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FRONT COVER

Pre-emergents for better weed control

Chris Preston from the University of Adelaide says new pre-emergent herbicides will broaden our weed control options. See articles pages 8 and 15.

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Editorial... Lloyd O'Connell

AUSTRALIA has had some very unwelcome visitors to her shores in recent months – and there's no turning them back. We are currently being overwhelmed with a crescendo of coronavirus information and predictions while the exotic fall armyworm pest has quietly slipped across the Torres Strait and into Queensland's Cape York Peninsula. Depending on where you live and run your farming business, both unwelcome arrivals are having immediate and varying degrees of impact on how we go about our daily lives.

Australian farmers, by the very nature of their way of life, are well ahead of the coronavirus curve and have been effectively practicing self-isolation for more than 200 years – but without downplaying the impacts on personal health, the virus has the potential to disrupt the supply of some imported farm inputs such as fertiliser and agri-chemicals, much of it sourced out of China. Many re-sellers are saying that these supply disruptions need only be small and short-lived, particularly with Chinese factories gradually coming back on line – as long as there is no panic buying.

There are some positives

People around the world will continue to eat and wear clothes. This puts food and fibre producers in a much more positive environment than most in times of a global pandemic. We are also seeing the lowest crude oil prices in many years putting downward pressure on major farm inputs while a low Aussie dollar is boosting the value of our farm exports. And the beautiful widespread rain across much of our national grainbelt since the New Year, is the cherry on top. Even the federal and state governments are doing their bit by offering a range of taxation and investment incentives for the coming season.

We can also a put a positive spin on the fall armyworm (FAW) outbreak. Given the world-class monitoring and control capabilities of Australian farmers when it comes to insect pests, we are well placed to manage FAW. Environmentally, we might also have an advantage in that the pest slows down considerably in temperatures below 10°C – and frosts stop it dead. It appears that in most seasons FAW may not be an issue any further south than Central Queensland.

We can also learn from our own as well as global experience – and mistakes – when it comes to the control of a new exotic pest. Australia is among the last food and fibre producing countries to have a FAW incursion, so we can learn from the control strategies put in place by countries such as the US. And we can learn from some of the past mistakes we have made (read here, the Ord River in the 1960s and 70s) in controlling unwelcome arrivals.

Let's hope the rains keeps coming and your families remain healthy, happy and optimistic.

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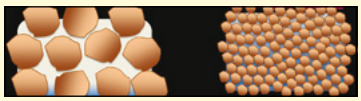
In this issue...

Pre-emergents for better weed control



Over the past 20–30 years, resistance to many post-emergent herbicides has developed to the stage where many growers are now again heavily reliant on pre-emergent herbicides as the foundation of weed control programs.
See article . . . . . Page 8

Contemplations

The new decade is now upon us. We enter it with anticipation, indeed assumption, that as 2020 progresses it will impart a more tranquil and favourable era, as distinct from the anguish and suffering from the drought and bushfires, inflicted mercilessly upon so many rural communities.
See article . . . . . Page 19

Wheat disease 'boom and bust' cycle

Latest research has uncovered a 'boom and bust' pathogen cycle that may be the key to developing new and improved management strategies and disease ratings for the damaging wheat disease septoria nodorum blotch.
See article . . . . . Page 24

Sorghum production lowest in 50 years?

What a difference a month makes. Substantial rainfall across the majority of the nation's winter and summer cropping regions, on top of isolated storms in the preceding five weeks, has swung the mood across rural Australia from one of heightened pessimism to one of guarded optimism.
See article . . . . . Page 25

Coronavirus and agriculture – how worried should we be?

The coronavirus outbreak is already having a severe impact on China's foodservice and on-trade channels and this could become "more serious and longer-lasting" if the virus is not contained in the next six to eight weeks, leading agribusiness banking specialist Rabobank has warned.
See article . . . . . Page 27

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‘Rule breaking’ plants may be survivors in a changing climate

AT A GLANCE…

- Plants that break some of the ‘rules’ of ecology by adapting in unconventional ways may have a higher chance of surviving a changing climate.
- Researchers are studying the humble plantain (*Plantago lanceolate*) to see how it became one of the world’s most successfully distributed plant species.

PLANTS that break some of the ‘rules’ of ecology by adapting in unconventional ways may have a higher chance of surviving a changing climate, according to researchers from the University of Queensland and Trinity College Dublin.

Dr Annabel Smith, from UQ’s School of Agriculture and Food Sciences, and Professor Yvonne Buckley, from UQ’s School of Biological Sciences and Trinity College Dublin Ireland, studied the humble plantain (*Plantago lanceolate*) to see how it became one of the world’s most successfully distributed plant species.

“The plantain, a small plant native to Europe, has spread wildly across the globe – we needed to know why it’s been so incredibly successful, even in hot, dry climates,” Annabel said.

The global team of 48 ecologists set up 53 monitoring sites in 21 countries, tagged thousands of individual plants, tracked plant deaths and new seedlings, counted flowers and seeds and looked at DNA to see how many individual plants have historically been introduced outside Europe.

What they discovered went against existing tenets of ecological science.

“We were a bit shocked to find that some of the ‘rules of ecology’ simply didn’t apply to this species,” Annabel said.

“Ecologists use different theories to understand how nature works – developed and tested over decades with field research – these are the so-called ‘rules’.

“One of these theories describes how genetic diversity or variation in genes embedded in DNA are produced by changes in population size.

“Small populations tend to have little genetic diversity, while large populations with many offspring, such as those with lots of seeds, have more genetic diversity.

“Genetic diversity sounds boring, but actually it’s the raw material on which evolution acts – more genetic diversity means plants are better able to adapt to environmental changes, like climate change.

“We discovered that, in their native range, the environment determined their levels of genetic diversity.

“But, in new environments, these rule breakers were adapting better than most other plants.”

‘Expat’ plants more adaptable

The team found the plantain’s success was due to multiple introductions around the world.

Yvonne Buckley, who coordinates the global project from Trinity College, Dublin Ireland, said the DNA analysis revealed that ongoing introductions into Australia, NZ, North America, Japan and South Africa quickly prompted genetic diversity.

“It gave these ‘expats’ a higher capacity for adaptation,” Yvonne said.

“In Europe plantains played by the rules, but by breaking it outside of Europe, it didn’t matter what kind of environment they were living in, the plantains almost always had high genetic diversity and high adaptability.”

Annabel said the finding was fascinating and critical, for two crucial reasons.

“It’s important we now know that multiple introductions will mix genetic stock and make invasive plants more successful quite quickly – an important finding given invasive species cause extinction and cost governments billions of dollars,” she said.

“And secondly, research on invasive plants gives us clues about how our native plants might adapt to a changing climate.”

Further information: The research is published in PNAS (DOI: 10.1073/pnas.1915848117).

Lead author Dr Annabel Smith measures a plantain during the annual census on Inis Oirr, Ireland. (PHOTO: Dr Annabel Smith)

A plantain (*Plantago lanceolata*) growing in its native habitat, Ireland. (PHOTO: Dr Annabel Smith)

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Understanding pre-emergents for better weed control results

By Mark Congreve, Independent Consultants Australia Network

OVER the past 20–30 years, resistance to many post-emergent herbicides has developed to the stage where many growers are now again heavily reliant on pre-emergent herbicides as the foundation of weed control programs. This is especially the case with annual ryegrass.

During this timeframe we have also seen a change in farming practice. Most paddocks now have zero or minimum tillage, with implications for the position of weed seeds in the soil and the ability to incorporate pre-emergent herbicides.

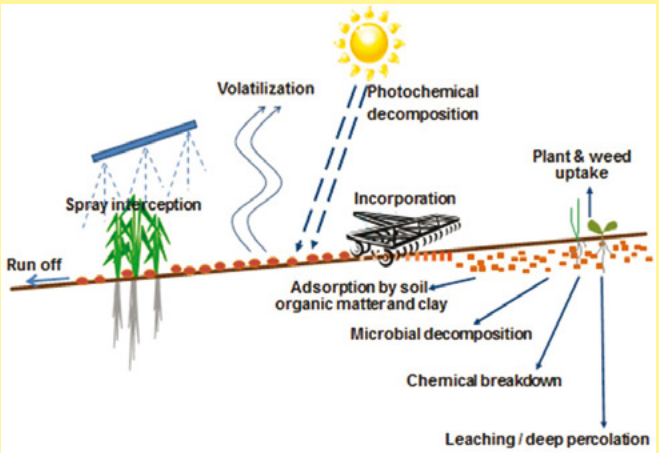
These factors have resulted in the development of 'incorporate by sowing' (IBS) technology which allows for 'grass killing' herbicides, several of which are toxic to the cereal crop, to be used at planting in crops such as wheat and barley.

To achieve acceptable weed efficacy with minimal crop injury, users benefit from understanding the chemical properties of pre-emergent herbicides and how they interact within their micro-environment.

This article discusses the main factors affecting pre-emergent herbicide availability, the importance of correct positioning of herbicide in the soil, and how to avoid carryover and crop damage the following year.

From 2020, numerous new pre-emergent herbicides will become available to Australian grain growers. Understanding the factors that influence pre-emergent herbicide availability will enable users to better predict how these herbicides will behave in their farming system.

FIGURE 1: Key loss pathways for pre-emergent herbicides



Factors affecting pre-em behaviour

Application of pre-emergent herbicides is targeted at the soil surface, with incorporation by sowing (IBS) or follow up incorporation moving the herbicide into the soil profile, where it is then available for uptake via weed seeds. Many factors influence how herbicides enter the soil and what happens once in the soil (Figure 1).

A wide range of pre-emergent herbicides are available for use by Australian grain growers. There are significant differences in the chemical properties of these herbicides, so it is important to understand how they differ and the impact on each loss pathway.

Interaction with stubble

Pre-emergent herbicides are typically applied with a standard boom spray, with the target being the soil surface. As would be expected, higher volumes of stubble in the paddock will intercept a greater percentage of the applied spray.

It is important to understand if spray deposited on stubble can be washed off with subsequent rainfall or whether it will be difficult to remove from stubble once it has dried.

To predict the ability to wash off stubble we need to understand the herbicide solubility and the absorption (binding) coefficient (Koc). Herbicides such as trifluralin, with low solubility and strong absorption to organic matter, will be almost impossible to remove from stubble after the spray has dried, so herbicide deposited on the stubble is effectively 'unavailable' for weed control.

At the other extreme, herbicides with very high solubility and very weak binding to organic matter, for example Group B (Acetolactate synthase (ALS) inhibitors), will wash off stubble and into the soil following the next significant rainfall event.

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GROUP K HERBICIDE

TABLE 1: Relative herbicide affinity for binding to stubble.

Tight binding	Relatively tight binding	Low mobility	Some mobility	Mobile
Won't wash off stubble after spray has dried	More difficult to wash off stubble after spray has dried	Requires significant rainfall to remove from stubble	Will wash off stubble with adequate rainfall	Relatively easy to wash off stubble.
Pendimethalin Trifluralin	Prosulfocarb Tri-allate	Diuron Flumioxazin Propyzamide Napropamide Isoxaben	Atrazine Simazine Terbuthylazine Pyroxasulfone	Group B Group I Metazachlor S-metolachlor

Other herbicides fall somewhere in between, depending upon their chemical properties.

Two new pre-emergent herbicides are expected to be available in 2020. Overwatch (bixlozone) is a Group Q herbicide and Luximax (cinmethylin) is expected to be initially allocated to Group Z. Based on published chemical properties of these new herbicides, it is predicted that they will most likely be included into the 'some mobility' group (Table 1).

Where stubble is no longer standing this is likely to increase spray interception and further reduce the ability of the herbicide to reach the soil. In these situations, users would be best advised to select a mobile herbicide that will be easier to wash through stubble.

When using pre-emergent herbicides that are less likely to wash off stubble, there are several tactics that can be employed during the spraying operation to reduce the proportion of herbicide captured by stubble. These include:

- Travel with the rows, ideally with a cross breeze.
- Use large (very coarse or greater), solid droplets.
- Reduce nozzle spacing to 25 cm.
- Lower boom height as far as practical (double overlap to be maintained at top of stubble, weeds, crop or soil – whichever is highest)
- Narrow fan angle (for example; 65° or 80°).
- Travel speed <16 km/hr, and/or backward facing nozzles.
- Increase water rates. As a guide, minimum carrier volume of:
  60 L/ha – no stubble.
  80 L/ha – light stubble.
  100 L/ha – moderate stubble.

The use of water sensitive paper to pre-check herbicide deposition on the soil surface is highly recommended.

Loss pathways before entering the soil

Some herbicides are subject to degradation by ultra-violet light on the soil surface prior to incorporation. This can be a significant loss pathway for certain herbicides particularly when applied to no-till fallows in summer. But when applied in autumn prior to planting winter crops and incorporation follows soon after application, this loss pathway is generally not significant.

Certain herbicides can be subject to volatilisation losses as some of the applied herbicide may transition into a gaseous phase after the spray has dried and then be lost to the atmosphere. While there are many factors that affect the rate at which volatilisation occurs, it is useful to look at the vapour pressure of the herbicide as this can show relativity between herbicides.

As a general principle, the higher the vapour pressure, the more urgent it is to have the herbicide incorporated into the soil before losses become significant. Volatility losses from herbicides with a vapour pressure below 1 mPa @ 20–25°C is generally insignificant.

Of the pre-emergent herbicides used in grain crops, trifluralin is the most sensitive to losses due to volatility. Trifluralin has a relatively high vapor pressure, very low solubility and tight binding to soil and organic matter. This means that rainfall is not useful for incorporation and trifluralin requires mechanical incorporation soon after application.

The rate of trifluralin loss prior to incorporation is difficult to quantify, as there are many factors that influence this (Table 2).

It is important to understand that where volatility losses are significant, they may not be noticed via compromised weed control in the immediate weeks after application. Often, 'enough' herbicide will still make it into the soil to achieve weed control for the first few weeks after application. Excessive losses to volatility prior to incorporation are most likely to be expressed as a shorter effective residual life of the herbicide.

Achieving weed control and crop selectivity

Most herbicides effective against annual ryegrass can be toxic to winter cereal crops should the herbicide be taken up by the crop. It is important that the herbicide is positioned where it will come into contact with the weed seed, but not into contact with the cereal crop seed and/or emerging shoot/roots.

To provide weed control and crop safety we need to understand herbicide mobility in the soil and the positioning of herbicide in relation to the weed and crop seeds.

Mobility in the soil (Table 3)

Mobility in the soil depends on the herbicide solubility and the absorption (binding) coefficient (Koc), soil texture and the level of soil moisture.

Herbicides with low solubility and strong binding to soil and organic matter (i.e. high Koc value) will tend to remain close to the soil surface. These herbicides are well suited to IBS application, in that the herbicide can be physically positioned away from the crop seed and will largely remain close to where it was incorporated. While this improves crop safety, it also

TABLE 2: Factors influencing trifluralin volatilit

Conditions where losses are minimal	Conditions increasing speed of loss and reducing length of residual control
• Cooler temperature • Dry surface at application • Still conditions • Rapid mechanical incorporation • Good incorporation – Well set up tine seeder	• Warmer temperature • Moist surface at application • Wind/breeze blowing across the surface • Delayed incorporation (>24 hours) • Poor incorporation e.g. – Poor soil throw from tine seeder – Low disturbance disc seeder – Cloddy soil

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TABLE 3: Herbicide mobility in the soil

Tight binding	Relatively tight binding	Low mobility	Some mobility	Mobile
Pendimethalin Trifluralin	Prosulfocarb Tri-allate	Diuron Flumioxazin Propyzamide Napropamide Isoxaben	Atrazine Simazine Terbuthylazine Pyroxasulfone	Group B Group I Metazachlor S-metolachlor
Will stay relatively close to soil surface (unless physically moved, or excessive rainfall soon after application). Suits IBS (incorporate by sowing) with tines.				Will move horizontally and vertically with soil moisture. More likely to come in contact with the crop seed = higher potential for crop injury.

means that the less mobile herbicides will not control weed seeds germinating in the crop row where the herbicide has been physically removed from the planting line.

Conversely, more mobile herbicides (high solubility, low Koc value) will be primarily positioned with the soil moisture and will move both horizontally and vertically in the soil profile with soil water movement. Rainfall after application will distribute these herbicides more widely in the soil, including potentially around the crop seed, with crop injury often observed when this occurs.

Soil type/texture and soil moisture also influence movement in the soil (Figure 2). 'Heavy' soils, or soils with high organic matter, have more physical binding sites and smaller air spaces between soil particles. This means that any herbicide movement is likely to be less in these soil types. Whereas in 'light' or 'sandy' soils, it is likely that all herbicides may move further than in a heavier soil. Risk is higher when heavy rainfall occurs soon after application in a light soil.

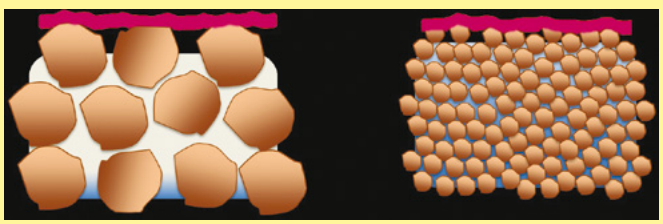
Where the herbicide is applied to a dry soil profile and there is a significant rainfall event after application, all herbicides are likely to move further than expected with a wetting front that is moving quickly down the soil profile. Conversely, if the soil moisture profile is relatively 'full' at application, herbicide movement is likely to be slower following the incorporating rainfall; allowing more time for soil binding to reach an equilibrium.

Where are the weed seeds?

Where zero till farming is practiced, it is likely most of the grass weed seeds will be very close to the soil surface (Figure 3). This is important for effective weed control when using immobile herbicides that are incorporated via the IBS technique. With IBS application, herbicide treated soil in the planting line is thrown into the interrow leaving an area of 'untreated' soil along the planting line in which the crop can emerge. Where the weed seeds are on the soil surface, these will also be thrown out of the planting line with a correctly setup tine seeder.

Where a paddock has been cultivated in recent years, it should be expected that weed seeds will be distributed throughout the soil to the depth of tillage. Should an immobile herbicide be used, and a tine seeder used to throw the herbicide away from the planting line, then it is likely that weed seeds at the bottom of the planting furrow will establish along the planting row.

FIGURE 2: Lighter soil types (left) have more air spaces between soil colloids, resulting in greater potential for herbicide movement and less binding. Herbicide movement will be less on heavier soil types (right).



Crop and weed physiology

The ability to use the IBS technique in winter cereals is further enhanced by the differences in crop physiology between wheat and barley and other grass weeds (Figure 4)

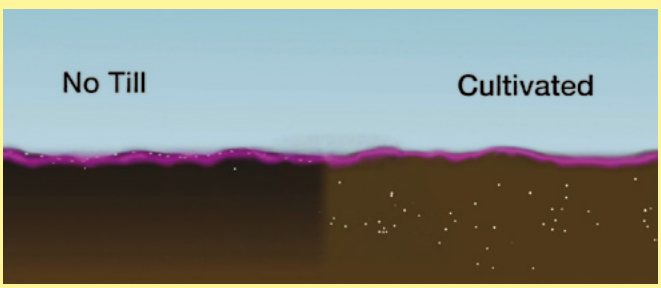
With most grass weeds (and some grass crops) the mesocotyl elongates during germination, pushing the herbicide sensitive coleoptile node and secondary roots towards the surface, and into the zone of herbicide (Figure 4). The mesocotyl does not elongate in wheat and barley, thus keeping the coleoptile node lower in the soil profile and allowing for vertical separation from the immobile herbicide at the soil surface.

IBS application of immobile herbicides

Australia has developed the IBS application technique using knife points and press wheels (Figure 5), to allow relatively immobile 'grass killing' herbicides to be positioned away from the wheat or barley crop. This technique relies on:

- Weed seeds being close to the soil surface, and therefore also thrown into the interrow with the pre-emergent herbicide.
- Seeder setup and soil conditions that ensure herbicide treated soil is thrown from the planting line, yet not into the adjacent crop row.
- This requires close attention to seeder setup, and this should be carefully monitored and adjusted during planting with changes to soil type, level of stubble and soil moisture.

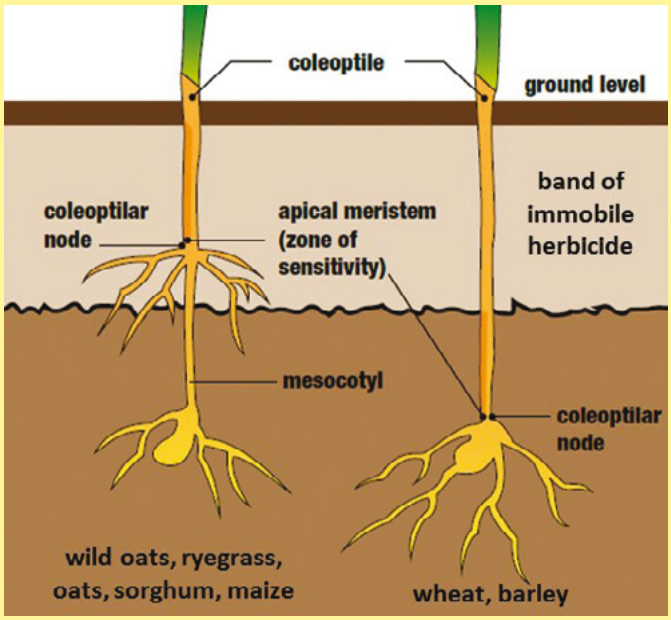
FIGURE 3: Location of weed seeds in the soil profile (weed seeds represented by dots)



Herbicide persistence

Persistence in the soil varies considerably between different herbicides. The length of persistence is a function of the speed of degradation and the application rate.

FIGURE 4: Differences in mesocotyl elongation is important for herbicide separation in wheat and barley



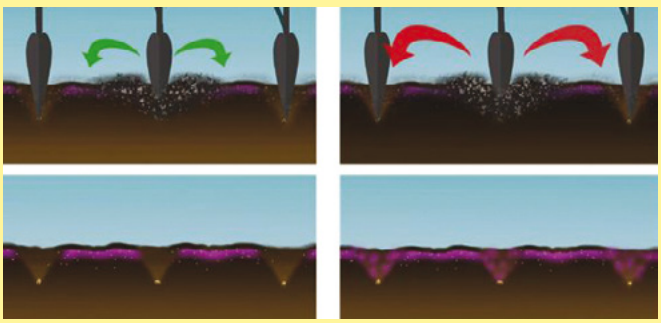
Adapted from Hall, Beckie & Wolfe (1999). *How Herbicides Work*.

Understanding the herbicide half-life in the soil is useful in predicting length of control and likelihood of carry-over issues the following season. Herbicide half-life is normally presented as an average and a range of DT50 values (days of time for 50 per cent of the herbicide to dissipate) when measured across several trials, environmental conditions and soil types.

Herbicides with an average DT50 of < 30 days are generally considered to be relatively non-persistent and usually have minimal plant-back constraints the following season. In order for these 'non-persistent' herbicides to be able to provide weeks/months of residual control, the application rate typically needs to be very high in relation to what is required to kill the weed, as they will be quickly breaking down over time.

Herbicides with longer half-lives (higher DT50 values) will

FIGURE 5: Correct IBS using knife points (left) removes herbicide treated soil and weed seeds from the planting line. Excessive soil throw (right) can result in unacceptable crop damage.



typically provide longer, but often more variable persistence. These herbicides are likely to have plant-back constraints on the label.

Herbicide breakdown

A small number of herbicide groups have non-microbial degradation pathways that significantly contribute to herbicide breakdown. Hydrolysis is typically the primary pathway in the degradation of sulfonylurea and triazine herbicides. For these herbicides, the hydrolysis reaction requires adequate soil moisture and a neutral or acidic soil pH.

As soil pH becomes more alkaline, the speed of this hydrolysis pathway slows and may stop completely. Should hydrolysis stop, the slower microbial breakdown becomes the degradation pathway for these herbicides.

The primary degradation pathway for most herbicides is microbial degradation. Sustaining soil microbe populations requires:

- Organic carbon (stubble) as a food source;
- Oxygen (for aerobic species);
- A neutral ph (preferable);
- Suitable temperature (not limiting in spring/summer); and,
- Moisture.

As a result of these requirements, microbe numbers are usually highest in the top 10–15 cm and rapidly decline further down the soil profile. Microbial numbers respond rapidly to temperature and soil moisture. In cold winters, little microbial activity will occur, regardless of soil moisture. In spring/summer, very high microbial activity is likely if there is moisture in the soil profile. Where the soil is dry, microbial activity is reduced and minimal herbicide breakdown will be occurring.

Highly mobile herbicides, with moderate to long persistence, (for example, some Group B and Group I herbicides) typically cause the most problems in terms of carry-over in following seasons. This can be made worse if there is a soil impediment at depth that prevents the herbicide from leaching right through the soil profile (for example; a plough pan, significant change in soil texture or pH).

In this situation, the mobile herbicide will disperse through the soil profile with in-season rainfall. If there is a soil impediment at depth, some herbicide will concentrate above this impediment. Rainfall over the following spring/summer will sustain microbial populations near the soil surface and this will degrade herbicides residues near the surface, but herbicide lower in the profile may not be fully degraded due to low levels of microbial activity at depth. Where a sensitive crop is planted the following season it often establishes well, providing the herbicide residue in the planting zone has fully degraded. Crop effects are then seen later in the crop as roots reach the herbicide remaining at depth.

Herbicides with residual soil activity and the capacity to affect subsequent crops have recommendations on their label on recommended intervals before re-cropping. Understanding that these intervals and rainfall requirements are linked with microbial degradation, it follows that the pattern of rain within this period can also influence the level of microbial degradation. Prolonged periods of drought/dry conditions, interspersed with short periods of very wet conditions, particularly when it is cool, could meet label requirements for herbicide breakdown. But this may not allow adequate microbial activity for herbicide breakdown to safe levels to occur.

2020 and beyond

Grain growers have access to a wide range of very useful pre-emergent herbicides with more herbicides to come to market in the next few years. Understanding the chemistry of these herbicides is important to understand how to best use these products in your soils and farming system.

It is likely that Sakura, BoxerGold/prosulfocarb, propyzamide, trifluralin and tri-allate will continue to underpin many ryegrass management programs in winter grain crops.

Three 'new' pre-emergent herbicides were introduced in 2017 and 2018. Butisan (metazachlor) and Devrinol (napropamide) are Group K herbicides targeting ryegrass in canola. While the third, Gallery, is a unique Group O herbicide that targets wild radish in wheat, barley and triticale.

Two new pre-emergent herbicides targeting annual ryegrass are expected to be available in 2020. Overwatch (bixlozone) is from the seldom used Group Q mode of action and will be registered for use in wheat, barley and canola. Luximax (cinmethylin) is registered for use in wheat and will be initially placed into Group Z.

Other pre-emergent herbicides are currently being evaluated in field trials (mostly from existing modes of action) and some of these are likely to come to market in the next two to five years.

With several new 'tools' being added to the pre-emergent 'toolbox' it presents a great opportunity for growers and their agronomists to rethink their herbicide rotation plans. Where possible, incorporate as many different pre-emergent herbicides as possible into a five-year cropping rotation and avoid using any herbicide more than twice in a five-year period. This will reduce the potential selection for herbicide resistance, while also reducing the likelihood of enhanced microbial degradation.

The author would like to thank cooperating growers and the GRDC for their continued support. GRDC Project code: ICN1811-001SAX
Contact: Mark Congreve, M: 0427 209 234 E: mark@icanrural.com.au ■

TABLE 4: Comparison of half-lives (DT50) of certain pre-emergent herbicides.

Average DT_{50}	Classification			
< 30	Non-persistent	Unlikely to have plant back constraints the following year. To achieve extended residual, relatively high application rates are required.	Metazachlor	Prosulfocarb
			Imazamox	Flumioxazin
			S-metolachlor	Pyroxasulfone
			Terbuthylazine*	
30 to 100	Moderate	Plant-back constraints likely to be required. Often there is considerable variability on different soil types and under different climatic conditions	Chlorsulfuron*	Clopyralid
			Tri-Allate	Cinmethylin
			Propyzamide	Atrazine*
			Napropamide	Diuron
			Picloram	Simazine*
			Imazapyr[1]	Bixlozone
>100	Persistent	Long re-cropping intervals will exist to sensitive crops.	Pendimethalin	Isoxaben
			Trifluralin	Imazapic[1]

* Persistence extended in alkaline soils; [1]Persistence extended in acidic soils.

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ASK AN EXPERT –

WILL THE NEW PRE-EMERGENT HERBICIDES HELP COMBAT ALPHABET-RESISTANT RYEGRASS?

■ with Chris Preston, University of Adelaide

THE new decade is bringing with it some truly new pre-emergent herbicides with activity on annual ryegrass. With multiple-resistance to current pre-emergent herbicides looming large, it is essential that plans are put in place to ensure that these new herbicides can do the job of keeping ryegrass numbers low well into the future.

Dr Chris Preston, Professor, Weed Management at The University of Adelaide has watched the multiple-resistance and cross-resistance story unfold through the weed surveys and grower submissions to the testing services across southern Australia.

"Annual ryegrass is well-known for its ability to evade different herbicide modes of action," he says. "In recent years we have found a number of populations that have resistance to pre-emergent herbicides in Groups J, K and D."

The herbicide resistance 'picture' in Australia is based on randomly-selected weed samples collected during official weed surveys and samples that growers or agronomists send in for testing, often following an apparent failure of a herbicide in the field.

"Through herbicide resistance testing we are finding that an increasing number of ryegrass populations have 'alphabet

Dr Chris Preston, University of Adelaide, says the recent and pending releases of a suite of new pre-emergent herbicides will broaden the options for growers to mix and rotate through the crop sequence. But they will not fix the ryegrass problem on their own and should not be considered the new 'go-to' products.

Annual ryegrass has been exposed to many different herbicides and there are now populations that have 'alphabet resistance', i.e. resistant to multiple modes of action. Seed testing can reveal what products still work.

resistance', that is, resistance to multiple modes of action," says Chris. "That doesn't mean that none of the herbicides work – some will still have good efficacy in the field, but possibly not for long. It is a clear indication that the 'mix and rotate' strategy must be implemented across the crop sequence."

Two recently-released pre-emergent herbicides (in Groups K and Z) and two more (in Groups Q, E) in the final stages of registration with release expected in 2020 or 2021, will broaden the options growers have to keep ryegrass numbers down.

Coupling the mix and rotate strategy for pre-emergent herbicides with strong crop competition is a winning combination within the WeedSmart Big 6.

What's the difference between multiple-resistant and cross-resistant weeds?

Short answer: Multiple resistance is due to multiple genes present in the plant conferring resistance to several herbicides while cross-resistance involves a single gene conferring resistance to several herbicides.

Longer answer: Multiple-resistance is where a weed possesses multiple resistance mechanisms that allow it to evade several different herbicide modes of action. Mixing and rotating between the available herbicides is the best option as the population will have varying levels of resistance and some herbicides will still be effective.

Cross-resistance is where a weed possesses a single resistance mechanism that enables it to evade multiple herbicide modes of action. Cross-resistance can make a weed resistant to a herbicide that it has never been exposed to. For example, resistance to Groups J and K appears to be genetically linked in some populations, with examples of Group J use selecting for resistance to Group K, and vice versa. In this situation, rotating between Groups J and K will not be sustainable. A broader herbicide strategy will be required to keep these two groups as viable options in the farming system.

Resistance to one herbicide in a MOA group does not mean the population is resistant to all herbicides in that group. For example, in Group D resistance to trifluralin is quite widespread while resistance to propyzamide, also Group D, is rare and populations can usually be controlled by using the full rate of propyzamide. Similarly, resistance to Group K Butisan is being seen in the field while Sakura, also Group K, is still effective.

The term 'alphabet resistance' covers all populations that have resistance to several herbicides – often both pre-emergent and post-emergent use patterns.

What are the new herbicides?

Short answer: Luximax (cinmethylin, Group Z) is now registered and available for use in 2020, carbetamide (Group E) is approved and a Group Q active is pending approval from the APVMA. They follow the recently-released Group K herbicide Devrinol-C (napropamide) that belongs to a unique chemical class (acetamides) within Group K.

Longer answer: The release of these new pre-emergent herbicides will broaden the options for growers to mix and rotate through the crop sequence. They will not fix the ryegrass problem on their own and should not be considered the new 'go-to' products. Annual ryegrass across Australia has been exposed to herbicides over a long period of time and populations can be expected to possess multiple resistance mechanisms.

In the face of increasing cross-resistance in annual ryegrass it is conceivable that some weed populations may challenge these new herbicides as a result of previous exposure to other herbicides. This highlights the importance of using the right mixing partners to ensure these new herbicides can be effective tools for ryegrass control.

How do I set up an effective mix and rotate strategy for pre-emergent herbicides?

Short answer: Get some resistance testing done on seed from 'survivor' ryegrass plants to see what still works; and boost crop competition.

Longer answer: Knowing what works is the first step. This involves collecting ryegrass seed and running tests with multiple herbicides. This can be done every five years or so as resistance to pre-emergent herbicides evolves relatively slowly.

Once you know what the pre-emergent options are, look for opportunities to mix and rotate the herbicide groups throughout the crop sequence. If there are limited options for one crop, be sure to 'save' those options for exclusive use in that crop. Where there are opportunities to mix pre-emergent herbicides, take them. Always apply the mixing partners at full label rates.

Growing a competitive crop is an important tactic in maintaining low weed numbers and delaying resistance to pre-emergent herbicides.

HOW TO ASK A WEEDSMART QUESTION

Ask your questions about alphabet resistant annual ryegrass on the WeedSmart Innovations Facebook page WeedSmartAU, Twitter *@WeedSmartAU* or the WeedSmart website *https://weedsmart.org.au/category/ask-an-expert/*

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

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Potential mouse threat this year

GRAIN growers are being warned about the potential for mouse damage at sowing of this year's winter crops. The combination of grain on the ground following strong winds prior to harvest in some regions last year – and recent rainfall – could promote a rapid increase in mouse populations.

Recent monitoring and trapping efforts detected high rates of pregnancy in females – adding to concerns about the risk of crop damage at sowing.

Those concerns were raised at the latest meeting of the National Mouse Group (NMG), a Grains Research and Development Corporation (GRDC) investment. The NMG, which co-ordinates actions to counter mouse plagues, comprises researchers, advisers, growers and other industry stakeholders.

GRDC-supported mouse researcher Steve Henry from CSIRO, Australia's national science agency, told the meeting that the combination of an abundance of grain remaining in paddocks and good rainfall were leading to ideal conditions for mouse breeding, and growers in some areas are already reporting increased activity.

"Parts of the Victorian Wimmera and Mallee and South Australia's Lower Eyre and Yorke Peninsulas incurred significant head loss in November 2019 when severe winds struck," Steve said.

"Such a large amount of grain on the ground combined with reasonably heavy rainfall over recent weeks could lead to a rapid increase in mouse populations ahead of sowing."

Steve said large quantities of grain on the surface of paddocks could reduce the chance of mice finding toxic bait, while at the same time providing an ongoing food source for mice.

"If strong winds have resulted in two tonnes per hectare of grain on the ground in some areas, that equates to up around 4000 grains per square metre.

CSIRO researcher Steve Henry (left) pictured during a mouse monitoring exercise in South Australia with National Mouse Group chair, Ian Hastings. (PHOTO: GRDC)

Reducing the food load and baiting

"The challenge for growers is to reduce the food load for mice in stubbles. Putting sheep on stubbles and strategic cultivation (burying grain) will assist with food reduction, and growers should spray out any summer germinations. Seeding with knife points assists in burying residual seed – enhancing bait uptake."

Steve emphasised the importance of timing of bait applications.

"It is critical that growers bait six weeks out from seeding if mouse numbers are reasonably high, and then follow up with another bait application off the back of the seeder if numbers are still high at sowing.

"A six-week break between applications avoids the risk of bait aversion."

Zinc phosphide bait must be spread according to the label rate of one kilogram per hectare.

Steve urged growers to get out of their utes and walk into paddocks to obtain an accurate understanding of current conditions in terms of the amount of grain on the ground and signs of mouse activity. High stubble loads hide the signs of mouse activity.

As summer spraying intensifies, reports of mouse presence are expected to increase.

"I also urge growers to report and map mouse activity – presence and absence – using MouseAlert (*www.mousealert.org.au*) so other growers can see what activity is being observed in their neighbourhood and via Twitter using @MouseAlert."

New insights

The GRDC's major mouse-related research, development and extension program is continuing to reveal new insights about mice in Australian broadacre cropping systems.

As part of the suite of GRDC investments, CSIRO researchers have been undertaking trials to determine if they can enhance the uptake of zinc phosphide bait by testing potential new bait substrates that may be more attractive to mice.

Researchers are testing the willingness of mice to transition from one food to another and then determining whether mice will continue to eat that alternative food source once zinc phosphide bait has been applied.

GRDC research investments have shown that: Mice prefer cereals over lentils; background food significantly affects consumption of bait; and, strategic use of bait is more effective than frequent use of bait.

The next phase of the research will examine the role of available alternative food on commercial zinc phosphide bait effectiveness.

The GRDC mouse-related investments include a focus on mouse ecology. This work will involve a series of experiments aimed at understanding how mice function in zero and no-till cropping systems.

Mouse ecology research will address five key topics: Farming practices; managing refuge habitat, understanding mouse movements; mouse burrows; and, bait delivery.

Data generated out of this work is providing the evidence that under modern conservation farming systems, mice are remaining in paddocks year-round and establishing large burrow systems. In previous conventional (tillage) cropping systems, mice would move to fence lines as a source habitat after harvest.

A comprehensive GRDC Mouse Control resource hub is available at *http://bit.ly–2ImjEEn*

■

Contemplations

By Ian M. Johnston

THE new decade is now upon us. We enter it with anticipation, indeed assumption, that as 2020 progresses it will impart a more tranquil and favourable era, endowed with a restructuring of prosperity and comfort, as distinct from the anguish and suffering resulting from the horrors of drought and fires, inflicted mercilessly in recent times upon so many rural communities.

Whenever in a contemplative mood, I tend to reflect, not upon sad times, but upon the good fortune that has brought love and laughter, plus fascinating challenges, into my thankfully enduring years. I count my blessings!

Family and friendship, of course top my list of blessings, but my association with classic tractors also rates very high.

Early days

As a youth during the latter 1940s, I grew up with these clanking contraptions. Then in the 1950s I earned my modest keep by merrily driving a diversity of them around paddocks on properties scattered throughout the land.

Possibly that accounts for me being today more than half deaf. Well let's face it, straight through exhaust pipes were common on many tractors, ear protecting mufflers were considered 'sissy' and sound proof cabs were unheard of! Plus, 14 hour shifts were routine!

A 1949 KL Bulldog restored by the author. The Australian made KL Bulldogs were carbon copies of the German Lanz Model P Bulldogs. During WW2 of course Lanz tractors could not be imported to Australia and the Victorian firm, that had been the importing agents, commenced the manufacture of the KL. It should be noted that although similar, there were significant minute differences which rendered the Australian machines notably inferior to the German originals. (PHOTO: IMJ)

This magnificent example of a 1929 Case 18/36 was restored by Norm Mackenzie. The 4 cylinder engine was mounted east/west immediately ahead of the operator, with its open exhaust blasting heat, fumes and noise in front of his face. (PHOTO: IMJ)

Try driving a Bulldog for 14 hours, with its giant single cylinder two stroke engine blasting out, what seemed like a million decibels, from its monstrous chimney, with each shattering stroke.

Or maybe a Case 18/32, with its side mounted engine positioned east/west across the tractor, and its stumpy straight through exhaust located immediately in front of your ear, which in sizzling hot weather could turn red hot, (er, the exhaust pipe that is).

Things changed a bit for me in the mid 1950s.

I was requested by a Narrabri share farmer, for whom I was doing some tractor driving, to call in to the Lanz Australia Pty Ltd office in Pitt Street, for some spares, while I was enjoying a few days break in Sydney. Well after all, it was raining at Narrabri and the wet black soil was not conducive to tractor work.

Incidentally – can you imagine with today's Sydney skyscraper landscape, there being a tractor works in Pitt Street?

This 1949 Case LA was considered one of the most powerful tractors in its day. The big four cylinder 403 cubic inch petrol/kero fuelled engine produced a lazy 58.3 hp. Beautifully restored by Chris Broers. (PHOTO: IMJ)

I am not sure why, but while ordering a variety of bits and pieces at the counter I was introduced to Herr Tronser, a large pipe smoking gentleman with a deep booming German accent, who just happened to be the Managing Director. We commenced a conversation, which apparently prompted him to invite me into his executive office. While plying me with cups of dangerously strong brewed German coffee, he proceeded to interrogate me with searching questions regarding my background.

It occurred to me that a mere decade previously we had been at war with the Third Reich and he would have been considered part of the enemy!

Two hours later, in a bewildered and dazed state of mind, I returned to my Indian motorcycle, which I had left parked in Pitt Street with my mate – a blue cattle dog called Suzie – sitting possessively in the side car, daring anyone to approach too close.

You see, I was no longer a casual tractor driver. I had emerged from the Pitt Street office as the newly promoted sales representative for Lanz Australia Pty Ltd, charged with the responsibility of promoting the sales of Lanz Bulldog tractors throughout NSW!

And so commenced the next chapter of my association and fascination with classic tractors which, in various directions and configurations, has remained part of my life for the past 65 years, and continues to do so!

Commitment

During the 1970s, now married to Margery and with two sons to educate and support, I purchased the 4000 acre property Chelmsford, located an hour's drive west of Wee Waa. Its rich self-mulching black soil sustained my family generously during drought free years, thanks to the high yielding grain crops and Mitchell grass fattened livestock.

Please note, while modern high tech tractors on Chelmsford were the mainstay, I also put into service a 1952 Case LA plus a 1954 Lanz D1706 Bulldog (see photos). I just loved these old tractors – reeking in character, a factor singularly absent with the 'moderns'.

But in 1980, for family reasons, we were obliged to seek a change in lifestyle. Accordingly, Chelmsford was sold to a neighbour and we purchased a 130 acre coastal farm located in an idyllic setting on the NSW mid north coast.

On the coast, while 'playing' at farming I did get involved with commercial activity surrounding modern equipment. But my thoughts always drifted back to these absurd, preposterous, bizarre, antiquated but profoundly loveable old tractors.

During my frequent journeys around the bush, I became conscious of the number of old tractors I was seeing, simply abandoned and rotting away, often parked under trees around a homestead. This saddened me, because as far as I was concerned these tractors were actually part of our heritage and undoubtedly had contributed to the development of our agricultural industry.

I decided – enough is enough! I would commence a program of 'saving' old tractors. Although ridiculously pious, I felt it was my duty. (Truth is – I was suffering from a degree of inactivity and needed to put some new enthusiasm and spice back into my life.)

So together with Margery, who shared my passion for classic tractors, we embarked on a mission of procuring rare and unusual tractors. Our commitment was to restore these machines to, as near as possible, brand new condition both mechanically and cosmetically.

Frankly we never imagined this involvement would develop into being practically never ending! But certainly, the next 20 years saw us travelling extensively in search of discarded tractor gems, transporting them back to our property, then attacking

them with spanners, grinders, sometimes even crowbars and finally paint.

While engaged in all this unaccustomed and often challenging activity, to my delight there was an awakening extending throughout Australia, Europe and North America of the importance and fascination of classic tractors. Hitherto, the focus on early vehicles had been confined more or less exclusively to cars, motorcycles, locomotives, tramcars and boats. Tractors had been overlooked.

But commencing in the late 1980s, tractor clubs were springing up everywhere. The previously valueless tractors were now much sought after and prices rose steadily. Weekend tractor rallies were becoming common popular occurrences.

I had for years been writing articles for various magazines, but now I was being approached by publishing houses to write books devoted to the subject of early agriculture and in particular old tractors. I required no second bidding. At the last count I have had eight tractor books published which surprise surprise, sold around the world.

To be truthful, I doubt if their sales hinged upon my writing capabilities, but rather because they were crammed with the subject matter tractor enthusiasts were craving.

So in between messing around with spanners and spray guns at home, I found myself, together with Margery, driving around Australia, North America and Europe visiting rural museums, tractor collectors and the archives of tractor firms, in pursuit of accurate and precise historic information to be shared with fellow classic tractor enthusiasts through the medium of my books.

A few years ago Margery and I took the difficult decision, with a heavy heart, to offload our tractor collection. We had reduced the number from 50 to 20, only retaining ultra rare machines. But

The German Lanz factory at Mannheim was heavily bombed by the RAF during the final days of WW2. Production commenced again in 1953–54 and the D1706 represented a new generation of Bulldogs. Gone was the blowlamp start, in its place the entire range of new Bulldogs were started using a unique pendulum starter motor. The D1706 was the smallest of the range, but despite its single cylinder two stroke semi diesel engine producing a mere 17 hp, it had amazing torque and could outpull Ferguson, International and Fordson equivalents, and ran on an average one pint of fuel an hour. This unit was restored by the author. (PHOTO: IMJ)

One of the restored gems in the author's collection was this 40 hp 1935 Marshall 12/20. Only a total of 200 were produced. Although having only a single cylinder, it differed from Lanz tractors by being a full compression diesel. Starting was by an igniter and hand crank of the flywheel. (PHOTO: IMJ)

of course these were hidden away from public view within the confines of our sheds. Accordingly, due to necessarily restricted invitations, sadly only a small number of enthusiasts ever shared the joy of gazing upon these glorious artefacts. That is apart from when I displayed a few at rallies. This situation had to be rectified.

We have a mate named John, who is president of a tractor club, of which I am a founding life member. John agreed to construct a large museum shed on his grazing property, into which he would house the collection for posterity and make it available for public inspection. So now it is John's collection, to which he has added numerous other classics.

Tailpiece

In my opinion, which is not widely shared, the interest in old tractors has unfortunately encouraged the introduction of competitive tractor pulls at tractor rallies. This involves dragging a grand old tractor out of retirement then hitching it to a type of sled, which as it is dragged along the ground automatically increases its draw bar pull load. The poor old tractor, often with tyre pressures appallingly reduced in order to gain greater grip, with counter weights added for the same reason, is flogged mercilessly in an endeavour to outpull the next injudicious competitor! The struggling tractor often ends up bucking and rearing dangerously as the apathetic operator endeavours to win the challenge.

Back in the days when these tractors were an important element on a farm, any operator treating his machine in such a manner would have been sacked on the spot. Okay, I know they are just bits of metal held together with nuts and bolts, but to a softy like me – they deserve better!

But let me not end this epistle on a cheerless note.

We should all be elated that around the world thousands of these glorious classic tractors are being preserved for posterity, ensuring that in years to come, future generations may have the opportunity to gaze in wonderment upon their magnificence. ■

IAN'S MYSTERY TRACTOR QUIZ

Question: Can you identify this early tractor?

Clue: It was made in Michigan.

Degree of difficulty: EXTREME. If you know the correct answer you should be entitled to a free trip to Michigan. (I said "should").

Answer: See page 48.

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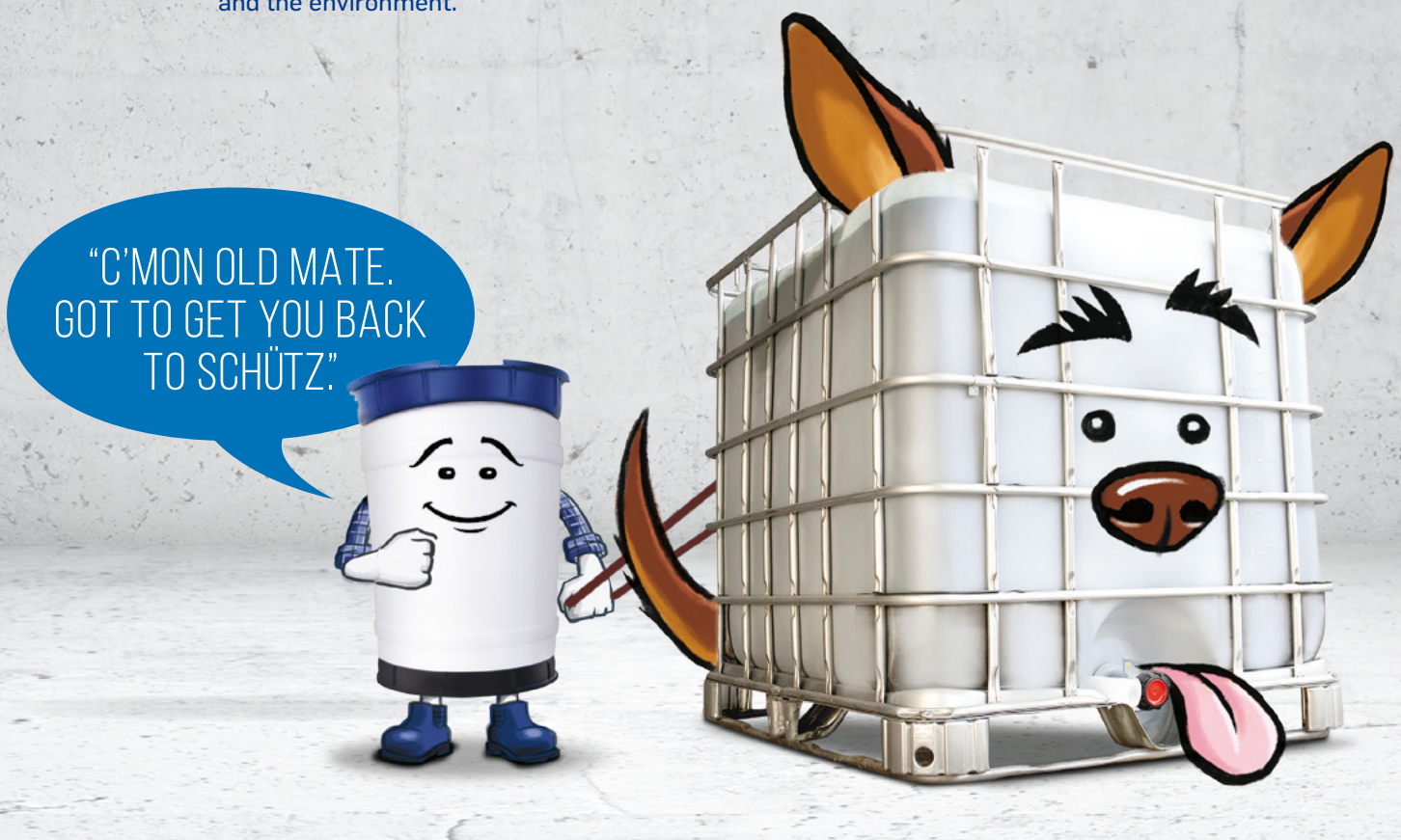

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SCHÜTZ PACKAGING SYSTEMS

Wheat disease 'boom and bust' cycle discovered

LATEST research, led by the Centre for Crop and Disease Management (CCDM), has uncovered a 'boom and bust' pathogen cycle that may be the key to developing new and improved management strategies and disease ratings for the damaging wheat disease septoria nodorum blotch (SNB).

Researchers from the CCDM, a national research centre co-supported by Curtin University and the Grains Research Development Corporation (GRDC), worked with European collaborators to discover that the pathogen *Parastagonospora nodorum*, that causes SNB, evolves over time in response to patterns in wheat variety adoption.

Using a statistics-based method, the research team observed evidence of a distinct genetic structure in Western Australian isolates of the SNB pathogen collected over a 44-year period from 25 wheat growing sites in WA.

They grouped the isolates into five clusters based on genetic similarity and, through analyses of their collection year, were able to track the pathogen's emergence and prominence.

Rare access

Access to such a large pathogen collection is extremely rare, so until now worldwide studies of the evolving SNB pathogen have been limited by a narrow sampling timeframe.

CCDM research fellow and the paper's lead author Huyen Phan, said the team discovered a low amplitude 'boom and bust' cycle in the SNB pathogen population following the introduction of more resistant varieties.

CCDM's researcher Huyen Phan says their research team has discovered a low amplitude 'boom and bust' cycle in the SNB pathogen population. (PHOTO: CCDM)

"Our research team identified many cases where the SNB resistance of wheat varieties declined over successive seasons, prompting their replacement with new and more resistant varieties, only to see the resistance of the older varieties begin to improve," Huyen said.

"This change in resistance often coincided with the mass adoption of popular wheat varieties and a shift in the pathogen population."

CCDM senior research fellow and paper co-author Kar-Chun Tan, said this was valuable information for the Australian grains industry looking to maximise disease resistance in current wheat varieties.

"Breeders are doing a great job releasing wheat varieties with improved resistance to SNB, but as our research shows, we're dealing with an ever-evolving pathogen. The best we can hope for is to find strategies to help prolong SNB resistance in modern wheat varieties," Kar-Chun said.

Good strategies to adopt

"Our research indicates that diversity in varietal selection and regularly rotating wheat varieties may be good strategies growers can adopt to limit the build-up of specialised and highly aggressive isolates of the SNB pathogen.

The research also suggests that the testing of modern isolates of the pathogen makes for more accurate SNB resistance ratings of commercial wheat varieties. Genetic markers are now available to help identify relevant modern isolates," Kar-Chun said.

CCDM Director Professor Mark Gibberd says research such as this has a crucial role in helping the Australian grains industry achieve better disease resistance.

"Fungal pathogens are highly complex, so we need to understand the mechanisms behind their impact and how they evolve, so that we can improve disease resistance," Mark said.

"The challenge then is to develop effective management strategies for their control, whilst also working to provide stronger preventative measures by working with breeders to help create more resistant varieties."

The full results are available in a just-published paper titled 'Low amplitude boom-and-bust cycles define the septoria nodorum blotch interaction' available in the *Frontiers in Plant Science* journal. ■

NORTHERN FOCUS
COVERING NORTHERN NSW AND QUEENSLAND

Fall armyworm has arrived

FALL armyworm (*Spodoptera frugiperda*) is an exotic pest that has been detected in north Queensland. Fall armyworm is reported to feed on more than 350 plant species, including maize, cotton, rice, sorghum, sugarcane, wheat, and many vegetable and fruit crops, and have caused significant economic losses overseas.

Fall armyworm includes two subpopulations, or strains, that are morphologically indistinguishable but differ in their host plant preference and certain physiological features. Diagnosis by a laboratory is required to identify strain.

Destruction of crops can happen almost overnight when infestation levels are high.

While this pest is native to tropical and subtropical regions of the Americas, since 2016 it has rapidly spread to and throughout Africa, the Indian subcontinent, China and Southeast Asia.

Description

Adults

- Moth, 15 to 20 mm long nose to tail when resting.
- Brown or grey forewing and a white hind wing.
- Male fall armyworm moths have more patterns and a distinct white spot on each of their forewings.

Larvae

- Caterpillar-like.
- When very young they are about 1.7 mm, light in colour with a larger, darker head.
- As they develop, they attain a darker greyish-brown colour with paler, slender, lengthwise stripes and small dark spots with spines on their upper surface, with a pale underside.
- They eventually reach a length of about 34 mm.

Pupae

- Shiny brown cocoon that is formed usually in soil, but also sometimes in plant debris.

Egg

- Pale yellow in colour and clustered together in a mass.
- An egg mass can contain 100–200 eggs.
- Egg masses are usually attached to foliage in a mound, with a silk-like furry substance.

Fall armyworm larvae. (PHOTO: Chazz Hesselein)

Plant stage and plant parts affected

The larvae can affect leaves, shoots, stems and fruit. Plants of different ages, from seedlings to mature plants, can be affected.

Plant damage

Fall armyworm larvae initially feed on leaves, creating pinholes and windows in leaf tissue, and giving leaf margins a tattered appearance. In grass-like plants, they often feed within the leaf

whorl (where leaves radiate from or wrap around the stem or stalk. Insect frass (droppings) is a sign that larvae are present.

Fall armyworm larvae can also eat buds and tunnel into and feed on fruit. Larger larvae can cut plants off at the base.

Many larvae may be present on one plant. When the larvae are very numerous they can defoliate preferred host plants and acquire an 'armyworm' habit and disperse in large numbers. Crops have been reported to be destroyed almost overnight.

May be confused with...

Fall armyworm can be confused with a number of armyworm species that are present in Australia. **If in doubt, contact the Department of Agriculture and Fisheries on 13 25 23.**

Hosts

Depending on the strain of fall armyworm, there are approximately 350 plant species hosts. These include economically important cultivated grasses such as maize, rice, sorghum, sugarcane and wheat but also other vegetable and fruit crops and cotton.

Impacts

Fall armyworm poses a threat to Queensland's agricultural industries. Damage caused by fall armyworm can reduce plant growth, significantly reduce crop yield and cause plant death. Severe infestations can destroy crops almost overnight.

Since fall armyworm can also graze on native grasses, our environment may also be impacted.

FALL ARMYWORM FACING DIFFERENT DEFENCES IN AUSTRALIA

In early March, Queensland Department of Agriculture and Fisheries entomologist Dr Melina Miles brought growers and advisers at the Goondiwindi GRDC Updates up to speed on the fall armyworm incursion in north Queensland. Melina had just returned from Georgetown in south-central Cape York and reported that by late February, FAW had not been detected in any commercial crops in the area. But Melina warned it was only a matter of time before detections are confirmed in crops.

Melina expects the arrival of FAW to Queensland will cause a few frantic early years as growers and researchers refine their control strategies. But she believes our sophisticated monitoring and management capabilities will put us in good shape to handle this new pest.

Melina points to several environmental factors on our side including some very handy native predators of FAW as well as our climate. International research has shown that at temperatures below around 10°C, FAW activity slows. It is also very susceptible to frost.

Although very early days in the identification of FAW's adaptability in Australia, these natural 'controls' would suggest that in most seasons, Central Queensland could be as far south as FAW is environmentally suited.

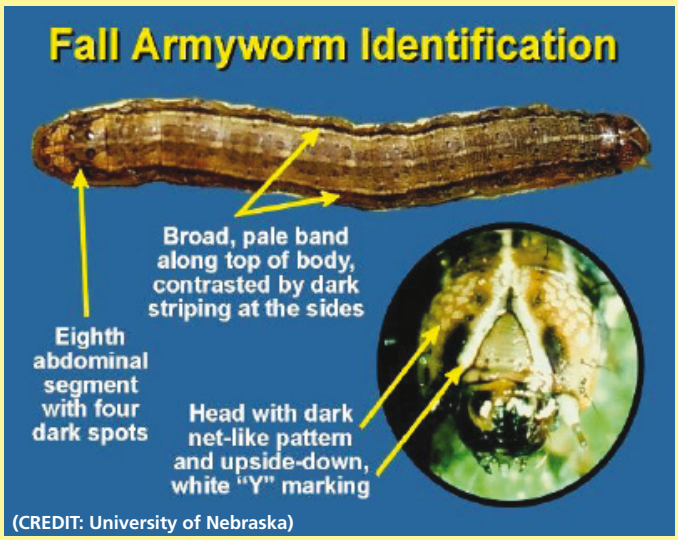
"The modelling suggests they could persist year-round as far south as Brisbane east of the Dividing Range, and in inland areas probably not much further down than Central Queensland," Melina said. "But we may see them in more southern areas such as the Darling Downs in summer – and particularly late summer – when the populations have built up in the north and moved south."

Keeping a lid on resistance

Melina says that correct identification of FAW is essential for the effective control of the pest as well as managing insecticide resistance. Melina reminded the Updates audience of the Ord River Irrigation Area experience of the 1960s and 70s when the wrong pest species – in that case the cluster caterpillar – was over-sprayed with broad spectrum insecticides and huge insect resistance issues were the result.

"If everyone starts spraying grubs they think are fall armyworms, and they're not, this puts a lot of resistance pressure on existing army worm and helicoverpa species," Melina warns. "We need to avoid a repeat of the Ord experience or the mistakes we made in the 1980s which led to widespread resistance to synthetic pyrethroids."

Melina said any on-farm outbreaks of fall armyworm should be "entirely manageable", particularly if growers and their agronomists detected the pest early.



(CREDIT: University of Nebraska)

"We are already familiar with Spodoptera species. We deal with the cluster caterpillar, for example, in our crops now. There is no reason to expect that fall armyworm will be more voracious in its in-crop feeding," she said. "The real challenge will come with detecting it early and with having effective control."

It is critical for growers and agronomists to be able to identify the pest and recognise the signs of its activity in a crop.

"It is important to know what to look for," Melina said. "Unfortunately, the diagnostic characteristics only appear in larvae that are relatively mature at the fourth or fifth instar."

"The first thing to look for is on the head between the eyes and an inverted 'Y'. Other army worm species also have that inverted Y, which is why you need to team it up with a second characteristic which is the four dots on the rear end." (See identification chart above.)

She warned growers not to mistake the damage caused by existing caterpillar pests with that from fall armyworm, as the damage looked similar.

"We don't want industry over-reacting and assuming that if they see shot holes in leaves, frass in the whirl or larvae in the cobs it must be fall armyworm because there are other species that also do this sort of damage, common armyworm and Helicoverpa in particular. It is very important when you think you have fall armyworm to actually sight the larvae."

Melina said there was some good news for cotton growers in that Bollgard 3 – due to the addition of the Vipcot gene – should be able to control any infestations of FAW.

How it is spread

The adult moths are capable of flying long distances. In the Americas, adult moths can undertake annual seasonal migration as far north as Canada.

Fall armyworm can also spread through people movement. It is believed that the arrival of fall armyworm in Africa was on a passenger flight.

Fall armyworm can spread on the illegal importation or movement of infested plant material.

Monitoring and action

Inspect your plants regularly for the presence of unusual pest and disease symptoms.

To help identify symptoms of fall armyworm, growers and advisors should examine plants for:

- Leaf damage, including pinholes, windowing, tattered leaf margins, skeletisation and defoliation of plants;
- Tiny larvae, less than 1 mm, that are more active at night, eating pin holes and transparent windows in leaves;
- Bigger larvae grazing on leaves, stems, trunk and fruit, and leaving behind insect frass (droppings);
- In grass-like plants, larvae are often in plant whorls (where leaves radiate from or wrap around the stem or stalk; and,
- Sudden crop damage and collapse.

If you suspect fall armyworm, report immediately to the Department of Agriculture and Fisheries on 13 25 23.

Source: Business Queensland

The Australian Department of Agriculture has import conditions in place for importing plants and plant products.

Further information about fall armyworm is available in the CABI Invasive Species Compendium. ■

Fall armyworm larva feeding on maize. (PHOTO: University of Georgia, Bugwood.org)

Adult moth. (PHOTO: Lyle Buss, University of Florida, Bugwood.org)

KEEPING AHEAD OF THE FALL ARMYWORM

Growers need to be alert for the invasive moth pest fall armyworm (FAW) *Spodoptera frugiperda*, which has been detected in Australia. GRDC Managing Director Dr Steve Jefferies said GRDC is encouraging all grain growers – especially those throughout central and coastal Queensland – to keep an eye on their crops for signs of fall armyworm incursions.

"GRDC has been monitoring the international spread of the incursions and anticipated the potential for an incursion of fall armyworm in Australia," Steve said.

"GRDC has invested in research aimed at characterising fall armyworm insecticide resistance and determining the most appropriate prevention and preparedness measures.

Main control is insecticide

"The main control measure available to Australian growers is application of insecticides. Experience in overseas countries is that fall armyworm has developed resistance to insecticides. So it's essential that this research is in place to rapidly inform grain growers about what chemicals are most effective to mitigate the impact of fall armyworm in Australia.

"This new fall armyworm incursion is a complex issue and will need a multi-agency response. GRDC is committed to collaborating with other plant based RDCs, the Department of Agriculture, Water and Environment, the Plant Biosecurity Research Initiative (PBRI), the Queensland Government Department of Agriculture and Fisheries and Plant Health Australia (PHA) to ensure there is an effective and coordinated response to the fall armyworm incursion," he said.

Chemical permits already in place

GRDC has been proactive in regard to preparedness for fall armyworm, investing with PHA to secure minor use chemical permits.

"We secured the first permit as early as April 2018, with a second permit issued earlier this month, which shows how we've tried to be on the front foot and as prepared as possible for this potential incursion," Steve said.

It is not technically feasible to eradicate FAW from Australia. This is due to the pest's reproductive capacity, ability to fly long distances and wide host range, combined with the remoteness and spread of the known infestations in Australia.

"The best shot we've now got to minimise the spread and contain the impact of fall armyworm is for early detection and effective control measures. It's important that growers monitor crops and use treatments according to the permit," Steve said.

"It's everyone's responsibility to watch out for this destructive pest and protect Australia's agricultural industries and environment."

To report a sighting call the Exotic Plant Pest Hotline 1800 084 881 or the Department of Agriculture and Fisheries on 13 25 23.

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Growers encouraged to consider post-drought disease risk

AS many growers across New South Wales and Queensland desperately look forward to planting and a sustained seasonal break in 2020, industry experts are encouraging growers to consider potential disease risks resulting from the prolonged dry conditions.

While drought conditions reduce pressure from leaf diseases that thrive in the wet, they can also have an impact by increasing the longevity of inoculum of stubble-borne diseases as well as the lifecycle of some plant pathogens.

With many regions having missed successive crops, growers have faced unprecedented business and paddock management challenges and will be quick to take advantage of planting and restocking opportunities as soon as they arrive.

Having a considered sowing strategy that involves identifying and managing paddocks with a higher disease risk will pay dividends.

Disease risk despite dry

NSW Department of Primary Industries (DPI) senior plant pathologist Dr Steven Simpfendorfer said although the dry conditions had resulted in dramatically reduced plantings in previous seasons with below-average biomass and yield, inoculum could still be present in paddocks.

"Extended dry conditions have increased the longevity of inoculum of stubble-borne diseases such as crown rot in cereals and Ascochyta blight in chickpeas," Steven said.

"This is a result of reduced decomposition of crop residues which harbour the fungal pathogens that cause these diseases.

"Unfortunately, cereal stubble from 2018 – or even 2017 crops infected with crown rot – could still provide sufficient inoculum to infect a new wheat or barley crop in 2020."

Steven said dry conditions also impacted on the lifecycle of some pathogens which resulted in two to four-year-old stubble residues being the primary source of inoculum for leaf diseases such as net blotches in barley, yellow spot in wheat or Ascochyta blight in chickpeas.

"The pathogens themselves have a moisture requirement to form the primary infection structures on previous crop residues," he said. "The extended dry conditions mean that this process is taking considerably longer and what would normally occur over one wet summer fallow is taking 12–24 months or longer to happen.

Dry condition can lead to long-term carryover of disease inoculums such as yellow spot on cereal stubble.

"Hence growers need to consider the longer-term rotation sequence within paddocks from a disease perspective."

Planning ahead

There's also likely to be a sizeable cereal plant within mixed farming systems once a general break occurs due to the reduction in animal stock numbers, failure of pastures and the need for ground cover.

Steven said a decline in legume species within pasture mixes, due to the passing of time and moisture stress, meant grass species and weeds were likely to dominate in many instances.

"These are therefore potentially higher risk paddocks for cereal diseases as the grasses serve as alternate hosts for many wheat and barley pathogens," he said. "So, the overarching message is be vigilant to minimise disease impacts and maximise profit when recovering from drought."

Crop choice, variety selection, seed quality and time of sowing will play a vital role in managing disease incidence and severity once paddocks can be returned to production.

While the production benefits of early sowing are well known, the practice can increase the risk of certain diseases such as barley yellow dwarf virus (BYDV), wheat streak mosaic virus (WSMV) and stripe rust at early crop stages due to warmer temperatures in early autumn favouring insect vectors or rust cycling.

But Steven said delayed sowing was not recommended as a strategy to reduce risk from these pathogens given the yield penalty associated with later sowing generally outweighed the yield benefit from decreased disease severity, and options were available for disease control in early-sown crops.

"Earlier sowing within the recommended window of a selected variety can reduce but not eliminate yield loss from crown rot by reducing exposure to stress during grain filling, which exacerbates expression of whiteheads," he said.

"A bigger risk with earlier sowing of cereals in the north is that it is often also associated with deeper planting to access stored soil moisture. Deeper and earlier sowing of cereals into warmer soils is associated with an increased risk of common root rot as the sub-crown internode, which is the primary infection point, is lengthened by this practice.

Assess options

"Growers also need to be aware that early sowing of cereals can potentially elevate frost risk during flowering depending on the maturity of the variety sown. Frost risk can also be quite specific to location and elevation of paddocks."

Steven said risks from stubble-borne diseases could largely be managed through paddock selection and the use of varieties with appropriate maturity and disease resistance ratings.

Paddock selection can be guided by the DNA-based soil test Predicta B which assesses crown rot, common root rot and root lesion nematode inoculum levels if sowing cereals, inoculum levels related to Ascochyta blight of chickpeas and beneficial Arbuscular Mycorrhizal Fungi (AMF), which when at low numbers causes long-fallow disorder.

Crown Analytical Services (CAS) is the service co-ordinator for Predicta B testing in the northern region and can provide growers and advisers with bags, soil corers, protocols and procedures for sampling, as well as an interpretation of results once tests are completed. Call 0437 996 678, email crownanalytical@bigpond.com or visit *www.pir.sa.gov.au*. ■

Planting early helps weather the drought

By Darius Koreis, CSIRO

DANIEL Wegener is a cereal and legume farmer at Brigalow on Queensland's Darling Downs. Although the season has rapidly turned around for the better, he reckons the drought conditions in late 2019 were by far the toughest he's seen in his 19 years of farming.

But with CSIRO help, Daniel has adopted early sowing and this is enabling his family's 1600 hectare farm to continue growing and harvesting crops, even in the face of drought.

"Changing what we've done over the past 20 or 30 years has continued to make us profitable," Daniel said.

"In tough conditions you need to make the most of opportunities. And planting earlier than we traditionally would allowed us to double-crop a harvest of sorghum and barley."

Without early sowing that second 'double crop' of barley wouldn't have been possible to grow in the same year, while most farms only plant one crop. It wasn't a bumper crop in 2019, but it still grossed Daniel an extra $465 a hectare. This is valuable cashflow for his farm.

But Daniel doesn't see himself as an early adopter. Before trying early sowing himself, years of evidence was being built to support the practice.

Planting early allowed a profitable double crop of sorghum and barley.

The Wegener's farm on the western Darling Downs.

Creating new opportunities

Our farming systems researcher Dr Lindsay Bell said we're seeing a drop in long-term rainfall averages. And rainfall patterns aren't as reliable as they once were – even when we're not in drought.

"Our research has demonstrated the benefits of using stored moisture in the ground after summer rains," Lindsay said.

"Early sowing means farmers can plant a crop after modest rainfall of 20–30 mm later in the year. This is an important opportunity to produce a crop in times of drought."

Daniel laughed when asked if he sees himself as a water farmer, but agrees it's an appropriate description.

"Capturing water and using it to the best of our abilities is what it's all about," he said.

But he isn't talking about capturing water in a traditional sense. Rather, he's talking about soil moisture after rainfall.

Soil moisture is priceless

By the end of 2019 Daniel's farm had been drought declared for two years, with only 180 mm of rain falling that year compared to the 350 mm average. But even then, when he dug a few centimetres below the soil surface, he revealed moist soil.

Lindsay said farmers should keep groundcover and by doing so they can keep their soil crop-ready thereby helping make farms more drought-resilient.

"Every gardener knows about the value of mulch, and groundcover is really on-farm mulch," he said. "It insulates the soil from above and helps the roots feed nutrients back into the soil biology as they breakdown. It also provides a path for any rainfall to infiltrate deeper into the soil."

Despite drought the future is bright

Farmers need to be open to adopting new practices to stay ahead of changing growing conditions. Daniel said the value of many on-farm resources like groundcover were overlooked at best, or destroyed at worst.

"In decades past, crop stubble would have been burned-off or ploughed in. It was trash. Now retaining it is a vital part of our practices," he said.

"You can't keep doing what you were doing 20 or 30 years ago because there's better ways of doing things. And you need to be open to trying them as they become available."

With over 70 years of farming in his family's history, Daniel is optimistic about their ability to continue by building drought resilience into their operations.

"The drought will break. But there will continue to be challenges, and as long as we're open to new ideas and innovations, we'll continue to adapt," Daniel said.

The CSIRO is continuing to research drought resilience in farming practices, risk management and digital agriculture. So, Daniel will have many new ideas to implement for years to come. ■

Seed of Light goes to 'Macca'

MENTION the name Paul McIntosh to anyone in the northern grains industry and it's almost guaranteed to invoke a smile, a humorous quip or an anecdote about his seemingly-boundless agronomic knowledge.

Paul, or Macca as he's better known to many, is one of the region's most recognised and respected agronomists and has been a luminary in broadening the understanding, adoption and community recognition of best practice farming throughout his 40-year career.

His tireless dedication to the industry was acknowledged when he was awarded the coveted Grains Research and Development Corporation (GRDC) northern region 2020 Seed of Light Award at the GRDC Grains Research Update in Goondiwindi.

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

GRDC Northern Region Panel chair John Minogue said Paul was an outstanding leader with an innate ability to distil complex scientific concepts into information that has practical relevance to the industry and broader community.

Paul currently holds two industry roles – northern region agronomist for Pulse Australia and northern extension agronomist for the Australian Herbicide Resistance Initiative (AHRI) and a regular Rural Weekly newspaper columnist.

Paul said he was honoured to receive the *Seed of Light* Award and proud to serve an industry that had given him so many friends, opportunities and experiences over the years including witness to enormous advances in farming technologies.

"I often say that technology has given us our paddocks back and those advancements are continuing – technology and innovation are things our industry has always embraced to overcome challenges and take advantage of opportunities. It'll be exciting to see what the next 40 years bring." ■

Paul McIntosh, John Kerlin and Hugh Reardon-Smith.

SOUTHERN AUSTRALIA FOCUS

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Fungicide resistant net blotch hybrid discovered in WA

AUSTRALIAN grain growers are advised to choose barley varieties and fungicide treatment programs carefully following the discovery of a net blotch hybrid that is highly resistant to some Group 3 (azole or demethylase inhibitor) fungicides.

The discovery was made by researchers from the Centre for Crop and Disease Management (CCDM) – a national research centre co-supported by Curtin University and the Grains Research and Development Corporation (GRDC) – in collaboration with plant pathologists from the Department of Primary Industries and Regional Development (DPIRD), and the Centre for Crop Health (CCH) at the University of Southern Queensland.

CCDM's Wesley Mair testing barley samples from the southern cropping region of Western Australia.

Resistant hybrid and a clone

CCDM Fungicide Resistance Management and Disease Impacts Theme leader Fran Lopez-Ruiz said not only had they discovered a fungicide resistant hybrid of the two common barley diseases spot form net blotch (SFNB) and net form net blotch (NFNB), the hybrid was also a clone.

"We've known for a couple of years that hybrids of NFNB and SFNB exist in nature," Fran said.

"But now, not only do we know they exist, we also know they exist with multiple genetic mutations that make them highly resistant to some Group 3 fungicides.

"On top of this, they're also genetically identical – they're clones, which means they are reproducing asexually across the Esperance and South Stirling regions."

Centre for Crop and Disease management researchers Wesley Mair (front) and Fran Lopez-Ruiz.

In 2017, DPIRD alerted CCDM of fungicide failure in a paddock that had been treated multiple times with formulations containing Group 3 fungicides and was thought to be infected by SFNB. The department sent leaf samples to the CCDM and fungicide resistance tests were carried out, with the hybrid first detected from these samples.

Further samples were then tested from an additional seven sites, across the South Stirling, Frankland, Amelup and Esperance regions, with hybrid clones detected up to 350 km apart.

According to CCDM researcher Wesley Mair, tests found strains of the pathogen that were not only resistant to some Group 3 fungicides, but far more resistant than any NFNB or SFNB strain the team had ever studied.

"From further genetic analysis we saw that this type of net blotch carried known mutations for fungicide resistance in NFNB, and known mutations for fungicide resistance in SFNB, and after further tests we are now convinced we have discovered a highly resistant hybrid," Wesley said.

Important discovery

CCDM director, Professor Mark Gibberd, said net blotch resistance was a focus of the Centre's research and this was another important discovery that would better inform growers and agronomists about treatment and management.

"By CCDM, DPIRD and CCH working together on these samples we're able to build a much clearer picture of the spread and impact of net blotch across Western Australia, building on a range of projects our fungicide resistance experts are working on that have in-field impact." Mark said.

Fran said growers in affected regions should continue with their robust integrated disease management strategies, particularly when it came to choosing varieties.

"We know the hybrid is quite virulent on Oxford, as most of the hybrid clones we have collected so far have come from infected Oxford samples. We're looking into Planet (PBR) and La Trobe (PBR) too, as these are the only two other varieties where we have found these highly resistant strains, albeit at far lower frequencies," he said.

"With improved knowledge of host sensitivity, it may be possible for growers to select varieties of low sensitivity, which could lead to a reduction in the population of the hybrid and slow its spread. But we can't rule out the possibility that it can adapt, so we need to keep tabs on it."

Group 3 compounds most compromised

Fran said tebuconazole and propiconazole were among the Group 3 compounds most compromised by these mutations. Therefore, their use should be avoided in solo formulations and limited when any of these two compounds were mixed with a different fungicide, especially from Group 3, as this would place extra pressure on the other mixing partner. The efficacies of epoxiconazole and prothioconazole were less affected.

"Other fungicide modes of action, such as those from Group 11 (QoIs) and Group 7 (SDHIs), should be in the mix too, as they remain effective at controlling these hybrids," he said. "But the use of SDHI fungicides should be monitored carefully given the recent discovery of SDHI resistance in NFNB in South Australia," he said.

The CCDM is urging growers and advisers to report fungicide resistance. If you suspect resistance in your paddock please contact the CCDM at frg@curtin.edu.au or ccdm@curtin.edu.au

A new GRDC Spot Form Net Blotch Fact Sheet, containing information about economic management of this disease, is available at *https://grdc.com.au/spot-form-net-blotch-factsheet*

Harm's contribution celebrated

THE contribution of Dr Harm van Rees to the Australian grains industry has been officially recognised with the Grains Research and Development Corporation's 2020 Southern Region Recognising and Rewarding Excellence Award.

In presenting the award at the GRDC Grains Research Update in Bendigo (Victoria), GRDC Southern Region Panel chair John Bennett said Harm was a most worthy recipient of the award.

"Harm is a man with a passion – an unwavering passion for all things agriculture and in particular the translation of scientific knowledge into practical application for grain growers and farmers more broadly," John said.

Based in Bendigo, Harm is an agronomy consultant and director of Cropfacts Pty Ltd.

Dr Harm van Rees.

He became well known and highly regarded throughout the farming industry for his instrumental roles in the MEYCheck (Maximum Economic Yield) and Top Crop programs which were transformative in the 1990s in terms of driving understanding around production constraints such as water use efficiency and nitrogen management.

In the early 1990s Harm began consulting to growers across the Victorian Wimmera and Mallee.

"The advice, recommendations and support delivered by Harm to growers in that region have influenced positive, profit-generating practice change," John said.

"Harm long ago recognised the value of farming systems groups in improving the understanding by growers of crop and pasture production techniques. Bringing growers and researchers together to solve production issues was his focus.

His involvement in many and varied GRDC investments over many years has been invaluable, and the outcomes from that work have been highly impactful, according to John.

"For instance, in 2002 Harm, on behalf of BCG, initiated the revolutionary GRDC-supported Yield Prophet program with then CSIRO researchers Drs Zvi Hochman and Peter Carberry."

"Harm has also been heavily involved in the National Paddock Survey, a four-year GRDC investment designed to quantify the yield gap on 250 paddocks across Australia and to determine the causes," John said.

Harm said it was a "great honour" to be presented with the Recognising and Rewarding Excellence Award.

"I love working in this industry. There are so many inspirational farmers, agronomists and researchers working for the common goal of improving production, life in rural communities and improving soil health and our environment – the GRDC is a huge part of this," Harm said. ■

Understand gaps to increase wheat crop yields

INSUFFICIENT nitrogen is one of the key reasons behind wheat crops not reaching their full yield potential, but a multi-layered approach is required to increase yields and reduce the size of the 'gap'.

This is one of the key messages from a nationwide study investigating the yield gap in Australia, which CSIRO principal research scientist Roger Lawes discussed at the Grains Research and Development Corporation (GRDC) Grains Research Update, Perth, that was held at Crown Perth on February 24 and 25.

The GRDC National Paddock Survey closely monitored 250 paddocks for four years (2015–18) to quantify the gap between the yield potential based on rainfall and the actual grower yield, and to understand the cause of this gap.

A 'yield gap calculator' was developed to indicate the key agronomic factors that contribute to the yield gap including weeds and diseases, previous crop, nitrogen and other variables.

Roger said of the 13 different 'types' of yield gap identified through the survey, four were evident in Western Australia and addressing these were key to maximising crop potential.

Yield option

"The most important variable driving yield gaps was the yield potential, with significant gaps evident when the yield potential exceeded 4.8 tonnes per hectare," he said.

"The inference is that the higher the rainfall, the higher the yield potential and yield gap, with growers less likely to capitalise on favourable seasons."

The importance of the timing of the rainfall was also highlighted, with more rainfall in the growing season causing a larger yield gap.

"Residual soil water at harvest points to late rainfall, which could lead to either an unused water resource, the onset of severe pathogens that are not always managed, or flooding," Roger said.

Nitrogen deficiency

The second-most important variable for crops in the western region was nitrogen deficiency, with this factor contributing 30 per cent to the yield gap in these paddocks.

"This confirms that producers are not achieving yield potential due to nitrogen deficiency and are under-applying nitrogen when situations could warrant applying more," Roger said.

In addition, in some situations, the previous crop was the next most important driver, which highlights the importance of crop rotation.

Other variables that were associated with yield gaps in localised situations included free-living nematodes, the region, the amount of nitrogen at harvest, yellow leaf spot, nitrogen at sowing, the root disease score of the seminal roots and Fusarium crown rot DNA concentrations measured in the soil.

In Australia's western and southern cropping regions, 42 per cent of wheat crops had yield gaps greater than 0.8 tonnes per hectare, while in the northern region, only 27 per cent of wheat crops had yield gaps greater than 0.8 tonnes per hectare.

Roger said the GRDC National Paddock Survey and yield gap analysis have demonstrated that while yield gaps occur in one in three paddocks, this is more likely to occur when yield potentials are high and nitrogen supply is inadequate.

"These problems can be compounded by cereal-dominant crop rotations and diseases such as Fusarium crown rot, Pythium, Pratylenchus species, yellow leaf spot and Rhizoctonia root rot," he said.

"Importantly, sound crop rotation does not necessarily remove or reduce the disease risk in high-yielding situations."

For more information see *grdc.com.au*

CSIRO principal research scientist Roger Lawes.

Canola and lentil establishment: What have we learnt?

Glenn McDonald, Sarah Noack, Claire Browne, David Minkey, Jon Midwood, Stefan Schmitt, Genevieve Clarke, Emma Pearse and Ashley Amgouris

AT A GLANCE…

- Crop establishment is variable and in many cases, improvements can be made.
- Improving establishment may lead to saving in seed costs.
- Establishment of canola and lentil is influenced by different factors and while some factors are outside the control of growers, there are a number of simple, beneficial changes that can be made.

GERMINATION and establishment of commercial crops determine the plant population, which influences the level of early crop vigour, competitiveness against weeds and yield. And the evenness of establishment influences the level of interplant competition. Early work on seedling emergence indicated that seedlings that emerged early had a competitive advantage over those that emerged later. And a uniform plant stand can reduce interplant competition and result in significant increases in yield but the benefits of this tend to be greatest at low plant populations.

There is relatively little information on the levels of crop establishment currently achieved in commercial crops. This article summarises the results of a survey of crop establishment in canola and lentil in the southern and western GRDC zones.

The aim of the survey was to provide benchmark data for current practices and identify the factors that most strongly affect establishment. This will inform current farmer practice as well as future research.

How the survey was done

Commercial crops were surveyed in South Australia, Victoria, Tasmania and Western Australia in 2018 and 2019. The crops targeted were canola, lentil and faba bean in the southern region and canola, lupin and wheat in the western region. This article reports on the results for canola and lentil.

In each paddock, five sample sites were randomly selected. At each location, seedling numbers were counted in two adjacent rows along a 3 metre length of row. The cumulative distance between 30 adjacent seedlings in each row was measured to estimate mean interplant distance.

Seedling depth was measured by cutting seedlings at the soil surface, excavating the seed and measuring the vertical distance from the seed to the cut surface.

The amount of stubble cover was assessed by comparison with standard photographic charts. A sample of the seed used to sow the crop was collected to measure mean seed weight and germination percentage.

A questionnaire was distributed to growers to gather information on the seeding equipment used, how it was set up and the management of the paddock and crop. Crop establishment percentage was estimated from the plants per m^2 and the seeds per m^2 sown. Uniformity of crop establishment was measured by the co-efficient of variation (CV) in plant number and interplant distance.

In a small number of paddocks, more intensive sampling of crop establishment was conducted to assess the variation in plant number and seedling depth across the width of a seeder bar.

What we found

Seeder age and set up

The median age of the seeders was six years in the southern region and eight years in the western region. Disc seeders were used by 13 per cent of the growers. Inter-row sowing was practised by 54 per cent of growers.

All the growers used press wheels but only 22 per cent knew the specific pressure at which the press wheels were used, and among those there was a great variety in responses. The most common pressure reported was 10 kg (by six growers) but values ranged from 5 kg to 130 kg.

Good seed-soil contact is important for germination, but these results suggest there is a lack of information on what are appropriate pressures to use, to optimise the performance of press wheels under different conditions.

Separate delivery of seed and fertiliser was more commonly used by growers in the western region (83 per cent), while in the southern region roughly half the growers used a single delivery system. Most growers in the southern and western regions sowed seed in a single row rather than using paired rows. The average depth of the furrow cut (mean ± SEM) was similar for canola (61 mm) and lentil (62 mm).

Sowing rates and crop establishment

The average sowing rate over all sites for canola was 2.7 kg per hectare (with a range of 1.4 to 4.0 kg/ha) and 48 kg per hectare for lentil (range 35 to 60 kg/ha).

On average, growers sowed 60 to 70 seeds per m^2 for canola and 118 seeds per m^2 for lentil.

Crop establishment averaged 51 per cent in canola in the western region to 82 per cent in lentil. Lentil showed less variation in plant number and interplant distance than canola.

Mean germination for all the seed samples submitted was 88 per cent in canola and 90 per cent in lentil.

Growers who indicated they adjusted their sowing rate

for seed size and/or germination percentage did not achieve significantly better establishment than growers who didn't.

But the method of calibration appeared to influence establishment, with manual calibration tending to result in poorer establishment compared to using the seeder's control system.

The specific reason for this difference is unclear but it was a consistent effect in both crops. Among the canola paddocks, establishment was higher in hybrid varieties than in open pollinated varieties which most likely reflects the greater vigour of the hybrid seed.

Inter-row sowing did not significantly affect establishment in canola. Most lentil crops were inter-row sown and their establishment was higher compared to crops that were not sown between the rows. But this result needs to be interpreted cautiously because of the very small number of crops (two paddocks) that were not inter-row sown.

Separating seed and fertiliser delivery improved establishment in both crops. The potentially harmful effects on germination and seedling growth of having seed and fertiliser close to one is well known and this effect can be exacerbated under dry conditions. Having separate delivery systems is an effective way of maximising establishment.

Using paired rows rather than sowing in a single row also tended to improve establishment, although there were fewer paddocks in this comparison. Using paired rows will increase the seed bed utilisation (SBU), which will help reduce interplant competition within the row and mitigate any potentially harmful effects of fertiliser.

Canola establishment in the southern and western regions region was lowest on sandy soils and in the southern region it tended to increase with the clay content. Lentil was less sensitive to texture. There was no consistent effect of soil properties (pH, EC and ESP%) on emergence.

Management practices and establishment

Time of sowing was an important influence on establishment in canola and wheat. Establishment improved with later sowing into May (Figure 1). This effect may have been associated with the dry autumn over the southern and western region in 2018, which resulted in many crops being sown dry or under marginal soil moisture.

This was supported by the relationship between rainfall and establishment in canola. Rainfall received in the four weeks centred on the time of sowing was positively related to establishment percentage.

In canola, there are clear yield advantages to early sowing, so delaying sowing to improve establishment is counterproductive.

But the survey indicated there was a trade-off between sowing time and establishment, which seemed to be driven in part by rainfall. The survey confirmed that the risk of poor establishment in canola increases as soil moisture declines. It was also noted in the survey that most of the canola had staggered emergence (that is, multiple canola growth stages), which is likely to have been largely affected by variation in soil moisture.

Lentil responded very differently to canola. Sowing date had no effect on crop establishment in lentil even though the range in sowing dates was similar to canola.

High rainfall around sowing tended to reduce establishment percentage and decrease the uniformity of establishment.

Although variable, sowing to about 30 mm improved establishment in canola in both the southern and western regions (Figure 2). It is likely that with the dry autumn in the survey area, there was insufficient moisture in the surface soil for high germination rates and growth of seedlings.

In contrast, lentil establishment benefited from shallower seed placement, but the range of sowing depths was greater than that in canola.

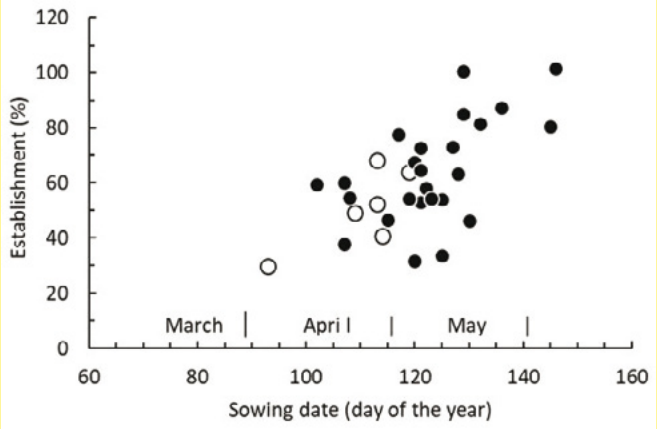
High stubble loads at sowing tended to reduce emergence of canola but the relationship was not strong. There was no effect of stubble cover on emergence in lentil. Emergence in both lentil and canola was sensitive to the condition of the surface soil with emergence being lower as surface structure became poorer.

The survey data suggests that emergence in lentil is less sensitive than canola to a number of management practices and appears to be a more robust crop in this respect.

The risk of poor establishment in canola is increased with shallow sowing under low soil moisture, high stubble loads and where surface structure is poor. The impact of reduced emergence on yield will depend on the degree to which plant number is reduced and how well the canola crop can compensate for low plant densities.

Recent sowing rate trials suggest that at a yield level of about 1.5 tonnes per hectare, populations of 20 plants per m^2 may not result in significantly lower yields compared to higher plant densities.

FIGURE 1: The relationship between sowing time and crop establishment in canola in the southern and western GRDC regions



FOOTNOTE: Southern region (●); Western region (○).

Variation across seeders

The average values for plant number and seedling depth were similar at the two sampling sites in each paddock, but this belies the variability across seedling rows.

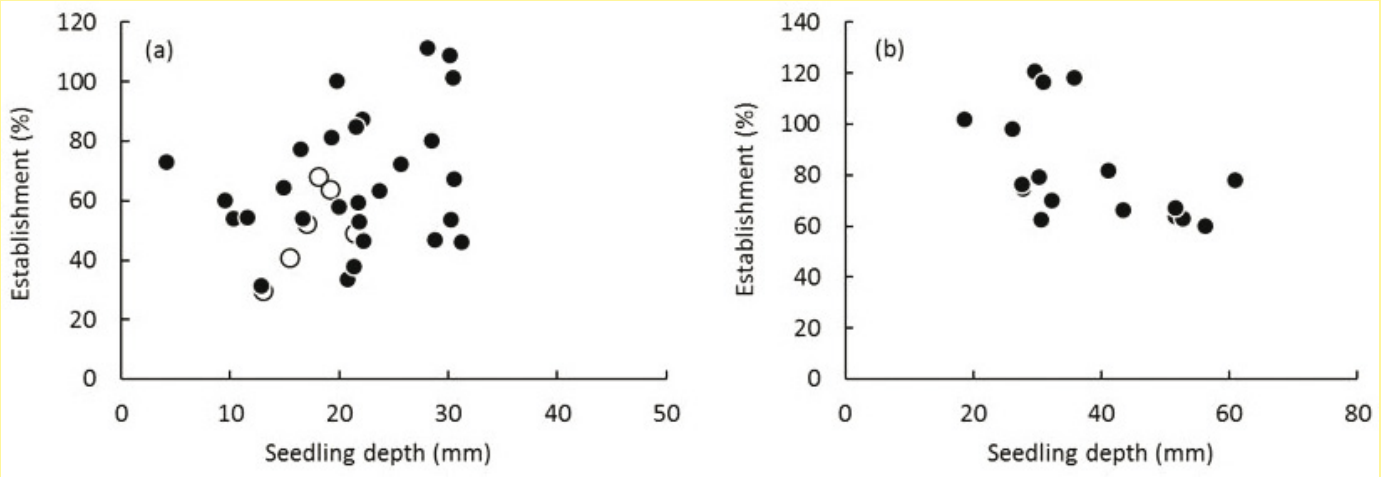
There was considerable variation in the number of plants established and the depth of seed placement across a seeder. The average CV for plant number were 42 per cent (SA site) and 33 per cent (WA site), compared to an overall CV for canola of 25 per cent across all the sites.

Similarly, the average CV for seedling depth were 25 per cent (SA) and 27 per cent (WA), while the survey average for canola was 17 per cent.

Comparison of paddocks with good and poor establishment

While variation in crop establishment in canola and lentil was high among the surveyed paddocks, there were some growers achieving high and relatively uniform establishment. The features of paddocks that recorded high establishment (more than 80 per cent), and poor establishment (less than 50 per cent), are shown in Table 1, where results confirm a number of the trends observed in the survey.

FIGURE 2: The relationship between seedling depth and establishment in (a) canola and (b) lentil in the southern and western GRDC regions



FOOTNOTE: Southern region (●); Western region (○).

In canola, better establishment was measured in later-sown crops, where there was slightly less stubble cover, slower sowing speeds and when there was more rainfall. In lentils however, sowing time and stubble cover were not related to establishment. In this case, higher establishment was associated with shallower depth of seed placement and when there was less rainfall after sowing.

To sum up

The survey highlighted the variation in crop establishment that occurs within a paddock and between paddocks. But a number of growers are achieving high establishment and relatively uniform crop stands, which suggests improvements are feasible. The key outcomes from this survey to date are:

- Establishment in canola was lower and more sensitive to sowing conditions than lentil and this is where greater improvements can be achieved;
- The age and make of the seeder are less important than how it is set up and the conditions in the paddock at sowing;
- Maintaining good soil surface structure to minimise crusting will assist with better seedling emergence (through stubble retention or management of sodicity for example);
- Know your seeder. Factors under the control of growers that can influence establishment include seeder set-up and operation (careful calibration), separating seed and fertiliser and increased SBU, sowing speed and sowing depth; and,
- Dry sowing – rainfall at sowing was more important to establishment in canola than in lentil, and early sowing will reduce establishment without adequate rainfall around the time of sowing. This is an inevitable trade-off that growers face with early sowing under dry conditions, but sowing rate trials suggest that as long as there are 20 – 30 plants per m^2 there may not be a significant yield penalty in canola.

The research undertaken as part of this project is made possible by the significant contributions of growers both through their cooperation and the support of the GRDC. The co-authors would like to thank them for their continued support.

We thank the many growers who collaborated with the survey and the assistance of the Leibe Group, the Facey Group, the Corrigin Farm Improvement Group and the McKillop Group in conducting the survey.

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TABLE 1: The average values of paddock and site characteristics from paddocks where high (more than 80 per cent) and poor (less than 50 per cent or less than 60 per cent) establishment was measured in canola and lentil in the survey in 2018

	Canola		Lentil	
	Est > 80%	Est < 50%	Est > 80%	Est < 60%
Seeder age (years)	9 ± 2.0	7 ± 1.9	7 ± 1.0	6 ± 2.1
Stubble cover (% ground cover)	34 ± 7.5	49 ± 10.3	70 ± 5.6	64 ± 5.9
Sowing date	16 May ± 3d	29 April ± 3d	3 May ± 6d	1 May ± 7d
Sowing speed (km/h)	8 ± 0.3	10 ± 0.6	10 ± 0.8	11 ± 0.8
Furrow depth (mm)	57 ± 13.5	54 ± 15.8	68 ± 7.3	47 ± 6.0
Seedling depth (mm)	25 ± 1.6	21 ± 2.1	30 ± 3.2	45 ± 3.9
Rainfall (mm)				
14 days before sowing	24 ± 8.8	11 ± 2.3	9 ± 3.6	10 ± 2.8
14 days after sowing	20 ± 4.2	5 ± 5.6	4 ± 2.1	13 ± 3.4
Seedbed moisture content at time of assessment (% v/v)	21 ± 1.7	20 ± 1.2	14 ± 5.7	23 ± 4.1

Experienced agronomist joins Incitec Pivot

LEADING fertiliser supplier, Incitec Pivot Fertilisers, has strengthened its agronomy team in South Australia and western Victoria with the appointment of James Stewart as technical agronomist.

James brings a wealth of experience to his new role supporting broadacre farmers, graziers and agronomists.

He is well known among producers around Hamilton and south-west Victoria for his agronomy knowledge and practical advice at Vickery Bros where he worked for almost 13 years. Prior to this, he was an agronomist at Elders Hamilton for three years.

He and his wife Penny also run a sheep enterprise at Bulart, outside Hamilton.

Originally from Wangaratta, James is an agricultural science graduate from the University of Melbourne's Dookie campus.

Jan Edwards, director of agronomy at Incitec Pivot Fertilisers, described James as a welcome addition to the company's agronomy team.

"Our team of six agronomists are industry leaders in plant nutrition and work closely with agronomists and farmers, providing practical, science-based advice on our innovative products and services," she said.

"One of James' first priorities will be to support our customers in bushfire affected regions like Kangaroo Island, to help restore pastures and cropping soils to productivity." ■

James Stewart, technical agronomist, Incitec Pivot Fertilisers.

'Whole of farm' approach recognised

WHEN it comes to grains research, Tony Swan has an approach that is as straightforward as the down-to-earth farmers he works with: "If you are going to do something, do it well".

The CSIRO senior experimental scientist, who has spent the past 30 years working on research projects designed to answer critical questions from inside the farm gate, has always felt enormous responsibility to ensure his work is accurate and meaningful.

"Research results I deliver must be right, because farmers are going to implement them on a scale that is at least a hundred times larger than a trial plot and they are going to spend their money and wear all the risk," Tony said.

It is this commitment to rigorous research that is at the heart of the experienced scientists' work and one of the key reasons he was chosen as the recipient of the Grains Research and Development Corporation (GRDC) 2020 Recognising and Rewarding Excellence Award.

Tony was presented with the award at the 2020 GRDC Grains Research Update in Wagga Wagga.

GRDC Panel member Roy Hamilton said the annual award celebrates the grains sector's most committed researchers and innovators, offering them an international travel bursary, which can be used to extend their professional networks and conduct collaborative research for the benefit of the wider grains industry.

"Tony was selected by the GRDC to receive this award in recognition of his long-standing track record in delivering useful, relevant information to growers and working with fellow scientists and technical staff to develop and manage complex research projects," Roy said.

"I have worked with some outstanding researchers across many organisations and agribusiness companies," says Tony, "and I consider myself very fortunate to be in an industry I enjoy, that I joke gets me out of Canberra, but more importantly keeps me intricately connected with agriculture.

"I feel very humble to receive this prestigious award for work that I really enjoy doing and thank the GRDC for selecting me." ■

Roy Hamilton (left) with award winner Tony Swan.

Sorghum production forecast to be lowest in 50 years

By Peter McMeekin, Grain Brokers Australia


Peter McMeekin.

WHAT a difference a month makes. Substantial rainfall across the majority of the nation's winter and summer cropping regions over the past four weeks, on top of isolated storms in the preceding five weeks, has swung the mood across rural Australia from one of heightened pessimism to one of guarded optimism.

The vision on our television screens of flooded roads, overflowing gutters, children playing in puddles and farmers dancing in the rain have been a welcome distraction from the summer bushfires and the global coronavirus pandemic.

While there is still a long way to go, the general change to the weather pattern has growers and consumers across the country genuinely excited about crop prospects for 2020 and the possibility of a significant turnaround in domestic grain supply compared to the previous two seasons.

After such a prolonged dry spell, particularly in the eastern states, the soil moisture in many regions was at record low levels entering 2020. Replenishing those soil moisture reserves will be a long process with above-average rainfall required for a prolonged period of time.

The recent widespread falls have started the process of reducing the significant rainfall and soil moisture deficits accumulated over the last couple of years. But despite substantial registrations in many locations, most were still below the long term average for the December to February period.

The rainfall has not been confined to the cropping regions. Drought affected pastoral districts have seen an unbelievable turnaround in pasture growth and feed availability. But most graziers were forced to substantially reduce stock numbers during the drought as the cost of maintaining livestock became prohibitive.

They are now looking to restock as quickly as possible to utilise the abundant forage. The challenge here is the rains have been so widespread that the demand for restocking quality sheep and cattle is unprecedented. It has forced the price of store stock in sale yards across the country to extraordinary levels.

From graziers to grain growers

Many livestock producers who have the option of planting a winter crop are looking to sow paddocks that haven't seen a tractor for many years as the costs involved in buying stock make growing a crop a much better financial option this season.

Growers with mixed farming enterprises will almost certainly have an extra paddock or two allocated to winter crop when planting commences as their livestock numbers are well below normal levels. This means that the potential area available for winter cropping in the eastern states of Australia in 2020 will be substantially higher than in recent years. The potential for a big crop is building, but there is still a very long way to go.

Meanwhile, in Queensland and northern NSW, the limited area sown to sorghum this summer now has a genuine shot at achieving average yields, assuming regular rainfall continues for the balance of the growing season. It is extremely difficult to get an accurate handle on the actual area sown as the planting rains came so late. Suffice to say it was well below the total area growers intended to plant if the rains had been more timely.

At this stage, total production in Central Queensland, Southern Queensland and NSW are estimated to be 250,000, 125,000 and 75,000 tonnes respectively. That comes to a total of 450,000 tonnes and would make it the smallest Australian sorghum harvest since the 1969–70 season.

One of the biggest challenges of a late sown sorghum crop in southern Queensland and northern NSW is the autumn/winter harvest. Getting grain moisture readings down to acceptable levels can be a challenge as the days are quite short, there is invariably a morning dew, and the daytime temperatures are much cooler. The harvest also tends to be occurring when the winter crop is being planted which strains farm resources and challenges management priorities.

International sorghum trade

In international marketing news, the USDA has revealed, via its daily reporting system, that China has purchased 110,000 tonnes of sorghum from the US. The global trade has been waiting for news of US grain sales to China as a sign that it was starting to fulfil the Phase 1 commitments it signed off on in mid-January.

The early March transaction is the first single sale of more than 100,000 tonnes of any agricultural commodity to China since the trade deal was signed. As part of the continuous disclosure regulations in the US, exporters must promptly report such transactions, commonly referred to as flash sales. Sales of smaller amounts only have to be reported on a weekly basis.

According to USDA export data, China has booked more than 475,000 tonnes of sorghum this marketing year. But that total does not include sales of 325,00 tonnes to 'unknown destinations' in the third week of February. Sales tagged accordingly are usually destined for China, and the trade is confident they were the buyer in this instance.

The USDA estimates that the US farmer planted 1.9 million hectares of sorghum last summer. This is 7 per cent lower than the previous two seasons and is well down on the peak of 6.7 million hectares back in 1986–87. Production in that year was just short of 29 million tonnes, compared to 8.7 million this marketing year.

China has been a traditional destination for Australian sorghum in recent years, particularly for the Baijiu market. But, one thing is certain, Australia will not be challenging the US for bulk sorghum business into China in 2020.

Report submitted March 10. Call your local Grain Brokers Australia representative on 1300 946 544 to discuss your grain marketing needs. ■

We may run out of toilet roll, but there will be plenty of cereal

By Andrew Whitelaw, Mecardo

THERE has been a run on toilet roll in Australia, however we will likely have plenty of cereal. This article steps away from COVID-19 and looks at some of the fundamentals driving the market.

The December 2020 Chicago wheat contract has dropped six per cent in the past fortnight (Figure 1). Levels have dropped considerably from A$318 to A$298, although in part have been assisted by a falling A$.

If the A$ had remained at the same level as the start of the year the A$ swap would be around A$285.

Coming closer to home the ASX January 2021 contract has also experienced dramatic falls. The contract reached its peak in early January at A$360 per tonne, but has since seen a gradual fall to A$317.50 (Figure 2).

Risk-off appetite partly to blame for price fall

One of the reasons for the fall in pricing of wheat (and other commodities/equities) has been due to a risk-off appetite. This is where traders reduce their risk by moving to traditionally safe investments, which causes a sell-off.

But it is not just this attitude that has caused a downfall in pricing – it is fundamentally driven.

FIGURE 1: December 2020 SRW futures (A$/mt)

FIGURE 2: ASX wheat price (Jan 21)

After two years of drought the east coast is starting (touch wood) to return to more fertile conditions. This has provided confidence that Australia will produce an average or above average crop in the domestically focused areas.

This has resulted in our basis declining as buyers don't have a 'fear of missing out'.

On a global basis the same sentiment dominates with global conditions improving. The FAO have forecast global wheat production at 763 million tonnes.

If global weather patterns continue to be benign then there is every chance that the world will be awash with cereals.

Report submitted March 6, 2020. ■

Coronavirus and agriculture – how worried should we be?

THE coronavirus outbreak is already having a severe impact on China's foodservice and on-trade channels and this could become "more serious and longer-lasting" if the virus is not contained in the next six to eight weeks, according to a report from agribusiness banking specialist, Rabobank.

But the extent of the impact on Australia's agricultural sector will be limited in the short-term and will depend on how quickly the virus is contained, it says.

In its February 11 report, *Recent Coronavirus Impacts on Chinese F&A,* by the bank's China-based research team, Rabobank says "disruptions are being experienced across the entire F&A (food and agri) supply chain" with the virus disrupting trade, production and supply chains as well as having a significant impact on out-of-home food consumption with the closure of many foodservice outlets.

With the virus outbreak arriving at the peak of 2020 Chinese New Year activities, it has had a large impact on out-of-home dining in the country, the report says.

"Given what we have seen on the ground, along with news received from major chains – for example, the closure of stores by Starbucks, Haidilao, McDonald's and Yum China – potential revenue losses for both retail and foodservice for the Chinese

Head of Rabobank Food & Agribusiness Research, Tim Hunt.

New Year week could range from 20 per cent to 80 per cent." This represents a loss of between US$31 billion to US$124 billion across the retail and foodservice, it says.

While the report says a quick and effective containment of the virus could lead to a rapid bounce-back, the longer the virus is uncontained beyond March, the more extensive, sustained and structural the impact will be on the F&A chain.

Impact on Australia

Regardless of when coronavirus is contained, Australian-based head of Rabobank Food & Agribusiness Research, Tim Hunt says it will "almost certainly" have a larger impact on food and beverage industries than the global SARS (Severe Acute Respiratory Syndrome) epidemic in 2003 – including in Australia.

Discussing the current and potential impacts of the virus on Australia and New Zealand's food and agribusiness industries in a podcast, *Coronavirus: How worried should we be*, Tim says coronavirus has already spread more widely than SARS but it is Australia's "much larger exposure to China" that is the biggest difference between current events and SARS.

"If we go back to 2002 just before the SARS crisis, Australia sent eight per cent of its ag exports to China," Tim says. And this was largely in the form of fibre to be processed for export.

Fast forward to 2020, he says, and Australia sends around 28 per cent of its food and agricultural exports to China, much of which is consumed within China. "Add to that, the stronger links that have been developed between Australia and China in terms of exports, tourism, education and investment, we have a very different environment in which we might see the potential impacts of coronavirus this time compared to SARS in 2003."

There are likely to be both first and second-round impacts of coronavirus on the Australian agricultural sector, Tim says, with the first round already being felt by any food and ag business relying heavily on the food service channel in China, particularly perishable goods.

"For example, rock lobster shipments to China have all but ceased in the past couple of weeks," he says, "while chilled meat shipments for food service are also a risk category given a lot of hot pot restaurants are closed at the moment." And while wine isn't perishable, Tim says, sales are also likely to be low for those focused on the Chinese food service industry.

Potential for 'second round' impacts

While Chinese consumption of meat, dairy and grains is unlikely to fall in the short-term, Tim says if the virus continued for many months to come, second-round impacts – "likely to hit our F&A industries" – would come into play.

"Hopefully we won't get to 'round two'," he says, "but if we do, incomes may fall in China and we may eventually see less growth in sales of premium food and beverages as that wealth effect starts to kick in.

"And this may start to go beyond just food service sales and logistical disruptions to potentially impacting consumption in general of meat, dairy, grains and seafood."

That said, in the event coronavirus has second-round effects, the currency exchange rate would act as an "important stabiliser" for Australian agricultural exporters, with the Australian dollar likely to depreciate significantly as the market responded to slowing economic growth and rising risk concerns. And this, he says, would "somewhat offset" any fall in global commodity prices when expressed in local currency terms.

Going forward, Tim says, it will be important to closely monitor developments and how the Chinese government continues to manage the outbreak including restrictions on the food service sector.

"But the most important development will be when we see a slowdown in the rate of infection," he says. "SARS took around three and a half months for the infection to start slowing but after that, it didn't take long for infections to cap a few weeks later.

"While we have no idea how this virus will behave compared to SARS, there won't be any easing of restrictions until it does."

Tim says it will also be critical to monitor the spread of the virus to other countries such as Indonesia, Vietnam and other parts of South-East Asia, because if it spreads "we will start to see the same set of impacts in a second very large set of export markets for Australia".

By commodity

Rock lobster – likely to be the most exposed sector, with 95 per cent of sales going to China. While rock lobster sales from WA have ceased for now, fishermen can leave the lobsters in the ocean and catch their quota later if quota windows allow.

Red meat – short-term disruption is likely given logistical disruption and reduced eating out by Chinese consumers. The general shortage of protein in China as a result of African Swine Fever is still expected to result in ongoing strong demand from China once the short-term impacts of coronavirus are overcome.

Grains – limited impacts are foreseen both initially and in the event of a second round phase.

Dairy – at this stage, limited first round impacts as most of what is shipped (i.e. powders and infant milk formulas) have a good shelf life and are consumed at home. That said, cheese consumption could be impacted as it is mainly used in food service (for burgers and pizzas).

Wool and cotton – labour shortages due to travel restrictions and factory shutdowns are expected to reduce Chinese import demand in the short-term. Depending on the extent of coronavirus, there may be implications for the Chinese economy which could impact the longer-term demand for wool. For cotton, there is expected to be very little impact as recent figures suggest increasing demand emerging from China.

Sugar – very little disruption is expected to impact sugar trade flows, processing and consumption. But indirectly, the dip in the oil market – associated with concerns on the impact of the outbreak on global growth – could push Brazilian millers to produce more sugar this season which would lead to a softening in global prices, and ultimately, Australian prices too.

Wine – on-premise consumption of wine in China in 2019 accounted for around one third of total wine sales. Sales into this channel are expected to fall in the short-term while restrictions on group dining remain in place. That said, volumes of wine sold via e-commerce are likely to rise as distributors attempt to push more product into, and invest more money in developing, this sales channel.

Horticulture – Fortunately the cherry industry had air freighted most of its crop to China before the virus hit, something that would have been highly problematic a month later. In the next two to three months the main threat to export fruit and vegetable crops will be logistical, with demand from Chinese consumers for quality imported fresh produce not expected to fall from current levels.

Rabobank's podcasts can be found on the RaboResearch channel via any podcast app or at this link *https://research.rabobank.com/far/en/sectors/regional-food-agri/Podcast-Coronavirus-how-worried-should-we-be.html* ■

Ratification of free trade agreement is a win for farmers

THE ratification of the Indonesia-Australia Comprehensive Economic Partnership Agreement (IA-CEPA) by the Indonesian parliament creates significant opportunities for the Australian grains industry. The agreement will provide Australian farmers with a new market for feed grains. With winter planting soon to commence and recent rainfall events, growers are hopeful that they will be able to capitalise on this new market in 2020 and beyond.

"We would like to sincerely thank the Australian Government for the significant efforts directed towards this really positive outcome for grain farmers" said Brett Hosking, GrainGrowers Chairman.

"In a period of global economic uncertainty, it is encouraging to see the Australian government take positive steps in shoring up trade opportunities. We hope that growers across the country will be able to take advantage of the opportunities IA-CEPA brings."

Indonesia is traditionally Australia's largest wheat market with annual trade volumes typically around 4.2 million tonnes, valued at around $1.3 billion, although in 2018 and 2019 volumes have been hurt by poor Australian seasons and increased competition.

The agreement includes a new quota of 500,000 tonnes of Australian feed grain to Indonesia per year, growing at five per cent per annum. This feed grain quota is equivalent to 12,000 B-double truckloads of grains.

The agreement also supports growth and development towards Indonesia's food manufacturing, stockfeed and livestock sectors.

New partnership for technical support

A critical component of IA-CEPA is the development of a grains-specific economic cooperation initiative, the Australia-Indonesia Grains Partnership. The partnership will ensure that Indonesian stockfeed and livestock industries have the right technical support when using Australian feed grains such as barley, maximising productivity for the sector.

"We look forward to working with the Australian government to ensure the partnership is appropriately funded and effectively implemented as quickly as possible," Brett said.

"This agreement is critical for our farming businesses. We are looking forward to working with our Indonesian colleagues and gratefully acknowledge the contributions of many organisations whose hard work has brought about the successful ratification of IA-CEPA." ■

In search of (any) clethodim damage in canola

By Grain Orana Alliance

Results at a glance

- GOA trials have shown that for a range of varieties commonly sown in Central NSW that there is no impact on canola yield or oil content when clethodim is used according to label specifications;
- But when clethodim was applied well beyond label specifications – such as at double the rate or later crop stages – some canola yield damage was recorded; and,
- More recent GOA trials have shown that tank mixing clethodim with other common herbicides, or with sulfate of ammonia, did not appear to exacerbate flower or yield damage in canola.

Increasing levels of Group A – 'fop' resistance and the drop in retail pricing of clethodim herbicides has driven an increase in both frequency of use and rates applied of these products in canola. At the same time there has been a marked increase in reports of clethodim damage, possibly related to higher rates and frequency of use.

It is well known that clethodim can at times cause some level of visual crop damage – but the factors that result in this expression or its actual impact on yield – have not been well understood.

Trial research by GOA from 2013 investigated what might trigger damage to canola by studying application rates and timings of clethodim. In summary, the research found that damage was generally only evident when clethodim was applied at timings and rates outside of label recommendations. But even when obvious clethodim crop damage was observed in crop flowers, yield impacts were rare, and those that were detected were mild.

In contrast, research by the Hart Group in SA, found significant yield impacts from clethodim damage when applied outside label recommendations. They also observed some varietal differences in crop tolerance to clethodim. Subsequent investigation by GOA in 2015 did not find major differences in varietal susceptibility to clethodim.

As GOA has been unable to replicate observed field level clethodim damage in commercial crops, our investigations moved on to assess the potential influence that tank mix partners may have on the occurrence and severity of canola crop damage.

Clethodim is often applied with a number of products including other herbicides, insecticides, water conditioners such as sulfate of ammonia (SOA), oils, wetters and fertilisers.

GOA has investigated if some common tank mix options could be contributing to observed commercial crop damage.

Grain Orana Alliance trials indicated no impact on canola yield or quality when clethodim is used according to the label. But when applied beyond label rates – or at later crop growth stages – some yield losses were recorded.

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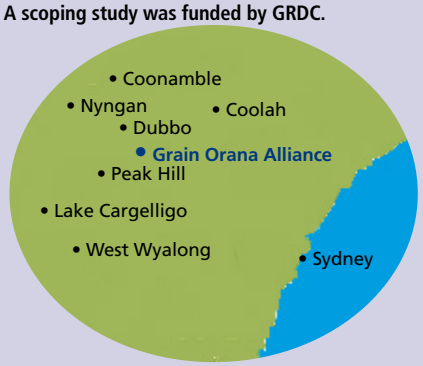
Overview: Grain Orana Alliance (GOA) – a not for profit incorporated association – was formed in 2009 through the efforts of a number of local growers and advisors in the Central West region of NSW. They tendered for a research project which evolved into one of the GRDC's Grower Solutions Group Projects.

The Grower Solution Group Project approach was pioneered by the Northern Grower Alliance (NGA), working across northern NSW and south eastern Queensland. This approach is now proven to be a very successful concept where growers and advisors come together to discuss and prioritise what is seen as the major issues or knowledge gaps they are facing in their region. These issues are reported to the GRDC to help guide their broader investments. They are also used to design local research programs seeking solutions to some of the key issues within the scope of the project. At these same meetings, GOA would report the findings of their locally guided and focussed research back to growers and advisors. This approach encourages a rapid adoption of research results.

GOA, and its operation of the Grower Solutions Group Project, is overseen by an elected Board of seven growers or key advisors. GOA now has a staff of three and has been in operation for 11 years. The project covers a region from West Wyalong in the south to Coonamble in the north, Lake Cargelligo and Nyngan in the west and east to Coolah and Cowra.

One of the key strengths of GOA – and a part of the original design concept for the Grower Solutions Group model – is the ability to respond to growers' needs quickly and efficiently. This can put research into the paddock in a matter of days if needed and can also put the results of that research back into the hands of growers and advisors very rapidly. Growers being closley involved in the design of the research means the research is very targeted and provides answers to the questions being asked. Through its design, the project is also able to tackle smaller, more specific issues, that can often 'fall through the cracks' with traditional research funding programs.

A scoping study was funded by GRDC.



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Why do the trials

To investigate and identify possible contributors to the expression of clethodim damage in canola, such as:

- Rate and timing;
- The environmental conditions at application;
- Variety choice;
- Tank-mix options and spray additives; and,
- We also set out to quantify any impacts the above might have on yield and grain quality associated with the use of clethodim.

How we did the tank mix trials

Small plots at two sites (Gilgandra and Wellington – see Table 1), using a randomised complete block design with three replicates were used for the research.

A number of tank mix options were identified and applied to either a Clearfield (CL) or Triazine Tolerant (TT) variety.

Treatments consisted of 14 clethodim tank mixes (8 with Clearfield herbicides and 6 with triazine herbicides) as detailed in Table 2. Trial treatments were applied by hand boom calibrated to apply 100 L per hectare of spray mixture through AIXR015 nozzles at 3 bar pressure. Rainwater was used as the spray carrier.

Treatments were applied when canola was 8 to 9 leaves with buds formed but not clearly visible. The crop was not yet elongating. This timing was towards the end of the ideal application windows in an effort to enhance any differences between treatments.

The trial areas had low weed populations after establishment and received an earlier post emergent application of Verdict and Lontrel Advance to remove any weed burden prior to treatment with clethodim.

Assessment was made at peak flowering for any level of flower abnormality and yields assessed by plot header.

Results were analysed by ANOVA and results compared by using LSD method with a 95 per cent confidence interval. Any references to differences between treatments should be assumed to be statistically different unless otherwise stated.

What we found

Only a small number of plots at both Gilgandra and Wellington were observed with minor flower damage at peak flowering.

Yields: There was no statistically significant impact of any of the applied treatments on yields when compared to the untreated control. Nor were there any yield differences of the Clearfield variety when clethodim tank mixes were compared to the application of the clethodim only treatment.

Oil: For the 44Y89 there was no impact of the treatments on oil percentage when compared to the untreated control or clethodim and Uptake alone. At the Gilgandra site in the ATR Gem variety, oil percentage was higher than the untreated control in all treatments containing Lontrel Advance.

Application of a number of common clethodim tank mixes on canola did not result in any significant flower damage or yield reductions when compared to either the untreated control in both varieties or a simple application of clethodim and Uptake alone in the 44Y89 (Clearfield variety).

In the case of oil percentage at the Gilgandra site there was no significant impact measurable in the 44Y89 but there was some in the ATR Gem in all treatments where Lontrel Advance was added. The impact was a lift in oil percentage of around one per cent, but there was no impact on yields or other observations that might help explain this situation.

It is noted that 2016 was quite mild growing conditions with good moisture. There were also fewer growers reporting incidences of clethodim damage than in previous years which could indicate seasonal conditions were not conducive to damage.

To sum up

From the trials we conducted there was no indication that the addition of tank mix herbicides or SOA to clethodim when applying to canola, results in an increase in flower damage nor any yield penalty in canola.

At the Gilgandra site there was a small impact on oil percentage when adding Lontrel Advance but this seemed specific to only one of the varieties (ATR Gem).

Table 1: Gilgandra and Wellington trial site details

	Gilgandra	Wellington
Soil type	Sandy Clay Loam	
Trial establishment date	Autumn, 2016	
Canola varieties	TT: ATR Gem and CL: 44Y89	
Pre-sowing stubble management	Cultivated	
Seedling equipment	Double Boot Tyne	
Sowing date	21/4/16	3/5/16
Targeted plant populations	35 plants/m^2	45 plants/m^2
Row spacing	27.5 cm	27.5 cm
Crop nutrition (kg/ha)	150 Trifos + 200 Urea	150 Trifos + 200 Urea
Previous crop	Oats (grazed out)	Lancer wheat (4.0 t/ha)
Harvest date	15/11/16	15/11/16

Table 2: Treatment list for both Gilgandra and Wellington trial sites

Product/timing	Rate (mL/ha), (g/ha) or % of spray volume	Variety
Nil (Y89)	nil	44Y89
Clethodim + Uptake	500 + 0.5%	44Y89
Clethodim + SOA + Uptake	500 + 800 + 0.5%	44Y89
Clethodim + Lontrel Advance + Uptake	500 + 150 + 0.5%	44Y89
Clethodim + Lontrel Advance + SOA + Uptake	500 + 150 + 800 + 0.5%	44Y89
Clethodim + Intervix + Uptake	500 + 500 + 0.5%	44Y89
Clethodim + Intervix + SOA + Uptake	500 + 500 + 800 + 0.5%	44Y89
Clethodim + Intervix + Lontrel Advance + Uptake	500 + 500 + 150 + 0.5%	44Y89
Clethodim + Intervix + Lontrel Advance + SOA + Uptake	500 + 500 + 150 + 800 + 0.5%	44Y89
Clethodim + atrazine + Uptake	500 + 1100 + 0.5%	ATR Gem
Clethodim + atrazine + SOA Uptake	500 + 1100 + 800 + 0.5%	ATR Gem
Clethodim + atrazine Lontrel Advance + Uptake	500 + 1100 + 150 + 0.5%	ATR Gem
Clethodim + atrazine Lontrel Advance + SOA Uptake	500 + 1100 + 150 + 800 + 0.5%	ATR Gem
Clethodim + Lontrel Advance + Uptake	500 + 1500 + 0.5%	ATR Gem
Clethodim + Lontrel Advance + SOA Uptake	500 + 150 + 800 + 0.5%	ATR Gem
Nil (ATR Gem)	Nil (ATR Gem)	ATR Gem

Research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and support of GRDC. The authors would like to thank them for their continued support.

Special thanks to the Kilby family of Gilgandra and the Masons also from Gilgandra for hosting the tank-mixing trials. Thanks also to the Wright family for hosting the rate and timing trials and Pioneer Hybrid for supplying seed.

Group H (HPPD) resistant wild radish

All of the Rocky movies go the same way. Rocky gets beaten, then fights back, and in the last fight he is taking an absolute beating when the inspirational music starts up in the 15th round and Rocky somehow musters the courage to rise from the ashes and win the fight against all of the odds.

WE were on the ropes with wild radish about 10 years ago with multiple herbicides failing and the farmers wondering what the future would hold, when over the hill, riding on a white horse, came Bayer with some new herbicides. Precept and then Velocity containing the HPPD inhibitor (group H) pyrasulfotole changed everything. Not getting Sylvester Stallone to do the marketing was a missed opportunity!

The first resistance to HPPD herbicides in wild radish has now been discovered by AHRI researchers led by PhD candidate Huan Lu. Wild radish is just the third weed in the world to evolve resistance to this group of herbicides.

The wild radish in this research was resistant to several other groups of herbicides which may have led to metabolic resistance to HPPD.

Looking forward to Rocky VII, I wonder how that movie will turn out!? Adrien!!

The population

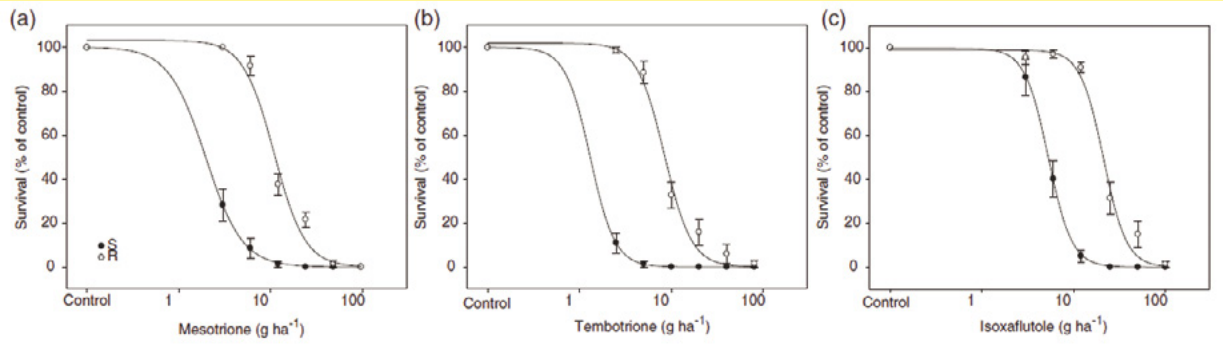
The resistant population of wild radish was sampled from the northern wheatbelt of Western Australia in 2015 during the AHRI random survey conducted by Dr Mechelle Owen every five years. This population tested to be resistant to the herbicides in the table below.

PSII inhibitors	Atrazine
ALS inhibitors (SU)	Chlorsulfuron (e.g. Glean)
PDS inhibitors	Diflufenican (e.g. Brodal)
Synthetic auxin disruptors (Phenoxy)	2,4-D

First round of testing for HPPD resistance

Wild radish plants were grown in pots to the 2–3 leaf stage (6–8 cm), then sprayed with Callisto (mesotrione). Eleven plants survived which were grown to maturity and hand pollinated to create the resistant population that underwent further testing.

FIGURE 1: The percentage survival of S (●) and R (○) wild radish plants in response to treatment with the HPPD-inhibiting herbicides mesotrione (a), tembotrione (b) and isoxaflutole (c) at 21 DAT



Callisto herbicide is not normally applied to wild radish post-emergent so this isn't considered a robust test for resistance on its own.

Dose response to three HPPD herbicides

The seed from the 11 surviving plants in the first round of testing was then tested as a dose response to three HPPD herbicides and compared to two known susceptible populations. While it could be argued that this isn't the normal use pattern for all of these herbicides, we can't argue with the fact that there's a shift in the dose response curve (Figure 1).

Low level resistance

This is low level resistance. The resistant population is just 4–6.5-fold resistant compared to the susceptible populations. But we must keep in mind that this is under controlled conditions in the laboratory where spray application occurs in a spray cabinet and plants are watered regularly. If plants are resistant in this environment, they will certainly appear resistant in the field!

What is the mechanism of resistance?

This is always a process of elimination.

1. It's not target-site resistance

Huan Lu studied this wild radish population and he found no evidence of target site changes in the HPPD gene. Sequencing of the HPPD gene between R (resistant) and S (susceptible) showed no evidence of a target site mutation and there wasn't HPPD gene amplification.

2. It's not reduced translocation

Huan Lu found no difference in rates of 14C mesotrione uptake or translocation. The black and white images (Figure 2) show the movement of radiolabelled mesotrione through wild radish plants 72 hours after application. There was no difference in uptake or translocation of mesotrione between R and S plants.

3. But it was metabolism-based resistance

Huan Lu used the P450 inhibitor, malathion, to turn off the P450 genes prior to spraying with tembotrione and found that this could reverse tembotrione resistance providing an indication of cytochrome P450 genes. This approach didn't work to reverse mesotrione or Isoxaflutole resistance and it's likely that there are other metabolism-based resistance mechanisms at play that will be the subject of further research.

What's clear is that this wild radish population has metabolic resistance and is resistant to several HPPD herbicides.

FIGURE 2: Visualisation of (^{14}C)-mesotrione translocation in S and R wild radish plants at 72 HAT with camera and phosphor images

How is it so?

It appears that many years of selection with other herbicides has led to metabolism-based resistance in this population of wild radish which has then caused resistance to the HPPD herbicides.

This is not the first time this phenomenon has occurred. One of the first populations of Pigweed (Palmer amaranth) from the US was also found to be resistant to HPPD herbicides despite never having been treated with this herbicide.

What about Velocity?

The population was not tested with Velocity (pyrasulfotole + bromoxynil) and the researchers were unable to obtain straight pyrasulfotole (the group H component of Velocity) and therefore were unable to test with pyrasulfotole alone.

To sum up

Wild radish is one of the world champions of evolving resistance to herbicides, so we knew this was coming. At present this is very rare and is only low-level resistance, but it should serve as a warning of what could be to come.

There are new herbicides on the way, but metabolic resistance knows no bounds and some of these new herbicides could be under threat before they are even released. As always, the WeedSmart Big 6 is a great checklist to look at to ensure that we're not entirely reliant on herbicides for wild radish control. New herbicides are coming, but so is Rocky VII and let's face it, Stallone isn't getting any younger. He might just go down next time! ■

Hot tips for compliant and effective spraying

GRAIN growers undertaking summer–autumn weed control are reminded of the requirement to comply with changes to 2,4–D label instructions which were introduced in October 2018.

Leading spray application specialist Jorg Kitt says changes to 2,4–D label instructions have implications for spray quality, efficacy and adjuvant use.

Jorg, who has led a series of Grains Research and Development Corporation (GRDC) effective spray application workshops, is reminding growers and spray operators of the changed label instructions, to ensure that summer–autumn spraying programs remain both compliant and effective.

Minimising drift

"2,4–D is a major contributor to drift damage in sensitive crops, and the new label requirement are designed to minimise these drift incidents," he said.

"In terms of spray quality, it is now mandatory to apply 2,4–D amine and ester products with a droplet size no smaller than very coarse.

"In the period from the October 1 to April 15, when most 2,4–D sensitive crops are growing, the Australian Pesticides and Veterinary Medicines Authority (APVMA) advises applying 2,4–D with a spray quality not smaller than extremely coarse," Jorg said.

These new instructions have consequences for nozzle selection and application decisions.

"As a starting point, to fulfil the new requirements, growers and spray operators should look at high-pressure air-induction nozzles which should be run on pressures at or above 'four bar'.

"But even these nozzles will generally not be able to meet the advisory requirements to spray with an extremely or ultra coarse spray quality from October to April, unless the pressure is dropped so low that droplet production may be compromised. There are only a few nozzle types that can produce droplets that size."

Jorg says the new regulations are mainly designed to avoid off-target drift.

"They are unlikely to reduce efficacy on larger summer weeds such as melons or larger marshmallows. But they are likely to reduce efficacy on smaller weeds such as fleabane seedlings, especially when stubbles interfere with the spray pattern."

Leading spray application specialist Jorg Kitt.

Tips for better efficacy

The spray medium – use of adjuvants

This is an often-overlooked aspect that can have a profound impact on spray quality and spray pattern. The spray medium interacts with different nozzle types in different ways:

- **TTI –** The Turbojet TTI is the most commonly used nozzle type in Australia to produce an extremely coarse spray quality. It is a very robust nozzle in reducing the amount of driftable fine sprays and can be used over a wide range of pressures. The principle of producing the spray fan is different to most other nozzles. Once the spray solution has left the output orifice it is thrown against an anvil-type plastic part that directs the spray fan in an angle downwards. The spray sheet is basically broken up before the liquid leaves the nozzle. This spray sheet is the part where adjuvants have the greatest effect. As a result, a TTI nozzle is barely affected by adjuvants.
- **Other nozzles –** With the introduction of new regulations in Australia and other parts of the world, other nozzle manufacturers have released other versions of nozzles capable of producing an extremely coarse spray quality, for example the agrotop TurboDrop XL-D. These nozzles generally have a conventional flat fan that appears uninterrupted underneath the output orifice of the nozzle. That means they produce slightly more driftable fine sprays compared to a TTI nozzle. But this also means they can be manipulated with adjuvants to reduce the amount of driftable fine sprays and, at the same time, optimise the spray pattern on the ground. On the other hand, they can also be counterproductive by increasing the amount of driftable fine sprays. The choice of the right adjuvant is important.

Increase in water rate

If the nozzle produces fewer and bigger droplets, the likelihood of hitting small targets is compromised. More water means generally more droplets. Applicators should change their practice to use 100 litres per hectare if they are chasing small weeds with an extremely coarse spray quality.

Decrease in speed

If there are stubbles present, a sprayer needs time to penetrate the stubble load. Slower speeds increase the likelihood of hitting relatively hidden targets. This provides additional benefits such as less dust production and less bounce of the boom which could be used to lower the boom height. Speeds of 12–16 km per hour are optimal, with a maximum speed of 18 km per hour.

Increase in product rate

This is not a popular option but generally this is the number one measure that has consistently increased efficacy in most trial work. After all, the most expensive spray is the one that has not worked. It is critical to not exceed the maximum label rate.

Seek expert advice

Jorg advises growers who are unsure about which nozzles to select (to meet new 2,4–D requirements) to seek expert advice from their agronomist or machinery dealer, attend a GRDC spray application workshop or seek out the extensive resources available on the GRDC's Spray Drift resource hub.

"While the new 2,4–D instructions can reduce the efficiency of spray operations, they are a positive move in protecting other agricultural crops, ensuring good relationships across sectors and enhancing our reputation as safe and compliant users of agricultural chemicals," Jorg says. "Under the changes, buffer areas came down significantly to more manageable distances and, more importantly, drift incidences are likely to decrease which is vital to secure a future of 2,4–D use in Australia."

Contact Jorg Kitt, M: 0429 939 403 E: jorgkitt@gmail.com ■

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Dual-purpose crops bring drought resilience to farming

By Darius Koreis, CSIRO

NICK Kershaw is a crop and merino sheep farmer in Greenethorpe, New South Wales. He credits the adoption of dual-purpose crops as providing critical stability to his farm in times of drought. Nick has been able to maintain a flock of 2000 merino ewes on his 1200 hectare property. This was despite 85 millimetres (mm) of 2019 growing season rainfall instead of the usual 300 mm average.

"Dual-purpose crops have been a real saviour for our farm," Nick said.

Grazed and grown

CSIRO farming systems agronomist John Kirkegaard said the use of crops like oats, wheat and canola provide mixed enterprise farmers with extra flexibility – especially in times of drought.

"Unlike traditional post-harvest grazing of crop stubble and split grain, dual-purpose crop practices also allow farmers to run livestock on their paddock while the crop is younger," John said.

"You might think you'd suffer from a loss of crop productivity by running sheep over a growing canola field. But we've found that when carefully managing the timing of their removal from the crop, there is minimal loss of yield from the eventual harvest."

Our research found that the practice comes with a significant net benefit for farmers. In fact, farmers gain an average of $400 per hectare for those already running sheep, through savings on additional feed and improved livestock condition.

During times of drought when the cost of feed rises, this means that farmers like Nick can minimise their costs and reduce financial stress.

Dual-purpose crops: Maintaining farm condition in drought

For Nick, adopting dual-purpose crops has had additional benefits during these tough times, when he needs to utilise every on-farm asset he has to keep it ticking over.

It rained heavily in Canberra the day before we visited Nick. Yet two hours north-west in Greenethorpe the rain gauge only recorded 8 mm.

While it isn't enough to breathe new life into his property, dual-purpose crops have allowed Nick to maintain his on-farm natural capital.

"It's allowed us to rest some of our pastures, rather than grazing them down to bare soil. It allows them to either maintain

Allowing sheep to graze on crops before they're harvested means farmers like Nick Kershaw can cut down on feed costs.

Nick Kershaw and CSIRO's John Kirkegaard checking on the progress of a dual-purpose canola crops

their condition, or quickly recover in the case of any good rain," Nick said.

"We've only had to bring in minimal feed from off-farm. And this was more to help supplement various nutrients the sheep need than anything else."

John said while dual-purpose crops provide added flexibility to mixed enterprise farms, there is no silver bullet to building drought resilience into a farming operation.

"Together with the Grains Research and Development Corporation, we're dedicated to further improving these methods to build resilience," John said.

"Our capabilities in agronomy and modelling are also developing new farming practices. This will help Australian farmers maintain profitability and sustainability during times of drought."

Dual-purpose cropping has been invaluable for Nick Kershaw during tough times.

When the drought breaks

Thirty-year-old Nick took over running the farm from his father in 2016. The farm has been in drought since 2017 and has seen the period of lowest rainfall on record. So, it's been a baptism of fire for the young farmer. But Nick sees positivity in his challenging start.

"We've had to think on our feet and be smart with how we go about things. We minimise risk by not taking chances, chase opportunities as they arise and keep informed about the latest developments," Nick said.

"If we can get through this like we have to date, we'll be on the front foot when the drought breaks." ■

Crop variety data released to inform 2020 sowing programs

IMPORTANT new data has been released to inform grain growers' crop variety choices for the 2020 season. Harvesting of the extensive winter crop variety trials conducted through the GRDC National Variety Trials (NVT) program is complete and data from those trials is now available to growers and advisers.

Single site results from successful trials in 2019 have been finalised and this data has been fed into multi-year, multi-environment trial (MET) variety performance analysis.

These multi-year, rolling datasets for all crops and growing regions will provide growers with the most valuable information to support their decision making around what to sow this year. Long-term MET results are the most accurate and reliable means of interpreting variety performance across sites and years, rather than results from a single year.

Look also at grain quality data when deciding

Growers and advisers are encouraged to base their variety decisions on not just yield results but also market receival quality data.

Data from trials compromised by seasonal conditions (such as frost and shattering) is presented in a 'quarantined' report on NVT Online. This report provides growers with a transparent account of the fate of unreleased but not abandoned NVT trials, however, the data is of no value for the purposes of head-to-head variety comparison and should not be used for any variety selection decisions.

GRDC NVT Senior Manager, Sean Coffey.

Meanwhile, GRDC NVT Senior Manager, Sean Coffey, says planning for the NVT program for 2020 is well underway, with the number of trials across the nation this year expected to be around 650.

"NVT represents a huge logistical undertaking, evaluating varieties for the 10 major crop types – wheat, barley, canola, chickpea, faba bean, field pea, lentil, lupin, oat and sorghum – within trials across the country," Sean says.

"The program evaluates more than 550 near-release or released varieties each year, generating highly valuable comparisons for variety agronomic performance, grain yields, disease and pest resistance and physical grain quality traits.

"NVT accepts lines into the program for testing two years prior to their commercial release. This ensures sufficient data is available for growers on newly released varieties to make informed variety selection decisions."

The largest co-ordinated field trial network of its kind in the world, NVT is a 100 per cent GRDC investment that is fully administered by the GRDC on behalf of Australian grain growers and the Australian Government.

A national program of comparative crop variety testing with standardised trial management, data generation, collection and dissemination, NVT seeks to assist growers to optimise the profitability of their farming systems through choosing the most appropriate varieties for their growing environments.

New features on the way

Sean says several new initiatives and features are being rolled out to enhance the NVT program and its value to the nation's growers.

"We will soon be launching *NVT Harvest Reports* to further support growers and advisers with variety decision making. The 16 regionalised reports, covering the entire NVT network of trials, will provide the very latest independent varietal information on yield, quality and disease ratings and they are designed to complement the GRDC-supported state-based *Sowing Guides*, which are published prior to harvest.

"We are also finalising our trial service providers for the next four years, have updated and improved the trial protocols to ensure we optimise the outcomes from our trials program, and our investment in the provision of plant pathology information has been contracted for another five years to underpin a standardised national disease resistance rating system."

Sean, who features in a video about NVT (at http://bit.ly/2PGLNbP), also thanked the many trial co-operators across the country who continue to support the NVT program by allowing trials to be conducted on their properties.

To support growers and advisers, the GRDC has produced instructional videos on 'how to interpret NVT data (long-term yield results) using the NVT website' and 'how to navigate NVT's website'.

Results and analysis from the trials harvested in 2019 across the nation can be viewed at www.nvtonline.com.au.

More infromation: Sean Coffey, GRDC NVT Senior Manager, 0428 652 226 ■

Plants uncovered: Extreme serendipity in polyploidy

By Louise Jeckells, CSIRO

IF you think the human genome is complicated, think again. Plants have one up on us. Genomes contain thousands of genes, and it's this genetic cocktail that determines the key attributes of a species. Most mammals, including humans, have two copies of their genome: They are diploid. But if you think that makes us more special than plants, you'd better think again.

The One Thousand Plant Transcriptomes Initiative (1KP) has published new research in *Nature* showing plants are rarely simple diploids.

At CSIRO we were involved in the most comprehensive survey of plant genomes to date. And it turns out most plants show the hallmarks of multiple rounds of whole genome duplication, known as 'polyploidy'. In other words, a polyploid organism has more than two paired sets of chromosomes.

A baggy set of genes

The CSIRO team identified and dated 244 polyploidy events in the plant family tree. Many of those polyploidy were associated with the creation of new and varied species. The broad scope and scale of this project lets us see patterns in gene diversification.

This gives us insights into how plants adapt to changing environments.

We have long known that many of our most important crop species are new polyploids. Polyploids tend to have higher yields and can adapt better to changing environments.

Wheat is the best-known example with three pairs of genomes (AABBDD). With each added genome there is higher yield and better adaptability.

But there's a downside to getting your poly-on

If it sounds like there are some stunning benefits to having a polyploid genome, you'd be right. But there is also a downside.

And it's a pretty big one if you want your species to continue. New polyploid species suffer from severe population bottlenecks.

Matt Nelson, an author on the 1000 Plant Transcriptomes Nature paper, in amongst polyploid canola plants. (PHOTO: Glen Riethmuller)

Canola has two sets of genome from other species – one from cabbage and one from turnip.

For example, a new polyploid species may be created from just one or two founding plants. If the new species survives, over time, it may become more diverse by mutation or through crossing with other plants from its more diverse parental species.

The problem is that many of our agricultural crop species are such new polyploids, they haven't had time to diversify. And that's a problem when it comes to risks such as a changing climate, invasive pests and diseases.

Breeding in diversity

A crop close to our hearts is canola (*Brassica napus* L.). It's an interesting example of genetic diversification and how fragile it can be. Australia is the second largest exporter of canola seed in the world. Our canola is in high demand for its oil which is one of the healthiest vegetable oils available.

Canola has two sets of genomes from two other crop species:

- Turnip (AA genome, *B. rapa*); and,
- Cabbage (CC genome, *B. oleracea*).

We think canola formed in a farmer's field as little as 500 years ago – or at most 7500 years ago. Canola was clearly seen to be a beneficial crop, and so it expanded to many parts of the world – because humans took it there.

Yet, when we study its genetic make-up, there's much lower genetic diversity in polyploid canola compared to its diploid parent species.

This lower diversity means that there is less room to improve canola further. But the good news is that we're seeking to expand the diversity of canola using its diploid parent species and other Brassica species. In time this means we'll be able to breed improved varieties of canola.

They'll be more vigorous, more tolerant to heat and drought stress, and more resistant to pests and diseases.

This will help canola continue to thrive in the face of changes in climate and land use – even if it's giving polyploidy a helping hand. ■

Novel approaches for better management of farming risk

WHILE many grain growers have traditionally managed revenue volatility by ensuring their business has sufficient cash and unleveraged assets on hand to cope with successive poor seasons, increased profit margin pressure means the opportunity cost of this approach can hamper the competitiveness of family farms.

That's according to a report by 2018 Nuffield Scholar and Western Australian grain grower, Dylan Hirsch.

With support from Grains Research and Development Corporation (GRDC), Dylan travelled throughout North America, Europe and the United Kingdom, meeting with farmers, agricultural lenders, insurers, reinsurers and farm lobby groups to better understand global approaches to managing seasonal weather risk.

In several case studies of businesses using financial risk management products, Dylan's report investigates investment confidence, lending behaviour, land values and profitability.

"Traditionally, Australian grain farmers have adopted strategies like operational and geographic diversity, equity protection through unleveraged assets, and multi-peril crop insurance to manage the risk of drought and other production perils," Dylan said.

"At the same time, industries like energy supply and distribution have developed more novel financial instruments to better manage revenue volatility caused by seasonal weather.

2018 Nuffield Scholar and Western Australian grain grower, Dylan Hirsch.

New risk management instruments

"These instruments are starting to make their way into agriculture, and I wanted to investigate how farmers and other industries are managing seasonal weather risk other than through traditional crop insurance models," Dylan said.

Travelling through Alberta, Canada, Dylan met with a wheat, barley and canola grower who illustrated the real value of insurance through what it enabled him to do – rather than the balance or premiums paid and claims made.

"Across a 2000 hectare cropping enterprise in Red Deer County, Alberta, the business formerly used government supported crop insurance, in conjunction with hail insurance," Dylan said.

"The issue with this approach was that 70 per cent of the yield replacement coverage was based on historical agronomic practices, which didn't cover the cost of the improved, cutting edge agronomic practices the business implemented when the younger generation returned to the farm.

"The solution was to take out additional private profit margin insurance and completely insure the cost of production, including all business costs, land payments and depreciation. This enabled the business to be completely covered against downside risk and take on opportunistic land purchases and lease opportunities with confidence.

"Despite spending more on premiums and rarely making claims, the grower was confident the family business had profited from being enable to farm aggressively and make the most of every opportunity," Dylan said.

Covering gaps in price

The report also details a novel UK based insurance product called Stable, which has been designed to fill major gaps in price risk management and help farmers manage price volatility.

"In Ireland, index insurance is being incorporated into agricultural finance. The Stable model has developed several products in conjunction with agricultural lenders to reduce the risk of loan default following poor market prices," Dylan said.

"It has been used in Ireland for dairy farmers, where the volatility of milk prices is unable to be managed with futures contracts."

Dylan concludes that the Australian agricultural industry currently lacks the structures required to attract support for broadscale implementation of insurance programs like those in place in the US, Canada and the European Union.

"The new age of big data is allowing developing agricultural nations to implement index insurance programs for farmers, which allows them to protect against seasonal production risks at a fraction of the cost of traditional crop insurance programs," Dylan said.

"The advent of these products in Australia will happen eventually, but the more immediate opportunity is for Australian farmers and the broader industry to shape how these products will function when they get here.

"Engagement with insurance and finance industries, as well as government, will ensure the industry can fully and collectively realise the benefits of more robust risk management programs."

Dylan's contact details M: 0408 790 816, E: dylanhirsch@gmail.com ■

Unlock the yield potential of your cereal crops

YARAVITA Gramitrel foliar fertiliser 'unlocks' the yield potential of cereal crops by providing a balanced combination of readily-available macro and micronutrients essential for crop growth.

Yara Australia Sales Agronomist – WA, Jason Brady, says foliar sprays enable the precise application of essential nutrients, including nitrogen, manganese, magnesium, copper and zinc, ready for immediate uptake by the leaves.

YaraVita Gramitrel has a guaranteed minimum analysis of N 6.4, Mg 15, Mn 15, Zn 8 and Cu 5 per cent.

"Even though the requirements for micronutrients and some macronutrients is small, efficient plant growth and function does not occur without these nutrients," Jason says.

"Manganese governs the function of many enzymes, including those that help to provide the oxygen needed to form carbohydrates.

"Magnesium is vital for plant growth and development, being the central component of chlorophyll.

"Copper plays a key role in photosynthesis, flower and seed formation and for the functioning of several enzymes, including lignin synthesis.

"Zinc is essential for root development and at crop emergence due to its role in growth hormone synthesis and flower fertilisation," Jason said.

YaraVita Gramitrel is applied to cereal crops at one to three litres per hectare from the two-leaf stage to second node detectable (Zadoks GS12–32) or one litre per hectare from second node detectable to flag leaf fully emerged (Zadoks GS 32–39).

Made using the highest quality ingredients, this easy-to-mix suspension concentrate is compatible with a wide range of crop protection products for cost-effective, one-pass application.

"Always check the compatibility of all the tank-mix partners before mixing by contacting Yara, visiting the Yara website or downloading the Yara Tankmix app," Jason says. ■

Nitrogen deficiency trials in wheat.

Low prices, zero interest and tax breaks: Go for it!

LONG-AWAITED rain has reached many parts of Australia, encouraging growers to think about investing in equipment upgrades – and with government incentives and big discounts, the timing couldn't be better, says Flexi-Coil Brand Leader Steve Mulder.

"Growers thinking about new equipment to optimise seeding for the upcoming season should talk to their Flexi-Coil dealer soon, because we have some very strong offers right now. Our clearance stock is heavily discounted, some units up to 15 per cent, so it's a great time to pick up brand new equipment at unbeatable prices. This is a rare opportunity to get premium Flexi-Coil equipment into your shed," he says.

"There's interest-free finance available via CNH Industrial Capital too, which makes for an even better deal, and the proposed Federal Government stimulus package means growers could claim a 100 per cent write-off for equipment up to $150,000 value, and greater depreciation for equipment over $150,000."

The zero per cent finance offer is only available until June 30, assuming stock lasts that long. "We have a limited number of clearance units available, so growers who are looking for a good deal need to be quick," Steve says.

Flexi-Coil's precision seeding products stand alone in terms of accuracy and innovation. From an unrivalled air delivery system to full section control and customisable configuration options, a Flexi-Coil unit will ensure the job can be done better, faster and more easily.

"Remember, a successful season begins with seeding. Get it right, and you're off to a strong start. Quality, reliable seeding equipment that helps you achieve precise, accurate seed placement is an investment that will pay for itself over and over. We are proud that Flexi-Coil has long been an integral part of the success of Australia's leading broadacre farmers," Steve said.

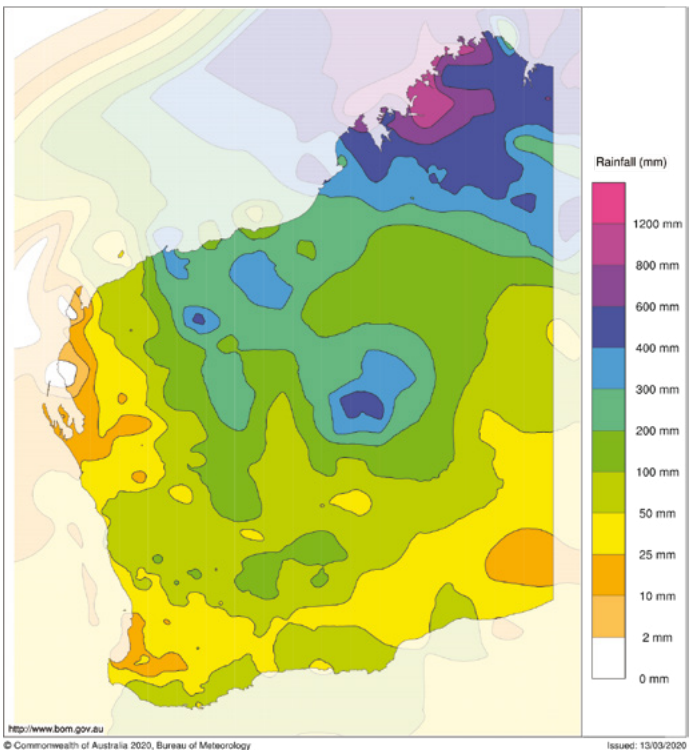
You can find a full list of remaining stock on the Flexi-Coil website: *https://flexicoil.com.au/deals/* Terms and conditions apply. ■

A successful season begins with seeding.

District Reports...

Western region

Western Australia rainfall totals (mm) January 1 to March 13, 2020
Australian Bureau of Meteorology



Late cyclone activity has produced enough rainfall in many areas to give a good weed flush and bolster soil moisture reserves.

WESTERN AUSTRALIA SUMMARY

Across the WA grainbelt it was "one extreme to the other" in 2019, irrespective of your location. In the north of the state grain yields were more than 50 per cent below 2018 for all crops (except oats), and in some cases up to 75 per cent below.

Moving south in the state the combination of severe frost followed by very hot windy conditions resulted in unprecedented loss of production for some growers. This was most evident in the south coast where some growers had their "best ever" result due to the lack of waterlogging – others had their "worst ever" due to the lack of rain and frost.

In traditionally higher rainfall regions of the south west, grain yields were spectacular and grain quality excellent, with some regions returning the highest whole paddocks grain yields ever.

During the 2019 harvest, grain quality was erratic, with some growers delivering into more segregations than ever before due to the range in protein and screenings. Having the ability to deliver into the number of segregations required (due to the wide range in grain quality) was a credit to WA's grain handling system. Reflecting market signals, the lack of price spread for protein reinforced the message to mostly grow for yield.

For most, the 2019 cropping year in Western Australia was one to forget. As is often the case when faced with a difficult situation, learning from what did and did not work can be very useful. A standout lesson from last year was the very good weed control achieved by loading up with pre-emergent herbicides when faced with the second year in a row without a knockdown.

Weed control was helped by the season in 2019, although strategies to keep herbicide rates up, use diverse modes of action, and to be spot on with post-emergent application timings, have also contributed to low weed loads for next season.

Climate prediction models are becoming more sophisticated each year. Predictions in early 2019 were that it was going to be a low decile year and warmer than normal in the spring – which turned out to be correct.

Growers are taking more notice of climate models and whilst many may not have necessarily changed plans based on early season predictions, it certainly was in the reckoning, particularly as the season break became later.

Outlook for 2020

This year there has seen a fundamental shift away from the weather patterns that were affecting our climate in 2019. We have moved from a negative situation to a more neutral outlook. This is good news for growers. And the recent late cyclone activity reinforces a more positive outlook for 2020, particularly with such dry soil profiles. Any summer rain would be of benefit going into the 2020 growing season.

The main shift in growers' cropping plans for 2020 for most areas is one of returning to conservative programs and making very careful decisions around spending and crop type mix. There will be more wheat sown in the north and more barley in the south. The possible exception to this thinking would be in the western and south western regions where growers enjoyed a good season last year.

In general, the canola and lupin break crop area will decline and will be highly dependent on subsoil moisture and the timing of the break to the season. The area of either pasture or fallow in the lower rainfall regions will increase, again highly dependent on the timing and amount of rainfall.

There is likely to be a slow down in the adoption of barley plantings in the north of the state, with barley being substituted with the Imi wheat variety, Chief. Oats as a break crop area will increase and early grazing of cereals for those who have sheep, will continue to keep the lid on pasture area.

Grain Industry Association of WA, February 7, 2020

NORTHERN DISTRICT

There has been some welcome summer rain across almost all of the region between February 19 and 28. Falls were from around 25 mm up to around 130 mm in a few places under storms. Most falls were in the 30 to 60 mm range. There has also been storm damage with one home losing a roof and several sheds blown over.

The low end of the rainfall tallies is a frustrating amount with only enough rain to get weeds away but not enough to give much subsoil moisture. About 25 per cent of the region fits this scenario.

The landscape is now green and at last we have some glyphosate going out on green paddocks. Most of the weeds are volunteer barley/canola/lupins/wheat with summer weeds.

But most paddocks have winter weeds up and it is great to see knockdown herbicides going on these. Some farmers have not had a good knockdown opportunity for three years. Farmers will be part nocturnal over the next couple of weeks as they burn the midnight oil spraying in the cool of the night.

The wet soil has deep rippers going and those who still cultivate paddocks are getting a chance to bury some weeds.

Other jobs include getting equipment ready for seeding. Lime applications are still happening along with general preparation of paddocks for the crop ahead.

It is so good to see some soil moisture and the landscape green. I hope you are getting the weather you want at your place. Hopefully, some April and May rains are also coming.

Peter Norris
Agronomy For Profit and Synergy Consulting, Geraldton
March 6, 2020

CUTUBURY CANOLA

The new TT canola variety with Group B tolerance, Cutubury, has been developed by local WA consultant and farmer, Peter Norris. One of its main uses is to allow a break from Imi herbicides. Most canola varieties have a 32 month plant back period.

Cutubury has a zero month plantback period.

This solves a big problem when trying to manage Imi herbicides in crop rotations.

As well as being TT variety with Group B tolerance, Cutubury will handle all the herbicides that TT canolas can. Its yield and oil performance in side by side paddock comparisons has been similar to Stingray, Snapper and Bonito. It has also consistently yielded higher than Yetna and has higher oil content.

For 2020 seed orders and further information contact Peter Norris, Agronomy For Profit, on 0428 850 850 or Email: afp@westnet.com.au or call ASG Moora on 08 9651 1069.

The new Cutubury canola at Tibradden in the Geraldton district of WA during a very difficult 2019 season. The 230 hectare paddock went on to yield an average of around 1.0 tonne per hectare at 44.4 per cent oil. The paddock had been treated with 40 grams per hectare of Sentry Imi herbicide in the 2018 season.

Southern region

SOUTH AUSTRALIA SUMMARY

The estimated total SA production for the 2019–20 winter crop season is 6.2 million tonnes from 3.85 million hectares.

Harvest was delayed for some growers by cool conditions in November and hot windy/high fire danger conditions in late December. By early January most areas had completed harvest with only a few farmers on Southern Yorke Peninsula and the Lower South East still harvesting.

Yields of cereal, oilseed and pulse crops were highly variable across the state, depending on rainfall received – but most areas produced below average yields.

The areas worst affected by lack of rainfall were the north and north-eastern section of the Upper North, the eastern Mid North, Northern Murray Mallee, and the Far West Coast and Eastern Eyre Peninsula. Some farmers in these areas were unable to harvest enough grain for next season's seed requirements.

Yields in the Lower South East and western part of the Upper North were generally above average. while yields in Lower Eyre Peninsula were generally average to slightly above average, despite severe grain losses of over 2.0 tonnes per hectare in some crops from strong winds on November 20.

High water use efficiencies were reported in many barley crops across the state. Barley handled the hot dry finish to the season better than wheat.

Canola yields on Western and Lower Eyre Peninsula, Kangaroo Island and the South East were average to above average. In all other districts, canola yields were below average. Oil content was average to above average across the state.

Grain quality held up

Wheat grain quality was average to above average due to low screenings, above average grain protein and high test-weights. A high percentage made milling grades.

Barley quality was better than expected with a higher than normal proportion of malting barley varieties classified as malt and most feed varieties classified in the highest feed quality segregation.

Bean and lentil crop yields were average to above average on Lower Eyre Peninsula and the South East, and below average to well below average in all other districts.

Chickpea crops performed poorly due to dry spring conditions and lack of stored soil moisture at seeding time. Some field pea crops were severely damaged by frost. Crops not damaged by frost still yielded below to very much below average.

Pests and diseases were generally low with minimal crop losses.

PIRSA Crop & Pasture Report, January 2020

VICTORIA SUMMARY

During the week ending March 11 good rainfall was recorded across eastern Australia. This heavy rainfall was generated by a deep trough and low pressure systems over northern and eastern Australia. Rainfall between 25 and 100 mm was recorded over parts of the Northern Territory, Queensland, New South Wales, Victoria and Tasmania.

Rainfall totals of between 25 and 100 mm were recorded across eastern and western Victoria.

ABARES analysis of daily rainfall data sourced from the Bureau of Meteorology indicates that an early autumn break has been achieved across much of central Victoria and eastern Tasmania.

The autumn break is typically driven by westerly fronts moving across southern Australia and cut-off low pressure systems. The recent autumn break in south-eastern Australia has been driven by incursions of moist tropical air from northern Australia resulting in substantial rainfall.

ABARES, March 12, 2020

District Reports...

March–April 2020

VICTORIAN MALLEE

As a result of the below average spring and big crops grown in 2019, soil moisture profiles across the Mallee were very low after harvest. Isolated thunderstorms throughout January and February have delivered varied rainfall across the Mallee with some areas recording up to 100 mm while paddocks 'next door' received less than half of this.

Most growers are on their second or third pass of the spray boom, tackling the summer weeds and volunteer cereal crops – and with rain on the horizon, it looks like the booms won't be put away for long. Growers are targeting larger weeds and volunteer crops first as these will be removing the most moisture.

As a result of the head loss experienced across grain crops during harvest, growers are being encouraged to clean up any grain to reduce the risk of mouse damage going into sowing.

Hay contractors were in high demand this past season with many growers in the Mallee incorporating hay crops into their regular rotation. Many new haysheds have been erected over the summer months.

Soil sampling is underway across the Mallee with growers wanting information regarding nutrient status and soil moisture levels to make more informed decisions around fertiliser requirements and to have a better understanding of any soil constraints. This will help with crop rotation decisions.

Farm plans have been finalised and growers are now cleaning and treating stored seed, performing germination tests, ordering new varieties, spreading gypsum, ordering fertiliser and ensuring the seeder bar is ready to go in preparation for sowing.

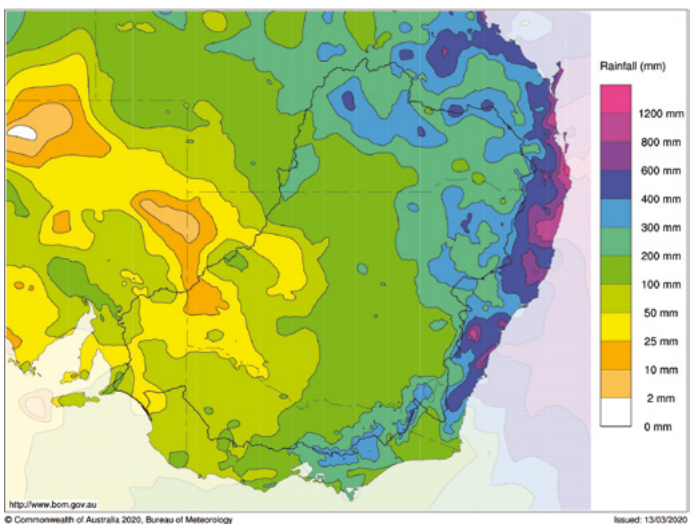
Mixed farmers are preparing to sell off sheep grazed on stubbles over summer – maintaining at least a 10 per cent stubble cover will be important. If autumn lambing, growers will be ensuring gestating ewes are receiving adequate nutrition over the next few weeks.

With preparations well and truly underway for the 2020 cropping season, farmers will be looking for some favourable weather forecasts and a decent and timely break to the season.

Brooke Bennett
Birchip Cropping Group
March 3, 2020

Soil sampling is allowing Mallee farmers to make more informed fertiliser decisions.

Murray–Darling Basin rainfall totals (mm) for Jan 1 to Mar 13, 2020
Australian Bureau of Meteorology



Year to date rainfall has added long-awaited optimism for the 2020 winter crop,

Northern region

NSW SUMMARY

High rainfall during the first two weeks of February weakened drought conditions across much of eastern NSW. And a widespread rain event during the first week of March continued to improve conditions and is assisting a promising start to autumn – and the coming winter crop – across much of the state.

Rainfall totals of between 25 and 100 mm were recorded across much of NSW in early March.

The drought event has weakened but is not over and a 'watch and monitor' status is in place. Recovery still depends on widespread follow-up rain and several weeks of pasture growth.

Despite variable rain distribution, rainfall totals for the 2020 calendar year have been average to very much above average for much of NSW.

The area planted to summer crops in NSW is estimated to have decreased by 76 per cent in 2019–20 to a record low 101,000 hectares. Very low supplies of irrigation water and record low soil moisture in many regions prevented widespread planting of summer crops.

Total summer crop production is forecast to fall by 66 per cent to a record low 343,000 tonnes in 2019–20.

NSW DPI & ABARES, March 6, 2020

QUEENSLAND SUMMARY

Area planted to summer crops in Queensland is forecast to have fallen by 61 per cent in 2019–20 to around 239,000 hectares. This is due to a significant fall in area planted to irrigated cotton and grain sorghum. Summer crop production is forecast to decrease by nearly 70 per cent to 459,000 tonnes.

Area planted to grain sorghum is forecast to have fallen by 66 per cent to 130,000 hectares – the lowest on record. Grain sorghum production is forecast to fall by 74 per cent to 260,000 tonnes, driven by the fall in planted area and an expected 23 per cent fall in the average yield.

During the week ending March 11 good rainfall was recorded across eastern Australia. This heavy rainfall was generated by a deep trough and low pressure systems over northern and eastern Australia. Rainfall between 25 and 100 mm was recorded over parts of Queensland.

Rainfall totals of between 15 and 50 mmm were recorded across cropping regions in southern Queensland.

District Reports...

March–April 2020

ABARES analysis of daily rainfall data sourced from the Bureau of Meteorology indicates that an early autumn break has been achieved across parts of southern Queensland.

The autumn break is typically driven by westerly fronts moving across southern Australia and cut-off low pressure systems. The recent autumn break has been driven by incursions of moist tropical air from northern Australia resulting in substantial rainfall.

ABARES, March 12, 2020

DARLING DOWNS

Weather conditions

What a wonderful turnaround in the weather since mid-January. Most growers have received between 200 and 300 mm of rain in the past seven weeks and the countryside is transformed.

Temperatures have been mild to warm and the rainfall was spread over a six week period so moisture infiltration was fair to good.

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)	2020 rainfall to date (mm)	Summer 25yr Annual Average (mm)	Summer 2019–20	Autumn 25yr Annual Average (mm)	Autumn 2020 to date	Winter 25yr Annual Average (mm)	Winter 2019	Spring 25yr Annual Average (mm)	Spring 2019
Emerald Qld	560	332	256	287	106	45	67	44	125	6
Toowoomba Qld	678	313	271	304	143	33	87	25	179	124
Roma Qld	567	402	245	385	118	27	74	18	131	35
Goondiwindi Qld	609	173	242	186	124	22	98	27	145	36
Narrabri NSW	617	306	213	272	121	40	122	15	161	60
Gunnedah NSW	622	243	206	220	110	25	125	28	182	38
Dubbo NSW	583	189	183	120	125	71	127	24	180	32
West Wyalong NSW	433	178	114	112	79	71	121	48	120	41
Wagga Wagga NSW	524	100	130	39	110	69	146	78	141	91
Swan Hill Vic	307	64	68	44	65	26	87	72	88	37
Bendigo Vic	491	113	96	74	107	43	159	139	129	81
Horsham Vic	365	76	73	67	72	13	121	133	98	58
Lake Bolac Vic	507	107	105	102	107	12	155	170	141	113
Murray Bridge SA	356	37	64	38	81	2	120	109	93	50
Kadina SA	328	31	59	41	79	3	108	76	82	59
Cummins SA	394	37	50	43	92	3	176	148	76	68
Esperance WA	620	31	91	35	137	0	253	248	138	97
Wagin WA	392	45	50	46	89	0	168	211	85	49
Northam WA	407	36	51	37	84	0	192	200	80	38
Mingenew WA	347	87	32	87	84	0	174	232	57	26
Moora WA	385	45	46	46	79	0	191	199	69	36
Mullewa WA	310	62	48	66	89	0	130	146	43	12

Last rainfall reading March 10, 2020.

District Reports...

March–April 2020

Summer crop

There was a rush of planting in late January to mid-February – which is right at the end of the Downs planting window. There was also a rush of weeds emerging, with pigweed being dominant and plenty of feather top Rhodes grass. Weed control has been a major issue and not helped by a tightening of herbicide supply.

Forage crops were the first to go in with forage sorghum and millets very popular. The grain sorghum area is small at about 40 per cent of a normal year, but the crops are looking good as they approach flowering. Late corn was popular in some areas and growers have also turned to mungbeans, as the shortest season crop, for a late plant. These crops are starting to flower and as expected, pest numbers are starting to increase. And there have been a few sunflower crops planted on the eastern Downs, which will please the tourists.

The few early sown corn and sorghum crops under irrigation have been harvested with expected results – lower yields and poorer quality due to the lack of rain and the harsh conditions.

A glorious sight on the Darling Downs! Sorghum growing well and more rain building up in the distance.

Winter crop outlook

There will be a massive winter plant, especially as quite a number of growers did not get enough soil moisture in time to plant any summer crop at all.

The wheat and barley area will be two to three times normal as growers turn to cereals for both the strong price and the groundcover that will be produced. Water run-off was an issue with some of the heavier rainfalls which meant the soils did not store enough moisture – so growers are looking to cereals to assist their zero/minimum till practices.

The chickpea area will be improved from the last two winters but below the long-term average, whilst the faba bean crop is heading for an increase in popularity.

This winter plant is expected to be spread over a much wider planting window than usual, as growers look to take advantage of planting moisture and start earlier.

All in all the outlook is quite positive for the next six months.

Hugh Reardon-Smith
Agronomist – Landmark, Pittsworth
March 6, 2020

A crop of Darling Downs mungbeans next to a fallow with weeds under control. The story of this summer/autumn – crop and fallow.

ANSWER TO IAN'S MYSTERY TRACTOR QUIZ

The Mystery Tractor is a 1918 Ruggles and Parsons 12/20, built by The Republic Motor Truck Co of Alma, Michigan. Photographed in New Zealand, owned at the time by B D Batchelor.

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