeds) prices have become. The historic 'demand versus supply and there's your price' relationship has been diluted by the speculative activities of non-traditional market players. Our farm commodity markets have never been more transparent, nor liquid. This attracts the hedge funds and other newcomers like bees to honey. The result is more market volatility than we have ever seen.

We need only think back to the northern hemisphere summer of 2010. A worsening drought in Russia and Ukraine at the time, prompting government grain export embargoes, sent global wheat and other cereal prices skyrocketing. Encouraging news for Australian growers is that much of the grain producing region of the former Soviet Union is again facing dry times.

This issue carries articles on the very pressing topics of herbicide resistance and the volatile international grain markets. We also take a look at dual purpose grain–grazing crops and how best to put maximum weight gain on your livestock and still harvest plenty of grain.

Australian Grain farm study tours

In the second half of this year we have farm study tours heading off to the US and Canada (including the Calgary Stampede); Cambodia, Vietnam and China; Turkey and southern Europe; and, South Africa and Argentina (taking in a bit of rugby). All of these fantastic tours are definitely going ahead so contact the office for more details or visit *www.greenmounttravel.com.au*

I hope the season is away well in your patch.

AUSTRALIAN GRAIN

In this issue...

New tool wages war on insects

When an some insects lands on a plant to feed, they begin a process of chemical warfare. Piercing-sucking insects use needle-like stylets to insert saliva into plant tissues and open a pathway to ingest fluids critical to the plant's survival. This warfare costs growers worldwide billions of dollars each year in lost agricultural and ornamentals crops.

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Supplements boost cattle weight gains on forage wheat

New research shows cattle grazing on cereals can record a 25 per cent increase in liveweight when offered supplements. Dr Lindsay Bell says winter cereals are an important winter feed supply in many mixed crop-livestock production systems, whether they are used as dedicated forage crops, dual-purpose crops or sacrificial grazing of poor grain crops.

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The good gear

Seven months after placing the order, I recently took delivery of a diesel fuelled European car equipped with one of these new high tech twin clutch semi-automatic transmissions. I have to admit, the brochure was right! The seamless gear changes can often only be detected by a close scrutiny of the rev counter.

See article . . . . . Page 21

Latest herbicide resistance survey

Surveys are an effective way of quantifying the occurrence and evolution of herbicide resistance in weeds. In 2010, the fourth herbicide resistance survey in Western Australia was conducted to determine the current level of resistance of key weed species to different herbicide modes of action and to assess the change in resistance frequency over time.

See article . . . . . Page 36

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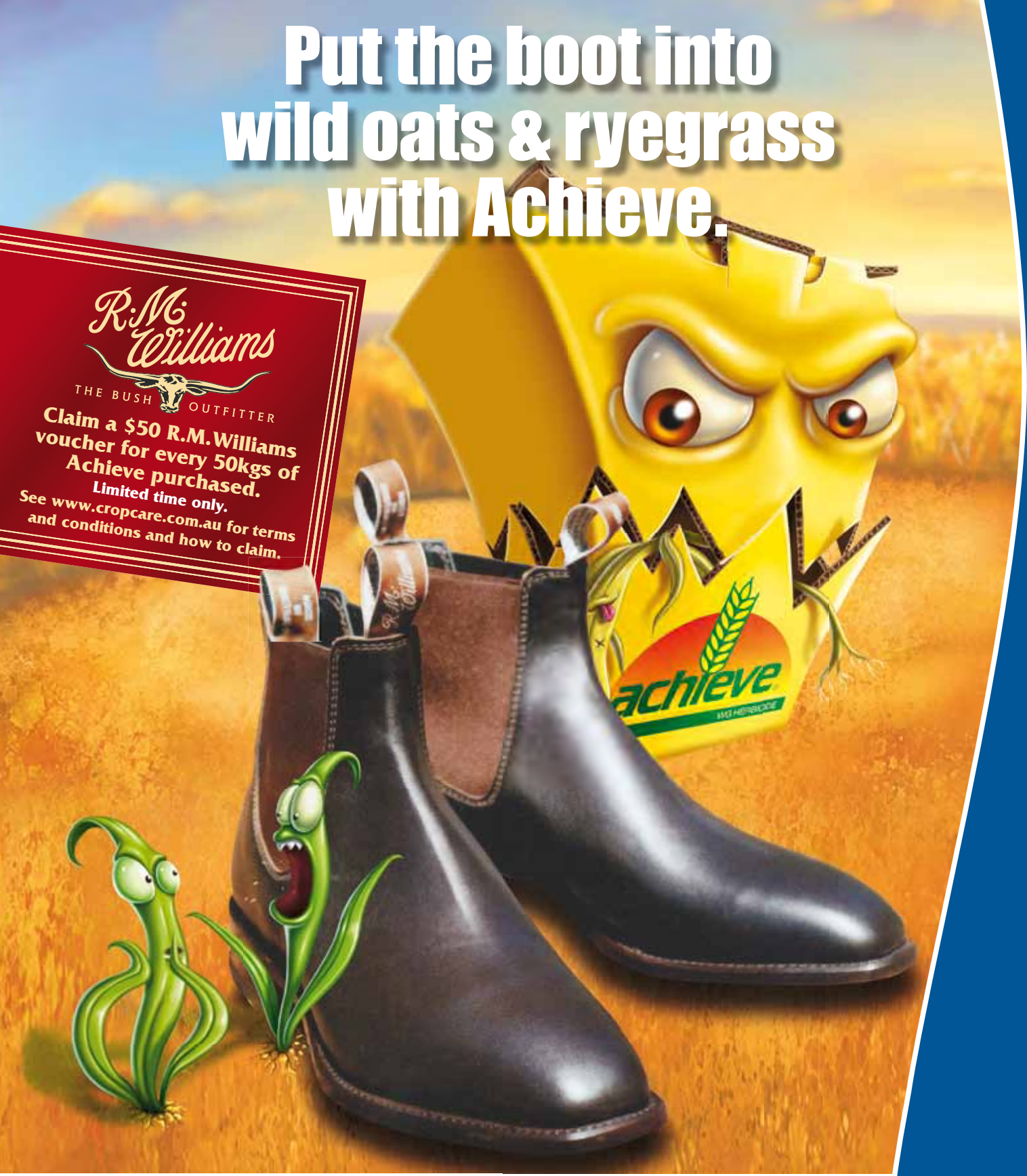

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New tool opens a bigger window to insect-plant warfare

By Dennis O'Brien, Agricultural Research Service – USDA

WHEN an aphid, leafhopper, or psyllid lands on a plant to feed, it begins a process of chemical warfare. As piercing-sucking insects, they use needle-like stylets to insert saliva into plant tissues and open a pathway to ingest fluids critical to the plant's survival. When punctured, the plant senses the attack and secretes proteins and other chemical defenses to prevent fluids from being pulled out, thus creating a stress on the plant. This warfare costs growers worldwide billions of dollars each year in lost agricultural and ornamentals crops.

Because much of the action takes place in the plant's interior, a scientific tool called an "electrical penetration graph" (EPG) is critical for peering into the process.

To use it, researchers connect the insect and plant to an electronic monitor that, like an electrocardiogram, reads electrical charges produced by tiny changes in voltage that occur as the insect feeds.

A new type of EPG, developed by Elaine Backus, an ARS entomologist at the San Joaquin Valley Agricultural Sciences Center, in Parlier, California, and the late William Bennett, formerly from the University of Missouri, is giving scientists the clearest window yet into the wars waged between piercing-sucking insects and the plants they infest.

Because these insects are often carriers of plant pathogens that are transmitted through feeding, EPG can also illuminate how pathogens are injected into the plant to start the infection process.

The new EPG – called the "AC-DC correlation monitor" – is much more versatile than any of its predecessors and is currently being used by researchers in ways expected to broaden our understanding of how plant-feeding insects cause so much damage. "We've expanded the flexibility of the current technology so that we're now able to evaluate any insect that pierces or breaks the surface of a plant and study the feeding mechanisms and the pathogen-inoculation process in more detail," Elaine says.

She and William Bennett described their AC-DC monitor in a 2009 issue of the *Journal of Insect Physiology*. Elaine also used it in a series of studies published in the *Annals of the Entomological Society of America*. These studies focused on the critical role that saliva plays when the glassy-winged sharpshooter injects the Pierce's disease bacterium, *Xylella fastidiosa*, into grapes.

Elaine believes that the saliva loosens bacteria living in the gut

Entomologist Elaine Backus demonstrates how she uses silver print paint to attach a pure gold wire – half the thickness of a human hair – to a glassy-winged sharpshooter. (Photo: Stephen Ausmus)

A young adult glassy-winged sharpshooter wired up while its feeding on a plant is being recorded by an AC-DC EPG. (Photo: Stephen Ausmus)

“We were in the middle of a drought, everything was just falling apart”

Ian Shippen Sheep and wool producer.
Moulamein NSW

Caught in a devastating drought and with no money coming in, Ian faced some tough decisions. He needed a bold plan to keep his ewe population alive. His answer: buy more property. It was ambitious, but Bankwest took the time to understand his vision and made a commitment to back Ian all the way. Today, Ian's business is one of Australia's leading sheep farms.

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and stylets and carries them into the plant when the mixture is "spit up" during feeding. That inoculation process begins the spread of the disease throughout the plant. Elaine could not have gained these insights without the AC-DC monitor.

Worldwide take-up

Elaine has promoted the monitor's versatility at scientific workshops and conferences. In recent years, William Bennett built more than a dozen monitors worldwide for scientists who were willing to reimburse him for the costs. Among its fans are researchers at Oklahoma State University, who are using it to study how plant pathogens are injected into watermelons by squash bugs and into corn by corn leafhoppers.

"We've found that you can use it to gather all sorts of information," says Astri Wayadande, a vector entomologist at Oklahoma State University.

Having such technology should prove useful to entomologists and to plant breeders. A goal for breeders is to develop plants with genes that make them capable of resisting pathogens.

To find those genes, it would help to learn more about the pathogen-inoculation process so that, ideally, you could identify steps in the process that can be partially or completely blocked, either by silencing or turning on the right genes.

A scientific workhorse

At least seven different EPG systems have been made by scientists around the world. Over the past 30 years, the monitors have earned a reputation as a workhorse among researchers who study aphids and a handful of other piercing-sucking insects. Scientists have reported on them in more than 400 peer-reviewed papers.

To use them, researchers glue one end of a gold wire to the insect's dorsal area (its back) and insert another wire into the moist soil around the plant. This establishes a continuous electrical circuit through the monitor that can detect even miniscule changes in voltage that occur when the insect pierces the plant, releases saliva, or draws juice (ingests) from the plant into its digestive system.

Fluids like saliva carry electrical charges, and the movement of saliva into the plant causes the levels of those charges to fluctuate. That in turn produces waveforms that scientists can read to decipher details about the feeding and pathogen-inoculation process.

Waveforms are also produced by fluid fluctuations caused by movements of the insect's internal valves and pumps as it feeds or by the breaking of plant cell membranes. When researchers study different species of insects, they correlate the waveforms produced by each species to different steps in the feeding process, such as the insertion of saliva, the initial tasting, and ingestion. For each insect, there are unique changes in waveforms from ingestion, salivation, and stylet movement. "It is a window into the internal mechanisms that the insect uses when it feeds and into the plant responses to the feeding," Elaine says.

A blue-green sharpshooter being monitored during feeding.
(Photo: Elaine Backus)

Entomologist Elaine Backus adjusts the position of a glassy-winged sharpshooter while its feeding is recorded by an AC-DC EPG monitor. Elaine uses the technique to study how the insect transmits Pierce's disease bacteria into grape.
(Photo: Stephen Ausmus)

The new monitor's advantages

Traditionally, monitors have been designed to work with either AC or DC current. Because of the physics that govern electricity and the flow of electrical current, researchers have gotten the best results when using AC monitors to study larger insects and DC monitors to study smaller ones. Ideally, a monitor should be capable of studying a variety of insect sizes.

As the name implies, the AC-DC monitor incorporates features from both AC and DC monitors, making it more versatile. The user can adjust the settings to the size of the insect being studied.

They can use it to study all kinds of insects – not just plant feeders – to see what happens when a tick, mite, mosquito, bed bug, deer fly, or any biting or chewing insect pierces the surface of a plant or animal when it feeds, Elaine says.

Entomologists will be able to view the feeding process in detail for more insects than ever before and compare the feeding of pathogen-bearing insects with those that are pathogen-free. Many pathogens, both animal and plant, affect the insects that carry them as well as the plants or animals they infect.

Astri Wayadande is using the monitor to study how squash bugs transmit *Serratia marcescens*,the bacterium that causes cucurbit yellow vine disease, to watermelon and other cucurbits. She hopes to find cultivars that breeders can use to develop commercial varieties that resist the pathogen. "We don't really understand how squash bugs feed, how they damage the plant, and how they inoculate it with plant pathogenic bacteria and cause disease. The monitor helps us study all of these things," she says.

Astri also used the monitor to study and publish research on how leafhoppers infect corn with corn stunt spiroplasma, a common corn pest. Squash bugs are much larger than leafhoppers, so before Elaine and William Bennett's monitor came along, Astri says she probably would have had to use two different monitors to effectively monitor the two insects. But with the AC-DC monitor, she collected quality data on both.

"It's a wonderfully versatile system," she says.

Elaine Backus is in the USDA-ARS Crop Diseases, Pests, and Genetics Unit, 9611 S. Riverbend Ave., Parlier, CA 93648, +61 (559) 596-2925. ■

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Debate continues on early-sown chickpeas

RESEARCHERS are questioning the merits of early sowing of chickpeas in Central West NSW after trial results show the practice may not result in higher yields despite earlier flowering.

Department of Primary Industries (NSW DPI) district agronomists, Leigh Jenkins, Warren and Rohan Brill, Coonamble told growers at the recent Grains Research and Development Corporation (GRDC) Updates the disease risk and the impact of low temperatures on flowering may undermine yield benefits.

"Later sown chickpeas have a shorter vegetative phase and flower at temperatures more conducive to pod development," Leigh said.

"Chickpea time of sowing has been a debateable issue through several recent northern GRDC Update sessions."

She says new chickpea varieties with high yielding attributes have led to the belief that sowing in early May would optimise water use, via increased biomass, and promote earlier flowering.

"This trial at Trangie Agricultural Research Centre has shown that earlier flowering does not necessarily translate into higher yield, due to the impact of lower temperatures during early flowering and a greater potential risk of disease."

Leigh says conversely there is also a yield penalty from later sowing (late June) but chickpea plants are able to compensate to some effect when compared to very early sowing.

She says further GRDC-supported research is planned over several seasons to develop sound recommendations for the region.

Chickpeas contribute to the profitability of northern farming systems through the ability to fix nitrogen and provide weed and disease breaks for both winter and summer cereal crops.

Disease and frost damage are the two major constraints to chickpea production in the northern cropping region and in both cases sowing date can influence yield through avoidance of cold temperatures during flowering, and to reduce the effect of disease, Leigh said.

"The optimal time to sow chickpea will depend on the interaction between the environment and the available varietal germplasm," she said.

"Current chickpea genotypes have excellent frost tolerance while in the vegetative stage, but conversely display one of the highest temperature thresholds for seed set among winter pulse crops."

For more information, visit www.grdc.com.au/updates ■

GRDC-supported research is looking at the time of sowing for Central West NSW chickpea crops.

What to expect if grazing cereals

RESEARCHERS are investigating the top three effects of grazing wheat and barley – canopy management, lodging and grain yield – in trials supported by the GRDC. Matthew Gardner, NSW Department of Primary Industries research agronomist based at Tamworth, NSW says that in 'normal' seasons growers should consider sowing cereals intended for grazing or dual purpose as early as practical up to around early May. This maximises opportunities to accumulate biomass for winter grazing.

"Grazing cereals early will minimise impact on grain yield but reduce livestock production, whereas, grazing late will increase the risk of a more negative impact on grain yield but more than double dry matter available for grazing," Matthew said.

"Increasing plant population can be used to slightly increase dry matter production for grazing in barley."

Right decisions needed for optimum balance

Matthew said optimising the balance between dry matter production and grain yield depends on decisions including sowing time, plant population, species/variety and grazing timing.

"Ensuring that grazing cereal crops are sown early is pivotal to allow sufficient time for biomass to accumulate for winter grazing and flowering to still occur within the optimum window," he said.

"Grazing crops planted in the main season sowing window are likely to suffer large yield penalties as flowering will occur later when conditions are hotter and drier and the opportunity to accumulate grain yield will be limited.

"Increasing plant populations is a means of increasing dry matter yield for grazing, but it has limited capacity to increase grain yields after grazing."

He said grazing could reduce the severity of lodging of susceptible cereals such as barley, particularly when grazing was later and closer to stem elongation.

"Livestock must be removed by the end of tillering (GS30) to minimise the risk of grain yield penalties associated with grazing," he said.

Matthew says the GRDC-supported research shows increases in dry matter yield ranged from 335 to 710 kg of dry matter per hectare when moving from 100 to 200 plants per square metre.

"In comparison, the timing of grazing can have a greater influence on dry matter yield, with late grazing systems offering an additional 74 per cent and 45 per cent dry matter yield compared to early and early plus late grazing systems.

"Despite the additional dry matter yield under the late grazing system it has the greatest risk as grazing occurs closer to GS30 and there is greater potential grain yield penalties."

While late grazing has the potential to reduce lodging severity, particularly in susceptible varieties such as Commander, growers are urged to consider the farming system as a whole.

"The late grazing system may be the most suitable as it offsets grain yield losses with reduced lodging and increased livestock production from additional dry matter yield," Matthew said.

"The emphasis on either dry matter yield or grain yield will be grower specific and a range of management options may need to be implemented to get the balance right."

Economic benefits?

Researchers admit determining the economic benefit of grazing cereals is difficult.

"If yield penalties from grazing are avoided then the gross margin obtained from a dual purpose system is greater than that obtained from grain only," Matthew said.

"In particular the greatest benefits would be obtained where the grazing cereals complement existing livestock enterprises by filling the winter feed gap and livestock don't have to be purchased to utilise additional feed from grazing cereals.

"Grazing cereals during the winter period allows for the potential to spell pastures, which could lead to substantial increases in available feed to the whole system."

He said grazing cereals also provided flexibility and risk management to make decisions about weather and commodity prices throughout the season. It may be more profitable to focus more on livestock weight gains and sacrifice grain recovery but this decision will vary from season to season. ■

If you intend to graze cereal crops, it is vital that they are sown early.

Canola for grazing also achieves high yields

A NEW canola variety is allowing farmers to graze their sheep on high quality feed during colder months while allowing pastures to regain health during the break.

The crop which can be grazed and still harvested has also proven to have good yields and high oil content.

CB Taurus canola is a new choice for canola growers as a dual purpose hybrid for grazing and grain production systems. It grows best in high rainfall areas of above 600 mm a year with longer growing seasons.

It is a winter canola variety and will not flower until it experiences long periods of cold weather so can be sown early in March without bolting early.

The crop is typically sown early in the season, in February and March, and heavily grazed through the winter months before buds have elongated more than 10 cm. It has excellent early vigour and growth, seed yield and oil content.

John Jeffreys in his CB Taurus graze and grain canola crop at Delegate, New South Wales.

Sheep and cropping farmer John Jeffreys trialled growing Taurus canola for harvest and stock feed last season.

John Jeffreys, who runs Delegate Station, a property south of Cooma, began using Taurus canola as part of field experiments with CSIRO scientist Dr John Kirkegaard.

On-farm trials

John's farm was chosen for the trial because it was near enough to John Kirkegaard's office in Canberra to make sampling possible and because his farm's environment has long-season characteristics.

John had been using grazing wheat in his operation for several years but ran into trouble controlling weeds and diseases in the crop.

He combated this by putting in a canola rotation crop on 600 hectares and choosing a variety suited to the long season that could also be grazed.

"John's system shows nicely how the wheat and canola go together in a system," John Kirkegaard said.

John Kirkegaard and his colleague Dr Hugh Dove have been researching the benefits of grazing two crops, like wheat and canola, in sequence to enable substantial pasture recovery and to get more out of the dual purpose system.

In a new system trialled by CSIRO and John Jeffreys, Taurus was sown in spring, allowing sheep to graze it for four to six weeks in summer – as he normally does with forage rape – before removing the sheep in autumn for crop recovery, and allowing them to graze again for four to six weeks in the winter.

After the second winter grazing, the crop was locked up and harvested 15 months after first sowing.

This unique system is about six months longer than the average period from sowing to harvest times, and allows for two grazing periods.

Although the 15-month trial in Delegate has only been run once so far, it has shown promise, albeit with the assistance of a wet summer which promoted crop growth.

John Jeffreys found that weed control remains an issue in a dual grazing system, but it is a manageable one.

"Because the canola is in the ground for so long, it's a lot more difficult for weed control. You have to make sure the paddock's relatively clean when sowing," John said.

Further testing is underway to determine how the dual grazing system will perform under different seasonal conditions.

While very dry summers may cause crop failure, it is anticipated the dual grazing system will allow farmers to switch to managing the crop as if it were a forage crop, so they can still get some value out of it.

"The idea is there are many 'exit' points for the farmer to avoid risks and make money along the way from dual-purpose crops," John Kirkegaard said.

For John Jeffreys, the unique system has the potential to reduce input costs.

"We're reducing our costs significantly with this system by essentially getting two crops in one. Instead of having two sowing and fertiliser costs, we're just getting one, reducing risk and saving about $350 to $400 a hectare. Further trialling is yet to determine if we are able to maintain yield compared to the autumn sowing window," John said. ■

Supplements boost cattle weight gains on forage wheat

NEW research shows cattle grazing on cereals can record a 25 per cent increase in liveweight when offered supplements. Dr Lindsay Bell, CSIRO farming systems research scientist says winter cereals are an important winter feed supply in many mixed crop-livestock production systems, whether they are used as dedicated forage crops, dual-purpose crops or sacrificial grazing of poor grain crops.

Lindsey says several studies have shown a response to magnesium and/or sodium supplement in sheep grazing forage wheat, but the response in cattle has previously received little validation.

Two recent GRDC-supported experiments investigated cattle response to these supplements when grazing wheat in the northern cropping region by comparing two mobs of yearling Angus and Angus-cross steers in side-by-side paddocks.

One paddock was supplemented with a mix of Causmag (MgO):Salt (NaCl) and cracked grain at an allowance of 140 grams per head per day. The second paddock received no supplements.

Lindsey said a 25 per cent increase in average steer liveweight gains were recorded across the supplemented herd.

Supplementation increased beef production per hectare by 92 kilograms and returns by $246 at a cost of $22 per hectare or 6 cents per head per day, he said.

"This response occurred across the whole supplemented herd, with some evidence of reducing within-herd variations in liveweight gain," Lindsey said.

Lindsey says supplementing stock grazing on cereals is a sound investment, increasing liveweight gains by 20 to 60 per cent. Growers can also reduce the incidence of tetany or magnesium deficiency in stock grazing wheat and some triticale varieties by supplementing with magnesium or sodium.

Lindsey says growers should provide stock with a mixture of 1:1 Causmag (MgO):Salt (NaCl) at an allowance of 20 grams per head per day for sheep and 140 grams per head per day for cattle.

"A small amount of added grain or hay – about 20 per cent of the total mix – may assist acceptance of the supplement initially," he said. "This supplement mix of salt and Causmag is a low cost solution for improving liveweight gain. It costs one cent per head per day for sheep and six cents per head per day for cattle and is a safe investment with 10- to 25-fold return."

Indirect supplementation

Additional research by former CSIRO researcher Dr Hugh Dove and others explored fertilising wheat with magnesium to indirectly supplement grazing animals.

"Results showed a rapid increase in magnesium concentration of the wheat after fertilisation with magnesium sulphate or Causmag," Lindsey said. "This increased magnesium content to 50 per cent above animal requirements, but magnesium concentration declined gradually after fertilisation.

"In the first year, animals grazing the magnesium fertilised crop gained 25 per cent more liveweight.

"But in the second year higher growth rates were observed in the first two weeks of grazing, when crop magnesium content was higher, but as magnesium concentration declined the difference in growth rate declined so that over the five-week grazing period we found no difference in liveweight gain."

Lindsey said in any case, fertilisation of the crop to indirectly supplement animals was not cost effective.

"The 70 kg magnesium sulphate used costs about $574 per hectare or 60 cents per sheep per day and this is unlikely to be recouped from increased livestock gains compared to the low cost for direct supplementation," he said.

Lindsay Bell, CSIRO Ph: 07 4688 1221 or E: Lindsay.Bell@csiro.au ■

A supplement mix of magnesium and salt given to cattle grazing wheat, returned up to 25 times the cost.

Elmore contractor adds compost to the mix

FRANK Harney's farming business, just north-east of Bendigo, comprises several parts – hay contracting, a piggery facility and cropping. It was a combination of issues arising from the different facets of the business that has seen him move into an interesting new enterprise – one that could have substantial waste management and cost benefits for local farmers.

He bought the property on the road between Bagshot and Mayreef 20 years ago, after growing up on the family farm just across the road, which was originally settled in 1910. His enterprise now covers around 1000 hectares, including some leased land.

Frank's main business has always been in hay contracting – it wasn't unusual some years ago for him to bale 100,000 small square bales each year. Now it is all in large square bales – growing oaten hay – mainly for export to Japan – on his own property, as well as baling other farmers' hay and straw, and buying it in.

In the drought they needed to travel further afield than they do these days. "It's all pretty local work now," Frank said. "We do about two-thirds hay and one-third straw." He buys standing straw off graingrowers to help them with stubble management. He also grows wheat on some of his own paddocks.

A contract growing-out facility on the farm holds 2000 head of pigs. They arrive, all from the one client, at eight to 10 weeks of age and leave at 100 kg liveweight. The housing and management of the facility are RSPCA-approved, based on six weekly inspections.

A distinctive feature of the property is the considerable number of large square straw bales stacked outside in the paddocks. Frank said that the weather-damaged top bales go into the piggery as mulch for flooring – the rest is marketed as straw for his established customers.

A lot of waste put to use

The relatively high quantity of waste material from his operations has pointed Frank in the direction of his current activity, making compost for farmers – and himself – as a partial replacement to the traditional methods of improving paddocks, in cropping as well as dairy, with copious amounts of fertiliser.

"Weather-damaged hay will be the catalyst," he explained. "At one stage we were cropping 7000 acres of owned and leased land, then we copped three years of bad weather in a row and that meant lots of damaged hay."

Frank explained that the eco-shelters generate 60 to 70 cubic metres of pig manure and straw every week and he had been looking at more efficient effluent management. The physical act of spreading the manure from the piggery onto his own

The compost made at Frank Harney's property, near Elmore, has shown impressive scientific analysis.

The Seymour Composter 4000TravelA suits a windrow of 1500 mm high and 3000 mm wide and pulls the material from the outside of the windrow to the inside with a fluffing action that lifts and aerates the hot material at the core of the heap.

The new composter can process 700 tonnes of material an hour, turning waste into organically rich compost.

paddocks to promote growth was proving to be difficult, and expensive, and he was anxious to try different ways.

In August 2011 he went to a farmers' field day at Pyramid Hill about composting waste and was impressed with what he saw. One of the machines on show was Seymour Rural Equipment's Composter 4000TravelA, and it looked like the solution to his problem.

This machine can process 700 tonnes of material an hour, turning what on most farms has traditionally been waste into organically rich compost to help get organic matter back into the soil. It is part of a system for making rows of compost from various types of manure and other material, which could include pig, poultry, dairy or feedlot manure, damaged hay or straw and green waste.

Many farmers are discovering that soil treated with a composted mixture has become more pliable, with more clover and more worms. This adds up to a more nutritious feed with lower nitrates and water content and better storage attributes.

The composter passes through the row mixing, aerating and conditioning the product. It is processed into a uniform blend by adding moisture, and then turned again when the compost heats

up to around 60°C. Up to five turns is usual before it is ready to be applied to pasture or worked ground.

Frank helped the team at Seymour Rural Equipment to set up the new composter for display and demonstration at the Elmore Field Days, where it subsequently won the award for *Australian Machine of the Year*.

He has had the Seymour Composter 4000TravelA on his property since then and is developing the contracting side of the business.

"Our intention is to help farmers to manage their waste. We will turn the compost rows for them and look after spreading the compost onto their paddocks, probably using the Seymour belt spreader. Plus we'll source the other raw materials that may be required by our customers."

Frank says that initially farmers have been hesitant because of the perceived amount of work. "But," as he said, "if you set it up properly it is not difficult, particularly for example on dairy farms that have installed feedpads since the drought.

How the composter works

The Composter suits a windrow of 1500 mm high and 3000 mm wide with an operating speed of 500 to 800 metres per hour. Working width is 7.4 metres. The tines are positioned on the drum so that they pull product from the outside of the windrow to the inside with a fluffing action that lifts and aerates the hot material at the core of the heap.

Frank has about 4000 cubic metres of compost ready to go. "We are hoping to put compost on all our own cropping paddocks this year. That's about 800 hectares. The compost that we've made consists half of damaged oaten hay, a quarter pig manure and a quarter chook manure that we've bought in. From what I understand, the pig manure is higher in potassium and the chook manure is higher in nitrogen."

They have had the compost analysed with some impressive results. The certificate of analysis indicates:

- 2.3% nitrogen;
- 1.3% phosphorus;
- 2% potassium;
- 0.62%b sulphur; and,
- 0.75% magnesium.

Copper shows 96 mg/kg, magnesium is 450 mg/kg, zinc 450 mg/kg and iron is 14000 mg/kg.

"This would be perfect for sowing canola", enthused Frank, "you get a real dollars per hectare advantage. On our crops we might only put 10 kg per hectare of DAP – or if it looks OK, none at all!"

"The biggest issue with compost is to incorporate it at initial seeding to get the plants out of the ground. As we go along, and get to know more, we can make a better brew – probably by increasing the amount of chook manure. The poultry industry is looking at doing more things with manure, proactively value-adding their waste in areas like composting and bio-char."

He speculates that EPA constraints will become stricter and that will affect stubble management, plus stringent rules may come in about spreading manure – poultry, pig or dairy – directly onto paddocks.

Frank Harney's hay contracting business now has a 'four-way draft' as he calls it – the export market, the local dairy market, his own compost and compost for other customers. He is looking to manufacture compost on-farm for a small scale local market, because as he has found on his own place, "the vegie gardens have gone mad."

More information on the Seymour Composter 4000TravelA is available from Seymour Rural Equipment at www.seymourrural.com.au or on (03) 5792 1100. ■

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Heavy stubble loads needn't slow you down

NEW research has shown that trifluralin sprayed with higher water rates of about 100 litres per hectare improves the herbicide's effectiveness on paddocks with heavy stubble loads, regardless of the spraying speed.

The trial results are timely for many growers who enjoyed favourable seasonal conditions in 2011 resulting in high levels of stubble biomass – which can reduce the efficacy of pre-seeding herbicides.

The research was funded by the Grains Research and Development Corporation (GRDC), the WA No Tillage Farmers Association (WANTFA) and Wheatbelt Natural Resource Management (NRM), and conducted by the Department of Agriculture and Food (DAFWA), WANTFA, Wheatbelt NRM and the Australian Herbicide Resistance Initiative (AHRI).

It builds on previous GRDC funded work by DAFWA weeds researcher Catherine Borger, which showed that increasing the water rate improved the performance of trifluralin in minimum tillage systems.

DAFWA weeds researcher Catherine Borger.

"But due to equipment limitations, the previous research was conducted at speeds often below those that growers would use to spray trifluralin," Catherine said.

"The current research used normal spraying speeds of 22–24 km per hour and resulted in similar improvements in trifluralin effectiveness, showing that the impact of high water rates on trifluralin performance is not affected by spraying speed."

Catherine said that in trials conducted at Cunderdin and Wongan Hills in 2011, the amount of annual ryegrass which survived 2.5 litres per hectare of trifluralin decreased from 19 to 14 per cent when the water rate was increased from 50 to 100 litres per hectare.

"This was probably because the spray coverage on the ground increased from an average of 9 to 26 per cent when water rates were doubled," she said.

"Both trials at Cunderdin and Wongan Hills in 2011 were sprayed at normal speeds that growers might use on-farm – 22 to 24 km per hour – in relatively windy conditions.

"But the trifluralin was applied using coarse spray quality to cause less drift, at pressures of 3 to 5 bar to give high droplet speed."

Catherine said research conducted by AHRI researcher Mechelle Owen under the same project had shown that trifluralin resistance in annual ryegrass was still at fairly low levels.

Analysis of a 2010 herbicide resistance survey had revealed that about 25 per cent of annual ryegrass populations in WA had low levels of resistance, where 1 to 20 per cent of plants might survive.

"These results show that trifluralin should still work well as long as it is applied correctly, and that cases of reduced effectiveness will usually be due to lower water rates on heavy stubble loads, not resistance," Catherine said.

She encouraged growers to check the label rate when planning pre-emergent herbicide application, and said trifluralin was most effective when used after a good rainfall event, and should be incorporated directly after spraying. ■

Keeping a weather eye on the current

CSIRO oceanographers left Brisbane in April on a 10-day, $2 million research voyage they believe will generate the most complete profile yet of one of Australia's most influential environmental features, the East Australian Current.

Working from the national marine research vessel, *Southern Surveyor*, the scientists deployed five deep water moorings across the current, extending 240 km east of Brisbane to gain specific insights into the characteristics of the largest ocean current in the Australian region.

Principal investigators for the voyage were Hobart-based scientists, Ken Ridgway and Dr Bernadette Sloyan, specialists in currents in the Australian region with CSIRO's Wealth from Oceans Program.

Bernadette said the East Australian Current impacts our climate and east coast ocean conditions, and so understanding its physical and chemical characteristics as recorded through the mooring network will be important for future natural resource management.

The mooring network is the latest addition to the Australian Government funded Integrated Marine Observing System (IMOS), which has a strong focus on how offshore conditions influence our coasts via the major boundary currents like the East Australian Current.

Bernadette said IMOS has provided $2 million in funding to support this mooring network, which will complement existing IMOS observations being taken off the Great Barrier Reef, the New South Wales coast, and the east coast of Tasmania.

"With this final piece of the jigsaw in place we now have the ability to accurately measure transfer of water, heat and salt from the tropics to the Tasman Sea, to see how it is changing

Feeding out the mooring – the long process of delivering a deep ocean mooring. (Photo: Danny McLaughlan, CSIRO)

BACKGROUND…

The East Australian Current is the largest ocean current close to the coast of Australia. What scientists already know is that the EAC:

- Transports up to 30 million cubic metres per second, with a strong influence to 1000 metres depth and 100 km width.
- Is strongest in summer, peaking in February, and weakest (by as much as half the flow) in winter, when its energy dissipates east of Tasmania.
- Generates ocean eddies as broad as 200 km across, rotating mainly anti-clockwise at up to four knots at the edge – these can be more than one km deep and have a life of up to a year.
- Frequently crosses onto the continental shelf and moves close inshore.
- Causes upwelling where it moves away from the coast at places like Cape Byron, Smoky Cape and Sugarloaf Point, drawing nutrient-rich water from a depth of 200 metres or more.

By comparison, the Leeuwin Current, originating off the north-west coast of Western Australia carries a fifth as much water, peaking in May-June.

Deploying a highly-specialised ocean measuring instrument that captures water at varying layers between the surface and the sea floor. (Photo: CSIRO)

over time, and to understand what these changes might mean for marine ecosystems and coastal populations along the eastern seaboard," she said.

The moorings consist of sensors recording temperature, salinity, and velocity of the current, spanning the region from the continental margin to off-shore in water depths of nearly five kilometres.

Ken said scientists have been studying the East Australian Current for perhaps 100 years, although for the first 60–70 years the focus was on the biology and how it may be influenced by the current.

"In the last 25 years real advances have been made in understanding the East Australian Current, its physical structure and seasonal changes, and more recently its influence on the biodiversity of the east coast.

"What we have also seen in that time is a strengthening of the winds in the Pacific that have intensified ocean circulation and are pushing the current around 350 km further south in the Tasman Sea.

"This research voyage was a terrific opportunity to study the current, and to understand its wider influences on our natural marine resources and for many Australians living on the eastern seaboard its influence in their lifestyle," Ken said.

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■

WARMING ALTERING OCEAN SALINITY AND RAINFALL

A clear change in salinity has been detected in the world's oceans, signalling shifts and an acceleration in the global rainfall and evaporation cycle.

In a paper published recently in the journal *Science*, Australian scientists from CSIRO and the Lawrence Livermore National Laboratory, California, reported changing patterns of salinity in the global ocean during the past 50 years, marking a clear fingerprint of climate change.

Lead author, Dr Paul Durack, said that by looking at observed ocean salinity changes and the relationship between salinity, rainfall and evaporation in climate models, they determined the water cycle has strengthened by four per cent from 1950–2000. This is twice the response projected by current generation global climate models.

"Salinity shifts in the ocean confirm climate and the global water cycle have changed.

"These changes suggest that arid regions have become drier and high rainfall regions have become wetter in response to observed global warming," said Paul, a post-doctoral fellow at the Lawrence Livermore National Laboratory.

With a projected temperature rise of 3ºC by the end of the century, the researchers estimate a 24 per cent acceleration of the water cycle is possible.

Scientists have struggled to determine coherent estimates of water cycle changes from land-based data because surface observations of rainfall and evaporation are sparse. But according to the team, global oceans provide a much clearer picture.

"The ocean matters to climate – it stores 97 per cent of the world's water; receives 80 per cent of the all surface rainfall and; it has absorbed 90 per cent of the Earth's energy increase associated with past atmospheric warming," said co-author, Dr Richard Matear of CSIRO's Wealth from Oceans Flagship.

"Warming of the Earth's surface and lower atmosphere is expected to strengthen the water cycle largely driven by the ability of warmer air to hold and redistribute more moisture."

He said the intensification is an enhancement in the patterns of exchange between evaporation and rainfall – and with oceans accounting for 71 per cent of the global surface area – the change is clearly represented in ocean surface salinity patterns.

In the study, the scientists combined 50-year observed global surface salinity changes with changes from global climate models and found "robust evidence of an intensified global water cycle at a rate of about eight per cent per degree of surface warming."

Fresh water availability more critical

Paul said the patterns are not uniform, with regional variations agreeing with the 'rich get richer' mechanism, where wet regions get wetter and dry regions drier.

He said a change in freshwater availability in response to climate change poses a more significant risk to human societies and ecosystems than warming alone.

"Changes to the global water cycle and the corresponding redistribution of rainfall will affect food availability, stability, access and utilisation," Paul said.

Dr Susan Wijffels, co-chair of the global Argo project and a co-author on the study, said maintenance of the present fleet of around 3500 profilers is critical to observing continuing changes to salinity in the upper oceans.

The work was funded through the Australian Climate Change Science Program, a joint initiative of the Department of Climate Change and Energy Efficiency, the Bureau of Meteorology and CSIRO. Paul is a graduate of the CSIRO-University of Tasmania Quantitative Marine Science program and he received additional support from CSIRO's Wealth from Oceans Flagship.

Credit for growers' reductions in greenhouse gas emissions

FARMERS appear to be emitting much less greenhouse gas with their tractors and equipment than previously thought, suggesting that they are not getting the 'credit' they deserve for reducing emissions.

Toowoomba researcher Craig Baillie said modern diesel engines in machinery such as tractors, harvesters and irrigation pumps were extracting more energy per litre of fuel, but with reduced emissions than a few decades ago when emission factors were decided on.

Craig said these emission factors were agreed on in the 1970s and are used to calculate emissions in given situations.

"We could reduce emissions just by reviewing (and recalculating) the emission factor," he said.

This occurred when the use of nitrogen fertilisers by cotton growers was reviewed, prompting recognition that cotton farmers had reduced emissions by 20 per cent by more efficient fertiliser use.

Craig is deputy director of the National Centre for Engineering in Agriculture in Toowoomba, and is involved in research on energy use and greenhouse gas emissions on cotton farms, a project funded by the Cotton Research and Development Corporation (CRDC).

He said work on seven cotton farms from Emerald in Central Queensland to Breeza near Gunnedah in New South Wales had provided the initial data and the base for more work.

NCEA research engineer Craig Baillie (right) and Vanderfield Machinery service manager Andrew White discuss the fuel system on a John Deere 8000 series tractor.

Vanderfield Machinery service manager Andrew White (left) and NCEA research engineer Craig Baillie with the large exhaust system on a new John Deere tractor. The tractor is equipped with Interim Tier 4 specifications, and the large exhaust helps to control emissions, unburnt fuel and other particulate matter.

"This could be significant for the agricultural industry."

He said newer engines fitted with turbo chargers and intercoolers were extracting more energy with fewer emissions per litre of fuel than similar sized power units of a few decades ago. The work of Craig and his team involves developing a method to assess energy use on farms.

"It's like the development of water use efficiency in the early 1990s."

Protocols and benchmarks

The work aims to develop a protocol to assess energy use, to quantify energy use for varying farming operations, and to evaluate the energy used and the associated emissions, for the various farming systems.

"We are developing a standard method that has repeatability, and we want to benchmark the best farms across seasons."

Craig said some farm sectors such as the cotton industry, were good at looking at energy issues, and he expected growers would get value from the work, both immediately and down the track.

Craig said the research also wanted to quantify the energy footprint of different farming systems.

He said such a method could be incorporated into *my*BMP (best management practice) and it could be a means for continual improvement.

Another method could incorporate a star rating, adapting a building rating system to agriculture.

Craig said an energy assessment system could involve three levels.

- The first level would involve benchmarking total fuel use, total production energy use, and total electricity use;
- The second level would process energy used for farming operations such as planting and irrigation etc; and,
- The third level would target aspects in more detail.

Craig said the system would be flexible and farmers would not have to start at level one.

But all sources of energy use on the farm would be assessed. Unlike assessing energy use for a fixed site such as a processing plant, most of this energy would be used, not in a shed or a house, but in a field, which made the system different.

The seven farms involved in the research were all irrigated cotton and grain enterprises.

"They are all different, but there are subtle differences," he said.

"We have a reasonably good handle on how much energy it takes to grow a crop of cotton for example, and what influences energy use, and some of the factors to reduce energy use."

Data is showing that it takes about 10 gigajoules of energy per hectare to grow cotton. That's about one gigajoule per bale

"We have also calculated the equivalent greenhouse gas and find that just over one tonne of greenhouse gas per hectare is produced.

"Before this no one knew what emissions were produced," Craig said.

He referred back to the 1990s before water use efficiency was developed. The accurate impact of water was not known.

But with the water use efficiency program, a general estimate is that one megalitre of water produces one bale of cotton.

Craig said irrigation is prominent in energy use.

It accounts for at least 60 per cent of energy used – and up to 70 per cent – depending on the pumping system and whether water was pumped from a bore or out of a ring tank.

Electricity is cheaper than diesel because it produces more energy per dollar.

More use of existing on-board computer power

As part of his energy research, Craig is also looking at using more of the data collated in the on-board computers on tractors and harvesters.

"Growers are using only five per cent of the capability of on-board computers and we are looking at the performance monitoring functions.

"We are focussing on the John Deere system, but we can also extract data from Case IH machines."

The research is also collecting special reference data, to measure ground speed and wheel slippage with the help of radar on the machine. And based on harvesting data, fuel use mapping also would be possible.

"And what we are doing with computers on tractors, we also want to do for irrigation pumps."

Craig and his team at NCEA are also involved with another project for the CRDC, looking at alternative energy and fuel options for the cotton industry.

They are investigating new fuel sources, mixtures and technologies for agricultural operations involving tractors and stationary diesel engines.

The use of CSG and bio-diesel will feature in this examination, and the work offers considerable opportunity for power generation with ultra-low emissions.

The project will help the Australian farming industry to identify alternative energy and fuel options to save energy, save money, and reduce greenhouse gas emissions, while assessing other benefits such as additional income. ■

The good gear

By Ian M. Johnston

Seven months after placing the order, I recently took delivery of a diesel fuelled European car equipped with one of these new high tech twin clutch semi-automatic transmissions. I have to admit, the brochure was right! The seamless gear changes can often only be detected by a close scrutiny of the rev counter.

Mind you, I have been subjected to ridicule from a handful of my car club alleged mates, who persist with the belief that a real driver prefers to change gears manually. Yet put them in a 1940s Austin truck, or my old 1928 Talbot, or better still – a 1920s Fordson Model F, with their soul destroying crash gearboxes and my car club compatriots would likely be in a state of extreme trepidation. But of course, no problems for we ageing tractor folk!

Frankly, in the year 2012 I am surprised that anyone desires to own a modern family car with a manual-change gear box. After all, automatic transmissions have come a long way since the chewing gum autos of the 1960s.

So having vented my views relating to car transmissions, predictively my thoughts now turn to tractors and the 20 forward and 12 reverse gears that I originally thought was an overkill in my Landini. But guess what – I use every one of them!

But I can assure you, there were some wacky transmission designs in many of the early tractors.

In the beginning

Apart from a few experimental machines, internal combustion engined tractors commenced their irrevocable march across the rural landscape during the first decade of the 20th century. In the main they were obstreperous, clattering and often dangerous contraptions of mammoth proportions.

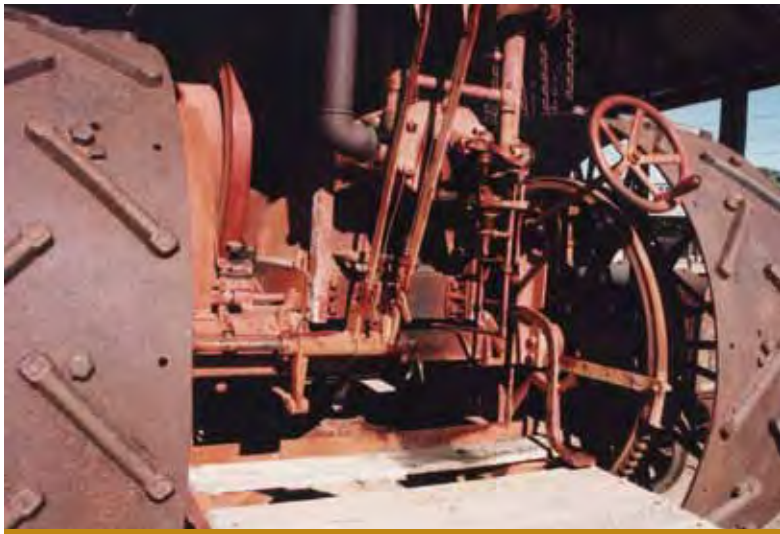
The philosophy inherited from their steam powered cousins prevailed. In other words, it was believed the new generation oil powered tractors had to equate the weight and size of steam traction engines in order to be capable of pulling the broadacre implements of the era.

For example, a tractor weighing around 10 tons with a huge but inefficient engine (by today's standards) producing a mere 20 hp, required at least half its power to simply propel the unit without a load.

The transmissions of these first tractors were crude in the extreme. Rough castiron gears were exposed to mud and grit, with the resultant rapid deterioration one would expect. Few manufacturers considered the frivolous idea of encasing the gears and having them running in oil!

Initially most tractors were only offered with one forward and one reverse gear, providing a plough speed of around two mph Eventually two forward speeds became the rule.

A 1906 International Friction Drive owned by Les Noll of Toowoomba. Note the crude chain steering. (Photo IMJ)



The operator's platform of an International Friction Drive. Note the cylinder head and the forward and reverse levers. (Photo IMJ)

Three examples of the more idiosyncratic early tractor transmissions are examined hereunder.

International friction drive

International Harvester's first tractor was based on a design patented in 1903 by an engineer named Morton, who had established a factory in Chicago specialising in the design of tractor chassis and transmissions, to which customers could add an engine of their choice.

The International marketing team saw this as a rapid way of entering the tractor business, thus bypassing much of the design development. All that was necessary was to adapt their well accepted single cylinder open crankshaft 15 hp Famous engine to the Morton chassis. The massive engine featured an 8 inch bore and 14 inch stroke and developed its 15 hp at 240 rpm, the speed being regulated by a hit-and-miss spark governor.

But what made the big tractor technically fascinating was the method of delivering the power from the engine to both the forward and reverse drives. The operator was required to manipulate two large levers positioned by his left hand, the first of which actually moved the engine either forward or backward along the chassis, thus engaging the flywheel by friction to the forward drive. The second lever smoothly engaged the reverse drive.

Surprisingly the Friction Drive was a pleasure to operate, requiring very little physical effort compared to conventional power trains utilising the heavy clutch designs of the period. The action could be likened to that of a modern hydraulic shuttle control, such was the ease and smoothness of the operation.

Ronaldson Tippett Super Drive

The Victorian Ballarat firm of Ronaldson Bros. & Tippett introduced their Super Drive 18-30 in 1924. The design was based on the Illinois 18-30 produced in America by The Illinois Silo and Tractor Company of Bloomington. The unit was powered by a 30 hp Wisconsin engine, featuring four cylinders in two banks of two.

Operating in Australia's torrid summer weather the tractor immediately encountered over heating difficulties. The problem was overcome by increasing the capacity of the radiator. The modified tractors were instantly recognisable by the profile of the heightened radiator header tank.

Interestingly, Australian engineers designed a special manifold which enabled the engine to be run on crude oil fuel, following the initial warm up with petrol. This added considerably to the

This magnificent specimen, being driven by the author, of a Ronaldson Tippett Super Drive has been restored by Master Restorer Newton Williams of The Pioneer Village Museum, Swan Hill. The cover for the pick-off gears can be seen just forward of the rear wheel. (Photo M. Daw)

A Super Drive in full flight. Taken some years ago at a twilight tractor pull at the excellent North Western Agricultural Machinery Museum, Warracknabeal, Vic. (Photo IMJ)

The operator's platform of a Super Drive provides the opportunity to sit or stand. (Photo IMJ)

appeal of the tractor, as crude oil was cheaper than petrol and even kerosene.

But undoubtedly the most interesting feature of the Super Drive was its 96 speed gearbox! Well – potentially 96 gears.

You see ostensibly the gear box provided two forward and one reverse speeds. But this could be augmented by first removing a cover on the left side of the transmission and swapping the position of two 'pick-off' gears. This now offered the choice of four forward and two reverse speeds.

But that is not all. Ronaldson Tippett could supply an extensive range of 'pick-off' gears which, according to the operator's

The extraordinary Fowler Rein Drive photographed outside the Pioneer Park Museum, Parkes, NSW.

manual, could provide no less than 48 speeds under 6.6 mph (The mind boggles!)

But wait – there is more. A choice of two rear wheel diameters was also available. So if one does the maths, there were theoretically 96 forward and 48 rear speeds. Undoubtedly a world record for any type of transportation.

The control of the clutch was also interesting. As the clutch was engaged, the engine revolutions were automatically increased. This was supposed to overcome the problem of the engine stalling when the clutch picked up the load. The downside was, the operator who was perched on a narrow wooden platform at the rear of the machine, had to really hang on as the machine jerked forward or be in serious risk of being jolted off – right in the path of the plough!

Fortunately most of the Super Drives were sold to grain farmers whose agricultural land was relatively flat and accordingly seldom had to apply the horrendous braking system.

If a gear was disengaged the brake would not operate! Think about it. Imagine a Super Drive negotiating a hill, either up or down, and it became necessary to change down to the lower gear. The perilous procedure would be to firstly apply the foot brake (there was no hand brake) with the hand clutch disengaged but the gear still engaged. Then, presumably with the aid of an offsider, a block would be placed against the wheel, preventing the tractor from taking off whilst the operator moved the gear shift through neutral and into the other gear. Scary stuff!

Fowler rein drive

In the 1920s the horse still reigned supreme on Australian farms. Even the bargain basement price of a Fordson was not a sufficient inducement for the average farmer to retire his team to the back paddock and invest in one of these new fangled intimidating tractors. I mean to say, one would have to comprehend the incomprehensible gearbox-clutch routine whilst wrestling with a steering wheel! And then there were all these levers and do-dahs to worry about!

On the other hand, it is a well known fact that the only controls necessary for the horse is a pair of reins. Such was the reasoning of the many farmers who were nervous of tractors.

Then up sprung Cornelius Murname, a design engineer from Melbourne. He had a weird but clever idea of how to overcome this farmer resistance to the complications of driving a tractor. He presented his patents to John Fowler and Company of Leeds, England, who were in the business of manufacturing very large heavy weight tractors and thus were losing business to the multitudes of lighter machines that were becoming increasingly popular.

In 1924 the Fowler Rein Drive was unveiled at The Royal Agricultural Show at Leicester, where it won a gold medal. But that was its one and only day of fame. It turned out that, in fact, farmers were not enamoured by the prospect of driving a tractor solely by means of a pair of reins, because whilst the driver was obliged to be perched on a sort of trailing buggy or astride a trailed implement, a rope rein was the only contact he had with the tractor. Different tugs on either the left or right rein controlled the clutch, gearbox and steering.

Considering the overall dimensions of the rig, it was powered by an engine of somewhat alarming proportions. It was a liquid cooled V twin configuration with a 5.75 x 7.5 inch bore and stroke and developed 32 hp at 1000 rpm. Designed by Fowler, it was virtually half an engine that was originally deployed for propelling a military tank.

The illustration below is of possibly the sole remaining Rein Drive and is on public display at the Pioneer Park Museum at Parkes, NSW. This rare exhibit was restored by Stewart Nash and is but one of scores of magnificent tractor artefacts lovingly cared for by a team of dedicated enthusiasts.

A few years ago I was offered a drive of the Parkes Rein Drive. Despite the fact that I have been privileged to have operated untold numbers of weird old tractors around the world, this was the scariest I have ever encountered. I mean – a pair of reins!!! What if the rope broke?

It is no small wonder that the Fowler Rein Drive was a commercial flop. ■

IAN'S MYSTERY TRACTOR QUIZ

Question: Can you identify this popular tractor of the 1930s?

Clue: The colour is significant.

Degree of difficulty: They don't come any easier than this!

Answer: See page 48.

A Rein Drive hauling a seven ton load. (IMJ archives)

NORTHERN FOCUS
COVERING NORTHERN NSW AND QUEENSLAND

THE RESEARCH VIEW

Keeping a close eye on fields to ward off herbicide resistance

By Steve Walker[1], David Thornby[2], Jeff Werth[2] and Michael Widderick[2]

MONITORING the effectiveness of herbicides and knowing the resistance status of every paddock is key for growers in the battle against herbicide resistance.

Northern region surveys show resistance is common and widespread and threatens the future of the no-till system. Added to this, the recent floods appear to have spread resistant seeds and this is potentially a huge problem as hard-to-control weeds such as flaxleaf fleabane can produce up to 100,000 seeds per plant.

Key resistances in the north include:

- Resistance to glyphosate in fallows and pre-sowing control including resistant ryegrass on the Liverpool Plains and resistant windmill grass around Dubbo;
- In-crop resistance among Group B herbicides such as Glean and Ally;
- Wild oats resistance to Group A herbicides in winter crops including chickpeas; and,
- Glyphosate resistant barnyard grass and fleabane found in southern Queensland and northern NSW.

Driving down the weed seedbank is an effective strategy being practiced in the western and southern regions where resistance has long been a problem. In the north this involves controlling survivors as seed shattering means many weeds may have already dropped seeds by harvest time.

GRDC-supported herbicide resistance research is examining benefits of the double knock technique in reducing resistant weed populations.

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.

Glyphosate resistance – avoidance and management

The risk of glyphosate resistance is reduced, and weed management can be markedly improved, if the principles of good crop agronomy and integrated weed management (IWM) are adopted.

This involves developing and implementing a strategy, where a range of chemical and nonchemical tactics target all parts of the weeds' lifecycles – depleting the seed-bank, effectively controlling seedlings, stopping seed-set on sprayed survivors and avoiding introduction of new weed seeds.

An important component of the strategy is the double-knock tactic (Figure 1), which is highly effective in controlling glyphosate-susceptible and resistant species. The Grains Research and Development Corporation (GRDC) is currently funding research into the double knock technique across the northern grains region.

FIGURE 1: Simulation of glyphosate resistance evolution in awnless barnyard grass in fallows with weed control relying only on glyphosate (circle) or after introduction of the double-knock (DK) tactic (square) following different lengths of glyphosate only use

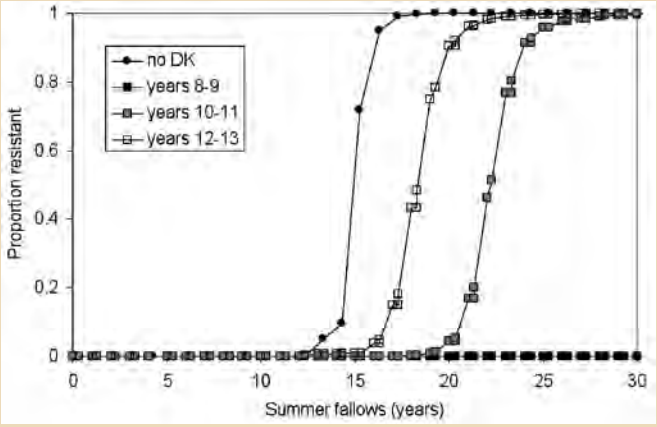
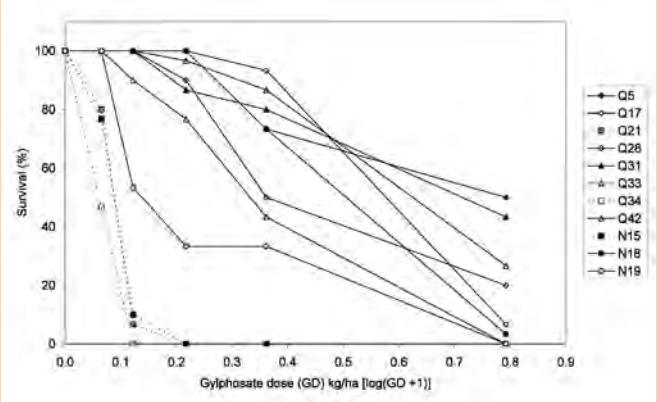


FIGURE 2: Survival of flaxleaf fleabane seedlings of three susceptible (dotted lines) and eight glyphosate-resistant (solid lines) populations following application of glyphosate at 0, 0.25, 0.5, 1, 2, and 8 times the registered rate of 0.65 kg/ha in a pot experiment



To maintain glyphosate as a highly effective and reliable fallow weed control tactic, the risk for evolution of resistance needs to be reduced. This can be achieved by introducing preventive tactics, of which the number and extent needed is determined by the risk level.

Fortunately, growers can now determine the risk level for their weeds and current practices using a simple on-line Risk Assessment Tool (*www.dpi.qld.gov.au/asp/glyphosate-resistance-toolkit.htm)*.

Growers should consider having their weeds tested for glyphosate resistance if:

- Their fields are assessed at moderate or high risk for glyphosate resistance; and/or,
- There are survivors of a glyphosate application.

As glyphosate resistance appears initially in a few isolated, healthy plants, surrounded by dead plants of the same weed species, diligent monitoring of fields after treatment with glyphosate is important. It is essential to prevent these plants from setting seed, as within a few years glyphosate-resistant weeds will infest the whole field.

Implementing an IWM strategy, undertaking a simple risk assessment, and routine monitoring will prevent development of glyphosate resistance. But failure to adopt these preventive actions now is likely to markedly reduce cropping viability in the sub-tropical region of Australia in the near future.

Glyphosate in Australia

Glyphosate has played a pivotal role in allowing widespread adoption of conservation cropping over the past two decades in Australia, as this herbicide provides reliable and broad-spectrum weed control in fallows and crop establishment.

But populations of five weed species have evolved glyphosate resistance in the sub-tropical cropping region of Australia. Modelling and field history have shown resistance becomes a noticeable problem after 15+ years of repeated use of glyphosate in reduced or zero-tilled fields with few or no alternative herbicides used and where seed-set on glyphosate-sprayed survivors is not prevented. Subsequently, poorer fallow weed control results in reduced stored soil moisture and increased weed seed-banks, resulting in lower crop yields.

Glyphosate-resistant weeds can be controlled with other knockdowns, the double knock tactic (sequential application of glyphosate followed by another herbicide) and residual herbicides, although these can be more expensive and less robust than glyphosate.

Once developed, glyphosate resistance will last for many years, as up to five per cent of seed can remain viable for more than two years in the soil without new seed replenishment. Regular field monitoring and testing of glyphosate sprayed survivors for resistance are recommended.

As well, growers can estimate the risk for developing glyphosate resistance for their current practices and crop sequences with the newly available Risk Assessment Tool, and thus adjust their practices to minimise risks for developing glyphosate-resistant weeds.

Glyphosate resistance – the risks

The majority of glyphosate-resistant grasses (awnless barnyard grass, liverseed grass, windmill grass) were found in fields with a long history of winter grain/summer fallow rotation, and one glyphosate-resistant awnless barnyard grass population was found in a summer fallow/transgenic cotton rotation.

The flaxleaf fleabane populations were in cropping areas, in which reduced or zero-tillage was practised for many years. The common factors consistently associated with these resistant

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populations are intensive use of glyphosate, few or no other effective herbicides used, and few or no tillage operations.

Glyphosate resistance – the impacts

The obvious impact of glyphosate resistance is this valuable herbicide is no longer effective in controlling these weeds in fallows and pre-plant knockdown. This is shown in our recent glyphosate dose response experiment confirming eight flaxleaf fleabane populations were resistant (Figure 2).

Options for control of these resistant weeds include applying alternative knockdowns such as paraquat, using the double-knock tactic (sequential application of glyphosate followed by another herbicide) and/or residual herbicides.

The potential disadvantages of non-glyphosate alternatives are increased cost, reduced robustness, restrictions with re-cropping intervals for residual herbicides, and loss of the advantages associated with conservation cropping if using tillage.

If not applied correctly, poorer weed control in the preceding fallows and prior to sowing will result in reduced stored soil moisture and increased competition with crops, which could then reduce crop yields.

More surviving weeds will greatly increase the weed seed-bank, and thus create more problems in following fallows and crops, again potentially impacting on yield. Grasses can produce 2000–12,000 seeds per plant and fleabane up to 100,000 seeds per plant. Glyphosate resistance also puts the new technology of herbicide tolerant crops, Roundup Ready cotton and canola, in jeopardy.

Glyphosate resistance is permanent in weed populations as long as resistant seeds remain viable in the soil. Even with cessation of the use of glyphosate, the ratio of resistant to susceptible individuals will remain the same – only the total number of weeds present can be reduced assuming there is no fitness penalty associated with this trait.

Seed persistence of grasses and fleabane is relatively short in zero-tilled systems. But approximately five per cent of grass seeds remain viable for longer than two years in the top five cm of soil, and this increases to 20–25 per cent remaining viable for over two years if seeds are buried to 10 cm.

Even if the seed-bank is reduced to very low numbers, the return to exclusive use of glyphosate without follow-up actions on survivors will result in a major resistance problem within a very short period. This means cropping can be adversely affected by glyphosate resistance for many years.

[1]The University of Queensland, Queensland Alliance for Agriculture and Food Innovation, Toowoomba
[2]Department of Agriculture, Forestry and Fisheries, Queensland

For more information, visit www.grdc.com.au, www.deedi.qld.gov.au or www.ahri.uwa.edu.au ■

Growers should consider having their weeds tested for glyphosate resistance if fields are assessed at moderate or high risk for glyphosate resistance, and/or there are survivors of a glyphosate application.

THE COMMERICAL VIEW

NEW CASE FOR STRATEGIC TILLAGE

■ By Dr Yash Dang[1]

With many growers resorting to cultivation to manage problem grass weeds and voicing their concerns about sustaining a no till system, the time has come to quantify when and how to incorporate strategic tillage.

Growers are concerned that even a single tillage operation may be enough to send their soil condition back to the start of conservation farming systems.

We are carrying out new research supported by the Grains Research and Development Corporation (GRDC) to quantify the impact of occasional strategic tillage.

It will look at contrasting soil types and soil chemical, physical and biological properties, crop productivity, and economic outcomes. The research will also examine the effectiveness in dealing with specific no till farming systems issues such as weed and disease pressure and nutrient stratification.

How we measure the effect of strategic tillage?

The trials are designed around multi-faceted measurements including:

- **Agronomic:** Establishment counts, weed pressure, insect/pest and disease incidence, and grain yield and protein/nutrient concentrations.
- **Chemical:** Soil carbon status (including fractionating soil carbon into pools with differing lability), profile mineral nitrogen and potentially mineralisable nitrogen in labile organic fractions, phosphorus, potassium and zinc, and crop nitrogen and phosphorus uptake.
- **Physical:** Soil moisture storage, bulk density, aggregate stability, soil strength.
- **Biological:** Microbial biomass, enzyme activity and microbial diversity, as well as more targeted measurements like the quantification of soil- and stubble-borne pathogens as well as nematodes and factors relating to pathogen suppression (eg inoculum loads and subsequent disease incidence in fields and controlled pot trials).
- **Profitability:** The impact of the strategic tillage will be assessed in terms of economic returns as well as biophysical and productivity effects.

A network of sites has been identified with specific issues of no till farming systems throughout northern grains regions covering different soil types in different agro-climatic zones. The sites include Walgett, NSW and Condamine, Moonie, Warwick, and Biloela, Queensland.

Different tillage implements including tynes, disc and/or Kelly chain for desired outcome will be used at appropriate moisture content.

An information package and extension program will be developed as part of the project.

[1]Department of Science, Information Technology, Innovation and the Arts, Queensland senior scientist (soil and nutrient management)

THE CONSULTANT'S VIEW

MANAGING FALLOWS TO SUSTAIN GLYPHOSATE FOR THE FUTURE

■ By Ian Taylor, Taylored Agricultural Systems and GRDC/CRDC weeds advisor

Glyphosate, as the cost-effect cornerstone to northern region weed management, is under threat. Glyphosate resistance is rapidly increasing and if it's not on your farm, it's most certainly on a farm near you.

The implications for the no-till system are grave and many growers are tinkering with a return to tillage to manage difficult-to-control weeds such as feathertop Rhodes grass and fleabane.

The GRDC advocates driving the weed seedbank down and using a diverse range of tactics, both chemical and non-chemical to manage fallow weeds.

With grain growers fighting a continuous war on weeds, being able to look back on paddock histories, know the weed burden, tactics and herbicides used and the response of the agro-ecosystem to those inputs is vital information for growers.

In the northern grain region effective management of weeds in fallow is critical to ensure successful cropping in the following season. But management can be challenging as conditions are not necessarily conducive to good weed control and restrictions due to plant back and challenges of incorporation often mean residual herbicides have little utility in rain-fed environments.

As a consequence, many growers rely predominantly on glyphosate for weed control or mixtures based on glyphosate supplemented with additional herbicides for broadleaf control.

Glyphosate the corner stone

Iain Macpherson, Macpherson Agricultural consultants Pty Ltd says glyphosate has become the cornerstone of our dryland farming systems with no-till making up most of our dryland area.

"Reduced erosion, improved water infiltration and soil water holding capacity has seen significant improvement and reliability in yields over the past decade which has helped growers keep up with increasing costs," Iain says.

He says the loss of glyphosate due to resistance is the biggest threat to the dryland farming system with a number of cases of barnyard grass resistance already showing up in the northern region.

"Farmers and agronomists need to consider resistance in every decision and take the opportunity to rotate chemistries as well as designing rotations that allow for a break in selection pressure," he says.

While options for fallow management are limited, Iain suggests growers should be trying to rotate chemistries that reduce selection to glyphosate.

"With knockdown chemistries we can rotate to paraquat, especially as a double knock and there is some potential to use Amitrole for some grass weed spectrums and other problem weeds," he says.

"Herbicides such as pendimethalin, trifluralin and metolachlor are not registered for use in fallow situations, but where significant grass issues exist, products like Flame will give will give excellent control. Growers need to be aware of their plant back periods for all intended rotations, similarly atrazine and diuron will give some control but growers should have a set rotation planned."

Ian says cultivation shouldn't be seen as a dirty word rather as a valuable tool which has a place in integrated systems if used sparingly and strategically.

"We use the double knock strategy not just for glyphosate management but as fleabane is our major weed, double knock technology gives the best control to date.

"Cost is still an issue and this is where camera spray technology such as the Weed Seeker can really have an impact by reducing product use by 80–90 per cent."

Ian says the best time for a double knock is seven days post-glyphosate but if delayed 14–20 days to get good conditions, it can still get reasonable results as long as it hasn't rained and the weeds begun to regrow.

While some growers might baulk at the cost of the double knock or having to respray a field with a low number of survivors, growers should also ascribe a future value to glyphosate as well as consider the implications of having to manage glyphosate resistance.

Bill Gordon, Bill Gordon Consulting, says most herbicide applications to fallow require the use of either a medium or coarse spray quality (or larger) for good efficacy although applicators need to check the label to ensure that herbicides are applied in accordance with label conditions.

Leading agronomists agree growers need to be prepared to do whatever it takes to ensure all weeds are controlled before they set seed in fallows. If there is any doubt that a glyphosate application will control all weeds then it needs to be followed by a second tool such as Spray.Seed or cultivation as a double knock to ensure weed escapes don't set seed.

Glyphosate is a one in 100 year herbicide and diminished performance or complete loss of this herbicide from the system would likely result in enormous challenges for the industry.

RESISTANCE ON THE RISE IN SUSPECT SPECIES

Since 2008, populations of four different weed species in cotton-grain or grain-based farming systems have been confirmed to have resistance to glyphosate:

- 20 populations of awnless barnyard grass;
- 8 populations of fleabane;
- 3 populations of liverseed grass; and,
- 2 populations of windmill grass.

It is inevitable that more populations with resistance to glyphosate will soon be found.

Weed scientists at DAFF Queensland have identified additional weed species with combinations of biological characteristics that make them just as likely to develop resistance in the cotton-grain and grain-based farming system. These include: Sweet summer grass, sow thistle, crows foot grass, button grass, summer grass and redshank amaranthus.

Resistant populations are most likely to be first observed as patches of plants surviving after a spray application. Left unchecked, a resistant population can the whole field within a couple of years.

If you are concerned about a suspect population, send samples for testing. Information on testing and how to collect samples is available at www. plantscienceconsulting.com.au.

Targeting high yields in dryland grain sorghum

By Loretta Serafin and Guy McMullen, NSW Department of Primary Industries, Tamworth

TYPICAL dryland sorghum row spacings are 75 cm on the Liverpool Plains of northern NSW, with narrower row spacings closer (as close as 22.5 cm) and as wide as 100 cm row spacings in the area east of the Newell Highway. Row direction for sorghum in this zone is usually based on suitability to the paddock layout.

The average grain yields in this area (four tonnes plus per hectare) are considered the highest and most reliable in NSW for dryland grain sorghum production. But in general the current row spacings are much wider than suggested by work from the middle of the past century, which predates the significant moisture advantages of no tillage sorghum. Bygott (1956) concluded narrow rows (35 cm) had a greater yield potential than wider rows (70 or 100 cm) under favourable conditions, but was also more susceptible to crop failure under water stress.

The characteristic combination of favourable in-crop rainfall and temperatures for grain sorghum production which prevail in this area, has led to some discussion on the potential benefits of narrower row spacings in increasing yield potential.

Established plant populations are typically targeted at 45–55,000 plants per hectare which is in line with many other dryland trials in the northern grains region – which have found 50,000 plants per hectare to be the optimum plant population.

The research

A series of trials over the past 10 years have focused on the key aspects of row spacing, population and variety. But row direction and the interactions between these factors have not previously been examined.

Two field experiments were conducted in the 2007–08 sorghum season, located in the Gunnedah district at Premer on the south western end of the Liverpool Plains and in the Tamworth district at Somerton.

Two sowing directions of north/south versus east/west were compared using the hybrid MR Buster in combination with narrow (37.5 cm) and wide (75 cm) row spacings at four plant populations, ranging from 30–70,000 plants per hectare. The effect on tiller and head number as well as grain yield was recorded.

Growing Season Rainfall at the two locations

2007–08		Nov 07	Dec 07	Jan 08	Feb 08	Mar 08	Total
Somerton	(mm)	54.4	124.6	76.5	95.5	3.2	354.2
Premer	(mm)	82.5	200.8	41.7	134.2	1.0	460.2

Source: Data sourced from the NSW Bureau of Meterology sites for Somerton "Glen Burn" station and Premer Post Office.

Row direction

Research into the benefits of aligning row direction in a north/south versus east/west configuration have to date mainly been confined to winter crops, predominantly in southern NSW.

But similar work was conducted with grain sorghum. Steiner (1986) conducted similar row direction studies in sorghum under water limited dryland production systems and found that row direction did not significantly affect water use or grain yield. Steiner did find that east/west orientated rows increased net radiation by 14 per cent.

Two trials were conducted in the 2007–08 season at Premer and Somerton using the hybrid MR Buster. Analysis of the Premer results showed there was little effect of row orientation on crop growth, grain yield or quality.

Apart from plant population, the only statistically significant result that was found was a higher head density in the north/south orientation (106,100 per hectare) compared to the east/west orientation (98,900 per hectare).

At the Somerton site row direction had no impact on any of the crop components that were measured or on grain yield.

Row spacing

In recent years more focus has been placed on comparing wider row spacings or configurations such as single and double skip in the north east than on narrower row spacings. This research has shown the benefits of solid plant on 75 or 90 cm rows compared to single, double and super single skip configurations – but narrow solid plant rows have received less attention.

These trials compared 37.5 cm (15") to 75 cm (30") as the availability of commercial winter crop machinery would easily allow adoption of this narrower row spacing.

At the Premer site there were few statistically significant effects of row spacing on yield and quality parameters. At the narrow row spacing (37.5 cm) there were significantly higher numbers of plants and tillers produced (Table 1). But head counts showed there was no significant difference between the narrow and wide row spacing with respect to head density.

Similar results for row spacing were found at the Somerton site – despite differences in tiller and head numbers between the narrow and wide row spacings there was no significant difference in final grain yields (Table 2).

Plant population

Established plant populations are typically targeted at the range of 45–55,000 plants per hectare.

These trials included a range of populations above and below

TABLE 1: Effect of row spacing on crop structures, grain yield and quality at Premer

Spacing (cm)	Plants (,000/ha)	Tillers (,000/ha)	Heads (,000/ha)	Grain yield (t/ha)	Screenings (%)	Grain size (g/1000)	Hectolitre weight (kg/hL)
37.5	59	190	109	8.8	3.2	33.1	79.9
75.0	48	157	103	8.8	3.1	33.3	80.2
	P<0.05	P<0.05	nsd	nsd	nsd	nsd	nsd

TABLE 2: Effect of row spacing on crop structures, grain yield and quality at Somerton

Spacing (cm)	Plants (,000/ha)	Tillers (,000/ha)	Heads (,000/ha)	Yield (t/ha)
37.5	66	137	106	5.9
75.0	40	107	88	6.0
	P<0.002	P<0.03	P<0.03	nsd

this general target to investigate interactions with row spacing and orientation. Steiner (1986) suggested that because of sorghum's tillering response, low plant population is not likely to be limiting to dryland production in favourable years. But the introduction of low tillering hybrids could alter these results.

The hybrid MR Buster has dominated hybrid selection commercially for many years and was used in these experiments. MR Buster is known to have a medium to high tillering capacity.

Despite significant differences between the numbers of tillers and heads in the population treatments there was no significant impact of population on grain yield or quality at Premer (Table 3).

At the Somerton site, established plant population had a significant impact on measured growth components and grain yield. At the lowest established population of 37,000 plants per hectare, yield was significantly reduced compared to all populations greater than 48,000 per hectare (Table 4).

This seems to have been primarily driven by head number.

To sum up

The 2007–08 season was one of the highest yielding sorghum seasons on record in northern NSW due to a combination of mild summer temperatures and above average rainfall. Under these essentially non-water limited conditions there were no significant differences between row direction or row spacing at both locations and the only population response was at the Somerton site at 37,000 plants per hectare resulting in a lower grain yield.

While additional yield has been recorded with north/south configurations in winter cereals in the absence of weed competition – mostly attributed to additional sunlight on the plants down the row and less shading – orientation responses were not detected in sorghum in this study.

But Steiner (1986) rationalised that in semi-arid, dryland production, the management of soil water depletion is more critical than the capture of radiation, which is far more abundant than water. The research presented in this article and experience in the northern cropping zone would clearly show that water is generally more limiting than sunlight to crop yield potential.

Although plant population treatments differed markedly in plant, tiller and head density it appears that the crop was able to compensate through increased grain numbers as there was no difference in the grain size between any of the treatments at the Premer site. Fukai and Foale (1988) also concluded that the main difference in grain yield with row spacing in sorghum was due to differences in grain number per panicle while panicle density had a slight effect.

TABLE 4: Effect of plant population on crop structures and grain yield at Somerton

Population (,000/ha)	Tillers (,000/ha)	Heads (,000/ha)	Yield (t/ha)
37	103	77	4.2b
48	119	95	6.3a
56	121	100	6.7a
72	146	115	6.6a
	P<0.10	P<0.015	P<0.001

Similarly, narrow row spacings failed to provide any yield benefit over wider row spacings under high yielding conditions. Steiner (1987) proposed that plants in narrow rows responded more to row direction than those in wide rows, this was not evident in this study. It may be possible that under such favourable growing conditions in which water was essentially non-limiting, other factors such as crop nutrition may be the most limiting factor to grain yield.

MR Buster, the hybrid used in both trials, is noted for its ability to increase tiller numbers under favourable conditions. There has been considerable interest in the northern cropping zone in sorghum traits such as staygreen and low tillering growth habits. The capacity of hybrids with these traits to capture maximum yield in favourable seasons needs to be investigated fully.

Further research in 'alternative' seasons is needed to conclusively close any discussion on potential impacts of row direction, population and row spacing in combination with the effect of planting date for these and new sorghum genotypes.

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Thanks to the trial site co-operators Ed and Fiona Simson, "The Plantation" Premer and Brett Mason "Allawah" Somerton for providing the sites and assistance with the trials.

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When there are effectively no moisture limitations, sorghum row direction and spacing have little influence on final yield.

TABLE 3: Effect of plant population on crop structures, grain yield and quality at Premer

Population ('000/ha)	Tillers ('000/ha)	Heads ('000/ha)	Grain yield (t/ha)	Screenings (%)	Grain size (g/1000)	Hectolitre weight (kg/hL)
29	113	88	8.4	3.1	33.3	79.3
42	144	103	8.7	3.2	32.7	80.4
54	179	109	9.4	3.1	33.7	80.9
67	191	109	9.0	3.0	33.3	80.3
	p<0.05	p<0.05	nsd	nsd	nsd	nsd

Converting mm to money – How does irrigated wheat stack up?

■ By The CSD Extension and Development Team

RECENT research results from 'The High Yielding Irrigated Grains in Cotton Farming Systems' and the 'Achievable Yields for Irrigated Grains' projects revealed seasonal crop water demand estimates when targeting eight tonne per hectare irrigated wheat yields. This collaborative research was initiated by the cotton and grains industries in the recognition of irrigated wheat as a viable alternate rotation crop for irrigated cotton systems in north western NSW and south east Queensland.

Similarly, in the past three seasons, the CSD Extension and Development team has been trying to get a better understanding of the evaporative demand of cotton crops to assess the performance of different varieties, technologies and farming systems – especially semi-irrigated skip row plantings and dryland production systems.

The publication of these evaporative demand figures for irrigated wheat provides an opportunity to compare the water use of both cotton and wheat and the return for each mm of water each crop uses.

For the cotton industry in the central region, these figures are of great benefit, as they allow comparisons between the irrigated cotton and wheat systems purely on a return for water used. This removes the reliance on data generated in cooler, more southern climatic zones, hearsay and influences of in-crop rainfall which may affect the seasonal water requirements for both systems.

Using evaporative demand is a better way of looking at water use, as relying on the number of irrigations or budgeted water has led to confusion in the past as it does not take into the account all sources of water used to produce the crop. This method concentrates solely on the crop water use and does not factor in other system constraints such as irrigation type or farm water use efficiency which is site specific and not repeatable seasonally.

Knowing the water needed to mature a crop, regardless of the source or seasonal conditions, allows analysis of the potential returns of that crop, highlighting those commodities which return the most for the water resource. In essence, we are comparing apples with apples.

In March 2008, CSD E&D published a gross margin analysis comparing the returns of irrigated wheat and cotton. Back then, in the middle of the drought, water was scarce and wheat was hitting a record price ($470 per tonne). Regardless of this, the conclusion reached in that analysis was that irrigated cotton was in front of irrigated wheat in both return per hectare and per ML.

At current prices irrigated cotton returns nearly three times that of irrigated wheat.

Table 1: Comparison between gross margins of high input and low input irrigated wheat and irrigated cotton

	Irrigated wheat		Irrigated cotton
	Low yield	High yield	Sicot 74BRF
Yield (t and bale/ha)	6.8	8.7	12.3
Estimated ML required	2.5	4	7
Water use (Etc mm)	410	490	760
WUE (kg/mm)	16.58	17.75	3.66
Commodity price	$243/t (delivered)		$450 (bale)
Variable costs ($/ha)	$942	$1,371	$2354
GM ($/ha)	$717	$752	$3168
GM ($/ML)	$287	$167	$453
GM ($/mm)	$1.75	$1.53	$4.17

Using better information

But this analysis had a downfall in that we estimated/guesstimated crop water requirements based on the best available information at the time, which when comparing crops across winter and summer growing seasons was full of uncertainties.

Table 1 gives a summary of the revamped analysis. The crop evaporative demand for the wheat is sourced from research in the Goondiwindi area. This represents a similar locality to the area where the cotton evaporative demand figures were also sourced.

The cotton figures are taken from 11 CSD agronomic and variety trials and the evaporative demand is calculated from time between planting and defoliation. Economic data has been spliced from the original CSD analysis which was based on the NSW DPI publication *Growing eight tonnes a hectare of irrigated wheat in southern NSW* by Lacy and Giblin, 2006.

Although it is not a true reflection on the yield/water use relationship in wheat, we have allocated the lower yield range with the lowest water use and vice versa for the high yield scenario.

As with the previous 2008 analysis conclusion, irrigated cotton is still in front on a return per hectare, and also per ML applied. But with the additional information now available on evaporative demand, we are truly able to examine the return per mm of moisture within each crop, regardless of whether it is from stored soil moisture, captured in-crop rainfall, irrigation water from on-farm storages or pumped from the river or a bore.

Under present yield, pricing and water use scenarios, irrigated cotton provides a 2.3 to 2.7 times greater return per mm of that water resource than irrigated wheat.

This analysis highlights the need to ensure that the water resource is used on the crop which will return the most – in this scenario it is cotton. Only if wheat prices return to record highs is it likely to again become competitive.

But this analysis also poses another question – what additional benefits will irrigated wheat bring to a rotation over and above a crop of dryland wheat? ■

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THE RESEARCH VIEW

Research points to less insecticide use but similar yields

FARMERS involved in research investigating reduced insecticide approaches to pest management in Australian grain crops have realised they may be able to get away with one less spray in the season, and not sacrifice yields.

The five growers have participated in the Grains Research and Development Corporation (GRDC) funded project 'Developing and promoting Integrated Pest Management (IPM) in Australian Grains' since 2010.

IPM principles involve understanding insect pests and first assessing insect damage on emerging plants before deciding to spray, rather than relying on pre-emergent 'insurance' sprays.

The large, on-farm trials have been run by The University of Western Australia (UWA), the Department of Agriculture and Food (DAFWA), New South Wales Department of Primary Industries, cesar, CSIRO and the South Australian Research and Development Institute (SARDI).

Several farming systems groups across southern Australia were involved in the research.

The project, which finishes in June 2012, involved on-farm

From left, Mary van Wees, of the University of Western Australia (UWA), Facey Group executive officer Felicity Astbury and Danica Collins, of UWA, take plant measurements and count pests and beneficial insects in the IPM plots at the Wickepin, WA trial site.

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.

trials at Wickepin and Beverley in WA, and at Junee Reefs in New South Wales, Charlton in Victoria and Curramulka in South Australia.

It also involved a survey of Australian grain growers to better understand the tools and strategies they use to manage pests in grain crops.

UWA entomologist Laura Fagan said the on-farm trials examined an on-farm IPM approach versus conventional practices in canola (2010) and wheat (2011) crops to increase farmer awareness of sustainable management of insects in grain crops.

"The canola and wheat crops examined in the trials were preceded by a pasture phase in 2009, except in the NSW site which was rotated from barley in 2009," she said.

At each of the trial sites, a series of 12 large plots – varying in size but measuring no less than 50 metres by 50 metres – were assigned to one of three pest management approaches:

- A no insecticide approach which was used as an experimental control;
- An IPM approach that involved monitoring pest and beneficial invertebrates, combined with plant damage assessments and the application of 'softer' insecticide sprays only when needed; and,
- A farmers approach, based on the current or conventional farming practice within each of the local areas or regions, to manage pests.

At each of the trial sites, bare earth and post-emergent insecticide sprays were applied to the 'farmers approach' plots with different products and rates preferred by different farmers.

When pest thresholds – based on current recommendations – were reached, as happened in the WA trials, 'softer' insecticide options were applied to the IPM plots at the recommended rate.

No insecticides were sprayed on the control plots so that the impact of controlled pest on each crop type could be assessed, as well as to understand the role beneficial insects (natural enemies) have on suppressing pest populations at the same time.

Observations

Laura said the field trials showed that monitoring – a key IPM component – could reduce the need for conventional chemical sprays without affecting the yield.

"Most of the farmers involved in the trial realised they can get away with one less spray in the season and still get the same outcome," she said.

"For canola, it seems that in years following heavy drought, or in years with above average rainfall and low pest pressure, the best course of action for a farmer is to not apply pesticides.

"For wheat, applying less chemical appears to be the best practice as similar yields can be achieved without the extra cost of applying chemicals."

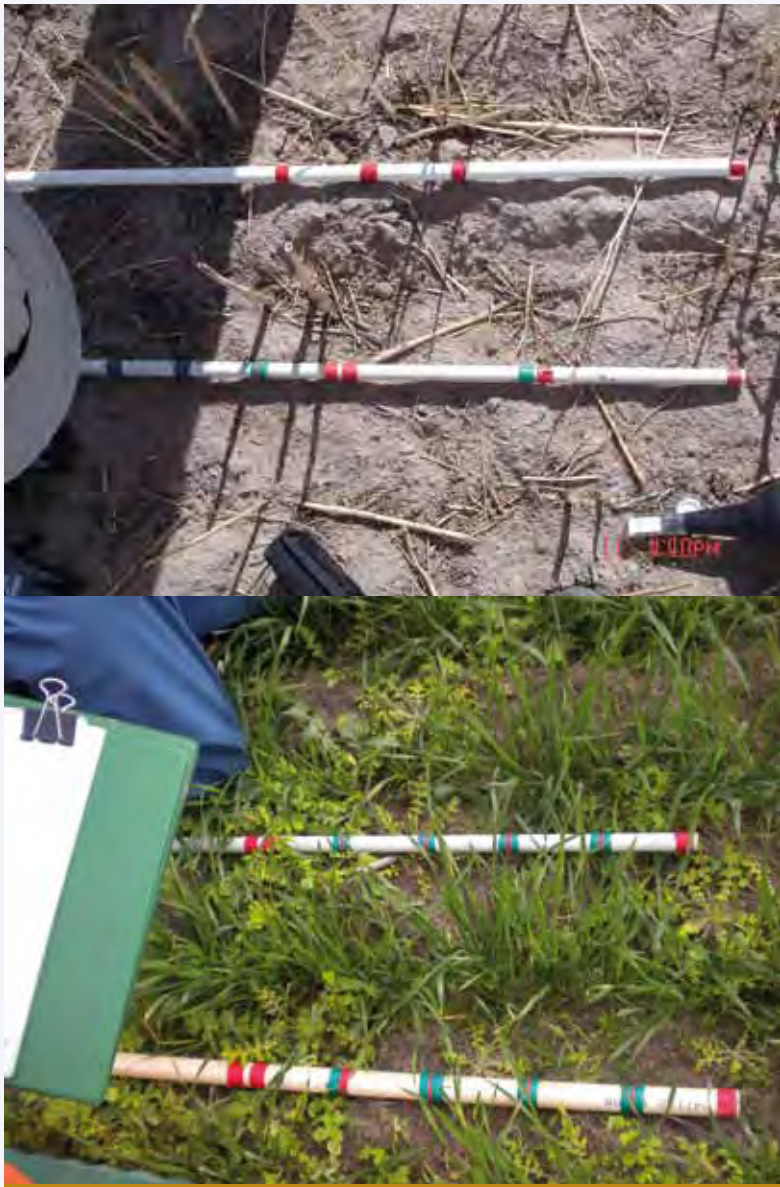
Laura said that the project was still working to produce a conclusive answer as to whether IPM was the best insect pest management approach in all Australian farming systems.

"The project showed that, following a rotation of pasture, canola, then wheat, the IPM approach was equally or more effective than the 'farmer approach' with respect to grain yield," she said.

"Overall, pest populations were generally higher than beneficial insect populations in a paddock, regardless of the kind of management approach taken.

"But importantly, the beneficial insect to pest ratio in the IPM plots was always higher than the ratio in the 'farmer approach' plots.

A beneficial ladybird beetle protects itself from the elements inside a harvested canola stalk. Habitat availability is important to maintaining beneficial insect populations.



Standard protocol for measuring one metre rows of wheat and canola.

"This means the pest population was lower with an IPM approach because the beneficial insects were more abundant in these plots, compared with the 'farmer approach' plots."

2011 trial results for wheat

New South Wales site

Pest pressure was again low during 2011, so there was no need to spray the IPM plots, making the IPM treatment the same as the control plots, and similar to the conventional treatment plots.

Conventional treatment plots were sprayed once with insecticide (100 mL per hectare of Talstar) at post-sowing or pre-emergence.

Harvest yields were very similar between the treatments.

South Australian site

The 2011 wheat crop at Curramulka grew well and yielded an average of 4.6 tonnes per hectare between the plots.

Invertebrate pest pressure was low throughout the season.

The IPM plots were sown with insecticide-treated seed and the farmer plots received one insecticide application (100 mL per hectare of omethoate and 125 mL per hectare of alpha-cypermethrin) at 49 days after emergence.

There were no significant yield differences between the control, farmer and IPM treatments.

Victorian site

Invertebrate pest pressure was low throughout the trial site in 2011.

THE COMMERCIAL VIEW
INTEGRATED PEST MANAGEMENT

By Living Farm managing director Richard Devlin

With the steady decline in price of some common broad-spectrum insecticides (such as bifenthrin, alphacypermethrin and dimethoate) it has become common practice for many growers to simply 'throw a bit in' the sprayer, regardless of whether insects are present at an economically damaging level.

This is problematic for several reasons, but probably the most worrying is the increased selection pressure this puts on insect populations.

Applying the same chemistry to the same populations year after year – especially at sub-lethal rates – is a guaranteed path to resistance, and with cropping margins being so tight the last thing growers need is to lose the activity of these cheap, efficacious chemicals.

The application of insecticides is a necessary part of the cropping program. But there are times when insecticide application is absolutely necessary – for protecting germinating canola, for example – and times when it is not required – such as applying a low rate of alphacypermethrin to wheat as an aphid 'anti-feed' (low rates of chemical which prevent insects feeding, but do not kill the target insect).

Living Farm, a York-based research and development and consulting company, was one of the organisations involved with Western Australian research under the GRDC funded project 'Developing and promoting Integrated Pest Management (IPM) in Australian Grains'.

On-farm trials at Wickepin and Beverley in WA were run by the University of Western Australia (UWA), the Department of Agriculture and Food (DAFWA), CSIRO, and Living Farm and the Facey Group.

What we found

In this research we started out with a canola phase of the rotation, which is traditionally the most intensive user of chemicals.

Results clearly showed that to use no chemicals was not an option, but the yield results from the IPM plots and the 'conventional farmer's practice approach' were very similar.

In the second year of the trial we moved into the wheat phase of the rotation – when very little insect control is traditionally needed.

Results from the wheat phase showed little difference in yields between any of the plots, supporting the theory that in most cases insect control is only needed in the most severe of cases.

There can be a lot learnt from the horticultural sector, where growers are used to monitoring pest numbers, understanding a pest life cycle, and using beneficial insects to their advantage.

Research undertaken under the GRDC IPM project has been important in extending these insect messages to broadacre farmers, with all who have attended workshops coming away with a far greater awareness of IPM and its importance.

While monitoring may seem a laborious process – especially when complete insect control comes so cheaply – growers need to take a long-term view.

To lose the usefulness of these chemicals through resistance will prove to be far more costly in the long run than the correct monitoring and assessment of pest populations prior to spraying.

As well as the threat of losing these chemicals to resistance there is the very real prospect of losing many common chemicals to legislation.

In recent years we have seen a tightening of the regulations surrounding insecticides, and it is possible that in the future we won't have access to many of the chemicals which we currently take for granted.

To operate a profitable farming enterprise without these chemicals becomes more difficult, and provides another strong reason for implementing and understanding IPM strategies.

Contact Richard Devlin, Living Farm, E: richard@livingfarm.com.au
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Living Farm managing director Richard Devlin addresses the Crop Research on Production Systems (CROPS) group at a canola variety trial near York, Western Australia.

Alpha-cypermethrin was applied to the conventional farmer plots at pre-sowing/pre-emergence at 120 mL per hectare, but no sprays were used to control for invertebrates in the IPM plots.

Harvested yields varied, with the control treatments recording, on average, the highest yield at 5.05 tonnes per hectare.

But the differences in wheat yield between treatments were not significant.

With pest pressure across most regions in Victoria and southern NSW relatively low in 2011, it was not surprising that pest pressure was also low at the Charlton, Victoria site during the winter growing season.

In direct contrast, the numbers of some beneficial invertebrates were relatively high, and likely contributed to the lower densities of pests seen in the crop.

Western Australian sites

Pest pressure was generally low throughout the 2011 wheat growing season and there was no need to spray insecticides on the IPM plots at either site.

The conventional farmer treatment plots at the Beverley site were sprayed with insecticide at pre-sowing (chlorpyrifos 500 at 100 ml per hectare and alpha-cypermethrin at 100 mL per hectare) and again at post-sowing/pre-emergence (alpha-cypermethrin at 200 mL per hectare).

The conventional farmer plots at Wickepin were sprayed with cypermethrin at 200 mL per hectare at 65 days after crop emergence).

Just one or two of the treated IPM or farmer plots did extremely well at the Beverley and Wickepin sites, and produced higher than average yields compared with the other plots which received the same treatments.

Determining what factors caused variability within these plots will lead to a better understanding of how to produce higher grain yields in the future.

Within plot variation

Laura said the project highlighted that conclusive differences between treatments were often masked by high variations in yield within the large experimental plots.

"As we attempt to establish a relationship between canola or wheat yields and insect pest attack, we will further investigate other potential causes of differences in yield, such as plant competition due to differences in crop density, differences in soil types, and differences in weed cover among treatments."

"But because the trials in the IPM project were designed using random plots and replicated across Australia, the patterns revealed by the research – that one less spray can be used in a season to achieve the same result – will still hold true," Laura said.

Other tactics for the toolbox

Laura said other research, development and extension (RD&E) areas which could be looked at to add to information to build a workable grains IPM program for Australia included:

- **Baseline biology:** Natural enemies (biological control); identification of predator-prey networks.
- **Pre-harvest:** Weed management and removal of infested plants; ground cover treatments to maintain beneficial insects; seed treatments to prevent early pest damage.
- **Post-harvest:** Optimal field conditions to initiate pest population decline; weed management and removal of infested plants; thresholds and times to monitor for predicting change; and, habitat manipulation strategies to increase natural enemy control.
- **Storage solutions:** Attractants and use of lures for capturing insects. ■

What aphids carry disease?

■ By Dennis O'Brien, ARS–USDA

APHIDS can transmit viruses that cause crop diseases. But not all aphids transmit viruses. So a key question for growers is knowing when and what to spray to control viral diseases.

Agricultural Research Service scientists Michelle Cilia and Stewart Gray, in the Biological Integrated Pest Management Unit at the Robert W Holley Center for Agriculture and Health in Ithaca, New York, have found a way to distinguish aphids that spread viruses from those that don't – by studying the aphid's proteins.

They knew from previous work that for aphids to pick up and transmit viruses, the virus must be able to interact with specific aphid proteins that direct movement of the virus through the insect and back into a plant during feeding. In laboratory studies of greenbug aphids, they discovered that the laboratory-raised insects' ability to transmit yellow dwarf viruses could be predicted by the presence or absence of nine different biomarker proteins in the insect cells.

To see if their lab findings would prove true in the field, they analysed greenbug aphids collected from cereal crops and noncultivated grasses.

The Ithaca researchers found the field-collected aphids consistently transmitted yellow dwarf virus only when they carried most, if not all, of the nine key biomarker proteins. "The aphid does not need all nine to spread the yellow dwarf virus, but some are essential," Michelle says.

The findings mark the first time that protein biomarkers have been linked to an insect's ability to transmit viruses, and the discovery is expected to lead to development of a test to identify potential disease vectors.

Michelle and Stewart are also collaborating on an international effort to test whether the biomarker proteins can predict disease-vectoring ability in other insects.

The project is being funded by the National Science Foundation Basic Research to Enable Agricultural Development program through Cornell University, with support from the Bill and Melinda Gates Foundation.

To reach scientists featured in this article, contact Dennis O'Brien, USDA–ARS Information Staff, 5601 Sunnyside Ave., Beltsville, MD +1 20705 5129; +1 (301) 504 1624. ■

Plant pathologist Stewart Gray and molecular biologist Michelle Cilia examine greenhouse plants for virus symptoms. (Photo: Kent Loeffler)

Compost may reap rich rewards for wheatbelt soils

JOHN Barton's fourth year honours project, as part of his Horticultural Science degree at The University of Western Australia (UWA), assessed the benefits to soils and subsequent crop yields of using compost to improve the efficiency of inorganic phosphorus fertilisers.

"My research supports the idea that accurately placed micro dose applications of compost can reduce the required application rate of phosphorus fertiliser by half," John said.

"With WA's typically low phosphorus wheatbelt facing the twin challenges of a drying climate and the looming issue of peak phosphorus, it is vital we develop economically sustainable amelioration systems."

He proposes that applying low rates of compost to the root zone of cereal crops will increase root growth, lift soil water holding capacity and change the population structure of soil organisms.

These effects combine with compost related changes in soil chemistry, largely through calcium and humates, to improve fertiliser use efficiency.

His experiment involved banding nitrogen, phosphorus and sulphur inorganic fertilisers at varying rates with and without compost pellets at low rates (50 kg per hectare) in pots sown with the popular and relatively drought tolerant wheat variety, Wyalkatchem.

"I then assessed the impact on population size and community structures of bacteria and fungi in the soil, paying attention to variations over time and across the soil profile," John said.

Probable link discovered

Significant differences were noted between treatments for microbial population size and community structure, with population sizes linked positively to total root growth, which indicated a probable link between microbial populations and root exudates or emissions.

"But when I assessed variation within each pot, root volume dropped significantly as the distance increased from the nutrient rich zone around the banded compost and fertiliser.

"There was no equivalent microbial variation within the pot, indicating the relationship between microbe populations and root exudates might be controlled by exudate quality, not quantity.

"Compost appears to be influencing changes in root growth and chemical activity, which, in turn, influences microbial communities equally across the root zone," John explained.

A mature age student, John grew up on an irrigation farm near Griffith, NSW, farming rice, wheat and meat sheep.

After leaving school at year 10 (school certificate only), he completed a certificate four vocational training course in agriculture and then spent eight years working on various types of farms up to assistant manager level.

He then moved to WA, working for two years in mining and construction as a machinery operator, before a major back injury prompted him to pursue higher studies and he enrolled in UWA's Faculty of Natural and Agricultural Sciences. "Now I've completed my degree (with 1st class honours), I'm working at Custom Composts in Mandurah, providing technical services and advice, continuing the part time work with Custom Composts I've had for the last three years of my degree," John said.

He is also now preparing his project thesis for publication and will commence a PhD in phosphorus use efficiency in wheatbelt soils in late August.

"During my career I intend researching farm sustainability, in the context of food security and minimising environmental impacts.

"This will include attempting to help farming adapt to climate change, while minimising any future greenhouse emissions, John concluded.

Smart Scholarship

To assist his UWA project John was awarded the Sir Eric Smart Scholarship for Agricultural Research, which encourages bright students in UWA's Faculty of Natural and Agricultural Sciences to research ways of improving the productivity and profitability of wheat, barley, lupins or canola growing in WA's light soil types.

UWA Institute of Agriculture Director, Winthrop Professor Kadambot Siddique, explained that the late Sir Eric Smart was a pioneer cereal producer in light land areas around Mingenew.

Once the world's largest individual wheat grower, Sir Eric showed his appreciation of science by endowing substantial funds upon his death in 1973 to UWA. This was later supplemented by a gift from his son Peter.

"He wanted science to improve agricultural production and the first allocation from his bequest to UWA was to help lupin growers deal with manganese deficiency," Siddique said.

John's UWA fourth year honours supervisors were Dr Sasha Jenkins and Professor Daniel Murphy, both of UWA and Mr Andy Gulliver of Custom Composts. ■

John Barton's UWA research supports the idea that accurately placed micro dose applications of compost can reduce the required application rate of phosphorus fertiliser by half.

Cheaper claying option works on water repellent sands

GROWERS need not use high rates of clay or expensive incorporation methods when claying non-wetting soils to improve yields, new Western Australian research suggests.

Analysis of three years of trial data from WA's Northern Agricultural Region shows the most reliable wheat yield responses were achieved when clay rates of 150 tonnes per hectare or less of clay-rich subsoil (containing 20 to 50 tonnes of actual clay) were incorporated to a shallow depth of 100 to 150 mm.

The findings were made under the research project 'Delivering agronomic strategies for water repellent soils in WA', supported by the Grains Research and Development Corporation (GRDC) and the Department of Agriculture and Food (DAFWA).

Project leader Stephen Davies, of DAFWA, said historically growers had tended to use higher and more expensive clay application rates to overcome water repellence in deep sands.

"But this research shows they can get similar yield benefits with much lower rates and cheaper methods of incorporating the clay," he said.

"While a full economic analysis of the trial data has not yet been done, we expect this approach would be profitable over time.

WA research shows that growers who are claying non-wetting soils can achieve good results with lower rates and cheaper methods of incorporation.

"Other research into claying has shown it produces yield benefits for 15 years or more, and we expect growers would recoup their upfront costs more quickly by using lower rates and cheaper incorporation methods."

Stephen said that in the latest trials, wheat yields improved by at least 0.2 tonnes per hectare when growing season rainfall was at least 300 mm and low rates of clay were incorporated to a shallow depth at sites including Meckering, Bolgart, Badgingarra, Binnu and Balla.

"In general, the yield gains from this treatment were better with higher rainfall, but no yield losses were experienced in lower rainfall seasons, although sometimes there was little yield advantage in drier years," he said.

Stephen said when moderate (150–300 tonnes per hectare of clay-rich subsoil) and high (300 tonnes or more) rates of clay were incorporated to a shallow depth, there was little additional yield advantage when compared to the lower clay rates.

"Even some yield losses were measured with high clay rates, particularly when incorporation was inadequate or where canola was grown in a drier season," he said.

"But evidence suggests that higher clay rates can result in good yield improvements provided the subsoil is deeply incorporated, for example with a rotary spader.

"In wetter environments with longer seasons and a cooler climate, higher clay rates with deep incorporation may still be beneficial."

The main points

Stephen said key points for growers to consider relating to the shallow incorporation of low rates of clay included:

- Clay-rich subsoil spread at lower rates can often be spread with a multi-spreader and incorporated easily with offset discs or even cultivator/combine tines;
- Lower cost and less reliance on contractors;
- Risks of poor yield responses in drier seasons are reduced compared with poor incorporation of clay-rich subsoil applied at high rates; and,
- Deep incorporation of lower application rates is not beneficial.

Stephen said it was important for growers to test clay-rich subsoil for its clay content, pH, salinity and the presence of nutrients such as potassium, sulphur and boron.

Growers should also be mindful that machinery traffic during claying could cause soil compaction, particularly if the soil was wet, and this compaction could reduce yield responses.

"Deep ripping can sometimes be undertaken after claying to help remove this compaction," Stephen said.

DAFWA researcher Paul Blackwell has previously conducted GRDC-funded research into controlled traffic systems, and said these systems should be used following any deep cultivation of soil during claying.

Controlled traffic farming confines all farm traffic to 'tram lines' to limit the area compacted by machinery.

"Controlled traffic farming is profitable and achievable and if growers do not use the system they risk even deeper soil compaction from increasingly heavy farm machinery," Paul said. "Deep compaction to about 500 mm below the soil surface is very expensive to correct." ■

Taking the right steps to combat resistance

USING a 'double knock', applying full label rates and correct timing are key steps for herbicide application to help minimise glyphosate resistance in annual ryegrass and phenoxy herbicide (2,4–D) resistance in wild radish.

This is the message from farm advisor 'learning groups' established in Western Australia under a national herbicide resistance project initiated by the Grains Research and Development Corporation (GRDC) focusing on understanding and managing herbicide resistance in glyphosate, paraquat and 2,4–D.

The two WA groups at Esperance and Moora are overseen by Department of Agriculture and Food (DAFWA) researcher Sally Peltzer, and will help design local field trials to test integrated weed management strategies to reduce the onset of herbicide resistance.

Extending glyphosate life

GRDC chairman Peter Roberts, who is involved with the 'learning group' at Esperance, said it was particularly important to extend the life of glyphosate – the best and cheapest knockdown herbicide – and 2,4–D, an important in-crop herbicide for controlling wild radish, which was becoming increasingly resistant to herbicides.

He said growers should apply glyphosate at the full label rate to help reduce the risk of any annual ryegrass plants surviving the knockdown herbicide.

"Growers can also improve the effectiveness of glyphosate by spraying it at the correct time – preferably when annual ryegrass has reached the two to three leaf stage," Peter said.

He said using a 'double knock' would help kill any annual ryegrass plants which survived an initial spray with glyphosate.

"The second knockdown herbicide application should be Spray.Seed (paraquat and diquat) or paraquat but can include the pre-emergent herbicides trifluralin or Boxer Gold (prosulfocarb and s-metolachlor)," Peter said.

He said annual ryegrass plants which survived being sprayed with glyphosate should be monitored and laboratory tested for herbicide resistance, so growers could confirm which herbicides remained effective on them.

"Herbicide resistance testing should be arranged through your agronomist or local farm supply agent," Peter said.

He said growers needed to manage fencelines carefully to help minimise glyphosate resistance.

"Fencelines and paddock margins represent a large number of situations where glyphosate-resistant annual ryegrass occur," Peter said.

"Using glyphosate as the only weed control practice along fencelines will result in glyphosate-resistant weeds occurring, which can easily spread to cropped areas."

Peter said growers could help minimise 2,4–D resistance in wild radish by seeding into weed-free paddocks to reduce the need to use the important in-crop herbicide.

"Diversifying crop rotations to broaden the range of chemical options to control wild radish is also recommended."

For more information about herbicide resistance, tactics to manage resistance and systems for farming, growers are encouraged to email givearats@agronomo.com.au to subscribe to the new GRDC-supported quarterly e-newsletter Giving a Rats.

More information about glyphosate resistance is also available via the GRDC Glyphosate Resistance Fact Sheet at www.grdc.com.au/GRDC_GlyphosateResistance or www.grdc.com.au/weedlinks ■

GRDC western panel chairman Peter Roberts, says it is critical that we do all we can to extend the life of glyphosate in Australian broadacre farming systems.

Wild radish with a high level of phenoxy resistance at Wongan Hills.

New research targets the control of wild radish

WHAT are the most effective sequences of in-crop herbicides that growers can use to control wild radish, while helping to delay the onset of herbicide resistance?

Answers to this question will be investigated under new research in the Northern Agricultural Region (NAR) funded by the Grains Research and Development Corporation (GRDC).

The GRDC is supporting the trial work after the Geraldton Port Zone's recently established Regional Cropping Solutions Network (RCSN) identified wild radish as the major priority for funding in 2012. With wild radish a priority issue for growers, the GRDC plans to make further research investments to help them manage the problematic weed.

The NAR wild radish research project will be a collaborative effort involving a number of researchers and farm advisers.

Consultants from agricultural consultancy Planfarm and the Department of Agriculture of Food's (DAFWA) Peter Newman will coordinate the research, while the Australian Herbicide Resistance Initiative will provide advice.

Planfarm agronomist and consultant Andrew Sandison said growers were facing significantly higher wild radish control costs due to herbicide resistance in many major herbicide groups.

"Having viable options for wild radish control in cereal cropping systems is vital to maintaining the financial viability of growers," he said.

Older chemicals to play a role

Andrew said that despite the difficulty in controlling wild radish in-crop, there was anecdotal evidence suggesting that older registered chemicals, if used at the right time, might provide adequate control if used in sequence with newer registered chemicals such as pyrosulfotole (for example, Velocity) and pyraflufen (for example, Ecopar).

"The new research project will test the effect of these herbicide sequences on wild radish at different sites in the NAR," he said.

Andrew said the use of older chemicals, in the correct sequence and mixes with newer herbicides, would also reduce growers' reliance on newer, more expensive herbicides and lessen the risk of resistance occurring.

"Some growers are using as many as four applications of the same herbicide in two years, which could lead to these newer chemical groups developing resistance much earlier than they should," he said.

Local knowledge

Andrew said the trial sites would be designed and selected by local agronomists, who would choose farmer paddocks containing wild radish populations with high levels of resistance.

"About four trials on different farms will take place, with a wide range of herbicide treatments tested in the 2012 season," he said.

The radish research in the NAR is one of a number of projects which will be funded by the GRDC as a result of its new Rural Cropping Solutions (RCS) initiative.

The RCS initiative aims to help speed up the time it takes for new varieties, practices and technologies to be adopted by growers, ultimately increasing the profitability of the Australian grains industry.

RCSNs each comprise about 12 representatives including a GRDC western panellist, farmers, and representatives from agribusiness and research and development organisations.

They are located in the Kwinana west, Kwinana east, Albany, Esperance and Geraldton port zones.

More information about the RCSNs is available at www.grdc.com.au/rcsg or contact GRDC western panel chairman Peter Roberts on 0428 389 060, or facilitators Julianne Hill on 0447 261 607 and Cameron Weeks on 0427 006 944. ■

New research in WA's Northern Agricultural Region aims to help provide growers with viable options for wild radish control in cropping systems.

The market takes off

Profarmer Grain AUSTRALIA
www.profarmer.com.au
May 23, 2012

LIKE a bolt out of the blue, the third week of May saw new season CBOT wheat futures post gains of 94 USc/bu in just five days. As well, the Australian dollar shed another couple of cents, to deliver price gains in A$ terms of around A$36 per tonne.

It pushed December swap prices to $276 per tonne, and forward APW multigrade prices to $264 per tonne ($279 FIS in WA).

Suddenly, we had the first forward selling opportunity for the 2012–13 crop. Also, the gap between wheat and canola has closed up to make wheat look not too bad against current canola prices, which are now some $20 per tonne under their recent peak. Wheat at $265 against canola at $567 per tonne is bit better relativity for wheat.

Some growers began their move on new season pricing using multigrade contracts at around $240–$250 per tonne. Those prices are too low (below what is needed to be fully profitable), and fixed price contracts at low prices are way too risky. If the current market gains lock in and carry through to our harvest, and we have a lean season here, fixed price contracts at $240–$250 per tonne will become a problem.

Please remember the lessons of 2007, when forward prices of $230–$250 per tonne were seen as very good selling, and yet by harvest prices were as high as $380–$400, with crop failures on top of that. In that year swaps performed much 'better' (losses were a lot smaller) than fixed price contracts, and put options have a place when the market is a bit too low, but could go lower.

And will the current gains get locked in for our harvest? A bit early to tell but the chances are increasing.

EU downgrade

The size of the EU wheat crop has been further downgraded by analysts, Strategie Grains. For a third month in a row they have reduced their estimate. This time their forecast has come in at 122.7 mt, down 4.2 mt. Their original forecast was 133 mt. The USDA is forecasting a soft wheat crop in the EU of 124–124.5 mt. This drop in production estimates was one of the factors contributing to the week long rally in wheat prices.

Massive shorts

The funds in the US had accumulated very large net short (sold) positions in the wheat futures market. In the process of doing that, they had of course been putting downward pressure on wheat prices. Arguably futures prices went lower than they should have.

At some stage those positions need to be cancelled out by buying futures. In mid May the trigger was pulled to fire up a buying spree. It started with a downgrading of the US crop condition, and then gained momentum as the trade focussed on hot dry weather in the southern US winter wheat belt, and in the Former Soviet Union. Further downgrades in the size of the EU crop helped as well.

The end result is that a fairly common May weather issue has driven US futures sharply higher, with new season prices up 94 US cents, or A$36 per tonne.

US weather

Until a few weeks ago it had been assumed that the HRW crop in Kansas would be a big one based on excellent yield potential. But the past three weeks has shown that the season is packing up at the end. The early yield potential is high enough to retain good yields, but the edge has certainly been taken off the potential. This has been behind some of the weather concerns that fuelled the May price rally.

What the tight finish in Kansas is expected to do is lift protein levels and replenish supplies of high protein wheat.

Former Soviet Union hot spot

The other 'hot spot' in the global weather story is the former Soviet Union, with dry conditions in Ukraine sapping soil moisture levels, pushing down the condition of their winter wheat crop. It is not at critical levels, but the dry is likely to impact on spring crops as well.

At this stage spring wheat planting in Ukraine is nearly finished. In terms of total output, the current estimates are for a winter wheat crop of 10–12 mt, down from 22.3 mt last year.

In Russia and Kazakhstan the season is more critical, with moderate to severe moisture deficiency in all of the major wheat production regions. Basically they need rain and they need it now. In a number of areas the planting window is rapidly closing. Crops planted in June yield poorly.

Russian crop estimate

Rabobank is one of the first to come out with a new estimate for the Russian wheat crop, putting it at 53 mt, down 2 mt and 3 mt under the current USDA prediction. Wheat exports have been cut by Rabobank to 15.5 mt compared to the USDA forecast of 18 mt with further downgrades possible against "escalating production concerns".

The market is fearful of a reaction by the Russian government like we saw in 2010 which caught everyone by surprise and forced limit up moves in wheat when exports were banned – even though commentators had been calling the crop smaller and prices had been rising.

In terms of the impact of the recent price rally, Rabobank does acknowledge that rallies like we have had are likely to be followed by a strong selloff, and that further bullish fundamental news will be required to keep wheat prices moving to the upside.

Basically the trade is very nervous about the Russian crop and Russian reactions to crop losses. Nervousness spells risk and risk means higher prices – until people relax a bit.

Australian dollar

A leading European economist is saying that our dollar is the most overvalued currency in the world, and that it is headed to sub 90 US cents, and possibly sub 80 US cents.

This is predicated on a 70 per cent rally in the dollar since 2008, and the now worsening global economy and slowdown in Chinese growth, and weak domestic growth, that will force the RBA to continue cutting interest rates.

Australia has had very high interest rates compared to the rest of the developed world since the GFC, which has seen investors move money to Australia, pushing up our currency. If the RBA cut rates to, say, 2.25 per cent (current rate is 3.75 per cent), it would undermine the current high value of the dollar. ■

Domestic grain market outlook

Wheat

If you are holding old season wheat you have been dealt a 'get out of jail' card. No-one would have expected the market to rally this strongly on the cusp of the northern hemisphere harvest, against such large global stocks. But May is one of those months that can deal us an opportunity that we would not normally bank on, with weather issues being very near the surface at critical stages of crop development in North America, Europe and the Black Sea regions.

Growers selling old season wheat now have made some gains on some grades. When we take account of holding costs (interest and storage fees), those with ASW have picked up $22–$27 per tonne since harvest.

Price outlook

The price rally of late May may change the outlook for this year's wheat price. The weather conditions and downgrading of the EU crop estimates seem to be late enough in the season to potentially have some impact on the global balance sheet.

There are two benchmarks to watch. These are:

- The March/April average futures price; and,
- The June to August average futures price.

If the latter comes in above the March/April benchmark, we go into our harvest with prices above the March/April level.

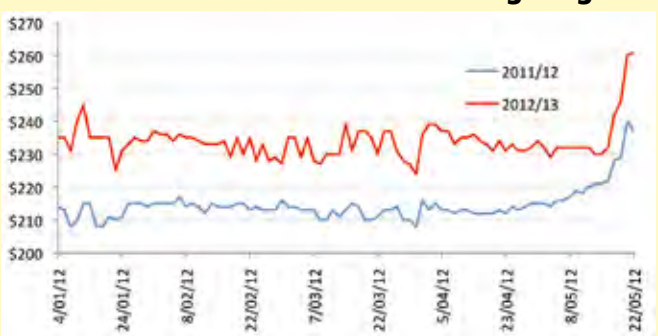
So how do May prices influence the final outcome? In short, not much.

- In nine out of the past 18 years average prices in May have exceeded the March April average.
- In only five of those years has the November close exceeded the March/April average.
- And in only four of those nine years has a high price in May continued on to a high price in June–August (and therefore to a high price in November).

The current May prices are above the March/April averages, but the May averages are not. It is not often that a lower May average results in a harvest price base above the March/April average. In fact in six years out of nine that May averages have been below the March April average, final prices are under the March April average. That is the scenario currently in place for this year.

So we are not getting much of a signal for end of year prices yet. Where prices go as we enter June will begin to build the picture. Only if the market holds at or above current levels, are we likely to get through the northern hemisphere harvest with a June–August average above the March–April average.

FIGURE 1: Wheat breaks out of trading range



Old season feed wheat

Stocks of old season feed wheat seem to be disappearing at the rate of 709,000 tonnes per month. If that trend remains in place until the end of October, we will go into the 2012 harvest with about 1.6 mt of feed wheat still on hand. This is not burdensome, and would easily be absorbed by the domestic market during early 2013, and force domestic endusers onto using AGP and ASW wheat, and possibly APW wheat in some regions.

Barley

Feed barley prices have risen capturing some of the gains seen in wheat prices in late May. Geelong and Pt Kembla prices have lifted the most for old season, reflecting where domestic demand for feed barley may well increase as wheat stocks tighten up.

In the main export zones of South Australia and Western Australia, new season feed barley is sitting at a $40–$50 per tonne discount to APW wheat. That is approaching a more 'normal' spread between wheat and barley.

International news

The barley market in the EU is now very quiet with little farmer selling, and most enduser needs covered. In terms of new season, it is similar. It is expected that export demand will not play a big part in the EU market this season, as long as supplies of barley from Eastern Europe, Australia and Argentina end up being adequate. If those alternative sources cannot meet demand, then demand will spill over to the EU, and prices will get some support.

Pulses

Pulse prices look like getting caught up in the impact on exchange rates that may result from further uncertainty about the future of the European economies. There are some pulse traders now thinking that the problems in the Euro Zone will result in lower base trading levels for pulses like peas.

Seeding of lentil crops in the US and Canada are well advanced this year, in stark contrast to the delays from flooding in the past two growing seasons

Overall the planting conditions in Canada are seen as being close to normal this year, with slightly more rain periods than dry, but overall, close to seasonal averages with crops being planted and emerging well.

Oilseed

Around 76 per cent of the US soybean crop is in the ground against 42 per cent on average. The rapid planting pace is being supported by fine weather. At the same time, that lack of rain is now becoming more of a concern for crop development.

Recent weakness in oilseed prices has been as much about a general weakness in all commodities, which spilled over to the agricultural commodities as well. This is being driven by the economic uncertainty engulfing Europe and spreading globally. ■

Supplied May 23 by *ProFarmer* Grain Australia. Information available at www.profarmer.com.au or call 1300 302 143

Promoting a sustainable and globally competitive grain industry

By Greg Quinn, Director and Ben Mason, Manager at PPB Advisory

THE international competitiveness of the Australian grain industry has come into sharp focus in recent months as the industry continues its transition towards full deregulation. The planned abolition of Wheat Exports Australia (WEA) has further highlighted concerns that the premium reputation of Australia grain could be damaged as accreditation of bulk wheat exports is eased and barriers to entry removed. Furthermore, despite efforts to increase production through better crop management, smart rotations and new technology, productivity has plateaued in the past 15 years.

So what measures are required to promote a sustainable and globally competitive grain industry?

Premium product, not a commodity

Firstly, growers need to shift perceptions that Australian grain is a commodity, but rather a premium product with distinctive and highly valued characteristics. Australian grain is unique and recognised by its white seed coat, low moisture, flour colour, colour stability and noodle texture. By adopting a rigorous approach to quality control, growers are better placed to consistently produce a premium product that stands out in a highly competitive and global market.

Clearly there is significant value in growers investing in quality assurance when customers are willing to pay a premium for Australian grain, particularly given the expected abolishment of WEA. Purchasers of Australian grain must have confidence they will receive the exact grade of grain they have ordered. Just one inferior cargo of Australian wheat has the potential to tarnish the reputation of the industry as a whole, affecting both growers and exporters.

So we believe varietal testing at the point of delivery needs to be increased to ensure quality standards are upheld and the industry's reputation protected.

Targeted promotions of our grain

In a post-deregulation environment, significantly increasing the promotion of the industry to international markets will be important to strengthen Australia's competitive position. By showcasing the qualities and characteristics of Australian grain products, and teaching prospective customers how to optimise the use of grain, growers create further opportunities to profile and promote the industry. These forums also enable the industry to gain a better understanding of their customer's requirements, which can feed back to plant breeders, researchers and ultimately growers and traders.

More market transparency

Growers also require assistance to prevent bulk handlers with geographic monopolies from exploiting their market power. Most industry participants now agree that one way to achieve this is through greater transparency of grain marketing information. Whilst beneficial in the present environment, current data funded by the Grains Research and Development Corporation and GrainGrowers is five weeks old, 'bulked up' on a state-by-state basis, and fails to drill down into the necessary detail to meaningfully assist growers making marketing decisions.

An alternative would be for WEA – or indeed a new statutory organisation – to be kept in place through the wheat export charge of 22 cents per tonne. In the interests of market transparency, the organisation would have broader powers that include publishing wheat stocks information by grade and port zone. This would enable a more level playing field, both between growers, traders, exporters and bulk handling companies, and assist growers in targeting their marketing activities.

While there is certainly a need for an improvement in grain data, greater transparency also raises concerns as to how this information may be used by grain customers. A potential risk is that by accessing marketing information such as availability of daily stocks of grain by port zone and binned grade, customers will only purchase grain from certain domestic destinations, or worse, from our international competitors in Canada, US or the Black Sea.

Need to work together

The Australian grain industry has made great strides in developing a product known for its quality, consistency and fine characteristics. As the industry continues down the path of deregulation and international competition intensifies, it is crucial that industry participants work together to maintain and protect the premium position of Australian grain exports.

PPB Advisory has extensive experience advising Australian grain businesses and their financiers. For more information visit www.ppbadvisory.com ■

Quality assurance and market transparency improves the Australian grain industry's competitive advantage.

New era for Canadian wheat growers

By Joanne Morrison, Deputy Editor of *Futures Industry*

ON December 15 2011, the Canadian government signed into law a bill to dismantle the Canadian Wheat Board's monopoly over the marketing of Canadian wheat, a throwback to the Great Depression designed to guarantee a fair price for farmers. The new law will not abolish the Wheat Board, but it will eliminate its position as the sole buyer of wheat from Canadian farmers, and in so doing give the farmers the freedom to offer their wheat for sale in an open market.

"We will have a lot more options. I think we are going to get a higher price for our wheat overall and it's going to be a true market price," said Kevin Bender, a fourth-generation Alberta farmer and president of the Canadian Wheat Growers Association.

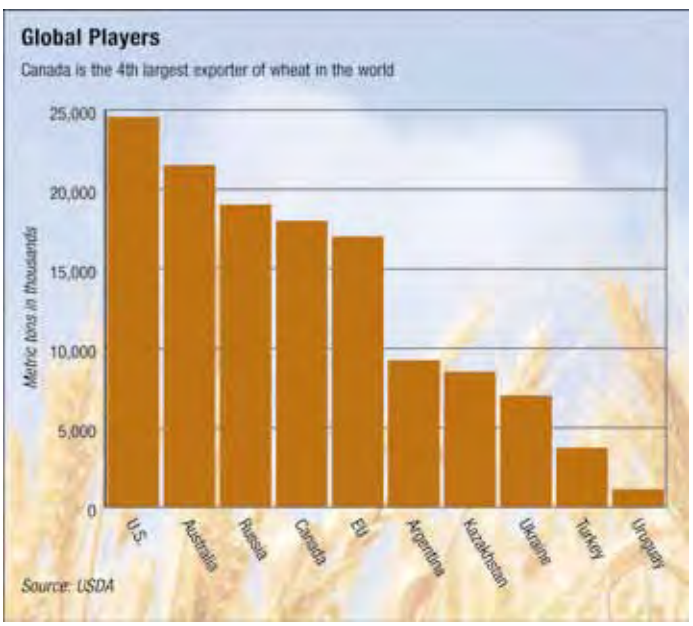
This landmark shift in how Canada's wheat is priced and sold is set to bring about many changes in North American wheat futures markets. For example, IntercontinentalExchange has launched two wheat futures contracts at its exchange in Winnipeg, bringing wheat futures trading back to Canada after nearly an 80-year hiatus. In addition, the Minneapolis Grain Exchange, the Chicago Board of Trade and the Kansas City Board of Trade are anticipating a boost in liquidity with the influx of new Canadian market participants.

"It's going to change the whole risk management and business model that we have today for sure," said Stephen Vandervalk, a fourth-generation Alberta farmer who is president of the Grain Growers of Canada.

Canada's wheat is in high demand around the world. Buyers of this wheat include grain and milling companies from Mexico to Japan as well as pasta makers in Italy.

A long road to change

The issue of removing the wheat board's monopoly has been under discussion for many years in Canada, especially after wheat boards in other countries such as Australia were dismantled. The strongest opposition came from Canada's older generation of farmers who liked the security of knowing where their grains would be sold and not having to market their crops.



"The older generation of farmers was not businessmen as much as they were operators. They farmed and they wanted to sell their products. They weren't interested in markets, they were interested in getting back on the fields and growing their crops," said Wade Sobkowich, executive director of the Western Grain Elevator Association.

Those opposed to opening up Western Canada's wheat markets also argue that farmers will lose the Wheat Board's bargaining power.

"Farmers realise that their livelihoods and their futures depend much on institutions and structures that seek to balance the huge powers exerted on them by large railways, international grain companies and consolidated input suppliers, like fuel, fertiliser, seed, chemical and machinery suppliers," Terry Boehm, president of the National Farmers' Union, said in testimony in December 2011 before Canada's Standing Senate Committee on Agriculture.

"The CWB is one such institution that by virtue of its single-desk marketing power brings some balance into the equation, as it acts in the farmers' interests only. It also brings premiums into the marketplace for farmers' wheat and barley by being a global trader that is able to exercise both market discipline and the ability to price discriminate in the international and domestic markets."

The Wheat Board was established by the Canadian Parliament in 1935 as a mandatory producer marketing system for wheat and barley in the provinces of Alberta, Saskatchewan, Manitoba and British Columbia. Since 1943, membership has been compulsory for Western Canadian farmers via the War Measures Act. Under this system, farmers deliver their wheat to grain elevators throughout the crop year. The board acts as a single desk marketer of wheat and barley. Prices paid to producers are based on an average price set by the wheat board.

"From what my dad has told me, the Wheat Board was brought in to provide a guaranteed food supply during the war and then the monopoly just stayed," said Kevin Bender. "In more recent years, they told us it was there to get us the highest price, but we can't compare it to an open market, because we have never had an open market."

The Australian experience

Proponents of the change point to Australia, where several years ago the single-desk approach was dismantled. That move led to competitive pricing and increased wheat acreage, leading to an increase in Australia's share of the world wheat trade. At the same time, Canada's share of the world wheat trade declined to 12 per cent from 22 per cent two decades ago.

"Australia surpassed us in 2010 and now has 13 per cent market share," said Kevin, adding that Canadian farmers have

seen the value of a competitive pricing system for their other crops but not wheat.

The Western Canadian Wheat Growers estimated that in 2010 prices available to farmers in the US open market over the 2010 crop year were significantly higher than the returns western Canadian farmers received under the Canadian Wheat Board. Price differentials ended up costing prairie farmers about $500 million on their 2010 wheat product and $190 million on durum, the association estimated.

Wheels in motion

Steps are already underway to capture the Wheat Board's business. Right after the legislation was enacted, Viterra, Canada's biggest grain handler, announced that it has begun entering into forward purchase agreements with growers for delivery beginning in August 2012. The company said that with greater marketing choice, there will be new contracting opportunities and additional risk management tools, which is good news for farmers and the broader sector.

"The Government of Canada has fulfilled its commitment to prairie growers, taking a major step forward for western Canadian agriculture," Mayo Schmidt, president and chief executive officer of Viterra, said in a statement.

On the exchange front, ICE Futures Canada launched two wheat contracts in January – a milling wheat contract based on protein-rich hard red spring wheat and a durum wheat contract based on similar high protein wheat used for pasta. The exchange also introduced a barley contract.

"We think there is a great opportunity here. Certainly the Canadian marketplace is significant enough in terms of being a prominent supplier to support its own futures contract," said Brad Vannan, president and chief operating officer of the Winnipeg-based exchange.

The contracts are modeled on ICE Futures Canada's canola contract, which has annual trading volume in excess of four million contracts (80 million tonnes) and is actively used by Canadian farmers, merchants and processors as well as the international trading community. Brad Vannan explained that all of the contracts are designed around delivery at source.

Delivery at source means that there are multiple delivery points located in grain elevators throughout the Canadian prairies rather than just at exporting port destinations. The majority of the Canadian wheat crop is produced within 160 km of one or more of these registered delivery points. "We have a very dynamic market that results from that, which is not prone to any kind of logistics squeeze," said Brad.

He explained that if ICE had chosen traditional delivery points such as the port of Vancouver, which is the dominant export port in Canada, it would have made the contract a less attractive hedge for the 35 per cent of Canadian production that does not typically flow through that port. To reach Vancouver, the exchange relies on railways and the trains must travel thousands of km through three mountain ranges. "These challenges are dealt with very effectively by the trade, but are too unpredictable to subject the nearby futures contract to them," he said.

The milling wheat and durum wheat contracts are 100 metric tonnes in size and priced in Canadian dollars. Many market participants say there is great hope for these new markets, but they note the difficulty in establishing new markets. Some also raised questions about currency risk. The contracts are priced in Canadian dollars and typically global cash market commodities are priced in US dollars.

Canada is the world's largest grower of durum wheat and the new durum contract will give market participants a new tool to hedge price risk in that commodity. Although durum is similar to the grades of wheat that are deliverable into existing futures contracts traded elsewhere in the world, there is no other contract for that specific grade of wheat. The milling wheat contract, on the other hand, will compete with the hard red spring wheat futures contract traded in Minneapolis, which has very similar quality specifications.

Michael O'Dea, risk management consultant at INTL FCStone in Kansas City, said he expects that the MGEX contract will see additional volumes from those hedging hard spring wheat. However, the ICE durum contract is likely to see some steady volume because there is no such contract anywhere else. "It is difficult to correlate futures with cash. For so long people who have traded durum have had a very difficult time hedging off risk."

The hedging activity among Canadian producers for other crops is seen as a sign of the success of the new ICE contracts. "There has been a misconception out there that the Canadian farmers won't know how to market their wheat. That's entirely untrue. The majority of farmers who grow wheat also market canola," said Brad. He added that prior to the establishment of the Canadian Wheat Board, Canada's wheat futures market was considered to be as significant as the Chicago market. "Now we have an opportunity to re-emerge," he said. ■

The global recipe for preparing seven trillion meals a year

THE Great Debate held during The Alltech 28th Annual International Symposium held in Lexington, Kentucky during May hosted a panel of four of the sharpest minds representing all corners of the agriculture and food ecosystem. The debate cut through the hyperbole to get to the heart of what really matters when trying to feed a population of 9 billion people by 2050.

Presented in front of nearly 3000 delegates from 72 countries, the topics debated were:

- Feeding nine billion people;
- Is Africa the new Brazil?
- What are the implications of the African land grab? and,
- What's next for biofuels?

Other topics included:

- Water – the fight for natural resources;
- Protecting the rainforests;
- Educating urbanites about agriculture;
- Dealing with groups hostile to agriculture;
- Solutions to obesity;
- Organic labels;
- Malnutrition;
- What 'local' really means; and,
- What does the future hold for the four year-olds of today's world.

Tom Arnold, CEO, of Concern Worldwide; Sean Rickard, senior lecturer in business economics, Cranfield University, United Kingdom; Dr Marcus Vinicius Pratini de Moraes, Former Minister of Agriculture and Food Supply of Brazil; and Tom Dorr, CEO of the US Grains Council in Washington DC, each took to the stage to discuss their ideas on what the future of agriculture and food supply will look like.

Experts at the Great Debate unanimously agreed that world hunger has declined dramatically over the past two decades. Tom Arnold summed it up by saying, "In 1969 the world had about three billion people and about 25 per cent of those three billion people were hungry. By 2004, the world had 6.3 billion people and 13 per cent of that population were hungry."

Left to right: The Great Debate featured Aidan Connolly, Alltech; Tom Arnold, CEO of Concern; Dr. Marcus Vinicius Pratini de Moraes, former minister of Brazil's agriculture and food supply; Tom Dorr, CEO of the US Grains Council in Washington, DC; and senior lecturer in business economics at Cranfield University in the United Kingdom, Sean Rickard. (PHOTO: Tim Webb)

Sean Rickard agreed and explained that a key driver of meeting that world population food demand was the ability of getting science and farmers together.

Tom used the phrase 'Food is back'. He talked about how a large proportion of the world's population has moved out of poverty. Sean highlighted the policy practices which he referred to as 'mad policies' such as the Common Agricultural Policy (CAP) in the European Union and the need to move towards smarter policies and polices that think through the implications.

Marcus Pratini de Moraes addressed the need to move away from protectionism and trade rules that effectively end up costing agriculture and consumers millions of dollars and eventually have a disproportionate effect on the availability of food.

Tom Dorr suggested that the world should appreciate the fact that agriculture delivers over seven trillion meals a year and suggested that agriculture may be where the information technology industry was at in the 80s.

Audience opinion was sought through a confidential electronic survey. Survey results were received from almost 600 delegates prior to the Great Debate. Of those surveyed 52 per cent resided in North America, 66 per cent were stockfeed focussed with 45 per cent conducting business in the ruminant market.

- Almost 50 per cent of those surveyed felt that nine billion people cannot be fed without using genetically modified foods (GMOs) while in contrast 20 per cent felt that the world can be fed without GMOs.
- 75 per cent of respondents think that emphasis should be placed both on food safety and in teaching people to better prepare their food.
- 33 per cent of those surveyed believe that biofuels should be subsidised but only for a short time, while 39 per cent disagree and believe that biofuels should not be subsidised having already received too much subsidisation.
- 88 per cent believe that countries should be allowed to prevent imports of food based on sanitary standards. Half said 'yes' with World Trade Organization approval and half said 'yes' in all cases.

Experts at the Great Debate all agreed that the agricultural industry is here to stay, and that demand for its output will continue to grow.

Commenting on the debate, Alltech Vice President, Aidan Connolly, summarised the key messages delivered: "Modern agriculture needs to continue to embrace technology, innovation and place an emphasis on education. We must recognize that we are going to face critical issues, particularly with regard to water shortages, and focus on the need for transparency."

Founded by Dr. Pearse Lyons, Alltech is a global animal health and nutrition company with 32 years' experience in developing natural products that are scientifically proven to enhance animal health and performance. With 2800 employees in 128 countries, the company has developed a strong regional presence in Europe, North America, Latin America, the Middle-East, Africa Australia and Asia.
For further information, visit www.alltech.com ■

Resistant starch in our grains will help protect against bowel cancer

CONSUMPTION of resistant starch leads to positive changes in the bowel and could protect against genetic damage implicated in bowel cancer.

Western diets are typically low in fibre and have been linked with a higher incidence of bowel cancer. Even though Australians eat more dietary fibre than many other western countries, bowel cancer is still the second most commonly reported cancer in Australia with 30 new cases diagnosed every day.

Dr David Topping, from CSIRO's Food Futures Flagship, said this is referred to as 'the Australian paradox'.

"We have been trying to find out why Australians aren't showing a reduction in bowel cancer rates and we think the answer is that we don't eat enough resistant starch, which is one of the major components of dietary fibre," David said.

Dr David Topping.

These findings, published in a recent issue of *The Journal of Nutrition*, reinforce the fact that dietary fibre is beneficial for human health, but go further to show that fibre rich in resistant starch is even better.

"It's not just the amount of fibre that we eat that's important, but the diversity of fibre in our diet," David said.

"We studied various sources of resistant starch, including corn and wheat, and the results suggest they could all protect against DNA damage in the colon, which is what can cause cancer."

Dr Trevor Lockett, colorectal cancer researcher with CSIRO's Preventative Health Flagship, said Australia has one of the highest incidence rates of bowel cancer in the world.

"Research suggests that improving our diets could go a long way to reducing our personal risk of developing this disease, which would also have the follow-on benefit of reducing healthcare costs associated with bowel cancer.

"These new studies suggest that increasing the amount of resistant starch in our diets may be one important step along the path to reducing the burden of bowel cancer. It takes about 15 years from the time of the first bowel cancer-initiating DNA damage to the development of full-blown bowel cancer, so the earlier we improve our diets the better," Trevor said.

The recommended intake of resistant starch is around 20 grams a day, which is almost four times greater than a typical western diet provides. Twenty grams is equivalent to eating three cups of cooked lentils.

"Currently, it is difficult for Australians to get this much from a typical diet," David said.

"We have already had success in developing barley with high levels of resistant starch, and now our focus is on increasing the levels of resistant starch in commonly consumed grains like wheat. These grains could then be used in breads and cereals to make it easier for Australians to get enough resistant starch from their diet." ■

Some wholegrain breads and cereals are good sources of resistant starch. (Photo: CSIRO)

WHAT IS RESISTANT STARCH?

Resistant starch is a component of dietary fibre that resists digestion in the small intestine and instead passes through to the bowel where it has positive effects on bowel health. Resistant starch is sometimes called the third type of dietary fibre (in addition to soluble and insoluble fibre) and is found in legumes, some wholegrain breads and cereals, firm bananas and cooked and cooled potatoes, pasta and rice.

The recommended daily intake of resistant starch is around 20 grams per day. This is equivalent to eating three cups of a cooked legume such as lentils – Australian diets are typically a quarter of this. (Photo: CSIRO)

Biological control – a natural solution in the war on weeds

BIOLOGICAL control has an outstanding history and great future potential in the battle to control the invasive weeds that impact Australia's landscapes, biodiversity and agriculture, according to CSIRO.

Australia's impressive 100-year history in biocontrol of weeds is recorded and celebrated, and the importance of future biocontrol is highlighted by CSIRO, state, national and international authors in the book, *Biological Control of Weeds in Australia,* published by CSIRO Publishing and launched recently in Canberra today.

"Using the natural enemies of foreign or invasive weeds has proven to be a key weapon in the war on weeds and is still front and centre as we tackle a range of new invasions in the 21st century," according to biosecurity research leader with CSIRO Ecosystem Sciences, Dr Paul De Barro.

"Australia has certainly led the world over the past century with its groundbreaking research and introduction of biological control starting with the spectacular success against prickly pear cactus in the early part of the 20th century and gaining speed from there," Paul said.

Along with state and Commonwealth agencies, CSIRO has played an important part in developing Australia's expertise and helping establish the rigorous exploration and screening processes and the mass rearing of biocontrol agents. CSIRO's biological control and exploration labs in Montpellier, France, and formerly in Vera Cruz, Mexico, have been key to that success, and Australian research and training continues to guide many international activities.

"CSIRO scientists and the Montpellier lab were instrumental in the first successful use of a plant pathogen or rust to massively reduce one of Australia's worst weeds – skeleton weed – from south eastern Australian agricultural regions over 15 years," Paul said

"Biocontrol successes can take 15 or 30 years to reach full effect, and while not all efforts succeed they invariably complement other measures and the cost benefits are indisputable."

"For every dollar spent on biological control of weeds up to 2005, it has been shown that $23 of benefits flowed to the agriculture and health sectors, and the environmental benefits would be on top of that."

Exceptional bang for the buck

"Weeds biocontrol represents exceptional bang for buck but requires commitment across both short and long-term horizons and across jurisdictions to deliver its full potential."

"CSIRO sees weeds biocontrol research as an important part of the contribution we can make to Australia's biosecurity and it is a key element of CSIRO's effort targeting pest and disease threats to be coordinated through our developing Biosecurity Flagship."

"For a book that will serve as an invaluable guide and reference source for anyone involved in biological control, I commend the editors Mic Julien, Rachel McFadyen and Jim Cullen, and all the chapter authors who have made it possible." ■

BIOLOGICAL CONTROL OF WEEDS IN AUSTRALIA

Published by CSIRO Publishing, *Biological Control of Weeds in Australia* provides a comprehensive review of the biological control activities undertaken against weeds in Australia over the past 100 years.

Edited by Mic Julien, Rachel McFadyen and Jim Cullen, the 648-page book demonstrates the far-reaching economic, environmental and scientific benefits that biological control has provided Australia, and the importance of its role in the future of the country.

From 1903 and 2010, a total of 73 weeds have been targeted for biocontrol in Australia, and more than 200 insect and pathogens have been released as biocontrol agents against these weeds.

By the 1980s Australia was a world leader in weed species targeted and new agents introduced, and also led the world with the first deliberate introduction of a plant pathogen as a biocontrol agent, the rust *Puccinia chondrillina*, released in 1971 to control skeleton weed *Chondrilla juncea*.

Young farmer award nominee makes a wholesome mark

FIFTH generation family farmer and one of this year's *Young Farmer of the Year* award nominees, 27-year-old Jim Maitland along with family members, has established an innovative sideline business in an effort to add value to existing farm outputs.

Jim joined the family farm in the Clare Valley, South Australia full time in 2007 after finishing a three-year Diploma in Farm Business Management at Marcus Oldham College. The total operation of 2600 hectares includes the 1200 hectare family farm along with leased land and a share farming operation based at nearby Auburn.

Traditionally, the rotation consists of hard wheat, durum, canola, faba beans and oaten hay grown for the export market.

Jim was nominated for the *Young Farmer of the Year* Award in recognition of his on-farm innovation in establishing a new business venture – Pangkarra Pty Ltd.

"Pangkarra Foods produces premium wholegrain dry pasta and stone milled wholegrain durum flour made from durum wheat grown on the family farm. It was established in an effort to diversify our current business beyond primary production and utilise the skill set of family members," explained Jim.

Healthy risk management for the farm and body

With a current output of 12 tonnes of pasta and flour produced per annum, the business aim is to grow production to 50 tonnes per annum in the next two years. "If the venture enjoys long term success it will play a pivotal role as a risk management tool against the ever fluctuating commodity prices."

The idea for the business grew in response to an ever increasing consumer awareness of the health benefits of wholegrain foods, explained Jim. "We also saw a gap in the market – that being the production of premium wholegrain pasta."

With the produce marketed to gourmet retail shops and restaurants, a commitment to sustainable farming methods underpins the business strategy. "The dedicated Pangkarra cropping program receives chicken litter prior to sowing and is grown on the back of a legume (beans) crop, which increases the nitrogen levels in the soil.

"The grain is stored chemical free in vertical, air tight, temperature controlled silos on the property and then sent to a miller in South Australia where traditional stone milling methods are used to grind the grain. This method enhances the health benefits by ensuring the flour retains all of the components of the grain itself including the wheat germ, the endosperm and the bran."

Jim believes that awards such as the *Young Farmer of the Year* are critical in promoting careers in agriculture to more young people. "Winning the award would provide a fantastic opportunity for me to promote the business," said Jim. ■

YOUNG FARMER OF THE YEAR

The *Young Farmer of the Year* award is sponsored by Dow AgroSciences in keeping with the company's commitment to attracting and retaining young people in the industry.

This award is one of the Kondinin Group's *Australian Farmer of the Year* Awards.

The *Young Farmer of the Year* award is open to all farmers aged between 18 and 35, with the winning applicant receiving the highest recognition from their peers for their efforts to build a sustainable and viable farming future.

Dr Matt Cahill, Research and Development leader from Dow AgroSciences, said sponsoring the award is in keeping with their organisation's long term goals. "Our research aims to provide the industry with the best technology for faster, better and more efficient agriculture long-term, to feed the world's growing population," he said.

"To do this, we need the best and brightest young minds to carry our agricultural industry further into the future. It's exciting to see people like Jim being nominated, as they highlight the wide range of innovation undertaken by young people across the sector."

Nominations for the award are open until Friday August 3. More information is available online at: www.kondiningroup.com.au

Jim Maitland, nominee for this year's *Young Farmer of the Year* award, has established an innovative sideline business, marketing wholegrain pasta and flour in an effort to overcome the ever fluctuating commodity market prices.

Farming in Foreign Fields...

a focus on the successful endeavours of innovative farmers around the world

Leading with technology pays with better peanuts

Kevin (left) and Mark Roberts have integrated site-specific technology into every crop operation.

FOR Kevin and Mark Roberts, of Lumberton, North Carolina, a technology revolution began on their farm in 2005 when they bought their first piece of equipment with autoguidance – a Case IH Patriot 3310 sprayer. As soon as they saw the ease and accuracy of autoguidance and the cost-savings performance of its AccuBoom section control, they began managing their 4500 acre (1820 hectare) operation differently.

Now they had the tools to analyse every field, every acre, to its highest profit potential. Immediately, practices such as flat-rate applications of lime seemed wasteful. Hand-steering for precise jobs seemed antiquated. And making decisions without yield maps seemed like driving blindfolded.

In just a few short years, brothers Kevin and Mark have integrated site-specific technology into every crop operation. And, their new stream of accurate site-specific information has helped them make major decisions focused on maximising their returns per acre.

Fourth generation but time for change

The Roberts are the fourth generation on their land, producing corn, peanuts, cotton, wheat and soybeans. As longtime growers of tobacco, they harvested their last tobacco crop in 2010. With rising costs, changes in contracts and the ongoing challenge of labour, they say tobacco no longer delivered the profit potential it once did.

In its place, the brothers planted their first cotton crop in 2011.

"Like tobacco, cotton is not an inexpensive crop, but it's not labour intensive," Mark says. Kevin adds that between planting and harvest, cotton simply requires spraying, which is his job. "It's a one-man show," he says.

The brothers have also invested in centre-pivot irrigation, with 13 drop-nozzle centre pivots now watering 800 acres (325 hectares). The results have been dramatic. Rainfall was short in 2011, and the yield difference between their dryland corn and irrigated corn was over 150 bushels per acre (9.4 tonnes per hectare).

From that first autoguidance sprayer, the Roberts' technology path next led to variable-rate lime using their own prescription-driven spreader. "We pull soil samples every year, doing 1-acre grids under the centre pivots and 2.5 or 5 acre grids elsewhere," Kevin says. "We figure soil sampling is the cheapest money we spend."

Annually, they review the results with their agronomist and develop rates for lime and fertiliser, based on the soil tests and the anticipated needs of the next year's crop. "We like to replace what the plants consume plus keep a bank of nutrients in the soil," Kevin explains.

They say the site-specific applications save time, fuel, fertiliser and lime.

"It's good for the environment, too," Mark adds. "We're not throwing all that extra fertiliser out there that could be harmful to watershed areas."

Autoguidance has proved its value in their peanuts which is a major crop for them. Planting peanuts using RTK guidance, then harvesting following the exact same path, puts more peanuts in the combine.

In a good year, Kevin explains, peanuts get tall and bushy, making it hard to tell where the row centres are. By using RTK on the tractor pulling their peanut lifter, its path doesn't vary at all, compared to the 5 or 6 inches (12 to 15 cm) of back-and-forth common with hand steering. More peanuts are harvested, fewer are left in the field.

The Roberts participated in university tests that confirmed the advantage of the perfectly straight rows.

First year pay-off

"We figure we paid for our first RTK system with our first year of peanuts," Kevin says.

After seeing the advantages of section control on their sprayer, the Roberts have equipped their Early Riser 1240 16-row planter with AccuRow row shut-offs. After several years of experience of using them, they say the row shutoffs are especially valuable in their small, irregular-shaped fields.

"They pay for themselves every year," Kevin says.

The Roberts have only recently started using Case IH planters, but have been impressed by the design of the row unit and its metering accuracy. "We've been involved in some planter comparison tests here on our farm, and the Case IH planter is number one for accuracy, at any speed," Mark says. "It really holds great if we need to run faster."

Using the Case IH Pro 600 display, he makes variable rate changes on the go. Mark plans to do prescription-based planting on their irrigated land to take full advantage of the yield potential.

On their compaction-prone soils, the Roberts say inline-ripping, using two Case IH eight-row Ecolo-Till 2500 rippers, greatly improves crop vigour. "We have a hardpan here, and we run these rippers just below that pan, usually about 10 to 14 inches deep, to shatter it," Mark says. It's another application that's more efficient with RTK autoguidance, eliminating any overlap. Both of their Magnum 305 tractors pulling the rippers are equipped with it.

It's an expensive tillage step, but worthwhile. "We won't plant corn without doing it," Kevin says.

The Roberts also use a 31-foot (14.6 m) Case IH True-Tandem 330 Turbo vertical tillage tool to help level beds after peanuts and cotton and to manage cotton stalks. "We're running it at 8 mph, 2 inches deep behind a Magnum 305," Kevin says. "And, we can conventional-drill wheat in cotton ground just with one pass from the 330."

"It's one of those tools that worked the day it was delivered," Mark adds. "We just hooked it up and ran it. We go at a slight angle across the beds, just enough to see the tractor rolling a little bit."

After seeing the improvement in corn yields from irrigation, the Roberts decided to increase their harvesting capacity, trading an Axial-Flow 7120 to an Axial-Flow 8230, gaining nearly 20 per cent in cleaning capacity. They're keeping the same 12-row corn head and 35-foot (16.5 m) draper head. They also added a grain dryer – uncommon in their area, where corn generally dries down naturally – to help them take off corn earlier if a hurricane threatens.

"Fifteen hundred acres of corn blown down is a sight you don't what to see," Kevin says.

Most of the equipment on their farm is red, the Roberts say, including the used Case IH Cotton Express 2555 picker they purchased as they moved into cotton.

They say the combination of good equipment and excellent dealer support keeps them in the brand. The brothers also say they're oriented toward keeping their equipment fleet fairly new for reliability, for cost-effective trades, and to gain the latest technology, which is important to them. Their next steps, they say, include using more variable- rate and prescription-based applications and integrating more information into their field maps.

"We don't see technology as an expense," Kevin says. "Rather, we figure if we don't stay up with it, we won't be as efficient as we could be." ■

Latest herbicide resistance survey

By Mechelle Owen, Neree Martinez and Stephen Powles, Australian Herbicide Resistance Initiative

SURVEYS are an effective way of quantifying the occurrence and evolution of herbicide resistance in weeds. In 2010, the fourth herbicide resistance survey in Western Australia was conducted to determine the current level of resistance of key weed species to different herbicide modes of action and to assess the change in resistance frequency over time.

Previous surveys

The first resistance survey occurred in WA in 1998 to determine the extent of herbicide resistance in annual ryegrass and wild radish and sampled a relatively small area of the wheatbelt. Annual ryegrass was tested for resistance to commonly used Group A and B herbicides.

In 2003, a survey was conducted across the whole WA wheatbelt area and examined a range of herbicide chemistries.

Annual ryegrass and wild radish seed samples were collected from 500 cropping paddocks, and showed a dramatic increase in herbicide resistance levels since 1998. While ryegrass was found in most cropping paddocks, research using the data from previous surveys found that higher levels of resistance in ryegrass did not necessarily lead to higher weed densities in cropping fields.

The first wild oat survey, conducted in 2005, found widespread resistance to the Group A herbicide diclofop-methyl and low resistance levels to other Group A herbicides tested.

The objectives of this project are to:

- Determine the current status of resistance for commonly used herbicides;
- Measure the change in resistance frequency over time;
- Determine which herbicides still work effectively;
- Assess the frequency of weed species in crop; and,
- Set benchmark data for brome grass and barley grass.

What we did

The latest survey (2010) was conducted to assess the current state of resistance to commonly used herbicides in the WA grain belt, for five important weed species. While previous surveys had been done randomly, the 2010 survey has engaged grower participation – but paddock selection within properties was still random to allow comparison with the previous data on resistance occurrence.

Grower engagement will also allow individuals to receive results for their paddocks used in the survey. Over 15,000 km was travelled, extending from Binnu in the north to Esperance in the south. In total 466 paddocks were visited in which mature seed heads from 362 samples of ryegrass, 96 wild radish, 128 wild oats, 47 barley grass and 91 brome grass populations were collected at harvest.

During the 2011 growing season, annual ryegrass seedlings were screened for resistance to commonly used herbicides including clethodim, trifluralin, diclofop-methyl, sulfometuron and glyphosate at recommended field rates. Wild radish, brome grass, barley grass and wild oat will be assessed in 2012–13.

KEY MESSAGES...

- Annual ryegrass was present in most cropping paddocks;
- Herbicide resistant annual ryegrass is widespread for Group A and B herbicides;
- Herbicide resistance levels have increased for Group A and B herbicides since 2003;
- Trifluralin, atrazine, glyphosate and paraquat still provide good weed control; and,
- Targeting weed seed production is vital for managing herbicide resistance.

What we found

Annual ryegrass resistance levels were found to be extremely high for the group B herbicide sulfometuron, with 98 per cent of populations containing resistant plants (Table 1) and most

Surveying paddocks at harvest for weed seed collection.

Annual ryegrass plants infesting a barley crop.

populations having a high number of plants surviving. This is a 10 per cent increase in the number of resistant populations since the last survey conducted in 2003. A similar result was found for the Group A herbicide diclofop, with 96 per cent of populations containing resistant plants – an increase of 30 per cent since the last survey in 2003. The greatest increase in resistance came from southern cropping regions for both of these herbicides.

Two label rates were used for the herbicide clethodim: The first rate of 250 ml Select was used as it was the label rate in 2003 and allows direct comparison with the 2003 survey. The label rate has since changed to 500 ml per hectare and so this rate was also used in the 2010 survey. Under the 250 ml rate of Select, 65 per cent of populations contained resistant plants (Table 1), a large increase of 57 per cent since 2003; a further 42 per cent of populations also survived the 500 ml rate.

This herbicide had the greatest increase in resistance levels since 2003 (Table 1), with resistance becoming widespread across the state rather than being isolated to the northern agricultural region as was found previously. Higher levels of resistance were associated with the northern agricultural region for the higher label rate.

The pre-emergent herbicide trifluralin remained effective on 73 per cent of populations (Table 1). Only 1 per cent of the resistant 27 per cent of populations had high plant survival, and these populations were controlled by the pre-emergent herbicides Boxer Gold and Sakura. Although similar to the 2003 survey results, these 2010 results show an increase in the proportion of resistant plants within an individual population.

TABLE 1: Change in herbicide resistance levels for annual ryegrass from the Western Australian wheat belt over an 11 year period

Herbicide	1999		2003		2010	
	R	S	R	S	R	S
Diclofop	46	54	68	32	96	4
Clethodim (250ml)	0.5	99.5	8	92	65	35
Sulfometuron	64	36	88	12	98	2
Trifluralin	NT	NT	25	75	27	73
Atrazine	NT	NT	1	99	2	98
Glyphosate	NT	NT	1	99	7	93

Populations are classed as: Resistant (R) (1–100 per cent survival) or Susceptible (S) (0 per cent survival), (NT – herbicide was not tested).

The number of glyphosate-resistant populations increased from 1 per cent in 2003 to 7 per cent in 2010 (Table 1), with all resistant populations coming from higher rainfall coastal regions in the southern cropping region between Albany and Esperance.

Only 2 per cent of populations contained plants that were resistant to atrazine (Table 1), while all populations were susceptible to paraquat. These results are similar to the 2003 survey results.

The number of populations with resistance to both the Group A and B herbicides had increased to 95 per cent, a reflection of the increase in resistance to sulfometuron and diclofop particularly in southern cropping regions.

Have resistance levels changed over time?

Overall, there has been a large increase in the level of resistance to the Group A and B herbicides, while, more encouragingly, atrazine and trifluralin resistance remains low and has not changed greatly over the past seven years (Table 1).

While glyphosate resistance is evident, it was confined to high rainfall southern cropping regions, and growers from these regions should be particularly cautious in their use of glyphosate.

Herbicide resistance screening of ryegrass populations conducted at UWA during 2010 (May–September).

There are a number of already-known glyphosate resistant ryegrass populations from WA cropping paddocks, and a further nine resistant populations for the Esperance area that have been confirmed in the current survey.

On-farm management solutions

While herbicide resistant weed populations are common in the WA wheat belt, there are a number of options available to growers to help keep plant numbers down. Using an integrated weed management approach with a range of chemical and non-chemical options may help to keep weed numbers low. Some options include:

- Select paddocks with lower seed burden;
- Delay sowing to allow maximum germination, then use knockdown at full rates to achieve maximum kill;
- Rotate pre-emergent herbicides to maximise the effectiveness for the future;
- Clethodim at higher rates still provides selective control for some cropping areas;
- If weed densities are high, consider green or brown manuring, cutting the crop for hay or silage or crop topping to minimise the amount of seed returning to the seed bank; and,
- Employ weed management systems at harvest which reduce the number of weed seeds – chaff carts, baling for hay or seed destruction and windrow burning are effective tools for reducing the number of weed seeds that are able to germinate the following autumn.

To sum up

Resistance to Group A and B herbicides is widespread but some herbicides such as trifluralin, atrazine, glyphosate and paraquat still provide good control, though it should be noted that resistance to these herbicides has become more common.

Any management practice that reduces the number of seeds going back into the seed bank will help to keep weed numbers low.

Unlike previous surveys, the 2010 survey required grower participation and we would like to extend our thanks to all the growers who gave us permission to enter their properties. We would also like to thank all those who helped promote the survey and distribute survey participation forms to growers. This work was funded by GRDC. ■

Barcoding to keep insects like Russian wheat aphids at bay

By Dennis O'Brien, Agricultural Research Service – USDA

MENTION barcodes and it often brings to mind the sales tags and scanners found in supermarkets and other stores. But Agricultural Research Service scientists are using 'DNA barcodes' in their search for ways to control and monitor insects that pose the greatest threats to crops as diverse as wheat, barley, and potatoes.

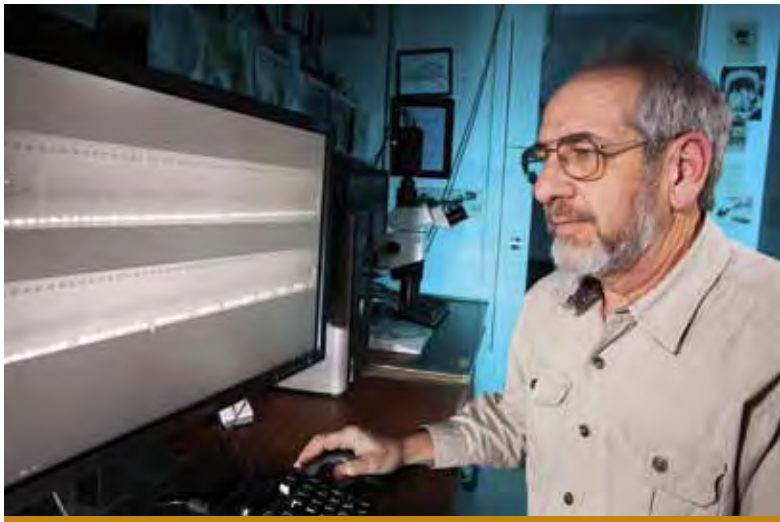
In DNA barcoding, scientists sequence a designated part of an organism's genome and produce a barcode from it for a systematic comparison with the sequenced DNA of other closely related species. DNA barcodes are being developed on a wide range of plants and animals as part of a global effort to catalogue the diversity of life on Earth.

At the Invasive Insect Biocontrol and Behavior Laboratory in Beltsville, Maryland, entomologist Matthew Greenstone is using DNA barcodes in an unconventional way: to identify insect predators best equipped to control the Colorado potato beetle. The Colorado potato beetle is the single most damaging insect pest of potatoes in the eastern United States. It also damages tomatoes and peppers and is known for developing resistance to any pesticides used to control it.

Matthew is trying to find the insects that are the beetle's worst nightmare. Numerous studies have analysed the gut contents of predator insects to evaluate their ability to control pests. But predators eat and digest prey at different rates, so simple gut analysis is insufficient for accurately comparing predator effectiveness, Matthew says. He has fine-tuned that approach and used barcoding to come up with a way to factor in how quickly different predatory insects actually digest the Colorado potato beetle.

"Scientists often use barcoding to distinguish one closely related species from another. We're using it to identify prey in the gut of an insect predator, and in a sense, that's an atypical use," says Matthew. Matthew and his colleagues collected four insects

Adults of the native carabid beetle *Lebia grandis* are voracious predators of Colorado potato beetle eggs and larvae. (Photo: Peggy Greb)



Entomologist Matt Greenstone examines DNA analysis results of Colorado potato beetle removed from the gut of an insect predator collected from the field. He is looking for evidence that the predator mainly consumes Colorado potato beetle. (Photo: Peggy Greb)

that previous studies showed were the most common potato beetle predators. They fed them laboratory-raised potato beetles and looked at the digestion rates of each of the four insects to determine the Colorado potato beetle's DNA "half life" – defined as the point at which at least some DNA of the potato beetle could still be found in half of the fed individuals of each predator species. They used the potato beetle's barcoded DNA to detect it in the predators' guts.

The results, published in the journal *Entomologia Experimentalis et Applicata*, show the importance of taking digestion rates into account when considering different insect predators as biocontrol agents. They may also provide guidance to growers on the most effective control strategies for combating a voracious pest.

"Different pesticides have different effects on different predators, and not all predators are equally susceptible to all insecticides. Based on what you learn, you might delay spraying insecticides, rule out the use of insecticides that harm your most important biocontrol agents, or limit spraying to certain times, depending on the predator's habits," Matthew says.

The Russian wheat aphid threat

ARS researchers are also using barcoding to understand and track the threat of various biotypes of Russian wheat aphid, an insect about the size of a sesame seed, that is a major worldwide pest of wheat, barley, and other cereals. Since it appeared in 1986 in Texas, it has cost US wheat growers alone about $200 million each year.

Gary Puterka, an entomologist in the ARS Wheat, Peanut, and Other Field Crops Research Unit in Stillwater, Oklahoma, periodically surveys Russian wheat aphid populations across eight western US states to provide guidance to wheat growers on infestation levels and on the range of biotypes so they can decide

Russian wheat aphid adult next to its young. This aphid gives live birth to young that are identical clones of itself during the asexual phase of its lifecycle. (Photo: Photo Gary Puterka)

whether to implement control measures. He works closely with ARS entomologist Kevin Shufran, who is also in Stillwater, on efforts to control the aphid.

Until recently, the Russian wheat aphid, in North America, was believed to reproduce strictly by asexual cloning, which made it particularly susceptible to resistance mechanisms bred into wheat and barley crops. But Gary's surveys have turned up evidence showing that it is reproducing sexually.

If the Russian wheat aphid is sexually reproducing, the resulting genetic recombination would produce new "bioytpes" that will be better equipped to counter resistant crops by giving each new generation a varied genetic tool kit, increasing the likelihood that offspring will be able to overcome the plant's resistance mechanisms, feed on it, and survive to reproduce resistant offspring. Sexual reproduction could also broaden the pest's range, enabling it to lay eggs as cooler weather approaches, like other alpine aphids do, and survive harsh winters.

Researchers found a new biotype of Russian wheat aphid in Colorado in 2003 that spread so quickly and caused so much damage – overcoming a new resistance gene that breeders had recently developed for wheat growers – that its success was seen as a new introduction or evidence that the pest had "gone sexual." Subsequent surveys have turned up additional evidence of new biotypes, an evolving threat.

Gary's survey showed that the Colorado biotype now makes up 90 per cent of the population in eight major wheat-producing states. Another study by Gary found a small, localised population of Russian wheat aphids in a Colorado field that were the offspring of male and female parents. This population of nymphs had a signature trait – missing antenna segments – that was evidence they hatched from eggs and were the result of sexual reproduction. Thirty-nine new biotypes were detected when these nymphs were increased and screened.

"These populations are continually shifting in terms of different biotypes, and as natural selection dictates, the biotypes that are the fittest are the ones that will survive and dominate," says Gary.

But the extent of the threat posed by the Russian wheat aphid largely remains a mystery, and the field surveys are time consuming. For accurate results, Gary must make clone colonies from each adult collected and screen them by exposing them to nine different types of resistant germplasm to confirm their biotype.

The most efficient way to determine whether Russian wheat aphids are sexually reproducing would be to find their eggs. When the females reproduce asexually, they give birth to live females, but they lay eggs when they reproduce sexually. The problem is that the eggs of all aphid species look alike, so the scientists cannot distinguish Russian wheat aphid eggs from other aphids' eggs.

Kevin and Gary have developed a process that uses DNA barcoding to tell the different aphid eggs apart. To establish that it would work, they extracted DNA from the eggs of 10 previously identified species of aphids, including several of the Russian wheat aphid's closest relatives. They sequenced the first 640 base pairs of a gene known as 'CO_1'.

In a blind test, Kevin compared DNA from eggs provided by Gary, who masked the identities of the different species. With help from various aphid genetic databases, Kevin was able to correctly distinguish the different aphid species by comparing their CO1 sequences. Results were published in *Annals of the Entomological Society of America*.

With the new tool, Gary and Kevin will be able to identify Russian wheat aphid eggs for the first time and can better track the biotypic diversity of an aphid that poses a major threat to wheat and other crops.

To reach scientists mentioned in this article, contact Dennis O'Brien, USDA-ARS Information Staff, 5601 Sunnyside Ave., Beltsville, MD 20705-5129; Ph: +1 (301) 504-1624. ■

Adult Colorado potato beetle on a potato plant. Adults and larvae eagerly consume potato foliage. (Photo: Peggy Greb)

INTERNATIONAL CONFERENCE ON HERBICIDE RESISTANCE

WITH the support of the GRDC, The Australian Herbicide Resistance Initiative (AHRI) will host an international conference on herbicide resistance in crops and weeds, in order to consider the global herbicide resistance challenge we face. The conference will take place in Fremantle, WA from February 18–22, 2013.

Global grain and fibre production is substantially underpinned by herbicides. But the evolution of herbicide resistant weeds threatens global crop productivity and ultimately, world food security. This threat must be addressed at levels from research through to practice – and this conference will play a key role in that.

To consider the state-of-the-science this international, multidisciplinary conference will address issues which range from molecular evolution through crop science, agro-ecology, resistance management and socio-economics.

In an era when science conventions are on offer on almost a weekly basis, what makes this event so special?

The answer is three-fold:

- The first is that convenor, Professor Stephen Powles from the University of Western Australia, has pulled together the leading worldwide authorities on herbicide resistance (for example, Dr Jason Norsworthy – see following). Until now, there has been no dedicated gathering of this science stream at an international level;
- In recognition of the significance of this science discipline, few other conventions of this type offer such support to nurture young and emerging scientists to attend and/or present; and,
- Western Australia is home to some of the most advanced broadacre cropping enterprises using best-practise pest and weed management – the opportunity exists to visit some of these farms. A field tour will be held on Friday, February 23, which will provide a great insight into some of the most advanced cropping systems in Western Australia. This will also be an opportunity to view the Harrington Seed Destructor in action and also to learn more about weed seed control strategies including the use of chaff carts and windrow burning at harvest.

The grain industry's latest weapon in weed management – the Harrington Seed Destructor.

Herbicide resistance in the US

Council of Australasian Weed Societies Orator for the conference is Dr Jason Norsworthy from the University of Arkansas. Jason reviews the resistance situation in the southern US.

My research has had both basic and applied components. I have documented seven new herbicide-resistant weeds in the mid southern US over the past six years. Two of these weeds, Palmer amaranth (resistant to glyphosate) and barnyardgrass (resistant to propanil, quinclorac, clomazone, and ALS inhibitors) have been the main focus of my research.

Herbicide resistance models for Palmer amaranth and barnyardgrass have been used to understand the evolution of herbicide resistance using current management practices along with changes in practices – both chemical and nonchemical – to mitigate the risk of resistance.

The rate of spread of glyphosate-resistant Palmer amaranth from a single resistant plant has been monitored in glyphosate-resistant cotton fields. Research focused on the biology of these weeds is helping shape weed management recommendations and point out weaknesses of particular weeds that can be targeted. For instance, we have found that Palmer amaranth does not form a highly persistent seedbank.

As a result, emphasis is placed on preventing return of weed seed to the soil seedbank, and in fields where resistant populations exist, emphasis is being placed on seed prevention through multiple means in order to rapidly deplete the soil seedbank.

Currently, we are focusing efforts on understanding when in the growing season particular weeds produce viable seed to better understand how management practices can be altered to prevent seed production and ways to target destruction of weed seed that is present at harvest.

We are evaluating and integrating diverse practices such as deep tillage and use of cover crops into our current production systems to reduce emergence of glyphosate-resistant Palmer amaranth and other weeds.

Research impact

This research has lead to the development of resistance management practices for many of the resistant prone weeds in the US.

For example, the common idea within the scientific community of using economic thresholds that allow weed seed production has been refuted by our research in terms of long-term management of weed populations to reduce the risk of resistance evolving. We have used our research, as well as that

of others, on low dose selection for herbicide resistance to point to the need to use full herbicide rates.

We have also shown that glyphosate-resistant Palmer amaranth seeds contained in cotton gin trash was being spread onto crop fields (as a 'compost') and hence, producers are no longer using gin trash as a soil amendment.

We have also pointed to the need to manage the soil seedbank not only in the field but also in areas adjacent to a field such as turnrows and ditchbanks. We have established and promoted the concept of 'zero tolerance' as a means of reducing the soil seedbank.

Best management across all crops

Best management practices (BMPs) that mitigate the risks of herbicide-resistant weeds evolving in cotton and soybean are generally no different than those recommended for other crops. Best management practices that should be emphasised in these and other crops include:

- An understanding of the biology of the weeds present;
- Start with clean fields at planting, overlaying residual herbicides;
- Scout fields routinely;
- Use multiple herbicide modes of action that are effective against the most troublesome or resistant-prone weeds;
- Use a full label rates at the recommended weed size;
- Emphasise cultural and mechanical practices;
- Prevent weed seed production;
- Prevent field-to-field and within-field movement of weedy propagules (eg suckers or buds);
- Prevent an influx of weeds from field borders;
- Manage weed seed at harvest or post-harvest; and,
- Use a diversified approach focused on reducing the soil seedbank.

Diversity of management practices, which has been lacking in most US cotton and soybean production systems, is the key to having a long-term successful weed management program. No doubt, these BMPs will increase weed management costs – but they are essential to ensuring sustainable weed management and crop production, particularly low soil seedbank densities.

Learning the lessons

Unfortunately, many of these BMPs were not used by producers of glyphosate-resistant crops in the Midsouth of the US until herbicide-resistant weeds became present. Reactive adoption of these BMPs is now occurring as a result of wide-spread glyphosate resistance in Palmer amaranth.

Hopefully, lessons learned as a result of glyphosate resistance in the US can be employed to preserve the effectiveness of glyphosate in other countries.

CONFERENCE SPEAKERS

Professor Stephen Powles

Stephen Powles is the Convenor of the International Global Herbicide Resistance Conference.


Professor Stephen Powles.

As the Director of the AHRI, Stephen has built an outstanding career as the acknowledged leading international authority in all areas of herbicide resistance. His expertise ranges from on-farm, applied agronomic research, management practices, through to an understanding of the evolution of herbicide resistance at the genetic and molecular levels. Stephen has made several world first discoveries in agrochemical research.

He was the first to show that multiple mechanisms of resistance can be combined in individual plants, conferring complex multiple resistance. Early in his career he also realised that some resistance mechanisms were able to confer broad spectrum resistance, not only to the particular herbicide that had been used on a weed population, but also to other herbicides, even chemically dissimilar herbicides or products not even used yet on a population. This opened up subsequent fields of research.

More recently, Stephen and his research team were the first to show that herbicide resistance evolution can occur when reduced herbicide rates are used. The practice of cutting rates has been common in many places around the world and previous consensus was that this did not exacerbate herbicide resistance. AHRI's research in this area, has resulted in significant management practice changes across Australia.

Dr Jason Norsworthy

Jason Norsworthy is Professor and Elms Farming Chair of Weed Science in the Crop, Soil, and Environmental Sciences Department at the University of Arkansas.


Dr Jason Norsworthy.

His research has involved understanding the evolution and spread of herbicide resistance in southern US cropping systems, specifically cotton, soybean, rice, and corn. His research has centred on developing strategies to manage resistant weeds and reduce the risk of herbicide resistance.

Jason has been awarded the title, Council of Australasian Weed Societies (CAWS) Orator at the Global Herbicide Resistance Conference. He will deliver a plenary paper on Resistance management in soybean–corn–cotton systems.

A new concept in powering large scale farming

NEW Holland has completely redesigned and upgraded its American-built T9 tractor range. The Brand's most powerful tractor, with outputs as high as 669 maximum Engine Power Management horsepower, is available in two versions:

- A standard 'Row Crop'; and,
- A heavy duty 'High Power' chassis to satisfy all farming needs.

The standard 'Row Crop' 36" chassis has been developed with tight-turning, row crop producers in mind following in-depth customer consultation.

The heavy duty 'High Power' chassis models are the most powerful four wheel drive tractors on the market and are perfect for extensive small grain growers, owner operators and large arable farmers

The ultimate operator environment

New Holland undertook extensive research with current users before designing the new T9 cab. The resulting best-in-class cab makes the T9's impressive proportions shrink around the operator. The operating logic will be familiar to users of the T7000 and T6000 series, and guarantees an unmistakeable New Holland experience.

The cab is packed with ingenious features that make farming easier. One example is the multi-award winning SideWinder II armrest that offers the ultimate in ergonomic operation, as all controls naturally fall to hand. The CommandGrip is used to control the full powershift transmission for precision gear changing, and a dedicated button also controls the forward/reverse shuttle.

The T9 range can be factory specified with New Holland's integrated IntelliSteer auto-guidance system. This complete package ensures the ultimate in ease of operation, as the roof hosts an integrated antenna position, and the system is controlled via the 178 mm IntelliView III monitor, which makes following guidance paths even easier. This fully integrated system enables year on year absolute pass to pass accuracy of 1–2 cm when using RTK signals.

New Holland's T9 tractor range comes in both row crop and high power versions.

Powerful and efficient FPT Cursor engines

The ECOBlue Selective Catalytic Reduction technology used to meet the stringent Tier 4A emissions standards was developed in partnership with Fiat Powertrain Technologies, our engine development partner. A fundamental element of the ECOBlue SCR system is AdBlue, the solution which is injected in the after-treatment system to neutralise the harmful exhaust emissions produced during combustion. It turns them into water and nitrogen, both of which are naturally present in the environment.

The ECOBlue SCR technology offers significant performance advantages. Cursor 9 and 13 SCR engines benefit from increased power of between 390 hp to 669 hp courtesy of New Holland's Engine Power Management system, which continuously adjusts engine output to perfectly match actual working conditions. This ensures the optimum generation of power by the engine, which also always runs at the most efficient settings. This guarantees both optimised performance and fuel consumption.

The FPT Cursor engines on the T9.615 and T9.670 are equipped with a two-stage turbo. The first turbo feeds the second, and results in improved engine performance due to the increased torque on offer. The constant and sustained power band, which is this system's hallmark, means that even in the most extreme conditions, the T9 will easily cope with the most demanding tasks.

Rugged frame and flexible ballasting

New Holland has completely redesigned the T9's frame to increase both strength and rigidity in order to unlock the full potential of the prodigious performance of the highest horsepower models. The range also benefits from improved manoeuvrability – the turning circle is a mere 4.9 metres.

Full powershift transmission with auto modes

The T9's transmission offering has been upgraded to perfectly match the engine offering, and ensures that the 669 hp available on the T9.670 is efficiently applied. The 16 x 2 Ultra Command full powershift transmission is easily controlled via the CommandGrip.

Ground speed management

In order to offer optimised productivity and fuel efficiency, New Holland have developed the Ground Speed Management (GSM) concept for the T9 range. Similar in operation to a CVT transmission, the operator sets the ideal working speed and then the engine rpm and gears are automatically calibrated to ensure the most efficient operation. Once the GSM mode has been engaged, the engine throttle will no longer control the engine rpm – instead it controls forward speed.

Reduced compaction and maximum traction

All T9 'Row Crop' chassis models can be fitted with extra tall RCI 50 tyres for reduced soil compaction, whilst improving the traction performance due to the longer tyre footprint. A wide offering of dual or triple tyres provides tailored performance through true power to ground traction with a large footprint. ■

District Reports…

May–June 2012

Western region

NORTH

Recent hot and dry weather has reduced prospects dramatically after patchy April rain that gave some areas good soil moisture. It is the patchiest start that I have experienced in this region with flukey rain events giving good falls on one property and next to none on the farm next door.

Seeding is about half done but many farmers in the drier parts of the region have pulled up and are waiting on rain. Some are seeding after a knockdown spray but they are putting seed into dry topsoil and will need rainfall to get these crops to germinate.

Some crops have emerged and are growing fast where there is good moisture – but crops are struggling to survive where there has only been a small amount of rain.

There may be some paddocks re-seeded once we do get a good general rain.

Three weeks ago prospects were very good for this season but with the recent prolonged dry spell, and no rain on the forecast websites, the polish has come off our start.

Peter Norris
Agronomy For Profit and Synergy Consulting, Geraldton
May 21, 2012

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)	2012 rainfall to date (mm)	Summer 25yr Annual Average (mm)	Summer 2011–12	Autumn 25yr Annual Average (mm)	Autumn 2012 to date	Winter 25yr Annual Average (mm)	Winter 2011	Spring 25yr Annual Average (mm)	Spring 2011
Emerald Qld	559	429	247	350	114	203	66	21	120	81
Toowoomba Qld	670	326	265	330	140	121	86	91	176	186
Roma Qld	594	385	238	550	133	64	75	38	139	143
Goondiwindi Qld	630	231	242	360	140	51	101	82	141	251
Narrabri NSW	661	206	235	197	130	57	132	68	163	329
Gunnedah NSW	682	314	232	371	132	39	128	44	184	321
Dubbo NSW	621	364	196	291	136	148	129	79	157	239
West Wyalong NSW	450	146	112	149	92	32	118	76	127	196
Wagga Wagga NSW	547	367	129	193	117	242	154	108	146	211
Swan Hill Vic	335	106	74	82	70	56	94	64	98	91
Bendigo Vic	543	201	114	140	112	95	176	147	142	146
Horsham Vic	385	58	86	42	77	46	133	101	110	95
Lake Bolac Vic	562	111	129	48	104	87	160	102	154	112
Murray Bridge SA	367	131	65	93	75	96	124	96	102	86
Kadina SA	344	80	56	79	78	51	117	102	91	62
Cummins SA	391	73	50	45	84	57	173	116	83	80
Esperance WA	613	166	76	107	141	121	254	230	140	186
Wagin WA	409	71	43	115	95	49	180	183	86	167
Northam WA	405	63	41	55	87	24	195	225	81	129
Mingenew WA	368	41	31	22	93	25	181	205	63	88
Moora WA	393	105	40	104	94	17	187	155	71	102
Mullewa WA	330	39	50	13	96	27	138	174	46	60

Last rainfall reading May 21, 2012.

District Reports…

May–June 2012

Southern region

SOUTH AUSTRALIA

Weather

Temperatures during March were average to below average across most of South Australia with above average temperatures during April.

Rainfall was above average in most districts during March. But falls were below to well below average during April.

Widespread rains were received from April 20 to 23 across the southern areas of the state, with more than 40 mm recorded in some areas (Lower Eyre Peninsula, Kangaroo Island, Adelaide Hills and Lower South East). Recordings varied greatly across the remainder of the state.

Crops

Control of summer weeds and the first germination of winter weeds continued through March and into early April. Cultivation was used in the Northern and Mallee districts where weeds were woody or had become moisture stressed and herbicide control would not have been effective.

Increasing snail numbers are being reported in almost all districts with burning and baiting during March and April being used to control numbers.

Mouse numbers are building-up on Yorke Peninsula, with growers preparing to bait paddocks at seeding.

Seeding commenced in those areas of the state that received significant rains from April 20 to 23. Canola, beans and lupins have been the first crops sown. In areas which received less than 5 mm, some growers started dry seeding.

Cropping area is likely to be reduced in the lower rainfall areas of the state with many growers opting to leave higher risk cropping paddocks as pasture. The area sown to wheat is likely to fall across the state due to forecast low prices.

There is also likely to be a small reduction in the area sown to barley and a continued swing away from malting varieties, particularly on Eyre Peninsula, where there are limited segregation options.

The area sown to peas and lentils may fall in a number of districts, due to problems with compliance with receival standards.

The area sown to canola is likely to increase substantially given the positive outlook for prices relative to other crops and significant levels of stored soil moisture in some districts. The final area to be sown to canola in low and medium rainfall districts may not be as large if significant rain is not received by the middle of May.

Growers are using a combination of black-leg resistant varieties (where available), seed, fertiliser and foliar applied fungicides and careful paddock selection to reduce the risk of black-leg in canola.

The area sown to milling oats is likely to increase in the South East with the expansion of Blue Lake Milling.

Pastures

Pasture feed supplies throughout the state are extremely low and most livestock producers have been supplementary feeding stock to maintain condition.

The rain in the last few weeks of April has germinated pastures in most areas of the state, except the Upper and Mid North and Mallee regions.

Growers began dry sowing cereals for stockfeed and pasture seeds during early to mid April in most districts, taking advantage of warm soil conditions.

Supplementary feed supplies have all but been exhausted in the South East.

Michael Wurst
Farming Systems Consultant, Rural Solutions SA
May 15, 2012

WESTERN MURRAY VALLEY

Winter crop sowing has all but finished and its only mid May. With little to no rainfall for four weeks sowing has been (unfortunately) uninterrupted.

Rainfall to date in 2012 has been 32 mm January, 44 mm February, 76 mm March, 8 mm April, 3.4 mm to May 17. Summer rainfall was 173 mm – and assuming 30 per cent of that is retained – we have received so far 87 mm.

As great as the early rains have been there are very few crops that have emerged from soil moisture and most crops are now sitting in dry topsoil waiting for a germinating rain.

It is interesting to note that best management practices have made a big difference with crop establishment. Good summer weed control, full stubble retention and minimal tillage with disc machines or knife point press wheels have been the key to crop emergence.

With a poor commodity price outlook for cereals there has been a substaintial increase in canola plantings. Lupin and pea crops are still only one to two per cent of the total crop area.

This canola emerged with no rainfall! The crop was sown with an NDF disc machine into full stubble retention and summer weeds were controlled to retain moisture.

Barley plantings are down to 10–15 per cent – this is a crop which usually comprises 30–40 per cent of the area.

With an increase in water allocation – and a strong likelihood with full dams that water will be available for the next three to four years – the traditional practices of sub clover pastures and livestock production is on the increase. Pasture production in general is up with livestock prices holding. Many dryland farmers have opted to sow paddocks to forage brassica's or dryland lucerne to improve fodder production rather than increase grain production.

Laurence Pearce shows off some magnificent Antas clover on the Gleeson brother's farm at Wakool. The clover was sown at eight kg per hectare under an irrigated crop of Wedgetail wheat in the 2011 season. With a vastly improved water situation, subclover is making a comeback.

The benefits of stubble retention and good planting equipment on show here at Ray Smith's Mathoura district property. Hyola 555TT canola was interrow sown at 12 inch spacings into five tonnes per hectare wheat stubble using an Excel disc machine. No rainfall at the time of this photo, but the canola is emerging nicely

District Reports...

May–June 2012

Summer crops

Rice harvest finished in late April–early May with some irrigation layouts slow to drain off after the big 70–100 mm rain in March. The majority of rice has been slightly above the district average of 8.6 tonnes per hectare with many growers reporting 9.0 to 9.6 tonnes per hectare. Hail affected the Bunnaloo area with a number of growers losing 60–80 per cent of their crop (a great reminder of how essential crop insurance is!)

With only minimal corn plantings, harvest was over quite quickly. Yields were very pleasing with some exceptional crops reaching 18 tonnes per hectare. With an increase in water availability growers will be leaving paddocks out this winter to try and utilise low value water for a high return crop (if corn prices can hold up!).

Soybean crops have been variable with some poorer drained soils – and lack of experience with a different crop – resulting in two tonnes per hectare yields. Better draining soils, with better management, has seen some 2.5–3.0 tonne crops which makes double cropping attractive with soybeans.

Fingers crossed for some crop emerging rains.

Laurence Pearce
Agronomist, IK Caldwell, Deniliquin NSW
May 17, 2012

SWATTING UP ON SUNFLOWERS

Expressions of interest are open for a workshop on better sunflower production, supported by the Grains Research and Development Corporation, to be run at Dubbo on August 3.

Interested growers and advisors should contact Liz Alexander, Australian Oilseeds Foundation (AOF) *Better Sunflowers* coordinator on 0429 471 511 or bluedogag@bigpond.com.au.

For more information on GRDC's investments or to download fact sheets on sunflower production, visit www.grdc.com.au.

District Reports…

May–June 2012

Northern region

LIVERPOOL PLAINS

While high grain moisture levels have seen a slow start to the sorghum harvest; frustrating everyone in the region, there has been a flurry of activity in the last week and it is finally happening. This year's sorghum saw three distinct planting periods in late October, late November and then December.

The early planted crops have yielded a very respectable 7.5 to 10 tonnes per hectare but the later plantings had a combination of wet feet, leaf rust and ergot getting the better of them resulting in more modest yields of between 5.5 and 8.0 tonnes.

Some crops planted very late December and early January suffered frost damage and didn't get a chance to finish properly and therefore will yield poorly.

Sunflowers have also been a tale of two plantings. Spring planted sunflowers yielded between 2.4 and 3.0 tonnes per hectare with some very good oil bonuses contributing to the bottom line. But the later planted crops have been disappointing to date, with crops suffering high pressure from loopers and not filling well in the centre of the heads.

While the entire late plant still hasn't been finished, there have been unconfirmed yield reports at much less than one tonne per hectare for some late plant crops. Hopefully very late plant crops will perform to a higher standard.

Cotton, although slow to finish, has been proving to yield above expectation – despite what has been a cooler and wetter summer than usual. Defoliation timing has proven to be a difficult decision for most, as the crop has been seemingly two weeks behind all season which has led some to delay their defoliations to well after the traditional first frost period of Anzac Day.

With early mungbeans, while providing a respectable yield, quality was spoilt by another very wet harvest period resulting in a lot of crops being relegated back to feed or low processing quality. Late mungbean quality was very good, although those who opted to plant on wider rows (75 cm) were severely penalised back to yields of 0.8 to 1.2 tonnes per hectare. Narrower row spacings achieved around 1.8 to 2.0 tonnes.

There has been a bit of winter crop planted to date – consisting mostly of canola and some very early planted chickpeas. On the whole, cereal area is expected to be down in favour of canola. Chickpeas will make a mini comeback to the area, although they still won't return to an average plant at this stage.

While it is still early, there will need to be more rain for the main season wheat plant to get underway.

Wishing everyone the best of seasons.

Peter McKenzie
Agricultural Consulting & Extension Services, Quirindi
May 19, 2012

DARLING DOWNS

Summer crops

The high yielding harvest has continued with sorghum, soybean and cotton all shining, whilst mungbeans have been very ordinary. Late corn is still to be harvested, but sorghum yields continue to be in the four to eight tonnes per hectare range.

Dryland soybean have had an exceptional year with yields around the 2.5 tonnes per hectare – some yield tested areas have gone over 3.5 tonnes.

Mungbeans have been disappointing with many crops only around 0.75 to 1.25 tonnes per hectare – the best has been around 1.5 tonnes.

Many sunflowers are yet to be harvested but early crops have yielded strongly and the late crops look just as good.

Dryland cotton yields have varied according to stored moisture with the best crops around a very healthy 7.5 bales per hectare. Irrigated cotton crops have been exceptional with yields between 7 and 12.5 bales per hectare.

The price changes across all commodities have made marketing more difficult this season – and with reduced prices, growers have been disappointed with the gross margin returns.

Winter crops

A smaller than usual planting of oats has benefitted from the late April rain and are now growing well, but some crops require a fungicide as leaf rust has started to appear.

Early chickpeas have started to be planted, into what will be a significant increase in area over last season. The strong price and a neutral SOI weather outlook has seen some grower confidence return to chickpeas.

Some growers are planting early wheat and barley, trying to catch the moisture before it disappears in the current dry spell. A small area of canola is already in.

The bulk of the winter plant is not expected to occur until late May and will continue through June. Growers have switched where possible with rotations to crops such as chickpeas and canola, due to the stronger prices with these crops.

Legumes are also popular because of the increasing cost of nitrogen fertiliser this winter.

Hugh Reardon-Smith
Agronomist, Landmark Pittsworth
May 16, 2012

MARANOA

Summer crops

This summer season we saw an average area planted to sorghum and mungbeans for our region. Yields held for the most part despite heavy rainfall through the early part of 2012.

Some mould issues in the spring mungbeans were inevitable with the untimely February/March rainfall. There were also reports of shelling in sorghum crops. But even with this grain loss, some crops were going as high as four tonnes per hectare.

There is still some late summer crop to be harvested.

The majority of cotton in the area has been picked, although some difficult weather conditions have hindered yields.

District Reports...

May–June 2012

Despite a difficult growing seaon, sorghum yields generally held up in the Maranoa district with some crops going as high as four tonnes per hectare.

Winter crop

The winter plant is well underway, although a dry start has prompted some growers to adopt an early and deep planting strategy.

The low wheat price is a hot and depressing topic, and has resulted in a large area of traditional wheat country going under chickpeas.

The oat crops are in and many are ready for grazing, although these crops are starting to look for a drink.

Kirsty Wild
Account Manager Agronomy, Landmark Roma
May 18, 2012

SOUTH BURNETT

Key issues

- Summer crop harvest still underway;
- Frosts have damaged late crops of peanuts beans and corn;
- Low corn and sorghum prices; and,
- Little enthusiasm for winter cereals.

Another summer season is drawing to a close. It has been a year of ups and downs, but much better than the disastrous floods of the previous summer.

Peanuts, our main summer crop, have produced some very good crops of over five tonnes per hectare and some poor yields of closer to one tonne. Some crops that received very heavy rain at emergence never recovered. Soil borne diseases such as white mould, neocosmospora and sclerotinia affected some crops.

We were fortunate not to have the devastating yield losses in Central Queensland from neocosmospora and around Bundaberg from fusarium.

Controlling net blotch in peanuts was a challenge with the wet days and susceptible varieties. Many crops were sprayed three times and should have been sprayed more, but with dryland crops the costs have to be balanced out.

As many crops were planted later than ideal, in late December rather than early January, we are running into cool weather and frosts as crops try to mature.

Corn crops are generally looking good. Again late plantings are at risk of late crops so it will be touch and go, but we should be safe in most situations. The earlier crop harvest will start in a couple of weeks. Most corn yields should be in the range of 3.5 to 5.0 tonnes per hectare. Price and ability to sell the grain quickly are the main issues at present.

Soybean yields have been good with excellent quality. Yields commonly range from two to three tonnes per hectare. Soybean loopers were an issue this year with some crops sprayed twice. Looper numbers were as high as 100 per metre. Green vegetable bugs, brown bean bugs and aphids were also issues.

Mungbeans are yielding above expectations at 1.25 to 2.0 tonnes per hectare. Issues have been powdery mildew, heliothis, pod sucking bugs and frosts.

Planting of winter crops has started around Murgon. Growers are quite disillusioned about the price prospects for wheat and barley. We will have an increase in the chickpea area.

Ian Crosthwaite
BGA AgriServices, Kingaroy
May 15, 2012

CENTRAL QUEENSLAND

Rainfall

Rainfall of 25–50 mm on the Central Highlands at the end of April 2012 was perfectly timed for winter crop planting. The Dawson received about 15–25 mm and would have liked more. The Callide Valley, which mostly missed out with only about two to five mm, is dry with only a few farmers choosing to moisture seek wheat and chickpeas. Many farmers in the Callide are waiting and hoping for more rain soon before planting.

Livestock and pastures

Pastures on the Central Highlands and Dawson have been excellent all summer and have only recently declined in quality as the grasses mature and cooler weather arrives. Pastures in the Callide Valley are much drier and less abundant.

District Reports…

May–June 2012

The condition of most cattle reflects the excellent pasture condition and cattle have generally achieved high weight gains throughout summer. Cows are fat and weaners are shiny and well grown and bullocks are generally in top order.

Cropping and horticulture

Sorghum: Sorghum harvest has started on the early January planted sorghum although most farmers have stopped harvesting at present to plant wheat and chickpeas. A few paddocks have recorded excellent yields reflecting high rainfall and good growing conditions but many paddocks were short of nitrogen during the growing season, with reduced yields the result. The late January/early February planted sorghum is still at the soft dough stage. I estimate the sorghum area at only about 160,000 hectares this summer. Low grain prices continue to cast a huge shadow over the grain industry. This doesn't look likely to change in the near future while the Aussie dollar remains high and world grain supplies – especially for lower quality grain – are high.

Mungbeans: Much of the CQ summer mungbean crop was downgraded by a wet week of rain in March. Yields were substantially reduced by a widespread infection of puffy pod. A lower price (down from the $800 to $1400 per tonne a couple of years ago) and the advent of puffy pod has changed mungbeans from a very attractive alternative crop with an increase in the area planted each year, to some farmers again refering to it as 'mongrel beans'.

Sunflower: Better prices for sunflower – coupled with lower prices for other grain and a reduced incidence of tobacco streak virus – has resulted in a sizeable increase in the area planted to probably about 15,000 hectares on the Central Highlands.

Winter crop

Chickpea: A few years ago 30,000 hectares of chickpeas was about average for CQ. Then in 2009 the area planted grew to 50,000 hectares and in 2010 a record planting of 80,000 hectares occurred only to end in tears with major weather and disease damage across most of CQ. I expect that the final count this winter may exceed 100,000 hectares with lack of seed preventing more area being planted. Grain price is the major driver – a higher price for chickpeas and a low price for wheat and sorghum.

Wheat: Both wheat and chickpeas are still being planted so the final number won't be known for a while but I estimate somewhere above 150,000 hectares of wheat for CQ.

Weeds: Controlling feathertop Rhodes grass is still a major issue for CQ farmers. Farmers are again buying large horsepower tractors and tandem discs. Some are resurrecting old chisel ploughs from the long grass. Large areas that were previously zero tilled for many years have been ploughed to control feathertop Rhodes grass. A few farmers have given up on their worst effected paddocks and are considering planting pastures.

Water: Following a run of wet years, natural springs on the Central Highlands have started to run again after even small rainfall events.

Maurie Conway
Principal Technical Officer
Grower Solutions for Central Queensland
Agri-Science, Emerald, Qld
May 18, 2012

ANSWER TO IAN'S MYSTERY TRACTOR QUIZ

The tractor is a 1936 International W 30, possibly the top selling grain farm tractor of the period. (IMJ collection)

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