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FRONT COVER

Getting in early

As part of a GRDC supported *Managing Early Sown Wheat* project, the Victorian Mallee-based Birchip Cropping Group is trialling the long season dual purpose winter wheat, Kittyhawk. The trial was sown on March 15 this year at the BCG Curyo site.

This photo of newly emerged Kittyhawk was taken on March 21 by BCG Senior Researcher, Kelly Angel.

Contents

Focus Sections

Southern Australia Focus

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

Northern Focus

Covering Northern NSW and Queensland


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Editorial... Lloyd O'Connell

THE vast majority of southern and Western Australian grain production areas have enjoyed wonderful summer and early autumn rains which have added to precious soil moisture reserves for the coming winter crop. Given the huge grain yields much of the grain belt produced in 2016, soil moisture levels were under pressure by the time harvest rolled around – despite the very wet 2016 spring.

But in the north, the summer rainfall story is unfortunately different. The age old farmer's lament of "if only she'd rained a few weeks ago" is bouncing off pub walls from Coonamble to Clermont. The northern rains finally arrived in early March – but only after some record high temperatures and prolonged dry conditions in February put paid to any thoughts of above average summer crops. But later sown crops will benefit and it looks like there's a lot more rain on the way.

As I write, Tropical Cyclone Debbie is about to cross the North Queensland coast near Ayr. The current BOM forecasts are that as Debbie turns into a widespread rain depression over land, she will track southwards towards central and southern Qld. Rain from this system could also extend into northern NSW. So let's hope Debbie has more of a dampening rather than destructive path over coming days.

The upshot of all this is that in most parts of the national grainbelt, soil moisture conditions are likely to be excellent as we enter the winter crop sowing period.

Planting intentions for 2017

Our chief government commodity forecaster, ABARES, has just released estimates for the area of the coming winter crop. The area planted to wheat is forecast to remain steady at around 12.8 million hectares.

But the total area planted to coarse grains is forecast to fall by around 6 per cent to 5.2 million hectares. This is largely on the back of a swing away from poorly-priced barley. Increased sheep and cattle numbers are also expected to take up some of this coarse grain area.

The good prices for canola and pulses will see a lot of interest in these crops. With timely planting rain, the area planted to canola this autumn will approach 2.8 million hectares – almost 500,000 hectares more than last season.

With favourable planting rains, ABARES expects chickpeas will again be at a near record area of 790,000 hectares. And with lingering supply and production issues in the sub-continent, many local marketers are expecting a continuation of strong chickpea prices this season (see article page 25).

Here's hoping for timely and plentiful sowing rain in your patch.

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In this issue...

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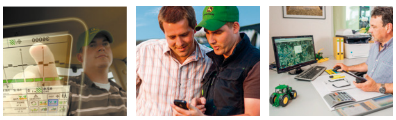

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Spray application tips and tactics

By Bill Gordon, Nufarm Australia

AT A GLANCE…

- Product choice and rate, timing and total application volume will normally have the largest impacts on the efficacy achieved from any spray job.
- The sprayer setup and operating parameters can also have a significant effect on the outcome by affecting the spray coverage on the target, as well as the drift potential.
- Assessing spray coverage is a simple process that can help to improve the sprayer setup.

THROUGHOUT the season there are a number of situations where spray applications are made to very different types of targets, often with products that have different types of translocation. This variation generally requires a change in nozzle type or orifice size and the operating parameters to achieve a change in total application volume and/or spray quality.

After adjusting the sprayer setup, being able to determine where the spray droplets are landing allows the operator to change the sprayer setup to improve the coverage for particular spray jobs. Often this requires that the operator is able to assess the impact of changes to the setup on where the droplets land.

The best spray jobs are achieved when you get product choice, rate and timing right.

How many setups should the operator have?

As a general guide, the main spray jobs, application volumes and typical spray qualities required by an operator are covered in Table 1. This highlights the fact that often more than two sets of nozzles are required to cover all situations.

For each type of spray application there may be subtle variations in the sprayer setup or operation that can be made to improve the coverage. This article discusses some of the practical considerations the operator should take into account when choosing the setup for various spray jobs throughout a typical season, including the factors influencing spray coverage and how to compare setups and operating parameters for continual improvement.

Suggestions to improve fallow applications

The following points have been included to provide a guide or starting point for the sprayer setup.

Total application volume: For fully translocated products volumes above 50 L per hectare for a coarse spray quality in low stubble environments are needed, and above 70 L per hectare in heavy stubble environments. Typically this volume should be increased by 10 to 20 L per hectare when using an extremely coarse spray quality.

For contact type products (translaminar) the total application volume should be above 70 L per hectare in low stubble environments, and up to 100 L per hectare in heavy stubble situations.

Spray quality: For small vertical targets (grasses) operating at the small end of the coarse spectrum will normally provide good retention of droplets on a range of weed types, but using coarser spray qualities may also be useful for many broadleaf weeds.

Often operating at the small end of the coarse spectrum will provide a good balance for a range of targets and products. This is normally suitable for daytime conditions, but may not reduce the spray drift potential if considering spraying at night.

TABLE 1: Typical spray quality and total application volume for different situations

Typical application volume	Medium spray quality (lower drift risk areas)	Coarse spray quality	Extremely coarse spray quality (higher drift risk areas)
Lower range 50–60 L/ha (low stubble load) to 70–80 L/ha (high stubble load)	*Only where permitted on label: Fully translocated herbicides. Small to medium sized targets.	Fallow spraying. Fully translocated herbicides such as glyphosate and Group 1 herbicides	Fully translocated herbicides, medium targets. Very sensitive areas or **NIGHT SPRAYING**
Higher range 70–80 L/ha (low stubble load) to 100+ L/ha (high stubble load dense crop canopy)	*Only where permitted on label: Contact type products. Small targets. In-crop spraying. Penetration and coverage in large and broadleaf crops.	Good stubble penetration. Pre-emergents. Fully translocated herbicides. Some contact herbicides at the higher application volumes.	Water soluble pre-emergents. Medium sized targets with fully translocated summer fallow herbicides. Very sensitive areas or **NIGHT SPRAYING**

*Note, the arrows indicate that one nozzle may be able to do more than one type of application, provided the spraying speed, application volume and operating pressure are suitable

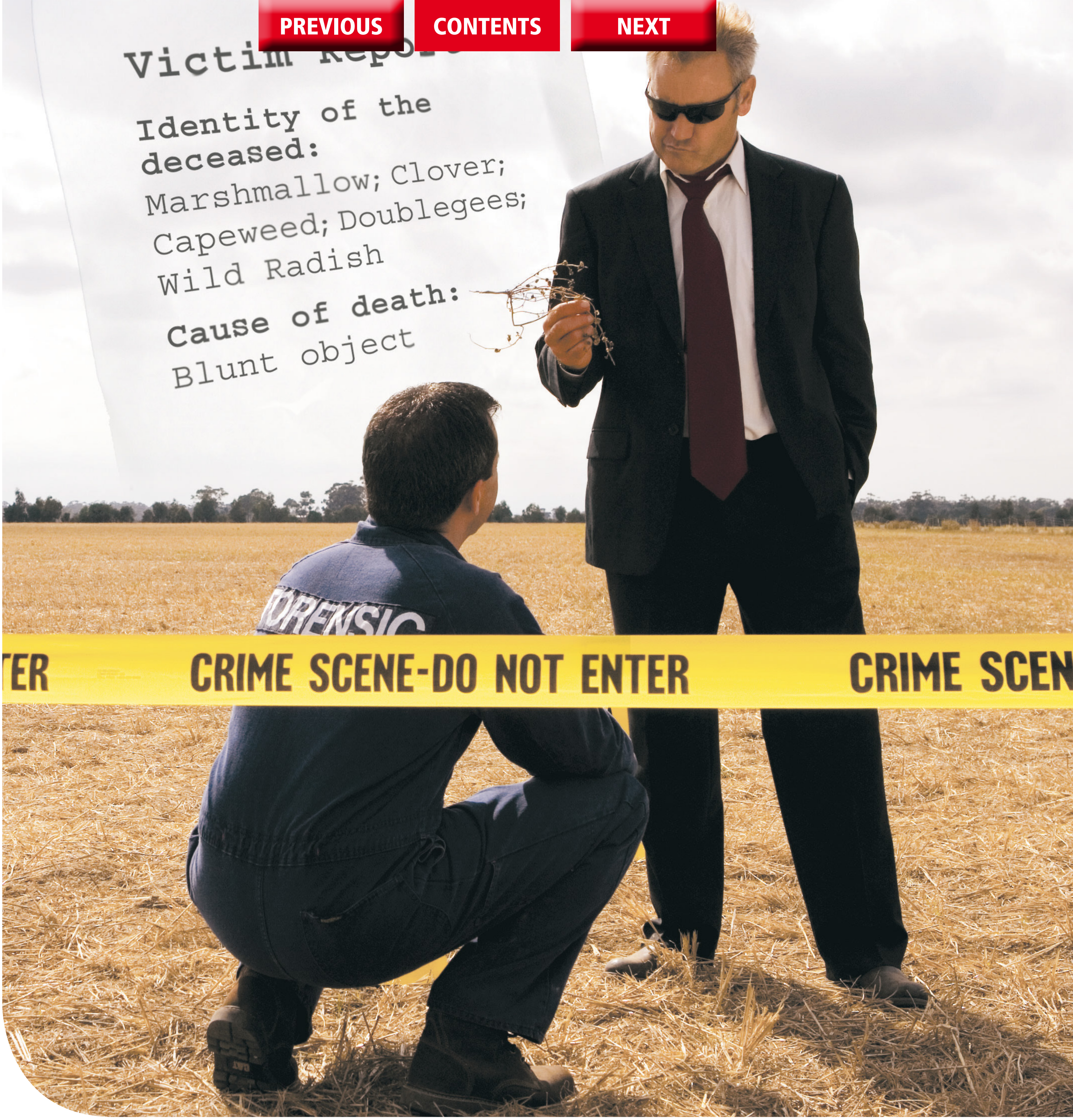

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TABLE 2: Variation in the Dv0.5 (VMD)[1] produced by selected low drift nozzles* operated at 3.0 bar, expressed as the standard deviation +/– from the Dv0.5 (VMD) in micrometres (µm) for three spray solutions

Spray solution	Water	Clopyralid	Pinoxaden + methylated oil	Average Standard Deviation
Nozzles tested (all nozzles were operated at 3.5 bar)	Standard Deviation +/– micrometres (µm)			
	7.33	4.69	4.45	5.49
Bellericay Bubblejet ABJ 110–015	28.62	26.01	14.52	23.05
Bellericay Bubblejet ABJ 110–02	9.60	5.11	3.54	6.08
TeeJet AITTJ60–110–02	8.40	8.72	9.78	8.97
TeeJet AIXR 110–015	5.44	10.28	9.06	8.26
TeeJet AIXR 110–02	19.63	16.40	12.80	16.28
Hypro Guardian Air 110–015	15.92	14.27	10.61	13.60
Hypro Guardian Air 110–02	6.14	8.17	8.73	7.68
Lechler IDK 120–02	4.64	6.35	4.84	5.28
Lechler IDKT 120–02	6.32	8.23	4.29	6.28
Hardi Minidrift MD-110–02	4.16	3.73	3.10	3.66
Hardi Minidrift Duo-110–02	5.23	2.30	3.53	3.68
TeeJet TTI 110–015	13.04	10.51	14.04	12.53
TeeJet TTI 110–02	5.39	8.71	12.25	8.78
Teejet TTJ60–110–02	41.71	11.69	5.83	19.74
Hypro ULD 120–015	7.75	14.11	8.54	10.13
Hypro ULD 120–02	7.63	3.39	3.89	4.97

[1]Dv0.5 or VMD is the droplet size (diameter in micrometres or µm) at which half of the spray volume produced by the nozzle will exist as droplets smaller than this size, and the other half will exist as dropets larger than this size.
*note the range of nozzles listed in this table does not include all of the nozzles tested by J Connor Ferguson

Nozzle spacing: Using narrow nozzle spacings, eg. 25 cm compared to 50 cm, can improve deposition into standing stubble. But before deciding to plumb the machine this way ensure that the orifice size and spray quality will be suitable if operating with nozzles that have smaller orifice sizes.

Boom height: Operating at heights above that required for a double overlap at the top of the stubble or weed (whichever is the taller) will reduce coverage and increase drift potential. Increasing boom height from 50 cm above the target to 70 cm above the target can increase the airborne fraction of spray by up to four times.

Adjuvant selection: Adjuvants should always be chosen to increase efficacy, but many adjuvants have the potential to change the spray quality and drift potential in unexpected ways.

Most non-ionic wetter 1000 type products can more than double the drift potential from some air inducted coarse nozzles. For fallow spraying it is important to select adjuvants that do not increase the drift potential of the spray application.

Spraying speed: Reducing spraying speed can reduce dust and wheel tracks, will improve penetration into stubble and crop canopies and can reduce shadowing.

Nozzle design: There are a number of nozzle designs that have twin patterns, where one pattern is angled forward and the other angled backwards. Generally twin nozzles are best utilised for increasing deposition onto vertical targets, which may also increase stubble interception. Twin nozzles are best operated at lower spraying speeds, commonly less than 16 km per hour.

Risk assessment: Before any spray application it is important to fully assess any risks including the weather conditions, sensitive areas and volatility risk.

Pre-emergent herbicides

Most applications of pre-emergent herbicides will benefit from using coarser spray qualities to increase penetration through stubble and by increasing the total application volume. But volumes above 150 L per hectare generally do not provide further significant improvements in efficacy.

For products with relatively low water solubility, such as trifluralin and pendimethalin, avoiding the tie up of product onto stubble is critical to maximising herbicide contact with the soil.

When using a conventional nozzle spacing of 50 cm, a VC spray quality or larger (such as XC) set to produce a double overlap at the top of the stubble can minimise retention on stubbles. But the uniformity of the spray deposit onto the soil surface will be more variable than compared to a coarse spray quality due to the lower number of droplets produced.

For reasonably water soluble products such as atrazine, simazine and metalochlor, interception by the stubble may have a smaller impact on efficacy, provided a reasonable rainfall event can wash the product back onto the soil. Where rainfall is anticipated, the more water soluble products may be applied in a lower total application volume – typically above 70–80 L per hectare.

Generally, reducing spraying speeds will improve the penetration into stubble and improve the evenness of the application. Narrower nozzle spacings can also be of benefit, provided the spray quality and boom height are suitable.

As an alternative, many operators have plumbed machines with nozzle spacings to match the crop row width. Where nozzles are positioned in the centre of the inter-row gap between standing stubble lines, the nozzle height may be lowered to

obtain an overlap close to the base of the stubble. This may improve soil contact and reduce interception by the stubble, provided spraying speeds and wind speeds are not excessive.

Early season grass sprays in-crop

Droplet retention on small, vertical grasses is usually optimised when using a medium spray quality (where permitted on label), but in a heavy standing stubble, the smaller droplet sizes tend to increase the amount of product deposited onto the stubble.

Generally, a spray quality at the smaller end of the coarse spectrum (towards medium) combined with total application volumes above 70–80 L per hectare, will provide a reasonable outcome.

Where operators typically work at higher spraying speeds, or with larger than coarse droplets, they may notice increased shadowing of small weeds behind stubble. Where this is occurring, slowing down would help, but ensuring that each new job is driven in the opposite direction to the last can also improve overall level of control – particularly when a 'double knock' strategy is employed.

When using a Group A product, always ensure that an appropriate adjuvant is used and through a nozzle that will not significantly alter the spray quality with the addition of the adjuvant (see Table 2). Also ensure the water quality is suitable by testing for bicarbonate levels before the application.

Broadleaf sprays in-crop

Fully translocated products such as the Group I herbicides should be applied with a coarse spray quality or larger at application volumes above 60 L per hectare. Where a product with contact activity is used the application volume should be increased to 80 L per hectare or more.

Late season applications into dense canopies

Late season fungicide and insecticide applications, along with pre-harvest desiccation, typically require that the droplets are able to penetrate into the canopy. The size of the canopy and the architecture of the plants will greatly influence how far droplets can penetrate into the canopy.

Leaf type, leaf shape and leaf surface all affect how well droplets will be retained. Droplet retention on most cereals and large grass type crops will be improved by using a medium spray quality (where permitted on label), but penetration through a canopy may be increased using a coarse spray quality. Droplet retention on many broadleaf crops may allow for good retention when using coarse spray qualities.

With a standard boom sprayer there are only a limited number of things the operator can do to potentially improve the penetration into the canopy. These include:

- Reducing the spraying speed;
- Increasing the application volume;
- Manipulating the spray quality; and,
- Utilise a narrower nozzle spacing.

To make a greater impact on penetration into the canopy generally requires the use of air assistance to help transport droplets into the canopy. While the addition of air into the equation can add another layer of complexity to the sprayer setup, it can also provide large improvements in canopy penetration when correctly setup and adjusted.

To assess which variations in the sprayer setup and operating parameters can actually improve the penetration into dense canopies, useful tools include water sensitive paper (WSP) and the *Snapcard* app, which can help the operator to determine where improvements are being made.

Consider assessing spray deposits to improve your spray coverage

Using tools such as water sensitive paper will allow the operator to look at where the droplets are landing and to compare various sprayer setups to see which ones provide the best coverage.

Often it is difficult to see small improvements in coverage. A tool that can measure the level of spray deposit can assist when trying to evaluate changes. The *Snapcard* app allows spray operators to measure the spray deposits onto water sensitive paper by indicating a 'percent coverage.' Taking regular measurements and recording this information allows for continual improvements in the sprayer setup for different types of spray applications.

Further reading https://grdc.com.au/GrowNotesSprayApplication

Contact Bill Gordon, Ph: 0418 794 514, Email: bill.gordon@au.nufarm.com ■

Weed competitiveness and varying effects on crop yield

By Sudheesh Manalil[1], Steve Adkins[1] and Bhagirath S. Chauhan[1]

AT A GLANCE…

- Turnip weed is highly competitive in wheat – a density of 18 plants per m^2 resulted in a 50 per cent yield reduction.
- Sowthistle was less competitive than turnip weed – a density of 51 plants per m^2 resulted in 50 per cent yield reduction in wheat.
- Least yield loss was suffered from Mexican poppy – a uniform planted wheat crop at 18 cm rows supressed Mexican poppy completely, leading to 100 per cent mortality prior to harvest.

TURNIP weed (*Rapistrum rugosum*), Mexican poppy (*Argemone mexicana* and *Argemone ochroleuca*), and common sowthistle (*Sonchus oleraceous*) are three major broad leaved winter weeds that are increasing in prevalence across the grain regions of Australia. High adoption of no-till systems and lack of diversity in the herbicide-based weed management practice are favouring these weeds to become increasingly prominent.

The biological and reproductive potential and superior growth habits are some of the prime factors that help these weeds to overcome the pressure of weed management, and thereby allow them to evolve as noxious weeds of the agro-ecosystem.

Turnip weed is increasing in prevalence in South Australia, southern Queensland and northern New South Wales. The abundant seed production, seed dormancy, and high vegetative growth are some of the features that have enabled turnip weed to rapidly emerge as one of the major weeds. Turnip weed can produce up to 77,000 seeds per plant, and is highly competitive even when present at a low density. The seed coat can impose dormancy and prolong its persistence in the soil seed bank, ensuring periodicity in germination.

In addition, turnip weed can germinate under a wide range of temperature conditions, salinity and pH levels. Very few studies have been carried out on its growth and competitiveness in grain crops.

Common sowthistle is present throughout Australia and is increasing in predominance particularly in the northern grain region. High seed production of up to 8,000 seeds per plant, and wind dispersal enable this weed to spread rapidly. Similar to turnip weed, common sowthistle is favoured under no-till systems. The ability to germinate under a broad range of temperatures, and the lack of innate seed dormancy favour this weed to germinate, set seed and enrich the soil seed bank throughout the year. Earlier, this weed was more adapted to winter growing conditions.

Mexican poppy is another winter weed that is increasing in its prevalence. This weed is poisonous to stock, and seed contamination can result in quality loss and unsuitability for milling. This weed can produce a significant amount of seeds and preliminary studies (as part of the GRDC project) have indicated a high level of seed dormancy that can ensure periodicity in germination. Little information is available on the biology and competitiveness of this weed under Australian conditions.

To fill in this information gap, the competitiveness of turnip weed, common sowthistle and Mexican poppy were evaluated in a wheat crop at the Gatton Research Farm of the University of Queensland.

What we did

A replicated trial was established in a wheat field in 2016. Prior to establishment, the field was cultivated to ensure a stale seed bed at the time of planting. Wheat variety Spitfire was seeded on May 20, 2016 at a seed rate of 60 kg per hectare at


Photo 1: Turnip weed establishment at anthesis.

Photo 2: Common sowthistle establishment at anthesis.

Photo 3: Mexican poppy establishment at anthesis.

Photo 4: Turnip weed smothering the wheat crop at harvest time.

18 cm row spacing using a tyne seeder. On the same day, the weed seeds were mixed with dry soil and broadcast over the trial site.

Plots were sprinkle irrigated to ensure good crop and weed emergence. Turnip weed, common sowthistle and Mexican poppy, were established at four densities.

- The density of turnip weed at anthesis was 0, 10, 26 and 48 plants per m^2 for the control (no weed plants), low, medium and high density plots, respectively (Photo 1).
- The density for sowthistle was 0, 13, 36 and 70 plants per m^2 for the control, low, medium and high density plots, respectively (Photo 2).
- The density for Mexican poppy was 0, 15, 44 and 74 plants per m^2 for the control, low, medium and high density plots, respectively (Photo 3).

The plots were continuously hand weeded to remove all other weeds except the target weeds. Other than crop yield, weed density was recorded at the time of anthesis (flowering).

What we found

Turnip weed was the most competitive weed in wheat, followed by common sowthistle. While Mexican poppy was the least competitive. Turnip weed grew rapidly and smothered the wheat crop (Photo 4). The average dry weight recorded for turnip weed, sowthistle and Mexican poppy were 15.0, 3.0 and 0.8 g per plant respectively at the time of anthesis. This clearly indicates the relative competitiveness of each weed species.

An average wheat yield of 6700 kg per hectare was obtained from the weed-free plots.

Turnip weed resulted in the maximum yield loss; there was 44, 67 and 78 per cent yield loss in the low, medium and high density plots, respectively.

The yield loss was 20, 50 and 56 per cent in the low, medium and high density plots of sowthistle, respectively.

Although there was a good initial establishment for Mexican poppy (Photo 3), the weed was poorly competitive and all the plants had dried and many disintegrated prior to harvest.

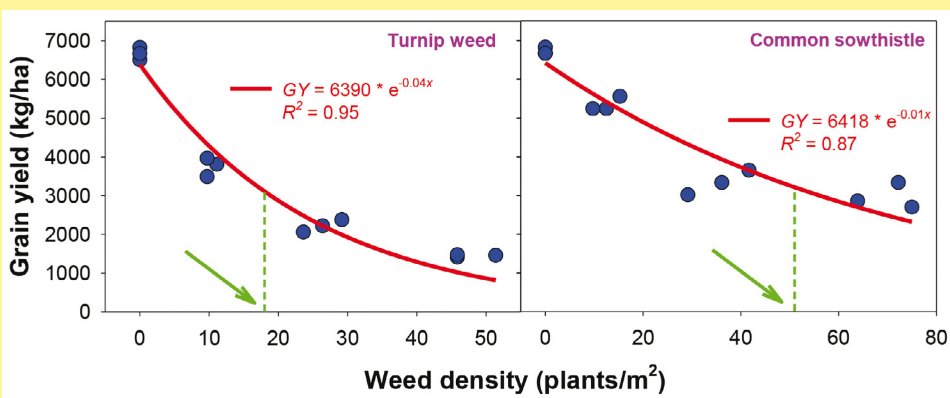
The analysis indicated that the weed density of 18 and 51 plants per m^2 of turnip weed and sowthistle, respectively, could cause a yield reduction of 50 per cent under the tested environmental conditions (Figure 1).

To sum up

The study indicates the relative competitiveness of the three emerging weeds – turnip weed, common sowthistle and Mexican poppy in a wheat crop. This information in turn highlights the relative importance of weeds in terms of their potential economic impact. More detailed study of the biology of these weeds is needed to prevent the emergence of certain weeds from becoming more prominent.

[1]The Centre for Plant Science, Queensland Alliance for Agriculture and Food Innovation (QAAFI), The University of Queensland, Gatton, Queensland 4343, Australia.

FIGURE 1: An exponential regression model showing the relationship of wheat yield and density of turnip weed and sowthistle at the time of anthesis



The green arrow shows the weed density (plants per m^2) to reduce 50 per cent of the maximum grain yield. These densities were 18 and 51 plants per m^2 for turnip weed and common sowthistle, respectively.

Russian wheat aphid – what do we know?

By Ken Young[1], Lauren Du Fall[1] and Craig Ruch[2]

AT A GLANCE…

- Russian wheat aphid (RWA) is likely to be a significant pest of Australian cereals.
- Overseas economic thresholds (20 aphids per plant then 10 aphids per tiller) need confirmation in Australia.
- Rain events significantly affects RWA populations particularly if weather allows for entomopathogenic fungal development.
- Beneficial insects are a major management mechanism overseas and have shown effects in Australia.
- Insecticides will also be a major management tool to be used in conjunction with beneficials.
- The biology and ecology of RWA in Australia is still being determined including likely survival in sub-tropical climates of the northern region.
- Plant genetics is not the be all and end all in management.

Currently recommendations are to use the threshold levels of 20 aphids per plant up to tillering, then 10 aphids per tiller after that.

RUSSIAN wheat aphid (*Diuraphis noxia*, RWA) was first reported in paddocks in Tarlee, South Australia in May 2016. After initial incursion management under the Exotic Plant Pest Response Deed, determined that RWA had spread over considerable areas of South Australia and Victoria, it was deemed as a management issue and not feasible to eradicate on June 8, 2016.

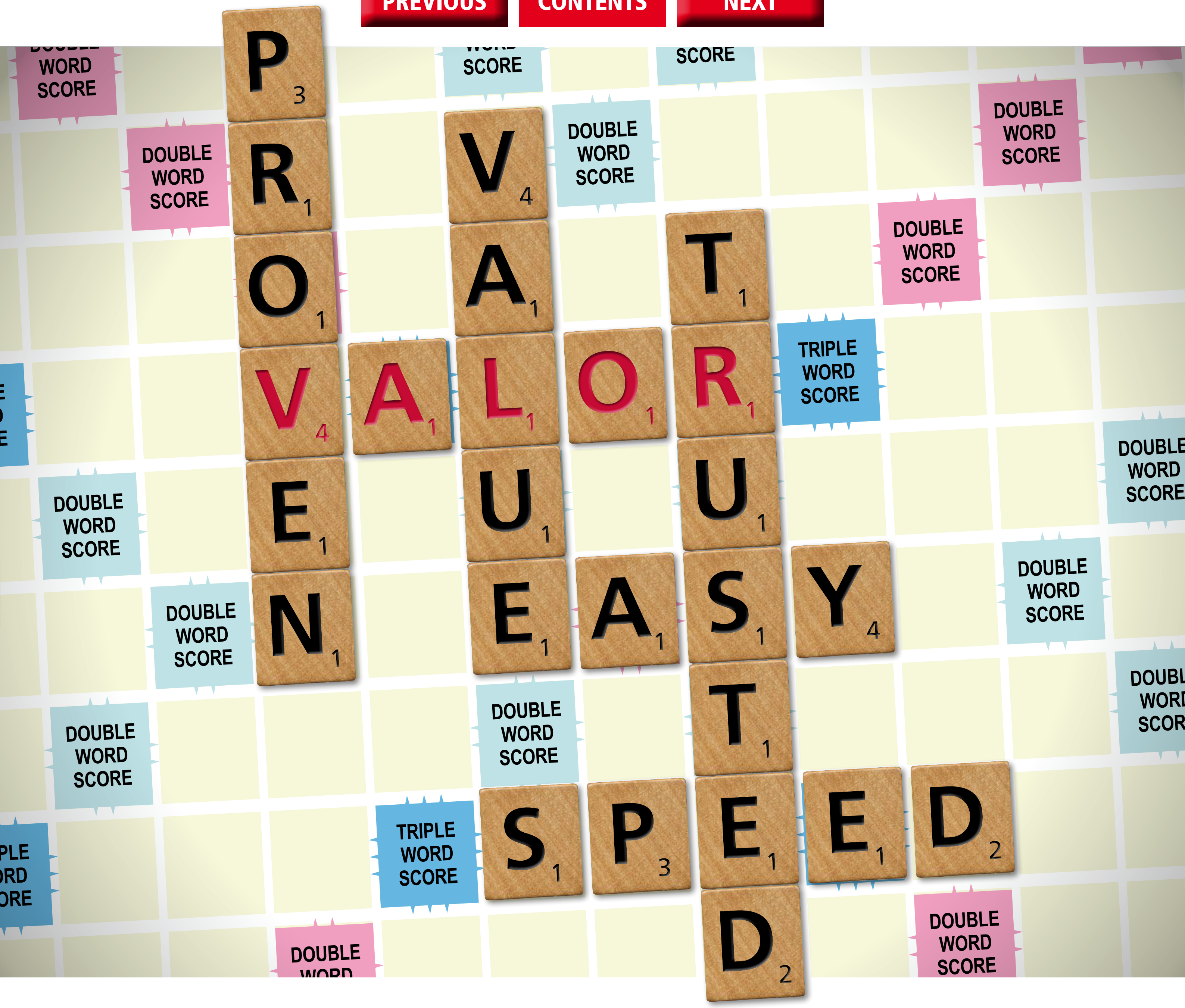
RWA has since spread across Victoria into southern NSW and has recently been identified in Tasmania. As the occurrence of RWA has been widespread, it is thought that it has been in Australia for at least a year if not longer but has gone unnoticed. It is still spreading and its final distribution could be across the whole of the Australian wheatbelt.

RWA occurs in all other major grain-growing regions of the world, originating from southern Russia, the Middle East and Central Asia.

Work commissioned by GRDC

Since the declaration that RWA can't be eradicated, the GRDC has commissioned several projects to enable better management of this pest this coming season and for the longer term. These projects included biology and ecology; economic thresholds, insecticide efficacy and plant resistance options.

A communications plan has also been implemented which includes presentations at Updates etc and the provision of a best bet management guide for growers.



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Biology and ecology

While RWA has originated from colder areas, it is associated with warmer drier climates preferring temperatures in the range 18–21°C, with low survival when temperatures exceed 25°C. In many areas, only females are present and reproduction is asexual, and this is what has been so far observed in Australia.

The primary hosts are wheat and barley but RWA also lives on triticale, oats and rye and can survive on a range of grass species including pasture grasses and wild genera including Poa, Bromus, Hordeum, Lolium, and Phalaris.

The full extent of the role of these other species on the invasion potential and survivability of RWA over summer and between crops is still to be determined under Australian conditions.

Symptoms, effects and thresholds

Large populations in autumn can severely affect crop establishment. Based on last year's experience where management practices were taken, crops can recover and yield normally. Currently recommendations are to use the threshold levels of 20 aphids per plant up to tillering, then 10 aphids per tiller after that.

It was expected that the populations of RWA would increase in spring last year as this occurs elsewhere overseas. But the wet spring conditions in the south in 2016 caused a large decrease in population levels through displacement of aphids as well as beneficial fungal aphid attack.

Last season's weather hampered testing of the above thresholds under Australian conditions. The estimated yield losses in Colorado are 0.5 per cent per each 1 per cent infested wheat tiller and 0.8 per cent per 1 per cent infested barley tillers.

Infected leaves can be seen to have white to purple striping on leaves. Leaves can be rolled, and later on, heads can be trapped by a rolled flag leaf and can appear bleached. The aphid releases a toxin during feeding causing the effects only on the infested leaf. So once controlled, new leaves do not show symptoms.

The GRDC commissioned SARDI to conduct population studies across 16 sites in South Australia and Victoria during late winter and spring 2016 and this continued over summer to determine the survival of RWA.

Don't allow a green bridge

Maintaining a summer fallow clear of grasses will decrease the numbers of aphids surviving the summer months. Due to the wide host range, it is not only volunteer cereals that need to be managed, but also grass weeds and possibly pasture grasses that are adjacent to paddocks intended for cereals.

Insecticide options

The current Emergency Use Permit APVMA PER82792 is for chlorpyrifos and pirimicarb and is in place until June 2018.

A range of other foliar insecticides registered for use in cereals have also been assessed in Victoria and South Australia. The results of these trials are included in both the best management practices guide.

The summary of these trials was that chlorpyrifos was the most efficacious, but that pirimicarb also performed strongly and had the added advantage of being less harmful to beneficials.

Water rate did affect efficacy with high water volumes (100 L per hectare) performing better than 60 L per hectare. Adhere to spray volumes stated on PER82792. A medium coarse spray quality is recommended.

The addition of adjuvants had variable results dependent on the insecticide used. There was an advantage in adding Hasten or BS1000 to pirimicarb and Uptake and SACOA Biopest to chlorpyrifos at some sites. Adhere to adjuvant recommendations stated on PER82792 and the insecticide labels.

Information from 2016 indicated that the various seed dressings that include insecticides do have an effect on RWA.

Trials are currently underway in controlled environments to determine the length of control seed dressings will provide in RWA management. Permit PER82304 (valid to March 2021) allows for seeds to be treated with seed dressing products containing 600 g/L imidacloprid.

Communication strategy

The GRDC in conjunction with Plant Health Australia and state agencies have provided continual updates on the distribution, spread and management advice since the incursion. A best practice guide has also been released. The information from the various projects commissioned by the GRDC is included in the guide. GRDC has also hosted international experts such as Prof. Frank Peairs from Colorado State University to provide information from Colorado's 30 years' experience in living with RWA to growers, advisers, entomologist and GRDC staff and panels. Some of Frank's information is presented here, but is also available from the Adelaide Update website.

[1]GRDC Canberra Office, [2]GRDC Adelaide Office.

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References: Peairs 2017 – Adelaide Update paper

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC. The authors would like to thank them for their continued support. GRDC would like to thank our research collaborators in SARDI, cesar, Peracto AgXtra and AgCommunicators for the on ground work. ■

PLANT GENETICS AND RWA

GRDC has previously invested in pre-emptive pre-breeding activities associated with varietal resistance to this pest in a partnership led by Murdoch University and involving national and international collaborators.

While no resistance to RWA was identified in a screen of major Australian wheat and barley cultivars conducted several years ago, encouragingly, the project did develop some material where resistance genes were introgressed into Australian cereal backgrounds.

Unfortunately, RWA has many biotypes and can develop new biotypes in new environments which make plant breeding more difficult. Currently, the GRDC has commissioned several studies with SARDI and NSW DPI to determine the biotype present in Australia and levels of resistance in current varieties and elite germplasm.

Early findings suggest the RWA populations collected in Australia are most likely closely related to a single North American biotype suggesting only one incursion.

A range of symptom expression was observed in a selection of current commercial bread wheat, barley and durum wheat varieties. This indicates that there may be a range of effective resistances present in current commercial cultivars, but further data would be required to assess the impact on yield and to provide rankings of these varieties.

Through assessing sources of resistance and the biotyping work it appears we have access to germplasm with potential genetic resistance that could be developed through breeding to deliver Australian grain growers with new resistant varieties.

A cautionary tale comes from the US, where resistant varieties where developed to the original biotypes with more than 25 per cent uptake by growers until a new biotype was found in 2003. While germplasm was available, no commercial lines were developed.

Guayule's past meets its future

By Sharon Durham, Agricultural Research Service – USDA

AT A GLANCE

- Rubber is made from petroleum or Asian rubber trees.
- Guayule plants are an important domestic rubber source.
- ARS scientists have genetically improved guayule to provide more rubber.

RUBBER is a substance usually made from petroleum or from the Asian rubber tree plant. But rubber can also be produced from a desert shrub native to Mexico called guayule (pronounced why-yoo-lee). Guayule is cultivated in the southwestern United States as a source of natural rubber (latex), organic resins, and high-energy biofuel feedstock.

ARS chemist Colleen McMahan and her colleagues molecular biologists Grisel Ponciano, Niu Dong, and Dante Placido and technician Trinh Huynh, in Albany, California, developed improved guayule for rubber production. Last year, they delivered more than 3000 experimental guayule plants to research partner Bridgestone America in Eloy, Arizona, for field testing.

In 2013, Bridgestone and ARS's Bioproducts Research Unit entered into a research agreement to evaluate ARS's genetically improved guayule.

"The genetic modification increased rubber content dramatically in the lab, and we have seen that in the greenhouse as well," says Colleen. Their work with Bridgestone has allowed them to evaluate the plants and test them in the field.

But a long-term goal is to supplement current guayule germplasm collections with plants that have important traits such as drought and disease resistance. The team needed to find guayule types that weren't already in ARS's collection.

Historical photo (1942) of a worker preparing guayule plants for planting at the Manzanar Relocation Center in California.
(PHOTO: Dorothea Lange)

Guayule plants. **(Photo: Byung-guk Kang)**

"Three years ago, a separate project with Cornell University was initiated to DNA fingerprint all known guayule germplasm in public seed collections that breeders rely on to create new types," says Colleen. "In the process, we searched for new – and old – sources to add to the collection, because this isn't the first time guayule has been used as a rubber source."

During World War II, Manzanar, California, was the site of a Japanese-American internment camp where guayule plants were selected, bred, cultivated, and processed into natural rubber to aid in the war effort. Manzanar is now a National Park Service Historic Site.

"Turns out Manzanar National Park had plants and was willing to donate seed from those plants," says Colleen. She also collected seed from guayule plants at the home of a former Manzanar guayule breeder, Frank Kageyama.

These guayule plants looked very different (silver-green lacy leaves) from most other guayule breeding lines (larger, deep-green leaves). The plants grown from the Manzanar seeds are still under evaluation by ARS and Cornell and may provide an important source of genetic diversity in the germplasm.

In the meantime, the genetic improvement program continued. In 2016, the ARS experimental guayule plants were ready for delivery to Bridgestone America's 70 hectare facility in Eloy, where the focus is on developing guayule as a domestic source of natural rubber.

"We packed close to 3200 plants in tissue culture," explains Trinh Huynh. "These plants have unique DNA modifications that may translate into increased rubber and biomass."

Since the route to Eloy isn't far from Manzanar, Colleen and team members returned to make a special delivery. "The curators of the museum asked us to provide some of the plants we had grown from the donated seed, so we delivered 33 legacy plants for planting in their interpretive garden."

And for part of that trip, those plants carrying the history of the Manzanar guayule breeding program rode alongside plants that may carry the future of commercial rubber production.

For more information: Colleen McMahan, Bioproducts Research Chemistry Email: Colleen.McMahan@ars.usda.gov; Ph: +1 (510) 559-5816. ■

GUAYULE IN AUSTRALIA

When Australia first became interested in developing guayule as a source of natural rubber, the plant had already had a long history of development in the US without a permanent profitable industry being established.

In Western Australia in 1959 the State Government exchanged a 'series of understanding' with the Pacific Rubber Company. The agreement stated that when the economics of rubber from guayule had been proven the Government would make available 600,000 acres at four sites for the Company to grow the crop and adequate water and infrastructure would be provided.

Fortunately the government agreed that it would conduct initial experimental trials on one acre sites. These failed and the 'understanding' lapsed.

In the late 1930s, with rubber prices increasing rapidly and knowing the limitations of synthetic rubber for high performance needs such as radial automotive and aeroplane tyres, CSIRO had maintained an agronomic interest in guayule. In NSW, yields of 1200 kg per hectare had been achieved.

In July 1942, at the request of CSIRO, trials began in South Australia at the Waite Agricultural Research Institute to determine if guayule could be grown in SA. Starting with 1000 seedlings air-freighted from CSIRO in Canberra, plots were established at Roseworthy Agricultural College, at Morphett Vale, in the mallee and under irrigation at Barmera.

These plots showed that guayule could be grown successfully in SA and valuable germination and planting needs were established but because it is a relatively slow growing plant (a desert plant) weed competition, without the availability of selective herbicides, proved a serious problem.

Interest revived during the late 1970s

For the same reasons that the industry failed to persist in the US, interest was lost in South Australia until 1979 when interest was revived with new guayule cultivars, the importance of resins as a byproduct and the availability of selective herbicides.

At around this time serious renewed interest was also growing in Canberra and a National Guayule Working Party was formed. At this point the South Australian Department of Agriculture took a leading role, by establishing the South Australian Advisory Committee on Guayule Commercialization, chaired by Arthur Tideman, Chief of the Plant Industry Division.

Arthur visited the US to assess the then current guayule developments. Most importantly, he was able to obtain small supplies of seed of cultivars bred for environments and soil types similar to those in SA. On his return to Australia, trials commenced in SA, mainly at Roseworthy College.

The US Joint Commission on Guayule Commercialization visited the SA projects in April 1982 which cemented research relationships.

But unfortunately, despite these very promising foundations, progress rapidly came to a halt. The SA Government, rightly, would not continue to supply funding without processing and marketing commitments from the rubber industry. This was never forthcoming despite repeated personal attempts by Arthur to influence the Bridgestone management.

Guayule could be successfully grown

Guayule can be successfully grown in Australia. Suitable high rubber producing cultivars are available to suit our climate and soils. The agronomy, disease and weed control technology is known. If the resources required for the production of synthetic rubber continue to increase – or tree rubber supplies decrease – then guayule could become a profitable crop.

Source: Arthur Tideman, former Chief of the Plant Industry Division, South Australian Department of Agriculture.

PREVIOUS CONTENTS NEXT

NATIONAL ROUNDUP OF

National overview

Across the vast majority of Australia's grain belt, idyllic seasonal conditions in 2016 created unprecedented production volumes. Just under 59 million tonnes of winter grains tipped the national scales smashing the previous record set in 2011 by more than 13 mt – or almost 30 per cent.

Total wheat production in 2016 exceeded 35.1 mt (our biggest ever) with many districts recording historically high yields per hectare for cereal grains and oilseeds. In many instances, these record yields offset the currently soft prices for most cereal grains.

Wheat is the largest grain type grown in Australia and accounted for 60 per cent of total winter grain production in 2016. Domestic wheat consumption and wheat for stockfeed use account for around 6 to 7 mt each year – this means most of our wheat produced each year is destined for export markets. As an indication, over the past five years, annual wheat exports have averaged 75 per cent of national production.

On the global scene, total grains production in 2016–17 is forecast to peak to the highest level ever recorded (2.1 billion tonnes) – although world wheat production is expected to fall by around two per cent. Balancing this is the ever increasing growth in global demand and consumption of grain for human food, stockfeed and energy uses.

Value of grain land continues to rise

Despite large world grain stocks, cropping land values in Australia have increased at unprecedented rates over the past five years. In southern Australia values have improved by up to 30 per cent while increases of 10 to 20 per cent have occurred in more marginal rainfall, northern areas.

Given recent excellent autumn rainfall in many areas – and the strong likelihood of a continuation of La Nina climate conditions – optimism is high for another above average winter grain crop.

A favourable exchange rate continues to spur on demand for Australian commodities from our major trading partners. Current forecasts suggest international wheat prices are likely to remain stable, given ample global supplies, until the next (inevitable) supply hiccup comes along.

Feed grain prices, also dampened by record production levels, are expected to ease into 2017 due to softer demand from China.

Farmer confidence high

Historically low borrowing costs, combined with improved seasons and cash positions for many producers, has boosted farmers' confidence to a level not seen for many years.

This has resulted in more aggressive acquisition strategies by individual growers – and corporate fund managers – looking for opportunities in a market relatively starved for choice.

Shane McIntyre, Head of Rural and Agribusiness
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With this feature, *Australian Grain* – in conjunction with Colliers International – presents a national and unique overview of grain farm sales. Indicative selections of individual farm sales over the past 12 months are categorised into the three major agroeconomic cropping regions and further categorised into average wheat 'yield bands'.

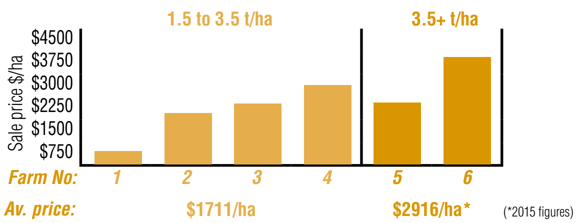
For the first time, prospective buyers and sellers (or just interested observers) have a national insight into current trends in the value of cropping farms across Australia according to region and production capability.

Yield bands:

Farm sales are categorised into Northern, Southern and Western Cropping Regions of Australia. Individual farm sales are further categorised into 'yield bands' reflecting the average yield history for wheat production on that farm.

1.5–2.5 t/ha wheat = 7–12 bags/ac
2.5–3.5 t/ha wheat = 12–17 bags/ac
3.5+ t/ha wheat = 17+ bags/ac

Indicative Farms Sales Western Region, 2016



Farm 1	**Wongan Hills, WA – $480/ha (4996 ha):** Large cropping holding with 2577 hectares of gently undulating open arable land. The remaining land contains strips and pockets of remnant vegetation and approximately 2360 hectares of salt affected land.
Farm 2	**Collanilling, WA – $1854/ha (2482 ha):** Aggregation of properties in the Wheatbelt which have been continuously cropped.
Farm 3	**Wongan Hills, WA – $1989/ha (3168 ha):** Three non-contiguous holdings occupying a collective land footprint of 3168 hectares utilised for the production of wheat, barley, canola, lupins and oats.
Farm 4	**East Pingelly, WA – $2520/ha (1548 ha):** Mixed farming property with a historic focus on canola and wheat production.
Farm 5	**Popanyinning, WA – $2122/ha (1414 ha):** Cropping holding located in the southern wheatbelt region with approximately 1200 hectares of arable land.
Farm 6	**East Pingelly, WA – $3710/ha (1428 ha):** Well improved cropping property in the southern wheatbelt with open land comprising productive grey sandy loam soils over clay.

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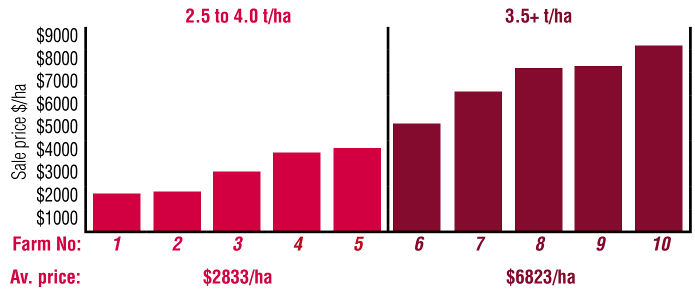
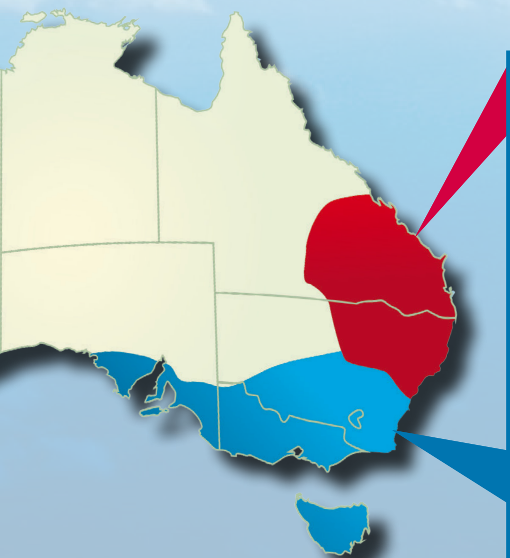
GRAIN FARM SALES

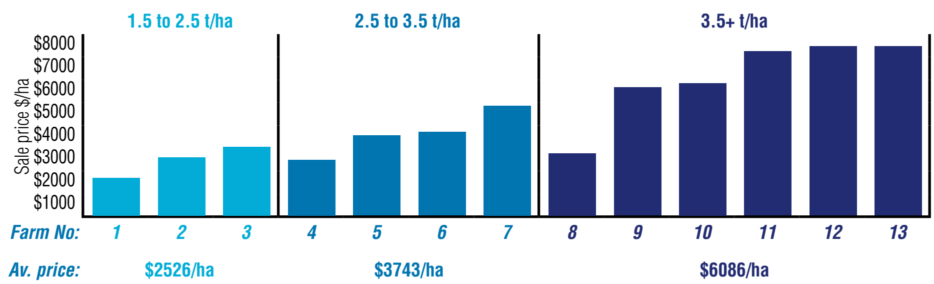
Indicative Farms Sales Northern Region, 2016



Farm 1	**Toobeah, QLD – $1894/ha (3200 ha):** 53% is dryland cropping developed lands on deep self-mulching black alluvial cracking clays. Developed lands reflect $2,950/ha.
Farm 2	**Goondiwindi, QLD – $1992/ha (5021 ha):** 64% is dryland cropping developed lands on deep self-mulching soils. Developed lands reflect $2,550/ha.
Farm 3	**Canaga, QLD – $2837/ha (511 ha):** 98% is dryland cropping highly developed lands on strongly self-mulching black cracking clays.
Farm 4	**Condamine, QLD – $3644/ha (1617 ha):** 83% is dryland cropping highly developed on sandy red soils. Developed lands reflect $2750/ha due to substantial improvements.
Farm 5	**Arcturus, QLD – $3800/ha (1274 ha):** 99% is dryland cropping highly developed lands on deep red and black self-mulching soils.
Farm 6	**Mullaley, NSW – $4923/ha (453 ha):** Approximately 91% arable. Black self-mulching clays. Located west of Mullaley.
Farm 7	**Milguy, NSW – $6178/ha (1210 ha):** Located north east of Moree. Approximately 90% arable. Chocolate and black self mulching soils.
Farm 8	**Bowenville, QLD – $7369/ha (538 ha):** 99% is dryland cropping highly developed lands on deep, self-mulching grey and black alluvial cracking clays.
Farm 9	**North Branch,QLD – $7392/ha (683 ha):** 94% is dryland cropping highly developed lands on deep, self-mulching grey/black alluvial cracking clays.
Farm 10	**St Ruth, QLD – $8256/ha (362 ha):** 99% is dryland cropping highly developed lands on deep, self-mulching grey and black alluvial cracking clays.



Indicative Farms Sales Southern Region, 2016



Farm 1	**Deniliquin, NSW – $1742/ha (1780 ha):** Located south west of Deniliquin. Approximately 88% arable. Medium red clays extending to some heavy grey clays.
Farm 2	**Urana, NSW – $2761/ha (1080 ha):** Located north of Urana. Over 90% arable. Red clay loams extending to some lighter red sands.
Farm 3	**Keith, SA – $3075/ha (1106 ha):** Mixed farming holding in the Upper South East of South Australia comprising approximately 829 hectares of arable land with soils primarily characterised by grey brown loams and sandy loams over clay and limestone.
Farm 4	**Garema, NSW – $2556/ha (1600 ha):** Aggregation of properties located south of Forbes. Approximately 88% arable. Red and grey loam soils.
Farm 5	**Daysdale, NSW – $3689/ha (1220 ha):** 95% considered arable. Located north of Corowa. Grey and red loams soils.
Farm 6	**Narrandera, NSW – $3785/ha (754 ha):** Located south east of Narrandera. Approximately 89% arable with grey clay and red loam soils.
Farm 7	**Cockaleechie, SA – $4942/ha (637 ha):** Cropping holding comprising two non-contiguous parcels located on the Lower Eyre Peninsula in the reliable district of Cockaleechie.
Farm 8	**Dobie, VIC – $2842/ha (1256 ha):** Cropping block with scattered timbers throughout, approximately 960 ha arable.
Farm 9	**Skipton, VIC – $5713/ha (6739 ha):** Property has a combination of arable cropping and grazing land, soils range from heavy brown loam to lighter sandier soils on rises.
Farm 10	**Bungor, VIC – $5931/ha (602 ha):** Approximately 530 ha arable cropping land with lower lying sections and river frontage at southern end.
Farm 11	**Edillilie, SA – $7202/ha (573 ha):** Well improved cropping holding located Lower Eyre Peninsula in the tightly held district of Edillilie.
Farm 12	**Skipton, VIC – $7413/ha (1415 ha):** Close to township of Skipton, all arable cropping with clay loam soil.
Farm 13	**Skipton, VIC – $7413/ha (574 ha):** Close to township of Skipton, all arable cropping with clay loam soil and river frontage.

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So what's new?

■ By Ian M. Johnston

IN the 'good old days' (or should that be 'the bad old days'?) farmers were undoubtedly among the hardest working coves around.

I mean to say, up at the crack of dawn, hitching up a team of cantankerous horses, or hand pumping a drum of kero into the tank of an equally cantankerous Inter W40, or lumping three bushel bags of grain, or trudging around a 1000 acre wheat field pulling out the black oats which seemed to be everywhere, or climbing stiffly down off the afore mentioned W40 after 14 hours of suffering the shattering bellow from the straight through exhaust pipe and every joint aching due to the soft ride (joke) provided by the cleated steel wheels!

Compare the above with the chap who worked in the Rural Bank in town. Started at 9 am, morning tea at 10 am, an hour for lunch, kept ducking into the loo for a well earned puff of a Player's Navy Cut, and knocked off at precisely one minute to 5 pm. Okay, so he was required to wear a collar and tie, but he was permitted to leave off his suit jacket when the temperature exceeded 80°F! Plus, he got a pay packet handed to him each second Friday, and don't forget he was magnanimously awarded two weeks annual leave!

A blissful life Granpa could only dream of

Now I am certainly not acquainted with the daily routine of today's banking chaps. But I do know that modern switched on farmers enjoy a blissful life of ease and sumptuousness compared to the rigours that were the lot of their Grandpas. (Farmers reading this please note: No correspondence will be entered into and I am always accompanied by a large vicious dog!)

You see, being a diligent and assiduous reader of this and its sister rural magazines, I know all about the technological marvels included in any modern tractor worth its salt. Although to be honest, I confess to struggling with some of the terminology. Take for instance – interactive interface, telemetry, telematics, real time satellite data, Zimmatic, Automatic Productivity Management, spatially continuous, CVT, Intellisteer, and so on.

(Could all have been thought up by a Federal Treasurer, upon his return from an overseas study tour).

Archive photo of Big 4.

Plus of course today we take for granted tractor cabins and associated luxuries, of which Grandpa could only dream about. Things such as sound proofing, climate control, cushion mounting, Bluetooth connected communication doo-dahs, cup holders and a mini fridge for the Diet Coke. In fact, an overpaid corporate executive, with an office on the 25th floor of a sky scraper overlooking Circular Quay, would probably envy the opulence of the farmer's office high up on his tractor! And – the farmer can drive his office back to his house! How good is that!

The Big 4

We, who watch the evening news on the telly, are regularly hearing about these amazing cars that can allegedly drive themselves. But most non-farming folk are not aware of the fact that self steer tractors, controlled by a satellite aloft, are now fairly common place.

So not only is the tractor operator cosily ensconced within his palatial apartment, er – tractor cab, but he can relax in his lounge chair and read about the latest ministerial scandals in yesterday's paper, while the tractor dutifully follows an imaginary geometrically straight line with pinpoint accuracy.

But guess what! There is nothing new about a self steer tractor! In fact, your Grandpa's Grandpa possibly drove one! Yes, seriously!

I recollect some years ago, while on a research trip travelling through the vast grain belt of Canada, I encountered an old timer, who related to me an amazing true story, about his youthful experience with a self steer tractor during the early part of the 20th century.

The tractor in question was one of several models somewhat euphemistically branded 'Big 4'. The original version was designed by a farmer/engineer named D.M. Hartsough in 1904. He considered the single and twin cylinder engines powering the limited range of tractors in that era, were inefficient and under powered. Accordingly, he designed a four cylinder petrol fuelled unit of massive physical proportions, created to power a 10 ton tractor.

In actual fact the engine could only produce 60 belt horse power, but this was considered powerful in the extreme, in 1904. But, as was typical of early giant tractors, much of its power was required simply to propel the machine!

The dimensions were indeed impressive. For example, the top of the radiator towered 10 feet (3.04 metres) above the ground. While the rear steel wheels stood 8 feet 3 inches (2.51 metres) and the fronts measured 5 feet (1.52 metres).

As it was the first American tractor to enter volume production with a four cylinder engine, Hartsough cleverly capitalised on this fact by naming his unit 'Big 4'.

But the mammoth tractor had one seriously bad feature! It required several acres in which to achieve a reverse turn. To add to this problem, unless you were an Irish navvy or a Japanese Sumo wrestler, it was a physically daunting task to even turn the steering wheel in order to navigate the monster round a wheat field.

Which brings me back to my old timer and his remarkable story.

Archive photo of Big 4 at work. Note the guy nonchalantly sitting on the mudguard while the tractor self steers.

Big 4, part of a town parade in the USA.

A true but comical event

I encountered my old timer in the canteen of The Western Development Museum, located just outside the small Saskatchewan prairie town of North Battleford. Among the scores of veteran tractors, the museum had in its collection an early Big 4. During the winter months, all tractor radiators were drained of water (for obvious reasons) and in the spring they were refilled and the engines fired into life.

Apparently, the Big 4, along with numerous other tractors in the collection, was a reluctant starter. Veteran retired tractormen were routinely called in as volunteers to oversee the starting procedures, as quite often the younger staff of the museum simply lacked the necessary skills and experience.

Armed with an absurdly large steak and a tall glass of Canadian cider, with a mandatory dash of maple syrup, I sat down at a table opposite a guy I took to be a real character. He was obviously ancient and reminded me of a well mellowed ironbark fence post. His name was Buck and he told me… "he was the only damned feller in the museum who could start a Big 4." He needed no encouragement when I asked him to tell me why this was so.

Buck was raised on a prairie farm and when "… jist a strippling, fresh out of short pants, when my Daddy took delivery of a Big 4. But he couldn't done drive the thing cos he caught the colic. So my Mamma she says I gotter be a man now an' drive

the big tractor, sayin' as how we was late with plowin' owin' to the bad season."

But there was a problem. Buck, especially as a youth, was a lightweight and simply did not possess the necessary strength to steer the machine. The local agent was contacted and he arranged to have the Big 4 Self Steer device railed in from the factory at Indianapolis and attached to the front of the tractor. Within a week Buck was ready to start ploughing.

All went well for the first four days and Buck managed to navigate the tractor and trailing plough around the field. On the fifth day he decided to work into the night, as there was a full moon and he was anxious to catch up on lost time – and this is where things turned into a disastrous shambles!

At this juncture of the story, Buck's eyes glazed over as he looked back in time, and then he started to chuckle.

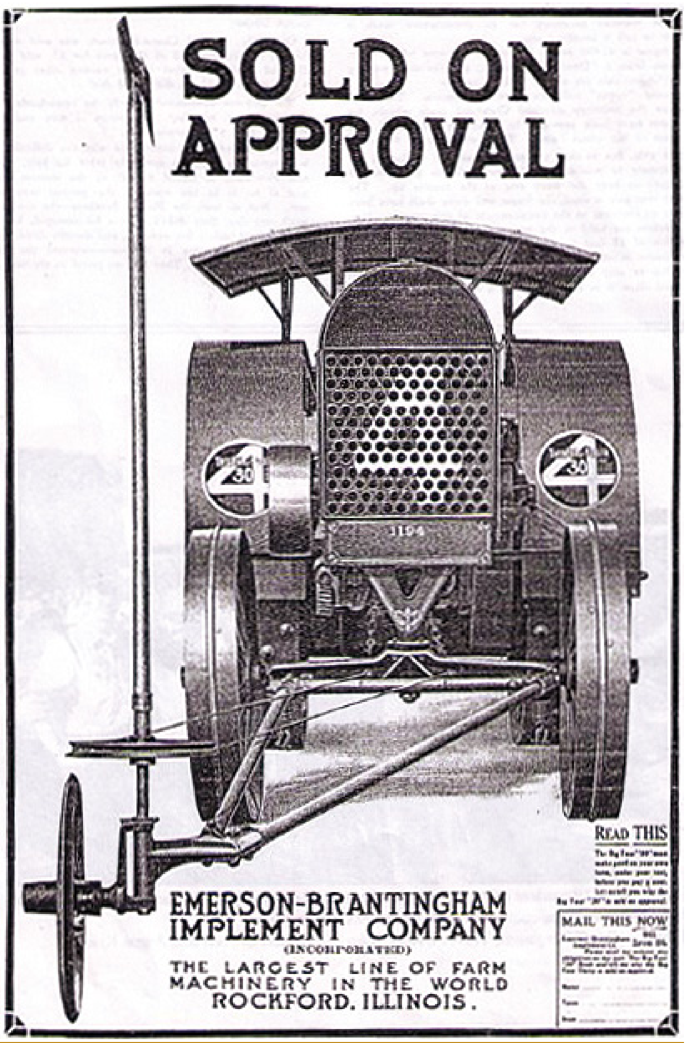
He had apparently been wedged into the operating platform of the tractor with the aid of two hay bales. They enabled him to be seated but with sufficient elevation to see ahead along the side of the long bonnet, albeit with some difficulty. But he was weary and his eyes closed, and dozed off despite, or perhaps because of, the drone of the big engine.

It is necessary here that I endeavour to explain the design and function of the self steer device.

It comprised two heavy duty rods extending forward of the tractor a distance of 20 feet (6.09 metres). Each was attached to the front steering mechanism and at the front end supported on a wheel, which was designed to run in the furrow, opened on the previous run. As the furrow wheel changed direction it actuated the tractor steering rods.

An arrow was fixed on the top of a tall post which extended upwards from the furrow wheel, which in turn pointed the direction of travel to the operator. This was necessary, as forward vision from the operator's platform was dangerously limited.

Sounds very complicated but it actually all worked. A number of tractor makes utilised the same device. A perusal of the adjacent drawing may help to comprehend the system.



An early advertisement for a Big 4 showing the self steer mechanism.

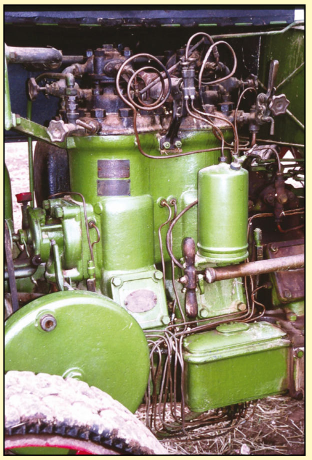
IAN'S MYSTERY TRACTOR QUIZ

Question: Can you identify the tractor by the odd ball engine?

Clue: It is European and only a few came to Australia.

Degree of difficulty: Only a REAL tractor enthusiast will know the answer!

Answer: See page 48.



Self steering snoozer

So we return to our snoozing young operator.

At the end of a long stretch, the guide wheel jumped out of its furrow and planted itself in a ditch. The tractor obediently followed the ditch, which just happened to lead directly into the outskirts of the local town! Buck dozed on, probably dreaming of the cute young daughter of the farmer next door, he explained.

Typical of the isolated prairie townships of over a century ago, the main street consisted of packed soil, lined by clap board buildings. The ditch doubled as a gutter through the town!

The plough of course extended behind the left of the tractor. So did the raised boardwalk! Great hunks were dragged along by the plough. The bits that didn't were chopped into match wood. The hard packed earth road was transformed into resembling a freshly ploughed potato field. Buck was unaware of all this.

Buck recalled he half remembered some jolts and shouts. The barber's pole was the brightest thing along the street. When it was pulled out, part of the roof of the salon collapsed. At the end of the short street, was the newly completed band stand – the pride of the town. It must have been well constructed, because it had the strength to stop the progress of the Big 4, but its drive wheels continued to rotate. The resulting jerking motion awoke the young Buck. He gazed around and behind at the carnage he had created, and nearly fainted.

Again, at this stage Buck started to chortle, which developed into a fit of coughing and laughter.

"Reckon not many whipper snippers can boast to havin' demolished a complete town. An' ah did it all by myself, so ah did. Mayor never did speak to my Daddy again," he concluded sadly.

Conclusion

My message to all the young farmer technocrats is, don't wholly trust your computer controlled satellite self steer device – and don't fall asleep! ■

Minimising risk of disease in 2017 chickpea crops

By Kevin Moore[1], Nicole Dron[1], Kristy Hobson[1], Kurt Lindbeck[2], Mark Richards[2] and Sean Bithell[1]

AT A GLANCE…

Seasonal conditions in 2016 were very conducive to Ascochyta, Botrytis, Phytophthora and Sclerotinia diseases in chickpea crops throughout the GRDC Northern Region.

Large amounts of inoculum of these pathogens will be available to infect 2017 chickpea crops.

Strategies described in this article will reduce the risk of these diseases – the more strategies employed, the greater the benefit for chickpea growers in 2017.

FOLLOWING high incidences of diseases (Ascochyta, Phytophthora, Sclerotinia and Botrytis) in 2016 chickpea crops throughout NSW and Queensland, there will be large amounts of inoculum to infect 2017 chickpea crops.

This article describes strategies that will reduce the risk of each of these diseases. Some of these strategies are based on local and international field experiments – others are based on observations of reduced disease in 2016 crops. The more strategies employed, the greater the benefit for chickpea growers in 2017 and beyond.

Seasonal conditions in 2016 were ideal for large inoculum build up and carryover into 2017. As a result, chickpea crops this year will be under pressure from diseases such as Ascochyta (pictured), Sclerotinia, Phytophthora and Botrytis.

Ascochyta blight – aka AB, Asco
(fungus *Phoma rabiei* previously called Ascochyta rabiei)

Ascochyta inoculum will be present in four forms:

1. Ascochyta infected chickpea residue being discharged out the back of headers or spread by floods and surface water;
2. Seed internally infected by the fungus (a consequence of pod infection);
3. Seed contaminated externally with infected chickpea residue during harvest and handling; and,
4. Volunteer chickpea plants infected over summer and autumn.

Recommendations for 2017 chickpea crops:

- Grow varieties with improved AB resistance (experiment/observation): These varieties will have less disease and require fewer fungicide sprays.
- Burn cereal stubble (this holds AB inoculum, observation): Infected chickpea residue discharged during harvest of 2016 crops blows onto paddocks that are intended for chickpeas in 2017 – most of these will have had a cereal crop in 2016 (or 2015).
- Remove volunteers (observation): Volunteer chickpea plants infected with Ascochyta will provide inoculum even if the volunteer plants are killed with herbicide. Controlling volunteers early will restrict their size and limit the amount of inoculum they can produce.
- Treat all planting seed (experiment): Proper treatment of seed with a registered fungicide will control both internally borne Ascochyta and external contamination.
- Sow later in planting window (experiment/observation): This reduces the number of infection events.
- Wider rows 66 cm+ (experiment/observation): Wide rows improve airflow through the crop leading to more rapid drying after a rain event or dew. They also delay canopy closure and improve penetration of fungicides later in the season.
- Tyne openers rather than disc (observation): 2016 observations of less Ascochyta where crops had been sown with tynes is thought to reflect burial and movement of Ascochyta inoculum away from the emerging seedlings.
- Double crop sorghum, cotton (experiment/observation): Stress and high biomass favour Ascochyta. 2016 crops double cropped into sorghum or cotton residue were less affected by waterlogging and did not produce the biomass of chickpeas sown into winter cereal or long fallow paddocks.
- Fungicide before first post emergent rain event, even PBA Seamer (experiment/observation): 2016 crops that had an early preventative Ascochyta fungicide had less disease than crops that were not sprayed until after the disease was detected. Even though PBA Seamer is rated resistant to Ascochyta, growers are urged to apply a preventative fungicide because:
  (a) The large amount of inoculum will increase disease pressure;
  (b) It safeguards against changes in the Ascochyta pathogen that are more aggressive or virulent on PBA Seamer; and,
  (c) It insures against contamination of PBA Seamer crops with plants of varieties with lower or no Ascochyta resistance eg. PBA HatTrick, PBA Boundary or Kyabra (varietal purity is still a major issue in our chickpea industry).

Phytophthora root rot – aka PRR
(fungus-like Oomycete *Phytophthora medicaginis*)

Phytophthora inoculum will be present in three forms:

1. Chickpea plants that had PRR in previous seasons (up to 10 years back);
2. Other hosts eg. medics, lucerne, and other leguminous plants including sulla (*Hedysarum* spp) and sesbania (*Sesbania* spp) in which Phytophthora can survive and multiply; and,
3. Soil and water containing PRR infected material and survival structures (oospores, chlamydospores).

Recommendations for 2017 chickpea crops:

- Avoid PRR high risk paddocks where annual or perennial medics have been a component of pastures and where PRR has occurred in the past – the oospores of *Phytophthora medicaginis* can survive for more than 10 years.
- Avoid paddocks with areas prone to waterlogging although the conditions which induce waterlogging may not occur every year.

Phytophthora root rot will be present in three forms in 2017.

- Avoid paddocks exposed to water flow from previous chickpea or medics areas; PRR infected material and survival structures can be spread though water movement to neighbouring paddock/s.
- Metalaxyl-based seed dressings are registered for PPR, but they are relatively expensive and provide only six to eight weeks protection after sowing.
- Grow a variety with the highest level of resistance, particularly in medium-high risk situations, such as where medics, chickpea or lucerne crops have been grown in the past five or six years.

Sclerotinia stem and basal rot
(fungi *Sclerotinia sclerotiorum, S. minor*)

In the northern region, Sclerotinia spp infect chickpea plants two ways:

(a) Sclerotia germinate directly in or on soil and invade the plant through root or basal stem tissue, producing Sclerotia on and within the basal stem tissues; and,

(b) Sclerotia germinate indirectly, produce apothecia at ground level and these release air borne ascospores (carpogenic germination) that infect plant parts higher in the canopy.

In most seasons we only see direct germination because carpogenic germination needs cool moist conditions.

Sclerotinia stem rot symptoms on chickpea.

In August–September 2016, Sclerotinia disease was very common in chickpea crops in north western NSW and southern Queensland due to high levels of canopy leaf wetness and favourable temperatures. Importantly, every case of Sclerotinia involved carpogenic germination (infection at mid canopy) meaning that the Sclerotia formed on and inside the chickpea stems which would have been captured during harvest.

This led to problems at receival because the cylindrical Sclerotia formed inside the stems resembled ryegrass ergots and some loads were rejected or docked.

Sclerotinia inoculum will be present in several forms:

1. Sclerotia spread by floods and surface water;
2. Sclerotia admixed with chickpea seed and introduced into 2017 chickpea paddocks during planting;
3. Sclerotia in canola residue in paddocks intended for chickpea in 2017 – large Sclerotia can survive for up to 10 years;
4. Sclerotia in weed hosts in paddocks intended for chickpea in 2017;
5. Sclerotia already present in paddocks with a history of broadleaf crops and recent Sclerotinia outbreaks.

Recommendations for 2017 chickpea crops:

- Grow varieties with lowest susceptibility: Sclerotinia basal rot was assessed in field trials at Wagga Wagga in 2014 and 2016 which led to the following tentative ratings:
  - Very susceptible: PBA Maiden.
  - Susceptible: Ambar, Genesis 090, Neelam, PBA Slasher, PBA Striker, PBA Monarch.
  - Moderately susceptible: PBA Boundary, PBA HatTrick, PBA Seamer.
- Avoid paddocks with a history of Sclerotinia. Paddocks with a history of Sclerotinia will already have a population of viable sclerotia before the crop is sown and these are a disease risk. A frequent history of the disease also indicates that the environment is also most likely favourable for Sclerotinia to develop. Be aware that even adjoining paddocks can be at risk due to movement of air-borne ascospores of the Sclerotinia fungus.
- Avoid paddocks with a history of canola. Canola is a very good host for Sclerotinia stem rot. Experience in southern NSW has shown that the number of sclerotia in the soil can build up very quickly when canola is frequent in the cropping rotation.
- Avoid paddocks with a history of broadleaf weeds. The collective host range of the Sclerotinia fungi (*Sclerotinia sclerotiorum, S. minor*) exceeds 400 plant species, mostly broadleaf plants. Weeds can be important in maintaining sclerotial populations in paddocks, even when the frequency of broadleaf host crops in the rotation is low. Broadleaf weeds such as capeweed, shepherds purse and variegated thistle are just some common hosts for Sclerotinia.
- Sow within the planting window. Observations from field trials at Wagga Wagga suggest that early sown chickpea is more prone to developing symptoms of Sclerotinia infection – this includes both direct infection and canopy infection from air-borne spores. Plots sown within the recommended sowing window developed significantly less disease. Dense crop canopies from an early sowing also favour Sclerotinia stem rot later in the season.

Botrytis seedling disease – aka BSD
(fungus *Botrytis cinerea*)

BSD and Botrytis Grey Mould (BGM) are caused by the same fungus – *Botrytis cinerea* – but they are very different diseases. BSD is a seed-borne disease that can occur at any temperature

Botrytis grey mould is more prevalent in warmer regions.

and under any conditions. BSD can only occur if pods of chickpea crops from which the seed came were affected by BGM. BSD is readily controlled with the standard chickpea seed treatments. BSD inoculum will be present in two forms:

1. Seed from pods infected with *B. cinerea* during a prior BGM outbreak.
2. Primary infections of BSD (ie. from *B. cinerea* infected seed); primary infections lead to secondary infection of initially healthy seedlings through root contact.

Recommendations for 2017 chickpea crops:

- Treat all planting seed: Field trials conducted in 2011 at Moree, Narrabri and Breeza using two *B. cinerea* infected seed lots from the 2010 BGM epidemic, showed treating chickpea seed with registered seed dressings controlled BSD, improved crop establishment and increased yield but proper coverage and rate were essential.
- Avoid using *B. cinerea* infected seed: Even though seed treatment controls BSD, Botrytis infected seed will have lower vigour than non-infected seed.

Botrytis grey mould – aka BGM
(fungus *Botrytis cinerea*)

BGM is an air-borne foliar disease active only when temperatures warm up towards spring (around 15°C). It is more prevalent in the warmer regions of the north, where significant crop losses can occur in wet winters and springs as occurred in 2016. BGM is controlled with foliar fungicides – seed treatment is ineffective.

Testing chickpea seed from the 2016 harvest at Tamworth has found that around half the seed lots are internally infected with Botrytis. Not treating this seed will lead to BSD (but will have no impact on BGM in 2017).

Botrytis cinerea is ubiquitous, has a wide host range (over 138 genera in 70 families) and is a good saprophyte, meaning it can survive, grow and sporulate on just about any dead plant tissue. The fungus readily produces air borne spores and some isolates form sclerotia. This means that inoculum of BGM is always present and if conditions favour BGM, it will occur irrespective of what has happened earlier in the chickpea season.

Recommendations for 2017 chickpea crops:

- Paddock selection: Avoid planting chickpeas next to paddocks where BGM was an issue the previous season. As for Ascochyta blight, chickpeas should be grown as far away from paddocks (in which BGM was a problem) as is practically possible. But under conducive conditions, this practice will not guarantee that crops will remain BGM free because of the pathogen's wide host range, ability to colonise dead plant tissue, and the airborne nature of its spores.
- Sow later: If long-term weather forecasts suggest a wetter-than-normal 2017 season (La Niña) consider sowing in the later part of the planting window as this will reduce biomass production; BGM is favoured by dense canopies.
- Wider rows 66 cm+: Wide rows improve airflow through the crop leading to more rapid drying after a rain event or dew. They also delay canopy closure and improve penetration of fungicides later in the season.
- Foliar fungicide: In areas outside Central Queensland, spraying for BGM is not needed in most years. But in seasons and situations favourable to the disease, a preventative spray of a registered fungicide immediately prior to canopy closure – followed by another application two weeks later – will assist in minimising BGM development in most years. If BGM is detected in a district or in an individual crop particularly during flowering or pod fill, a fungicide spray should be applied before the next rain event. None of the fungicides currently registered or under permit for chickpea BGM have eradicant activity, so their application will not eradicate established infections. Consequently, timely and thorough application is critical.

Waterlogging

Waterlogging (WL) and other stresses can reduce disease resistance and efficacy of management. Plants exposed to environmental stresses have altered architecture, metabolism and elongation – these reduce the plant's ability to maintain resistance and re-shoot post disease infection. This was evident across chickpea crops in 2016 with increased severity of AB on resistant lines (including PBA HatTrick, MR) when under WL stress. Preventative fungicide spray application on stressed, disease prone areas is critical to reducing yield loss.

There are currently no released varieties with significantly improved waterlogging (WL) tolerance. Further studies are currently being carried out to exploit potential for improvement in conjunction with PRR resistance. During the 2016 season the northern growing region reported significant crop losses due to PRR. Surveying and quantitative PCR testing of soil samples collected from a number sites across this region concluded that both PRR and waterlogging were involved in plant death at various growth stages. Differentiating WL and PRR crop damage is difficult, often WL is incorrectly identified as PRR.

The following will reduce the risk of waterlogging in 2017 chickpea crops:

- Avoid poorly drained paddocks and those prone to waterlogging.
- Sow later if the weather forecast for 2017 predicts a wetter-than-normal early-to-mid season. Evidence suggests that in chickpea and other crops early vigour associated with plants in the early vegetative phase will re-shoot and recover root growth more efficiently reducing plant death.

Further information on chickpea disease management can be found at the Pulse Australia website www.pulseaus.com.au and in the NSW DPI 2017 Winter Crop Variety Sowing Guide.

This research is made possible by the significant contributions of growers through both trial cooperation, field access and the support of the GRDC; the authors most gratefully thank them and the GRDC. Thanks to Woods Grains, Goondiwindi, Glen Coughran, "Beefwood", Moree and Joe Fleming, "Parraweena", Blackville for providing seed for the trials. We also thank agronomists for help with the crop inspections and submitting specimens, Paul McIntosh, Pulse Australia for industry liaison and chemical companies who provide products for research purposes and trial management.

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Deep P nutrition trials in the northern grains region

By James Hagan, David Lester and Andrew Zull – Queensland Department of Agriculture and Fisheries

AT A GLANCE…

Yield increases of 10 per cent or more in 21 of 43 site observations, whilst 30 of 43 observations had responses of 5 per cent or more to 20P.

There does not appear to be a significant difference in response to P rate, with the average yield increase across 20P, 30 and 40P (combined), and 60 and 80P (combined) rates all being approximately 10 per cent.

The majority of treatments did not create a positive return in the first two years, with seven of 21 sites having currently returned a net benefit.

PHOSPHORUS (P) requirements for early crop development are well known in the Northern Grains Region with critical limits defined and the use of starter P fertilisers well adopted. But sub-soil P requirements are not so readily understood.

Later season P has traditionally come from native subsoil P reserves. But as we deplete this P in harvested grain the need to introduce fertiliser sources to replenish these reserves as stratification occurs is becoming more urgent.

Nutrient stratification occurs when there is a redistribution of non-mobile nutrients such as P from the lower parts of the profile (10–30 cm) and then being released through stubble breakdown into the top 10 cm of the profile, is an increasing issue across the region.

TABLE 1: Critical P values and their relationship to P fertiliser decisions in northern vertosols

	Colwell P	BSES P	Fertiliser decision
Do I need to apply deep P? (10–30 cm depth)	>10 mg/kg	NA	No
	<10 mg/kg	30–100 mg/kg	Possibly
	<10 mg/kg	<30 mg/kg	Highly likely

The values shown in Table 1 are the estimated subsoil P critical limits required for vertosols in the northern grains region prior to trials and case studies being commenced.

As P is an immobile nutrient, replacing it in this subsoil layer requires it to be either placed there or moved there mechanically after being placed on the surface. To fit in with current no-till farming systems, we decided placing the nutrients at depth via less intensive tillage would be preferable to inversion for the aims of this project – and it was more likely to be adopted across the northern grains region.

How the trials were done

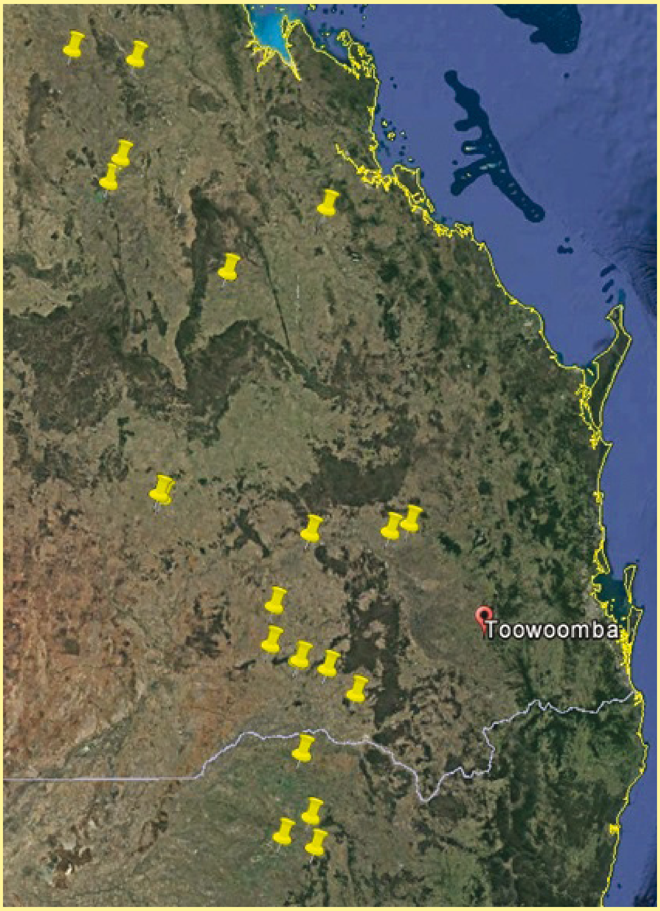
Trial sites were setup across the region from summer 2011 onwards (Figure 1), with the first crops harvested in 2013. All sites were initially treated with background levels of 80 units nitrogen (N), 50 units potassium (K), 20 units sulphur (S) and 0.1 kg of zinc (Zn) in order to ensure that the sites were unconstrained by other nutrients. These treatments are outlined in Table 2.

Each of the sites selected had a 10–30 cm Colwell-P of less than 10, and were chosen with the expectation that they would be responsive. Only three of the sites had a 10–30 cm Colwell-P of greater than 6.

Rates of P ranged from 0–80 kg, every site had a 0 and 20 kg P rate, whilst the upper end luxury rates were either 40 and 80 kg, or 30 and 60 kg. The analysis in this article merges the results from 30 and 40 kg, and 60 and 80 kg, whilst keeping costs separate. The sites also had a farmer reference treatment, which was the farmer's normal fertiliser treatment of that paddock without any tillage as a baseline.

The fertiliser makeup varied across trial sites as would be expected for farm based implementation, with choices driven by nutrients required and the price of different fertiliser mixes to achieve these nutrients – eg. MAP vs DAP, NPK mixes etc. The analysis in this article will use the examples of urea for N, monoammonium phosphate (MAP) for P and sulphate of potash (SOP) for K and S, with Zn applied as Trace Zn.

FIGURE 1: Trial site distribution across the northern region



Costs for the application of deep-P when applied with current commercial farm equipment has ranged from $15–$40 per hectare – the analysis in this article will use a flat rate of $30 per hectare.

As noted above, K and S were applied to ensure measured responses were to P and that the size of the responses would not be constrained by lack of some other element. In practice if a paddock's K and S levels were not deficient then it would be reasonable to remove this treatment and its $96 per hectare cost.

Average crop prices (Table 4) are used to avoid the large fluctuations in chickpea and mungbean prices that occurred during the trial period. This ensures that a percentage change in crop production in 2013 is equivalent to the same change in 2015. The use of average prices also gives a more realistic indication of the long term economics of deep P.

What we found

Positive yield responses greater than five per cent to the 20P rate were witnessed in 30 of 43 observations, whilst 21 of 43 observations had responses of 10 per cent or more. There does not appear to be a rate response between the rates of P used with rates from 20–80P providing a very similar range of responses across the 16 sites.

A number of sites appear to have had a positive response to the background K, N, S and Z treatments, with the 0P treatment having an average yield response of four per cent, and nine of 46 responses being greater than 10 per cent. The data (not shown) suggests that the sites with highest 0P responses were heavily influenced by K.

Three crop types dominate the dataset, with 42 of 43 observations being one of chickpea (15), sorghum (14) or wheat (13). Chickpea yield responses were lower than both wheat and sorghum on average, but had a similar distribution as shown in Figure 2.

There is a strong similarity in the responses between the different P rates as illustrated in Figure 2. Because of this, further analysis in this article will focus on the 20P rate, which is most likely to have provided net positive returns over a shorter time period given its lower upfront costs.

It should also be noted that despite the background treatment of N in year 1 in all trials, some extremely low sorghum proteins have been recorded in following years. This suggests that a number of sites may have been N constrained, which would mask any P response.

Only one of the 21 sites achieved a positive return in the first year as shown in Table 5. This is typical of longer term decisions with large upfront costs and returns expected over a number of following years. If the K and S treatments were assumed to not take place then the 20P treatment would have generated a benefit at five of the 21 sites in the first year.

TABLE 4: Average crop prices used in deep P analysis

Crop	Price ($/t)
Barley	230
Chickpea	500
Mungbean	750
Sorghum	250
Wheat	250
Durum	300

TABLE 5: Cumulative net benefit generated over time by 20P treatment

	Year 1	Year 2	Year 3
Number of sites	21	15	7
Average cumulative net benefit	–$160/ha	–$77/ha	–$67/ha
Max net benefit	$10/ha	$126/ha	$235/ha
Number of positive sites	1	5	3

FIGURE 2: 20P yield distribution vs farm reference by crop type

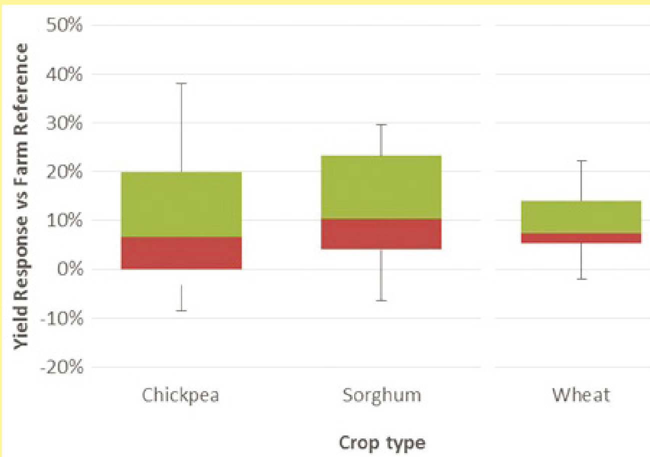


TABLE 2: Trial nutrient makeup and cost ($/t)

Nutrient	Treatment (kg/ha)	Applied as	Price ($/t)
Nitrogen (N)	80	Urea (46N)	$400
Phosphorus (P)	Variable	MAP (22P, 11N)	$800
Potassium (K)	50	SOP (41.5K, 18S)	$800
Sulfur (S)	20	SOP (41.5K, 18S)	$800
Zinc (Zn)	0.1	Trace Zn (93Zn)	$2000

Note: 80N background rate was total N applied to site pre seeding, as MAP rate increased urea application was lowered by approximately 25%, Likewise SOP applied for 50 units of K would also supply around 20 units of S.

TABLE 3: Estimated trial treatment costs by P rate ($/ha)

	Application ($/ha)	Urea ($/ha)	MAP ($/ha)	SOP ($/ha)	Elemental Zinc ($/ha)	Total treatment cost ($/ha)
0P	$30	$69	$0.00	$96	$0.22	$196
20P	$30	$61	$73	$96	$0.22	$260
30P	$30	$57	$109	$96	$0.22	$292
40P	$30	$52	$145	$96	$0.22	$324
60P	$30	$43	$218	$96	$0.22	$388
80P	$30	$35	$291	$96	$0.22	$452

Note: K and S were applied as backgrounding to ensure unconstrained soil for scientific results. Grower implementation may be able to remove this cost depending on soil test status.

The average first year result for the 20P treatment generated an income of $100 per hectare more than the farm reference treatment, but this was not enough to offset the $260 per hectare upfront cost. Five of the 15 sites generated profits in the second year, with the average income increase being approximately $80 per hectare.

But if it was assumed that these sites had sufficient K and S (ie. no additional K and S treatment), then nine of 15 sites where we have two or more years of data for, would have returned a positive net benefit in the second year.

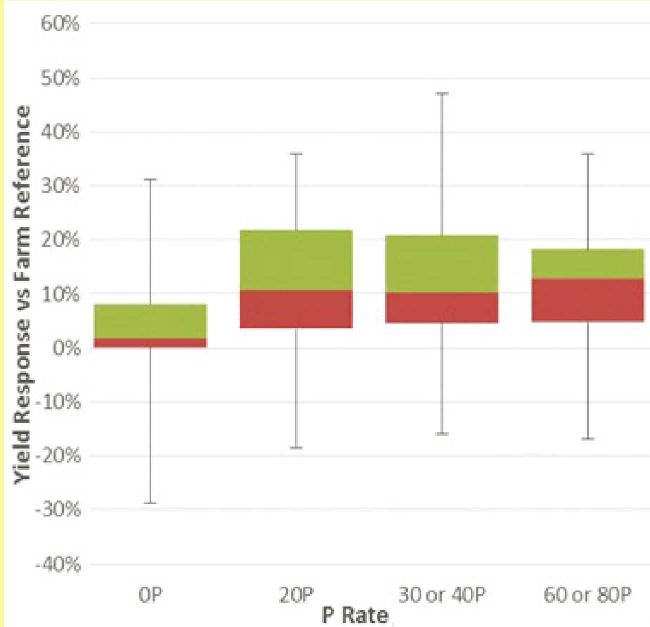
TABLE 6: Cumulative net benefit to 20P assuming no additional K or S required

	Year 1	Year 2	Year 3
Number of sites	21	15	7
Average net benefit	–$73	–$5	–$11
Max net benefit	$106	$222	$331
Number of positive sites	5	9	3

Unfortunately, four of seven sites for which three or more years of data exist, were largely unresponsive and removing the K and S cost is not sufficient for these sites to generate a profit. There was no correlation between the sites that were unresponsive and their starting Colwell-P test results.

The data from these trials has been used to assist in the development of a deep-P calculator which will be available soon.

FIGURE 3: Distribution of yield responses across 46 observations per treatment vs farm reference



To sum up

The majority of sites achieved positive yield responses to deep-P application, but the majority of sites have not generated additional profits in the first two years. Additional monitoring will be required to determine what the difference in duration of response is between the rates used and whether the higher rates can prove economical over time.

Responses to P have varied by year, with season type being an important factor. It is believed that in-season rainfall will allow plant access to P in the 0–10 cm layer, reducing the reliance on sub-soil P, thus reducing the potential benefits.

Seasons where there is minimal in-season rainfall are expected to obtain greater benefit from deep-P.

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

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Darling Downs field day unveils new corn hybrid

OVER one hundred farmers and industry representatives attended the February launch of the latest Pioneer brand gritting corn hybrid.

Held at Wayne and Leanne Ziesemer's property 'Tosari' near Norwin on the Darling Downs, the event showcased the new gritting corn hybrid Pioneer brand P1888 and allowed growers to view the hybrid in both dryland and irrigated plots.

"We are very excited to launch our new P1888 gritting hybrid and we have been extremely happy with its high yields and strong trait package over multiple locations and years," said Robert Crothers, Regional Sales Manager for Pioneer brand products.

"In the very challenging dryland conditions of 2016–17 it has shown the ability to produce good grain size under stress, which is very important to the confectionery and corn flake end-users."

Keen interest from South Korea

Mr Yum from Dongil Grain in South Korea also inspected P1888 at Norwin mid February and was suitably impressed by the quality of the grain.

"Mr Yum is the largest importer of Australian gritting corn so it is great news for Australian corn producers that he is showing such a keen interest in the new hybrid," Robert said.

Also in attendance was Andrew Cogswell from Lachlan Commodities, a company specialising in supplying high quality grains to the international and domestic food industries. Andrew was very impressed with P1888 and believes it will be well received by the snackfood industry.

"Considering the conditions last year, P1888 performed unbelievably on both dryland and irrigation," Andrew said."In both farming systems, it looks fantastic and has shown good disease tolerance. The performance on dryland was stellar given the pressure of the season and I believe this will be an excellent performing hybrid.

"P1888 should be well received by snackfood manufacturers and initial trials have demonstrated this. We'll be conducting more trials this year and I fully expect the hybrid to be approved for use by these manufacturers."

Attendees also viewed the latest technology available from Vanderfield, Norseman Planters, Toowoomba Engineering and Flying Ag Australia. There was a demonstration on the latest seed metering and placement technology by Precision Seeding Solutions, as well as a correct planter setup discussion.

Ben Thrift, Pioneer's local Area Manager for the Darling Downs, says the success of the field day indicates P1888 is a welcome addition for local growers.

"When you organise these events you really hope growers and the industry will find it useful. Looking at the turnout and speaking to attendees they got a lot out of the day.

"We are really pleased to have been able to showcase the great characteristics of our new variety P1888 to such a wide range of industry," said Ben. ■

The field day and launch of the new gritting corn hybrid was held at Wayne and Leanne Ziesemer's property, 'Tosari'.

SOUTHERN AUSTRALIA FOCUS

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

Agronomy for early sown canola

By Martin Harries, Mark Seymour, Jackie Bucat, Bob French and Sally Sprigg – DAFWA

AT A GLANCE…

- Agronomic management of canola changes considerably when sowing very early.
- There was a large yield benefit from establishing canola in mid-vs late April of approximately 40 kg per hectare per day but the additional benefit of sowing in late March vs mid-April was only about 10 kg per hectare per day.
- Climatic and agronomic risks increase with early sowing.

IN recent years March and April rains – particularly in Western Australia – have provided good opportunities to push the boundaries of early sowing of canola. But there has been little information as to whether there are changes required in agronomy to give the best chance of success from early sowing. To help fill in this information gap, a wide range of trials have been undertaken.

What we found

Yield and time of sowing

Two time of sowing (TOS) x variety trials were implemented:

- 2015 Binnu (85 km north of Geraldton, WA) April 15 vs April 29; and,
- 2016 Wongan Hills (180 km northeast of Perth) March 31 vs April 15.

At the Binnu site mean yield was 1322 kg per hectare. Averaged across all varieties TOS 1 (April 15) yielded 1647 kg per hectare compared to 997 kg per hectare for TOS 2 (April 29).

So delaying sowing by 15 days led to 650 kg per hectare less yield – equivalent to a loss of 43 kg per hectare per day. At this short season site, using the highest yielding variety – rather than trying to match variety maturity to sowing date – was the best option as there was no increase in yield with the longer season varieties at the earlier sowing date.

At the Wongan Hills site mean yield was 2755 kg per hectare. Averaged across all varieties TOS 1 (March 31) yielded 2853 kg per hectare compared to 2658 kg per hectare for TOS 2 (April 15).

Delaying sowing by 15 days led to 195 kg per hectare less yield, equivalent to an average loss of 13 kg per hectare per day.

The effect of sowing time by variety was almost statistically significant (P=0.066) and differences in the response to TOS were associated with variety maturity length. Mid-season 5 and 6 series mid and mid/late varieties responded best to March sowing while shorter season 4 series varieties produced similar or less yield from earlier sowing.

Agronomic management and climatic risk profiles change with early sown canola.

These results match well with NVT data which indicate that the longer season varieties yield better relative to shorter season varieties at high yield potential sites. These often correlate to longer season length sites.

Seed quality

Oil concentration is affected by many variables such as variety, nitrogen nutrition – and most markedly – environmental conditions at seed fill. So there is unlikely to be a consistent response of seed oil content to sowing time.

In the 2015 and 2016 time of sowing trials there were significant varietal responses but no significant differences in oil content between the sowing times.

Establishment

Several trials were run in 2016 across sites from Merredin to Geraldton which looked at how establishment from a mid-April sowing was impacted by seed depth, seed size and hybrid vs OP.

Hybrid and OP varieties were sown at three seed depths from

1 to 7 cm and seed was graded into three size lots from each variety. The reason for testing seed depth was to see if chasing moisture at depth would improve establishment when sowing early, in hot conditions.

Sowing canola at 1 cm produced higher establishment than sowing at 3 or 7 cm, even when sowing in mid-April into sites with sub-soil moisture (20–50 mm of rain received one week prior). Measurements of soil moisture at the three seeding depths of 1, 3 and 7 cm – along with deeper measurements – indicated that soil moisture at the top 1 cm was similar or greater than at depth in the two weeks following sowing despite ambient temperatures in excess of 30°C.

In difficult conditions, hybrid seed was better able to establish than OP canola. Sowing small OP seed deep resulted in very poor establishment and reduced yields (Figures 1 and 2).

The gross margin of both the OP and the hybrid decreased as sowing depth increased, in line with yield. The effect of seed size on gross margin was much greater for the OP so it is important to grade the OP seed while there was no benefit in grading the commercial hybrid seed lot as it was already large at around 180,000 seeds per kg.

The highest gross margin treatment of the OP and the hybrid were similar at $991 and $866 respectively. The OP yielded less but this was off-set by lower input costs and a commodity price premium.

Plant density

Establishment rates in commercial fields range from 90 per cent or more through to less than 30 per cent depending on seeding conditions – and harsher conditions can be expected at very early sowing dates. This inevitably means that there will be paddocks where the target density is not achieved. In 2014, 2015 and 2016 trial plots with five plants per m^2 sown in the northern region in mid-April yielded over 1.5 tonnes per hectare.

The conclusion was that in situations where weeds are not an issue density must be less than 10 plants per m^2 before considering re-sowing. In fact some growers in the northern agricultural region are targeting 15–20 plants per m^2 in wide rows (50–60 cm) as a method to reduce intraspecific competition of seedlings and drought stress.

Ben Cripps, who farms at Binnu, tested interactions of row spacing and seeding rate and concluded: "We found the highest-yielding combination in our two years of trials was wide rows with low seeding rates. Lifting the seeding rate suppressed yields in both the narrow and wide rows, especially in dry conditions where plants in the narrow rows became stressed earlier."

Seedling water stress

As the sowing date is brought further forward the risk of not receiving substantial follow-up rains increases. Figure 3 shows the probability of a second wet period (plant available soil moisture

FIGURE 1: Mingenew site sown April 15, establishment by seed size and seed depth (a) ATR Bonito; and, (b) Hyola 559TT

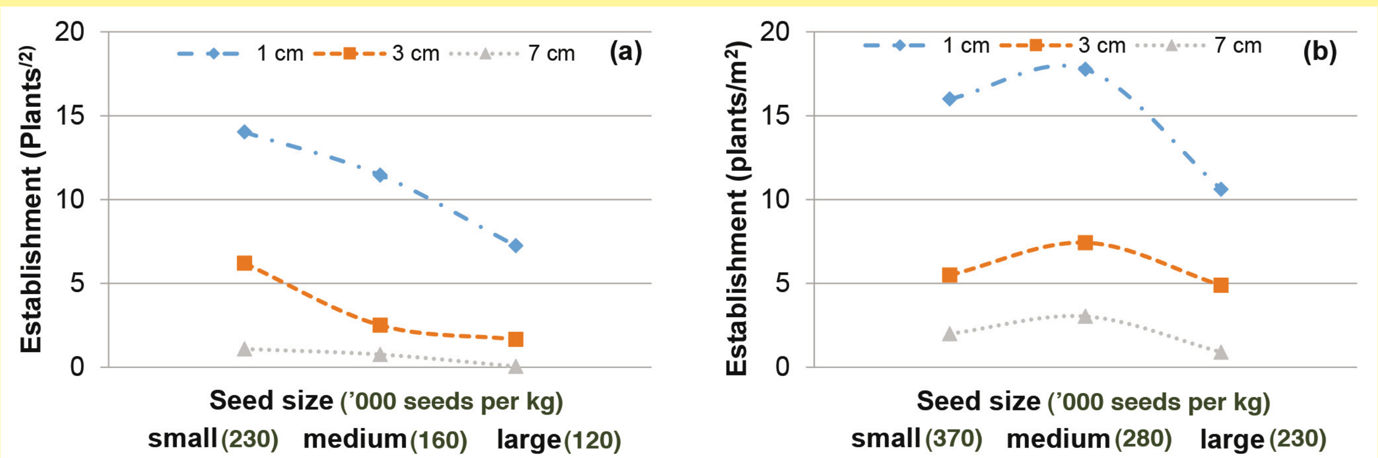
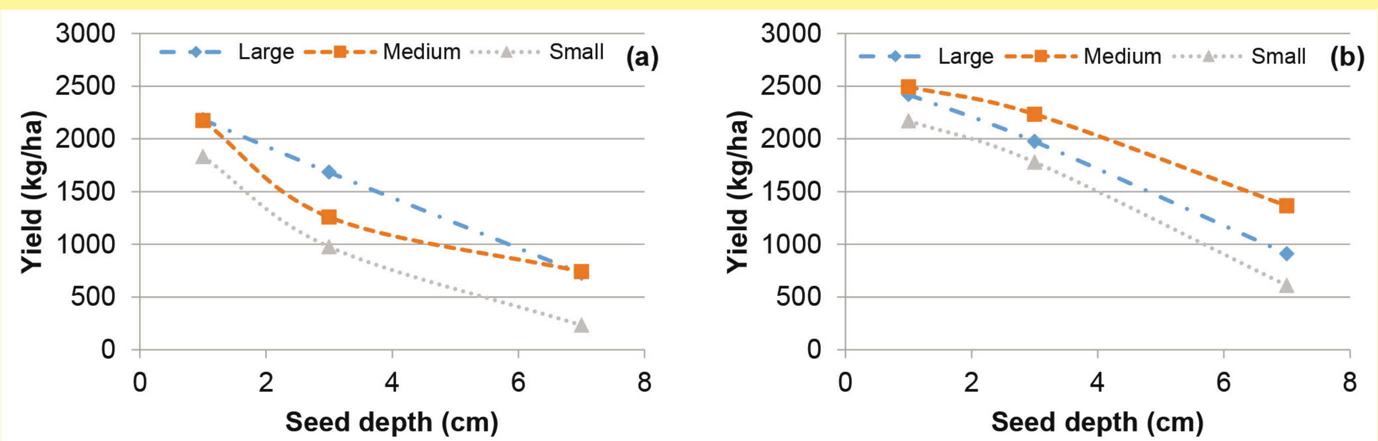


FIGURE 2: Mingenew site sown April 15, yield by seed size and seed depth (a) ATR Bonito; and, (b) Hyola 559TT



greater than 50 per cent at 0–10 cm) occurring a week or more after the break (15 mm or more received in two days or less). The earlier the break the greater the chance of soil moisture dropping below 50 per cent for a long period after the rain event.

For example, when a break of 15 mm occurs between March 20 and April 5 the probability of a second period of wet soil not occurring for at least 13 days after the break is 45 per cent. For all the early sowing periods – March 20 through to April 21 – Figure 3 shows there is a 25 to 30 per cent chance of not having a second sowing opportunity for 30 days or more.

This means missing a sowing opportunity from an early break can often lead to a large delay in sowing date.

The earlier the crop is sown the greater the likelihood of a long period of low soil moisture after sowing, and the risk of seedling drought. Mitigating the period of seedling drought stress is a key to the success of early sowing.

Moisture stress after sowing will be reduced if there is a substantial amount of stored soil moisture, hence summer rainfall and/or cropping into a fallow paddock may be less risky options for early sowing.

As mentioned earlier, reducing intraspecific competition along with increasing water harvesting in wide rows is being used on northern region farms to delay the onset of plant stress should conditions be dry for an extended period after sowing.

Nutrition

Many soils will have adequate phosphorus (P) and potassium (K) to carry extra yield from early sowing. Sampling commercial focus paddocks showed that P soil levels were high with an average of 36 mg P per kg in the top 10 cm and 108 canola tissue tests indicated 81 per cent adequate or above, 16 per cent marginal, and only 3 per cent deficient.

For K, 85 per cent of paddocks had over 50 mg per kg and 108 canola tissue tests indicated 83 per cent adequate or above, 15 per cent marginal, and 2 per cent deficient.

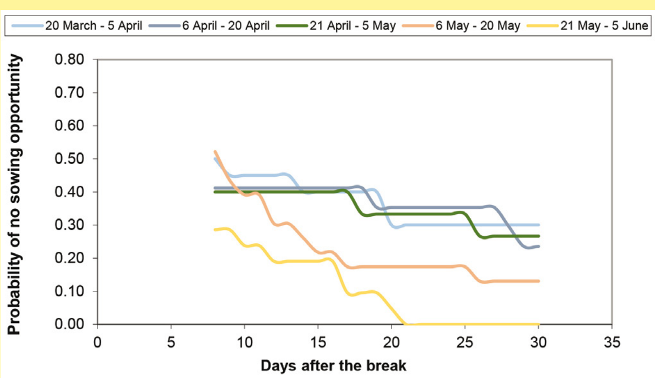
For sulphur (S), 69 per cent of paddocks had a 0–30 cm S content considered adequate for canola (ie. greater than 7.5 mg S per kg) and 108 canola tissue tests indicated 82 per cent adequate or above, 13 per cent marginal, and 5 per cent deficient.

Canola grain contains around seven times as much sulphur as wheat – at approximately 10 kg per tonne – hence additional sulphur will be required for higher yielding crops.

Within the current Tactical Break Crop Agronomy Project there has been an extensive field trial program to assess nitrogen requirements. In the majority of experiments, delaying nitrogen application to 12 weeks – near flowering – produced similar results to other times of application (Figure 4). Delaying post-emergent N application until flowering reduces up-front costs and the financial risk of early sowing.

Total N requirement is likely to be higher from earlier sowing due to increased yield as shown in APSIM outputs, Figure 5. Because very early sown canola crops are most commonly sown in conditions with good levels of sub-soil moisture, N budgeting should account for mineralisation of organic N over summer months.

FIGURE 3: Probability of there not being a sowing opportunity after different break of season dates, Mingenew climate data



Other things to consider

There are a number of additional things to consider with very early sowing. In a high frost risk area early sowing is likely to increase the risk of frost damage. Conversely early sowing in the northern region may ensure flowering occurs prior to conditions likely to cause heat stress.

The dynamics of pests and diseases will also change. For example when using Round-up Ready varieties growers need to factor in that plants can reach the 6 leaf stage rapidly in warm conditions and be prepared to apply post emergent applications while the rest of the program is still being sown. Growers also need to be aware that the window for grass selective herbicide application is reduced and ensure these herbicides are applied prior to the crop flowering.

There is also an increased risk of aphid colonisation causing yield loss from both feeding damage and transmission of Beet Western Yellows Virus (BWYV).

A 2015 trial at Geraldton showed that the length of the spikelet colonised by cabbage aphids is directly proportional to yield loss.

Early infestation with green peach aphid increases the risk of

transmission of BWYV into plants at an early development stage which increases the yield loss caused by this virus.

Sclerotinia has also emerged as a major pest, but it is difficult to predict disease epidemiology and make broad recommendations as to the impact of sowing date on infection and yield loss. Crop infection requires sclerotes to germinate and release ascospores (at least 7–10 days of ongoing moisture at 10–20°C). And this must coincide with canola flowering for petal infection to occur and moist conditions once petals lodge within the crop canopy.

If conditions are conducive to sclerotinia early, then earlier sown crops may be at more risk due to early flowering and more biomass. But if conditions are not conducive to disease, early sown crops may escape the main ascospore release period.

Work is continuing within the DAFWA pathology group to better define these relationships.

Nutrient budgeting of a paddock following a high yielding canola crop also needs to be taken into account. Canola grain removes around twice the amount of N, P and K compared to wheat per tonne and seven times the amount of sulphur. Burning windrows will also cause changes in nutrient dynamics, losses and increases in plant availability depending on the element.

Further work

The Tactical Break Crop Agronomy group will continue a range of activities in this area including:

- Testing very early sowing with new varieties across a wider set of locations;
- Phenology and APSIM work to better identify flowering periods and associated frost and heat stress risk periods;
- Establishment methods in difficult conditions;
- Defining establishment rates under different conditions and soil types more accurately; and,
- Investigation of genetic variations such as emergence from depth to improve establishment in hot drying conditions.

To sum up

In the time of sowing trials reported in this article there was a large yield benefit from establishing canola in mid-vs late April but this declined when sowing in late March compared to mid-April. There are some agronomic changes that can be made to improve the chances of success of an early sown canola such as:

- Sowing after a fallow or after summer rains;
- Using heavily graded OP or hybrid seed to obtain a better establishment rate in tough conditions; and,
- Altering plant density and geometry.

Input costs can be reduced by applying fertiliser post emergent, but there are still significant risks when sowing very early – weeds and pests need to be controlled over a longer period and plants may be flowering at high frost risk times.

Thanks to the Geraldton and Wongan Hills DAFWA Research Support Units for trial management and the GRDC for project funding (DAW00227). ■

FIGURE 5: APSIM yield predictions for canola at various nitrogen input levels and sowing dates using Mingenew climate data

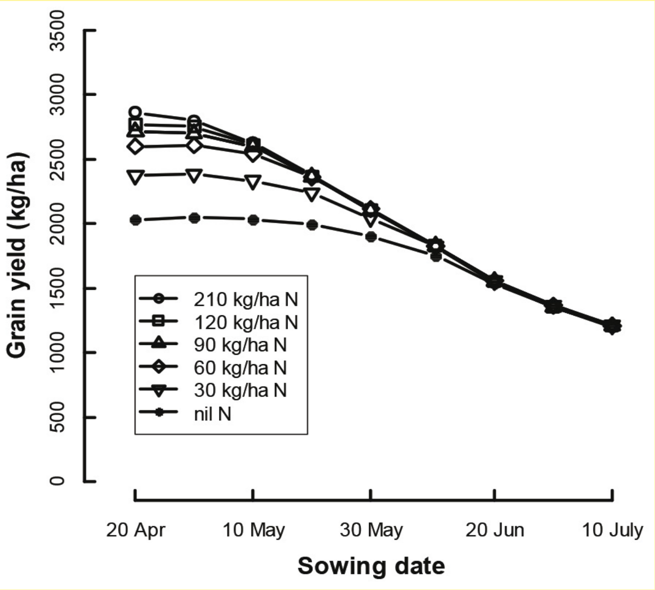
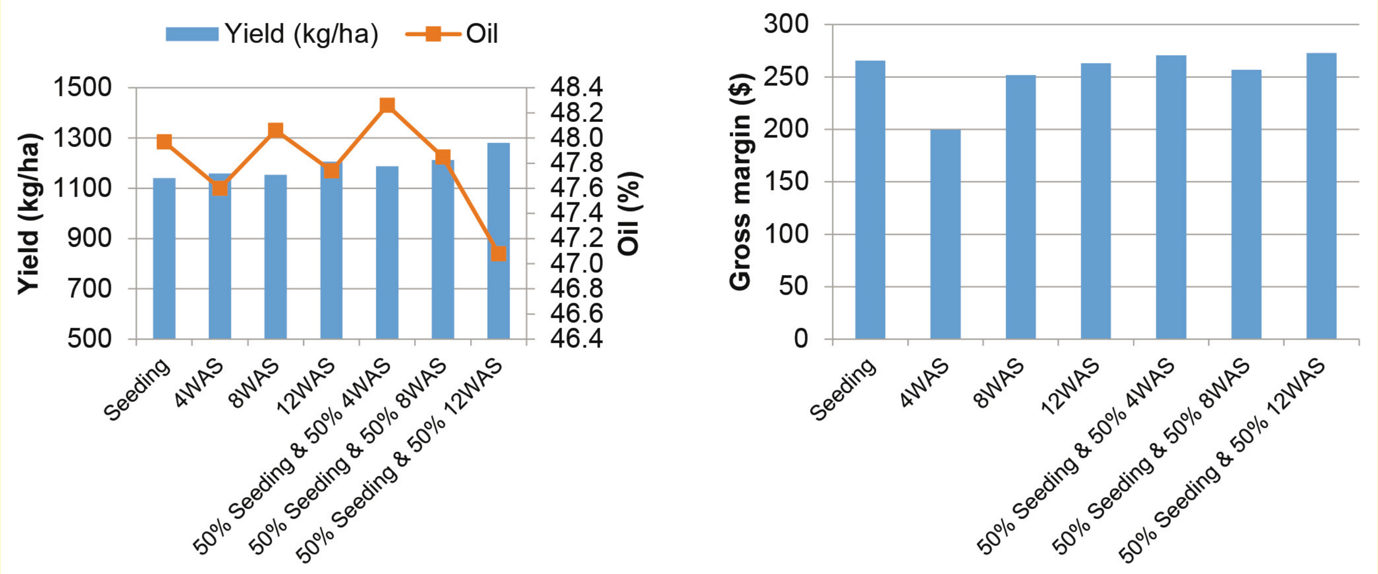


FIGURE 4: The effect of applying 50 kg per hectare of N at different timings on canola yield, seed oil content and gross margin



Seymour et al, 2015.

Capturing early sowing opportunities for wheat

By Brenda Shackley, Christine Zaicou-Kunesch, Jeremy Curry and Dion Nicol – DAFWA

AT A GLANCE…

- Highest grain yields are not always achieved at the earliest sowing opportunity.
- Western Australian trials show Mace is not suitable for April sowing times but other current mid to long maturing varieties have good adaption for yield.
- Frost events were severe and repeated in some regions in 2016 and even longer season spring and winter wheats were severely damaged.

IN 2016 a series of time-of-sowing trials for various wheat varieties were carried out across a range of Western Australian locations. The locations were Mullewa, Merredin (Merredin Dryland Institute), Katanning (Great Southern Agriculture Research Institute) and Gibson (Esperance Downs Research Station, EDRS). These trials examined 12 wheat varieties sown at three sowing dates – mid April, early May and late May (Table 1).

The varieties included in all trials were Mace, Magenta, Trojan, Yitpi, Cutlass, Zen, DS Pascal, Forrest, Wylah, the newly released LRPB Arrow and two potential mid to long season varieties (advanced breeding lines). At EDR,S Bremer was sown in place of Zen.

Wylah is an APW winter wheat, Forrest is a longer maturing daylength responsive variety (default classification of ASW), and DS Pascal is a feed wheat in WA (default in WA, APW in SA) that exhibits the leading germination index (ie. inherent resistance to sprouting) of current commercial varieties.

A number of these varieties are also popular in South Australia, Victoria and southern NSW.

Grain yield at different sowing times

The average grain yield in the trials ranged from 4.5 tonnes per hectare for the mid-April and early May sowings at EDRS,

TABLE 1: Summary of trial details for the sites at Mullewa, Merredin, Katanning and EDRS in 2016.

	Sowing dates	Establishment (plants/m²)	Rainfall (mm)			No. of frost events	
			Pre (Jan–Mar)	Grain fill (Sep–Oct)	GSR (Apr–Oct)	Min 0–2°C	Min <0°C
Mullewa	April 14, May 5 and 26	118, 120 and 162	37	12	358	12	2
Merredin	April 15, May 10 and 27	96, 102 and 104	183	30	255	14	13
Katanning	April 14, May 5 and 26	146, 148 and 132	105	54	303	14	3
EDRS	April 14, May 9 and 26	155, 165 and 171	135	98	480	0	0

to a near total yield wipe-out due to frost at Katanning sown mid-April (Figure 1). Most varieties produced their highest yields at the early May sowing time or the yields were not significantly different between mid-April and early May sowings. The exception was Forrest at Merredin which obtained the highest yield when sown mid-April.

To sum up

Traditionally, sowing wheat in Western Australia was not recommended until after Anzac Day – a date based on the yield performance and maturities of commercially available wheat varieties in the 1990s. Since then, changing rainfall trends (particularly at the start of the growing season), as well as changes to farming systems, have seen growers show willingness to sow wheat even earlier than Anzac Day.

This has coincided with the release and dominance of Mace, a high yielding and very adaptable short to mid maturing variety. This presents the challenge of knowing 'how early is too early' with the accepted and popular Mace, or whether there are varieties that are better suited to taking these early sowing opportunities.

Unfortunately there is limited information on which wheat varieties to grow with a very early sowing opportunity.

Research carried out by Dr. James Hunt in 2014 suggested that the faster maturing winter wheat Whistler appears to be well adapted to WA and when sown in mid-April was able to yield as well as, or better than, Mace planted in late May. The results of Whistler in 2015 or the similar maturing Wylah in 2016, do support this suggestion, but this research also suggests there are commercial mid to long maturing varieties currently available in WA which can yield similar or higher than both these winter wheats and Mace.

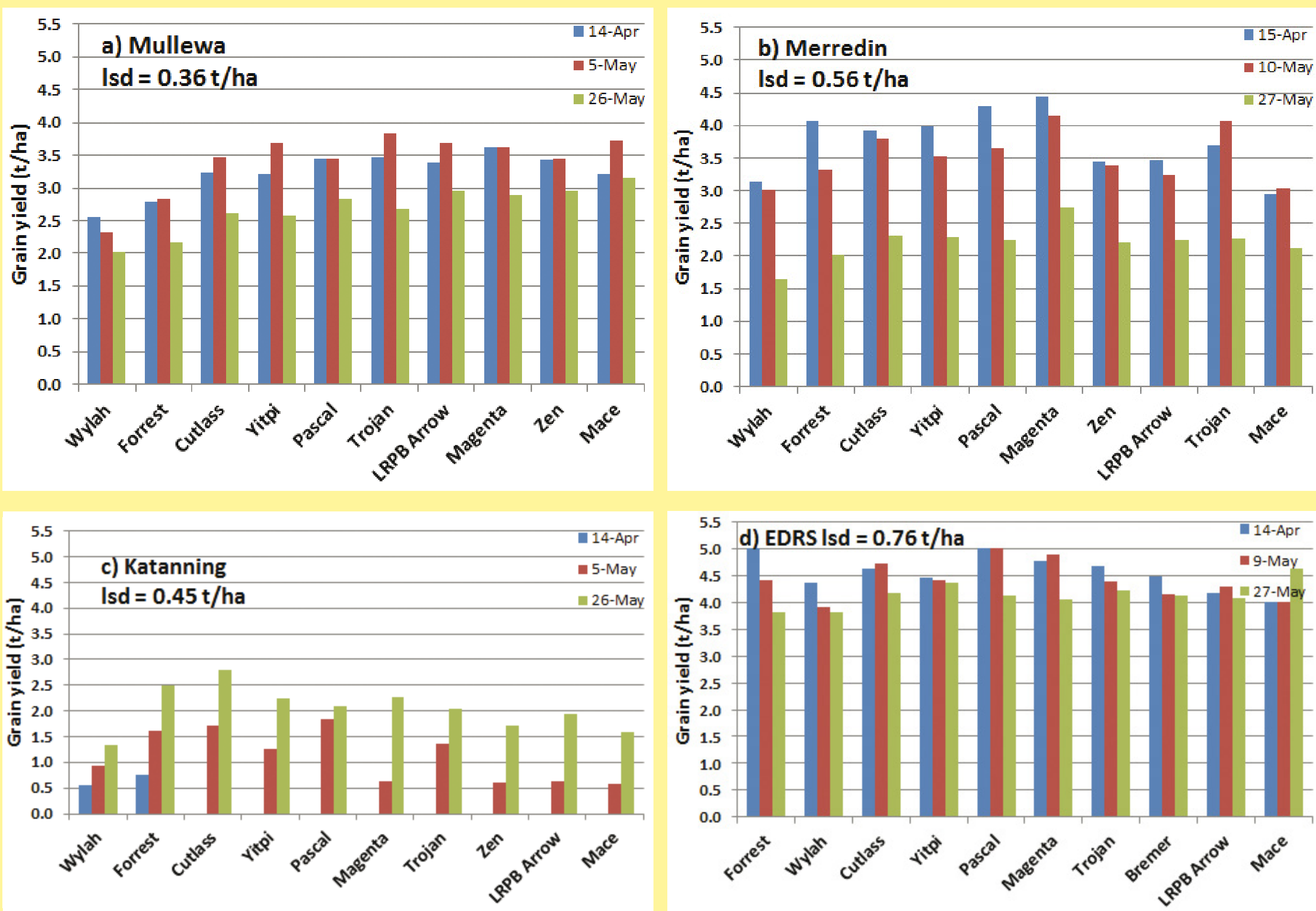
The longer maturing variety Forrest was examined in 2016 and appears to be more adaptable to WA conditions than Wylah.

But all these varieties can still be at the risk of frost and grain quality problems associated with very early sowing and despite replicated trials across WA, no variety has consistently shown the ability to outperform others in any particular set of conditions, be that geographic location or sowing time.

The research continues to highlight the need for a variety which is better suited for early sowing opportunities in WA and that will give an improvement on traditional strategies of sowing an early to mid maturing variety in May. Such a variety would not only need to consistently out-yield other varieties sown at early or conventional sowing times, but would require some level of resistance to common grain quality issues associated with early sowing, such as pre-harvest sprouting, staining and frost.

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, the author would like to thank them for their continued support. This research is also co-funded by DAFWA. Sincere thanks Nino Messina for the provision of land at Mullewa, to the Geraldton, Merredin, Katanning and Esperance RSUs for the management of trials and for the technical support of Melanie Kupsch, Bruce Haig, Rod Bowey and Rachel Brunt. ■

FIGURE 1: Grain yield (t/ha) response of wheat varieties to sowing time at – a) Mullewa, b) Merredin, c) Katanning and d) EDRS in 2016. Varieties arranged from left to right in order of average maturity at that site. Severe frost damage occurred at Katanning.



Insecticide shown to reverse metabolic herbicide resistance

HERBICIDE resistance occurs at a genetic, molecular and cellular level in ways that challenge some of the most agile scientific minds. In following interesting lines of enquiry, scientists working to understand the mechanisms that drive herbicide resistance sometimes come across some unexpected findings.

One such finding is the discovery that an insecticide can reverse metabolic resistance to a herbicide, making the resistant population susceptible to the herbicide once more.

'Metabolic resistance' is the lesser known cousin to 'target site resistance' in the world of herbicide resistance mechanisms. Target site resistance is comparatively easy to identify and study, being a more direct 'cause and effect' type mechanism that usually confers quite high levels of resistance.

But metabolic resistance is more complex and more difficult to study due to many internal mechanisms involving secondary enzyme production and activity. This type of resistance is often moderate, but it is also frequently effective across multiple herbicide mode of action groups. It is not uncommon for plants with metabolic resistance to be resistant to herbicides that they have never been exposed to.

This has a dramatic and limiting effect on herbicide choice and makes herbicide rotation a much less powerful control tactic.

In simple terms, metabolic resistance occurs when the plant uses its metabolic pathways to produce enzymes that 'protect'

AHRI researcher, Roberto Busi.

target sites from the applied herbicide molecules. If the herbicide molecule never reaches the target site then the plant survives. The same enzyme or multiple enzymes can 'protect' multiple target sites, resulting in cross-resistant plants.

Weed surveys in Western Australia have revealed a high rate of multiple-resistance in annual ryegrass populations with 70 per cent of populations possessing both metabolic and target site resistance to herbicides.

An unlikely synergism

Research into gaining a better understanding of one group of enzymes – known as P450s – has uncovered an unlikely synergism between an insecticide and current pre-emergent herbicides to control ryegrass. Australian Herbicide Resistance Initiative (AHRI) researcher, Roberto Busi, has shown that it is possible to reverse metabolic resistance to trifluralin in annual ryegrass using an organo-phosphate insecticide.

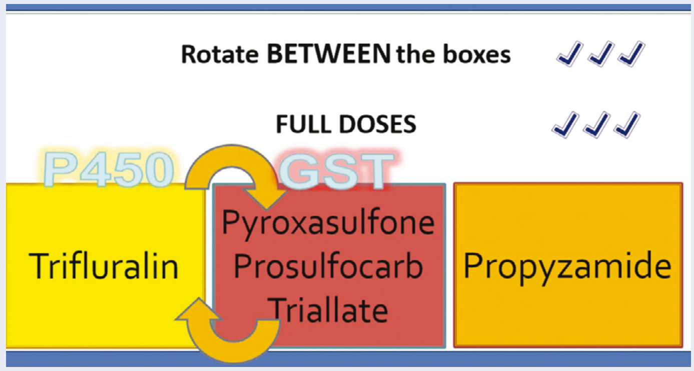
In conjunction with Colorado State University researcher, Todd Gaines, Roberto is working to better understand the genetic basis of metabolic resistance and how this knowledge can be used to control metabolic resistant weeds.

"There are just five types of pre-emergent herbicides, utilising only two modes of action, with no new modes of action in the pipeline," says Roberto. "The most recent pre-emergent product, pyroxasulfone (Sakura), was commercialised in 2012 yet even before it was brought to market, research had shown its mode of action can be 'broken' within just three generations using low application rates to result in 10-fold resistance."

This means that it is very important to find ways to keep current herbicides effective rather than just looking for new modes of action. In the case of trifluralin-resistant annual ryegrass, Roberto's research demonstrated that inhibiting the production of P450 enzymes was the key to reversing resistance to this useful pre-emergent herbicide.

"Inhibiting the production of P450 enzymes requires the suppression of different genes in the plant that are responsible for regulating production of the enzymes at different stages of the plant's development," he says. "In ryegrass there are probably several different P450 enzymes that are active during the plant's development that are offering protection against the herbicide, so there is a high level of complexity involved in trying to manipulate the genes responsible for herbicide resistance.

"Using the insecticide phorate, applied in granular form to the soil immediately before spraying with trifluralin, we were able to prevent establishment of plants with known resistance to trifluralin," he says, "But the effect was not as clear for plants that were resistant to Sakura. Phorate is not the solution to



metabolic resistance but this proof-of-concept research confirms that it is possible to manipulate and even reverse metabolic resistance with the use of existing pesticides."

Phorate is not currently registered for use in any crop except cotton and the described use is not permitted in the field. Phorate is highly toxic and it was used under carefully controlled laboratory conditions for these experiments.

It is not desirable to turn off P450 production in a crop so chemicals that inhibit P450 production are best suited to use with pre-emergent herbicides. Current research is investigating ways to design better P450 inhibitor mechanisms using gene technology and to use these mechanisms in future crop breeding programs to confer crop tolerance to certain herbicides.

Further experiments showed that ryegrass plants with metabolic resistance to Sakura use another metabolic pathway involving enzymes known as GST. In a similar manner, these mechanisms can probably confer cross-resistance for pyroxasulfone (Sakura), prosulfocarb (Boxer Gold) and triallate. To date, the fifth pre-emergent active ingredient, propyzamide, does not seem prone to metabolic resistance.

The best advice

Roberto says that for now the best advice to growers and agronomists is to rotate between these three groups of pre-emergent herbicides:

- Trifluralin;
- Sakura, Boxer Gold and triallate; and,
- Propyzamide

"We are researching the potential benefits of mixing herbicides from these three groups as a means of delaying metabolic resistance," says Roberto. "As always, full label rates must be applied."

For more information about managing herbicide resistance visit the Weedsmart website: www.weedsmart.org.au ■

Triazine applied to a pot containing triazine-resistant ryegrass seed. Centre: Triazine applied immediately after applying phorate insecticide granules to pots with triazine-resistant ryegrass seed. Right: Triazine applied to a pot containing triazine-susceptible ryegrass seed.

Chickpea optimism remains high

By Peter McMeekin, Nidera Australia Origination Manager

WITH decent (albeit patchy) rain around during March helping to bolster soil moisture reserves, the focus for many has turned to the winter crop planting program. After a generally successful 2016 harvest, chickpeas are certainly featuring heavily in many growers' plans with most pundits suggesting that chickpea planting intentions are similar to last year.

Despite all the concerns with regard to excessive rain in September and October last year, yields – and hence the final 2016 crop size – has surprised all. While it is still difficult to accurately pinpoint, it is now becoming evident that Australian production last season was close to 2.0 million tonnes (mt) – a clear national record.

At the same time, demand from the subcontinent has continued for longer than usual. Total exports to the end of March are expected to reach around 1.5 mt. While we still have some export work to do, it appears 'regular' demand should comfortably deal with any remaining surplus, leaving the domestic cupboard pretty bare come new crop harvest.

Continued Indian demand helps keep prices buoyant in this high production environment. Around 70 per cent (more than 1.0 mt) of the exports to the end of March will be to India.

Nonetheless, India needs to be a strong importer once again this coming season given that Aussie growers are becoming ever more fond of growing a lot of chickpeas.

The Indian domestic scene is helping prices

That said, India's growth in pulse demand continues to substantially outstrip local production, despite government market intervention. India has had two years of poor production leading up to this year's harvest. This has led to a significant shortfall in supply and strong imports, especially from Australia.

But the 'supply pipeline' in India is completely dry, meaning they remain vulnerable to any further hiccups in local production.

So what are the prospects for the current Indian chickpea harvest?

Reports to date suggest it is 20–30 per cent better than last year, which sounds good. But in reality, last year's crop was so poor that even a 30 per cent increase will mean that their crop is still well below the long-term average and certainly not substantial enough to rebuild stocks.

Accordingly, expectations are now strong that we will see India importing strongly again this coming season. Maybe not as much as the current season, but substantial just the same.

Whether they import to satisfy nearby demand or to rebuild

stocks will not only depend on the size of this year's harvest – but more importantly – next year's harvest. Certainty around that harvest will not be known until the time of the retreating monsoon – which normally occurs on the cusp of the Australian harvest.

Problems in Pakistan as well

Like India, Pakistan has had two years of poor production. This year's crop is unlikely to exceed 300,000 tonnes, less than 50 per cent of their domestic demand of 600,000 to 650,000 tonnes.

This adds up to an import requirement for Pakistan of more than 300,000 tonnes.

The Pakistan market lacks the sophistication and financial stability of the India market – as strange as that may seem.

Imports for the first quarter of 2017 have been far greater than nearby demand, resulting in significant stocks sitting on the wharf, unable to find prompt homes. Some of the importers of these stocks are unable to finance this unsold inventory, forcing them back into the market wanting to washout or cancel contracts.

This has caused a sharp fall in nearby values in Pakistan and an easing of values here in Australia. The irony is that eventually they will need the product – but not now. And like India, they are expected to be a regular importer again once new crop stocks are available.

Whilst we still have a long way to travel, it would appear Australia is on track for another good crop – weather dependent of course. Indian demand is critical and is expected to continue into the next Australian crop. But it is the extent of that demand that will be the primary driver of domestic new crop values.

Report submitted March 23, 2017.
For information: www.nidera.com.au or the Grower Hotline 1300 NIDERA. ■

Global overview

■ By International Grains Council

AT A GLANCE…

- Grains production in 2016–17 is expected to exceed 2.1 billion tonnes for the first time, including record harvests of wheat and maize.
- A 7 per cent accumulation of grains carryover stocks is forecast to 508 million tonnes, including inventories in the major exporters expanding by 19 per cent.
- The outlook for world 2017–18 wheat production remains mostly favourable, with only a small y/y drop anticipated.
- Plentiful and attractively priced supplies are expected to ensure that buying interest is strong as soybean trade rises by 3 per cent, to a new peak.

IN their February 2017 Market Report, the IGC increased their estimate of world total grains (wheat and coarse grains) production in the 2016–17 by 5 per cent, to an all-time peak of 2102 million tonnes (mt)

A bigger maize crop, to a record level, accounts for 80 per cent of the year on year gain. An increased wheat output – also placed at the highest ever and helped along by Australia's huge 2016 crop – added to the record production forecast.

Despite a solid rise in consumption, global carryover grain stocks are projected to rise by 33 mt (to 508 mt) as inventories of wheat and maize each climb by about 7 per cent.

Downturns for barley and sorghum are largely behind a drop in trade, outweighing a predicted record for wheat.

Only a slight fall in world 2017–18 all-wheat harvested area is projected, but with a fall in average yields, production is tentatively placed 2 per cent lower y/y, at 735 mt.

Firm domestic prices, including attractive levels of government support, will help to underpin sowings in some regions. But a poor outlook for profits could contribute to a switch to other crops. For example, the winter wheat area in the US is the lowest in more than a century.

Preliminary expectations are for a modest increase in global 2017–18 barley plantings, mainly owing to a recovery in North Africa where drought had an adverse impact in the previous season.

Record soybean production

The world soybean outturn is predicted to expand by 7 per cent y/y in 2016–17, to an all-time peak of 336 mt. In addition to record crops in the US and Brazil, better harvests are anticipated across a range of relatively small producers.

Uptake is seen at a new high, linked to continued growth in demand for soybean products, while inventories are projected up by 8 per cent as heavy accumulation in the US more than compensates for falls elsewhere. Plentiful and attractively priced supplies should ensure that buying interest from leading importers in Asia remains firm as trade rises by 3 per cent, to a record of 139 mt.

Consistent with an expected increase in processing volumes amid firm demand for high-protein meals, global soyameal trade is projected at a fresh peak of about 64 mt.

World rice production in 2016–17 is forecast 2 per cent higher y/y, at 482 mt, narrowly eclipsing the record of two years ago. Growing populations will underpin a further increase in food demand as consumption expands by 7 mt, to 482 mt. ■

Nitrogen removal maps find better fertiliser strategies

By Phil Clancy, Next Instruments Pty Ltd

PROTEIN is made up of approximately 17.5 per cent nitrogen. When grains, pulses, oilseeds and other crops are grown, nitrogen is removed from the soil and ends up in the plant tissue and seeds as protein. This simple relationship can be used to generate a Nitrogen Removal Map (NRM) based on protein and yield maps collected using an on-combine NIR analyser and a yield monitor.

The NRM can then be used to generate a Variable Nitrogen Rate map showing the amount of nitrogen that must be added back to the soil as fertiliser in order to sustain the available nitrogen in the paddock for the next crop.

An on-combine NIR analyser is the tool needed to quantify the protein in the seeds and thereby the amount of nitrogen removed from the soil through the seeds.

This article describes and analyses protein, yield and nitrogen removal maps collected from Australian farms during the 2015 and 2016 harvests

Research background

More than 100 farmers in Australia, the US, Canada and the UK have now installed the CropScan 3000H On-Combine Analyser into their combine harvesters. Three Australian growers were asked to provide protein, yield and GPS data from a single paddock off their farms. The farms are located in South Australia and Victoria.

The protein data was collected by the CropScan 3000H at a frequency of approximately 11 seconds per reading – or approximately every 50 metres. The GPS coordinates were taken from the combine's GPS receiver and added into the protein data file.

The yield data was collected at a much higher frequency – every one to two seconds.

By aligning the protein and yield data at each GPS coordinate, a file was generated that contained protein, yield and GPS coordinates. *Farmworks* software was used to import these files and generate protein and yield maps.

The following computation was applied in *Farmworks* to each of the aligned data points in order to generate the nitrogen removed value for each data point.

N removed (kg N/ha) = Yield (kg/ha) x Protein (%) x 0.00175
eg. N removed = 4340 kg x 14.5 x 0.00175
= 110.2 kg/ha

The nitrogen removal map was generated by plotting the N removed at each GPS coordinate.

Case Study 1 – Yorke Peninsula, SA

Figures 1 and 2 show a protein map and a yield map off the Tintara Pastoral property of Ashley and Louise Wakefield, Urana, Yorke Peninsula in South Australia. The Wakefields run a John Deere S970 Combine with the Greenstar GPS and yield monitor.

The protein map shows protein readings at approximately every 50 metres across the paddock. Figure 3 shows the nitrogen removal map for the Wakefield's 221A paddock where they grew hard wheat in 2015.

The protein and yield maps support the 'dilution theory' that yield and protein are inversely related, but there are areas within this paddock where the dilution theory does not hold.

In the bottom right hand corner of the yield map (Figure 2) there is a red section where the yield is low and in the protein map (Figure 1) the same area is also red indicating low protein.

FIGURE 1: Protein map – Tintara, SA

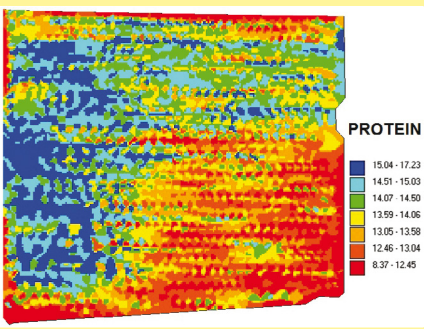


FIGURE 2: Yield map – Tintara, SA

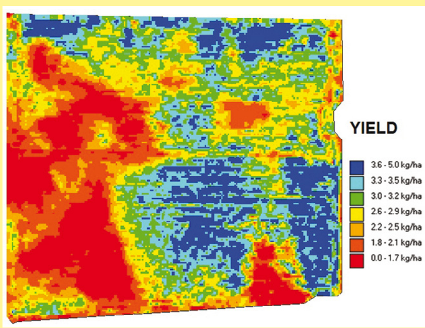


FIGURE 3: Nitrogen removal map – Tintara, SA

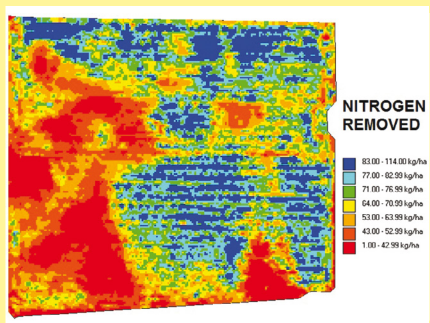


TABLE 1: Cost analysis of variable nitrogen rate vs blanket fertiliser application – Tintara, SA

	Cost of urea using VNR	Cost of urea at 40 kg/ha	Cost of urea at 56 kg/ha	Cost of urea at 60 kg/ha	Cost of urea at 70 kg/ha	Cost of urea at 80 kg/ha
Cost	$10,632	$8,710	$12,194	$13,065	$15,243	$17,420
Savings		–$1,922	$1,562	$2433	$4611	$6789
Savings/ha		–$10.4	$8.4	$13.2	$24.9	$36.7
Savings as a %		–22%	13%	19%	30%	39%

STRENGTH

where it counts

Fendt 936 with 3m extension kit

Some twenty five years ago, C&C Machining & Engineering (Tasweld at the time) were approached by Jamie Grant to extend the axles of his John Deere tractor to three metre centres for Controlled Traffic Farming (CTF). Since then a lot has changed. The number of farmers practicing CTF has increased and so has the variation in machine types. C&C have become global leaders in heavy axle modification with their growing Widetract product line used by farmers all over Australia.

> “We knew our conventional ‘cotton reel’ spacers were wearing out the front axle assembly and messing with the steering. We had to offer our customers something better...”

“We knew that our conventional ‘cotton reel’ spacers were wearing out the front axle assembly and messing with the steering. There were concerns about the strength of new independent front suspension systems being offered by Fendt and John Deere. We had to offer our customers something better. After an extensive R&D process we can now give farmers a safer alternative that allows the use of front weights and heavy implements on wide spacing without damage”.

The bolt-in kits take a few hours to install and are fully reversible if the customer wants to sell the tractor or kit separately.

C&C now offer wheel spacing solutions for nearly every machine out there: “It’s a constant R&D process. These days everything is computer designed and tested and then CNC machined.”

A number of farmers are going to four metre spacing now so C&C have to keep up with trends: “We have just installed a four metre kit for a Claas header and we are working on some four metre JD ILS kits too”

WIDETRACT

07 46 332 344
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John Deere ILS 3m extension kit

FIGURE 4: Protein map – Longdam, SA

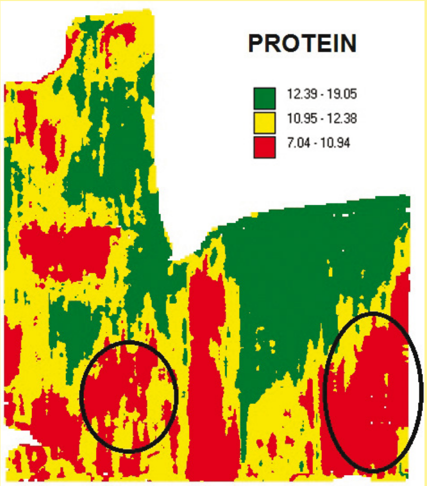


FIGURE 5: Yield map – Longdam, SA

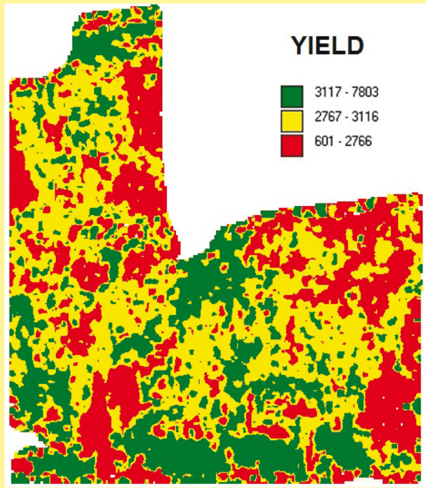
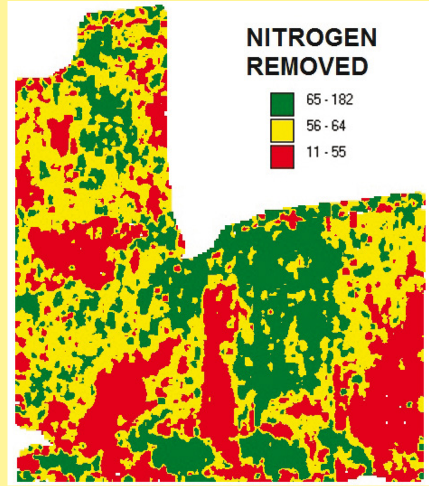


FIGURE 6: Nitrogen removal map – Longdam, SA



This suggests that this area is suffering from a nutrient deficiency. Additional nitrogen could increase both the yield and protein content in this area.

The nitrogen removal map (Figure 3) shows that in the top right hand corner of the paddock, there is more nitrogen removed than elsewhere in the paddock. The left hand side of the paddock shows a very consistent pattern that would suggest a higher N application rate would increase the protein content but reduce the yield. The right hand side of the paddock shows considerable variation in N removed and suggests that a Variable Nitrogen Rate (VNR) application would be beneficial.

Ashley Wakefield assessed the cost savings of applying urea based on the NRM against a blanket rate across the entire paddock. Table 1 shows the cost analysis based on urea at $437 per tonne and applying urea using VNR versus blanket application rates of 40, 56, 60, 70 and 80 kg per hectare. Note that previously Ashley had applied 56 kg per hectare across this paddock.

Based on this data, Ashley could reduce his urea costs by 13 per cent or $1562 for this paddock if he used VNR compared to his historical blanket rate of 56 kg per hectare. But if he used a higher blanket rate of urea to increase protein and/or yield then the cost savings would be even greater.

Case Study 2 – Eyre Peninsula, SA

Case study 2 was taken from the farm of Thomas Schmucker, Kimba, Eyre Peninsula in South Australia. Thomas runs a Case IH 7160 combine fitted with GPS receiver, yield monitor and CropScan 3000H. The paddock is called Longdam and covers approximately 280 hectares. Figures 4, 5 and 6 show the protein, yield and nitrogen removal maps for this paddock where he grew hard wheat in 2016.

The Longdam paddock exhibits gradual undulation and the soil types vary from grey clay to sandy clay to sand from top to bottom. This paddock was originally four smaller paddocks that were separated by fences. In general the high yield zones correspond to low protein and vice versa, but there are two areas where the yield and protein are low – the lower left hand corner and right side bottom. These two areas could potentially be targeted for additional N fertiliser.

TABLE 2: Variable nitrogen rate vs blanket fertiliser application – Longdam, SA

	VNR	60 kg/ha	80 kg/ha	100 kg/ha	120 kg/ha
Urea cost	$36,511	$36,365	$41,214	$60,608	$72,730
Savings		–$146	$4703	$24,098	$36,219
Savings/ha		–$0.6	$17.8	$91.3	$137.2
Savings as a %		0%	11%	40%	50%

FIGURE 7: Protein map – Elertons, Vic

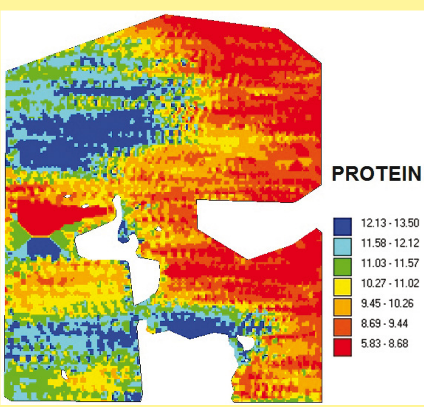


FIGURE 8: Yield map – Elertons, Vic

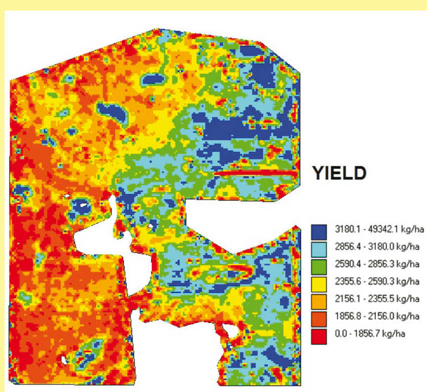
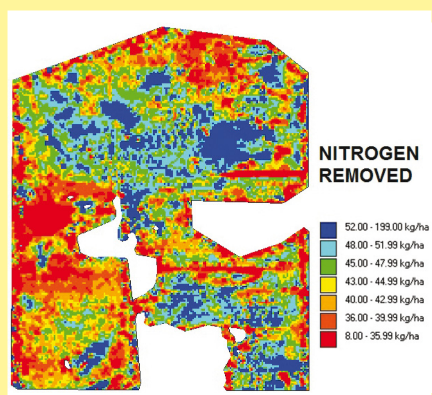


FIGURE 9: Nitrogen removal map – Elertons, Vic



Thomas plants legumes as a rotation crop in order to replenish the nitrogen in the soil, but the specific legume does not grow evenly across the paddock especially in the sandy soil types. As such the nitrogen availability across the paddock is not consistent.

The nitrogen removal map could be used to develop a VNR prescription in order to even out the protein and yield across this paddock. Table 2 shows the urea cost analysis of using a variable nitrogen rate application versus a blanket rate of 60, 80, 100 and 120 kg per hectare.

Case Study 3 – Mallee, Victoria

The third case study is for a farm in the Mallee region of Victoria. Leeton Ryan operates a mixed farm at Winnambool and grows wheat, barley and some pulses. The CropScan 3000H was fitted to a Case IH 8240.

Figures 7, 8 and 9 shows the protein, yield and nitrogen removal maps for Leeton's Elertons paddock where he grew wheat in 2016. Leeton's agronomist is Michael Ayres from Injecta, based in Adelaide.

"Farmers have traditionally always concentrated on the 'timing of management' for planting and the productivity of their crops," Michael says. "Now they need to 'manage the timing' to further add value to the uptake and availability of nitrogen and other nutrients as they relate to soil performance.

"The zones in the Ellertons paddock are defined by the sodic soils, dispersive clay layers and higher rising ground (sandy soil). The high yield zones in this particular paddock are located in the higher rising sandy soils whereas the high protein zones are in the more sodic soil management zones.

"The yield map correlates directly to soil performance and the protein map is a very good proxy for plant performance. The nitrogen data is what makes everything else fit together – productivity and performance. The on-combine protein analyser is a tool of exceptional value and its true value is only just starting to be understood," Michael said.

To sum up

Protein mapping is now a reality. As with any new technology there are anomalies and glitches but during the 2016 harvest, over 100 farmers used the CropScan 3000H On-combine Analyser to measure protein in their paddocks. The majority of the users have used the protein data to blend grain in the paddock to optimise payments based on protein premiums – or they have segregated their grain into on-farm storages based on the bin average protein data generated.

Several farmers have used the protein mapping as a precision ag tool and have also benefited from increasing yield, receiving higher premiums for protein and reducing nitrogen fertiliser costs.

Matt Hill from Coolinup, WA, operates four New Holland CR9090 combines fitted with on-board yield monitors and CropScan 3000H Grain Analysers.

"I have been able to combine the yield and EMI maps collected over many years – and now protein maps – to develop zones across the farm," says Matt. "We have been able to look closely at the yield response curves to optimise VNR application across the paddocks. The increase in yield and protein in certain zones across the farm have resulted in a significant return on investment for the precision ag equipment and services.

"By going to variable nitrogen rate applications we have been able to increase the tonnage, to jump to higher protein grades and also to reduce our input costs," Matt said.

The CropScan 3000H On-Combine Analyser is an Australian designed and manufactured product. Contact Next Instruments, Ph: 02 9771 5255. ■

Damaging spring frosts a result of 'blocking' highs

By James Risbey[1], Peter Hayman[2], Ben Biddulph[3], Mick Faulkner[4] and Mike Pook[1]

AT A GLANCE…

A series of significant frost events occurred throughout August and September of 2016 in the grain regions of Western Australia, and in October in the South Australian grain region.

In this update we provide some information on the extent of the frosts, their impact, and the weather conditions that produced them.

Western Australia

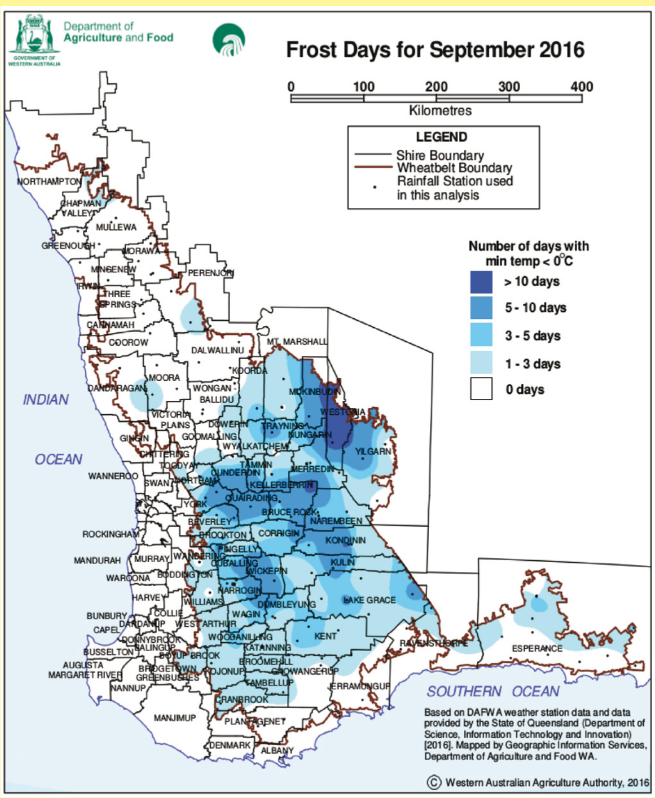
At least four significant frosts occurred during late August and September in the central and eastern WA grainbelt. In late September and early October a further three frost events affected the Upper Great Southern and Lakes district.

The combined effect of these frosts has caused considerable yield losses to barley and wheat and to a lesser extent canola and lupin crops. While some crops escaped damage because of their advanced growth stage, many cereals were damaged at a range of growth stages from booting through flowering and grain fill.

Due to the severe nature of the frost events the crops were also damaged across large areas of the landscape and in elevations and soil types where frost damage does not typically occur.

The most damaging event was on August 23–24 and September 23–24 as this was preceded by light rainfall in the Great Southern, Central and Eastern wheatbelt. The Central and Eastern wheatbelt and the Lakes District reported the largest losses of about 25–85 per cent across the cropping program in these regions. The prevalence of frost days through September for WA is shown in Figure 1 and shows some regions with up to 10 frost days for the month.

FIGURE 1: WA frost days in September 2016



The frosts that occurred in southwest WA through the spring followed a similar sequence. Typically, a cold front passed through southwest WA in the day or two preceding the frost event. This frontal passage brought an initial burst of cold air over the region. The frontal passage was then followed by rapid development of a high into the region

The rapidly developing high helped trap the cold air in the region and entrain (incorporate) further cold dry air from southern latitudes. The high also brought clear skies, which enhanced the radiative heat loss from the surface at night. These conditions sustained frost conditions for two or more days (in most cases) as the high developed in position.

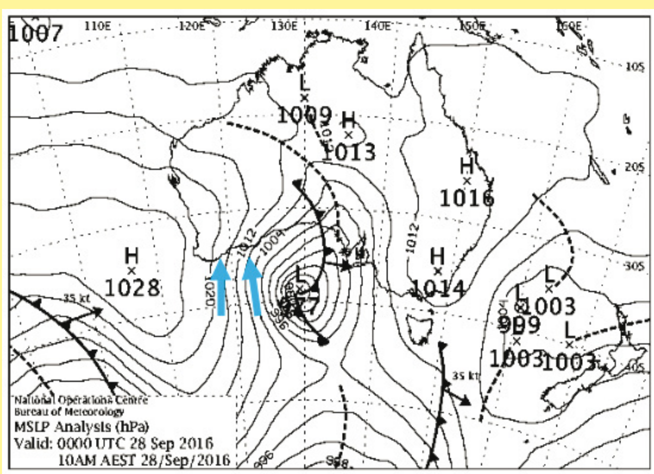
A synoptic chart that typifies this configuration is shown for the frosts of September 28 (Figure 2). It shows the high moving into position behind the front and strong southerly flow over the region.

The question arises as to why these highs resulted in severe frost, but not every high in the region does. The centre of every high pressure system provides clear still nights but it seems that this is necessary – but not sufficient – for frost.

Persistent highs and severe frosts

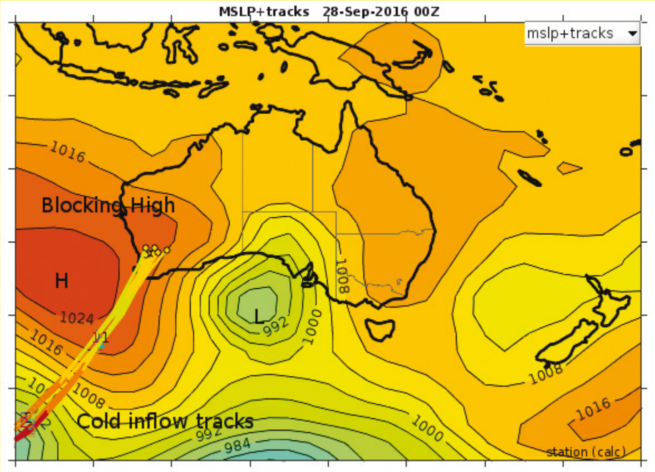
Our research shows that the answer is related to the fact that these highs are developing rapidly and forming persistent highs known as `blocks'. The developing block is more efficient at

FIGURE 2: Mean sea level pressure on September 28, 2016



Blue arrows indicate the flow of cool air from the Southern Ocean generated by anticlockwise flow around the high pressure system in the Indian Ocean and the clockwise flow around the cut-off low pressure system in the Great Australian Bight.

FIGURE 3: Back trajectory of air parcels on September 28, 2016



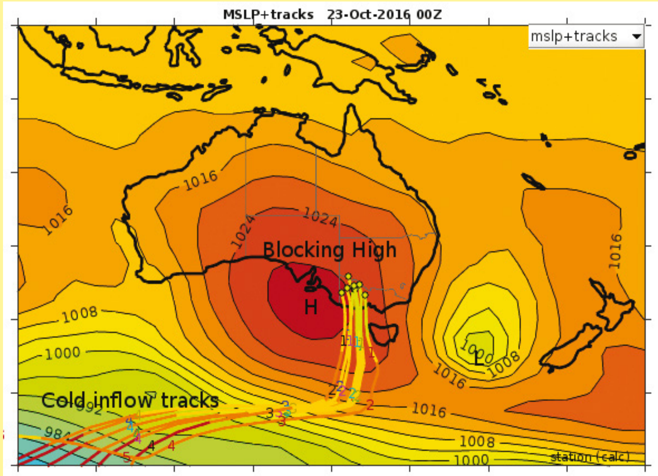
bringing cold, dry air into the region from the polar regions than ordinary highs.

The trajectories for the air parcels that were at the surface at the time of the frost on September 28, are shown in Figure 3. The developing block has entrained air to the surface that originates polewards of 50 degrees south in the middle troposphere. This air is exceptionally cold and dry when it is brought to the surface by the time the frost occurs.

Such extreme southerly origin air trajectories are not associated with most high pressure systems in the region and occur mostly in association with the developing blocking high.

The month of September in particular was unusual in displaying numerous blocking events in the Tasman Sea and in southwest WA. These two blocks occurred together and 'pinched' the trough in between over the continent. This pinched trough in turn generated an unusual number of cutoff lows in the Bight (as in Figure 2) that went on to generate persistent storms over southeast Australia in September.

FIGURE 4: Back trajectory of air parcels on October 23, 2016



Work is being undertaken to assess forecast and management options for mitigating extreme temperature impacts on grain production as part of the GRDC's multidisciplinary National Frost Initiative. Our work shows that southwest WA spring frosts are more likely to occur when a blocking high develops just to the west of southwest WA.

Research is ongoing to determine why blocks are favoured more here in some springs than others. We know that these blocks depend on conditions upstream in the atmosphere over the Indian Ocean, and so we are focusing on what determines the variability there, and to what extent these conditions can be forecast at various lead times.

South Australia

In South Australia, most of the frost damage occurred in late September and late October. Damage occurred in the Mid North, upper Eyre Peninsula and southern Mallee cropping regions. The October damage occurred on the 19th and 23rd and like in WA – while some crops escaped damage due to their advanced growth stage, many cereals were damaged at a range of stages from booting through flowering and grain fill.

The late frost was particularly damaging to some pulse and canola crops. The yield losses were estimated to be from 25 per cent to near total crop loss in some cases. The subsequent quality downgrades of wheat, barley, canola and pulses contribute 30 to 50 per cent of the financial loss.

Most of the South Australian grains belt had well above average growing season rainfall and, apart from crops directly affected by storms, many growers reported one of the best seasons ever with high rainfall and limited damage from frost and heat.

This makes it especially difficult for the minority of growers affected by these late frosts.

In some cases the impact of the frost was relatively insensitive to topography, with damage at the top of rises as well as hollows. This pattern reflects the strong advection (transfer) of cold air into the damaged regions.

The strong cold advection in these SA frosts can be seen in Figure 4 for October 23. Cold, dry air has been advected from well south of the region down into the surface at the time of the frost event (as shown by the set of air parcel trajectories).

The event on October 23 also coincides with the growth of a blocking high in the Bight following passage of a frontal system in the days prior. That is, the profile of this event is similar to the WA events in displaying strong cold air advection in the wake of frontal passage and as a blocking high establishes itself.

The main difference is that for SA the block needs to be established in the Bight in order to direct these very cold and dry airflows into the region.

To sum up

In this study we found that severe frosts are preceded by the rapid development of blocking high pressure systems. Frosts occur when these developing highs are situated to the west of the frosted region and advect particularly cold, dry air down to the surface during the frost event.

Our work is ongoing to establish the conditions that control the variability of blocking high pressure systems and to assess the potential for forecasting conditions which are more or less conducive to their occurrence.

Due to the unpredictability and potentially devastating impact frost can have on crops, growers are encouraged to adopt a comprehensive management plan which includes pre-season, in-season and post-event tactics.

[1]CSIRO.
[2]South Australian Research and Development Institute.
[3]The Department of Agriculture and Food, Western Australia.
[4]Agrilink Agricultural Consultants, Watervale South Australia.

More information contact James Risbey, E: james.risbey@csiro.au or from www.grdc.com.au/ManagingFrostRisk

Aggressive agronomy on weed seed blowouts

By Greg Condon[1], Kirrily Condon[1] and Michael Walsh[2]

AT A GLANCE…

- Be aggressive on weeds in high pressure paddocks – crop competition is your weapon.
- Follow up crop topping in canola or pulses with narrow windrow burning (NWB) – the 'canola combo'.
- Stack the 'big six' for six years – a combination of herbicides and non-herbicide tools for maximum effect.

THE 2016 season will long be remembered in southern and central NSW as 'that really wet year'. Yields were generally above average on better drained soil types but crops on clay soils suffered substantial waterlogging. Constant rainfall throughout winter shortened the residual value of pre-emergent herbicides and wet conditions restricted trafficability for post emergent spraying. The effects of waterlogging also reduced crop competition, with the combination of all these factors allowing weeds to proliferate, even in paddocks that were previously considered 'clean'.

Careful planning of rotation and herbicide options is essential to manage weed numbers in 2017 and beyond.

Weed seed banks – strive for zero

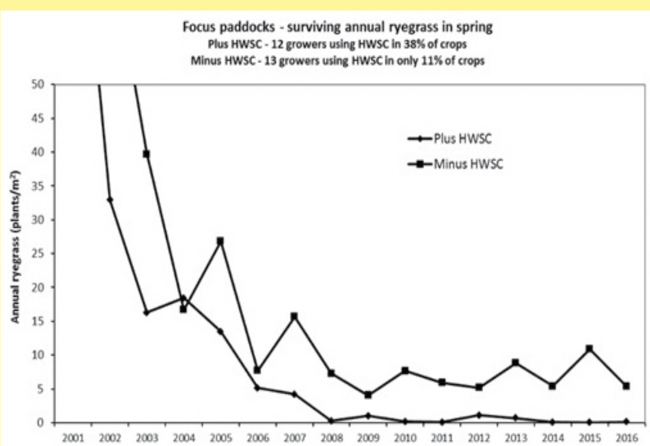
AHRI research and paddock survey data has clearly shown the value of managing weed seed bank numbers. Peter Newman from AHRI in WA has annually recorded annual ryegrass populations in 25 focus paddocks for the past 16 years and has shown that for 12 paddocks, growers have achieved (and maintained) near zero weeds in continuous cropping systems.

These growers simply don't let weeds set seed, using tactics including crop topping, mixing and rotating herbicides and Harvest Weed Seed Control – mainly NWB. In the other 13 paddocks growers have successfully reduced their weed numbers to a low to moderate level (5–10 plants per m^2) using a herbicide focus with little or no HWSC.

Figure 1 shows the difference in ryegrass numbers between the groups, highlighting the impact HWSC has had on keeping the weed seed bank population near zero. Keeping in mind that ryegrass sets around 200 seeds per plant, the key message for growers in this region following the weed blow out in 2016 is that an aggressive approach is required to prevent seed numbers from continuing to build.

HWSC is obviously critical to achieving near zero weed status, but ultimately successful growers keep seed bank numbers low every year by using all the tools available. This stems from a commitment by the grower and their agronomist to plan ahead and target weeds at every opportunity using an integrated approach, not just with herbicides alone.

FIGURE 1: Focus paddocks and surviving ryegrass numbers in spring



(Source: Peter Newman, AHRI).

Recent HWSC research

The long term impact of HWSC on annual ryegrass is driving the introduction and development of HWSC options for Australian growers. The iHSD is now commercially available following several years of field stationary mill testing that have proven its efficacy and commercial capacity (Table 1). This system has the potential to deliver 99 per cent control of the seed of major weed species during harvest.

Chaff tramlining (chaff decks) is the most recently introduced system and is now the second most widely adopted system behind narrow windrow burning. This system is a perfect fit with growers as they move to tramline or controlled traffic systems and look to reduce residue burning. Both approaches are similarly highly effective weed control tools and can be expected to result in an annual reduction in annual ryegrass populations of approximately 60 per cent.

TABLE 1: Efficacy of the iHSD mill on the survival of four weed species

Weed species	Seed kill (%)	SE
Annual ryegrass	93	0.7
Wild radish	99.8	0.2
Wild oats	99.9	0.1
Broome grass	99	0.2

TABLE 2: Impact of narrow windrow burning and chaff tramlining on the autumn emergence of annual ryegrass compared with conventional harvest (control) at two sites, North Parkes, NSW

Treatment	Site 1	Site 2
	Annual ryegrass (plants/m^2)	
Control	18	11
Narrow windrow burn	6	5
Chaff tramlining	7	3
LSD (P=0.05)	8	8

Ryegrass infestation in canola.

Target weedy paddocks – let's get competitive

For paddocks where large numbers of weeds have set seed in 2016, crop competition (along with a robust herbicide program and HWSC) will play an important role in getting them back on track. There are a few ways to 'get competitive':

Sow professionally graded seed. Start with a clean slate and eliminate any more weeds being added to the mix. Early crop vigour can also be increased by grading out smaller seeds.

- **Sow competitive crop species or varieties.** Hybrid canola reduced weed biomass at flowering by 50 per cent in CSU trials when compared to open pollinated triazine tolerant (OP TT) varieties (CSIRO 2014). SARDI and CSU trials have shown Fathom barley and Condo wheat exhibit strong early vigour which translates into late season weed competition while maintaining high yields.
- **Increase plant population in weedy paddocks, especially with cereals using higher sowing rates.** This can be a challenge depending on your rainfall zone, subsoil moisture levels and variety, but NSW DPI research has proven targeting higher plant populations will reduce weed biomass.
- **Sow east-west to reduce ryegrass seed production.** NSW DPI data has shown similar yields from east-west sowing with weed biomass reduced by 30 per cent. Orientation trials in WA saw yields increase by 24 per cent in cereals with a 37 to 54 per cent suppression in weed biomass.
- **Reduce row spacing.** Narrow rows have been proven to increase crop competition against weeds but also increase yields due to reduced competition between crop plants. Glen Riethmuller from DAFWA has run a rotation trial at Merredin, WA for 29 years using 9, 18, 27 and 36 cm row spacings. At harvest 2013, there was only one ryegrass seed per m^2 in the 18 cm rows compared with 171 seeds per m^2 in the 36 cm rows. Reduced row spacing is a controversial topic as growers have invested heavily in no-till seeding systems on wider rows and are reluctant to change, yet hard data is proving narrow rows means less weeds, higher yields and more profit.
- **Ameliorate soil with lime or gypsum to improve crop growth and subsequently weed competition.** Tools such as normalised difference vegetation index (NDVI) imagery, pH mapping and electromagnetic (EM) surveys help identify soil types and crop areas where lime and/or gypsum is needed. This often correlates with areas of poor crop growth and where weeds such as wild radish or silvergrass flourish.

Narrow windrow burning has been a popular and highly effective component of Harvest Weed Seed Control.

- **Consider precision seeding equipment to encourage rapid early crop development.** Crops will generally establish quicker and compete better with weeds when sown with parallelogram tynes or precision disc planters in clod free soils. Their value is particularly evident when dry sowing or when conditions are marginal. The cost benefit of investing in precision seeding gear is influenced by yield potential, soil type and scale but the benefits of weed competition also warrant consideration in the mix.

Any of these practices used in isolation will help reduce weed pressure when used with herbicides, but the biggest benefit comes with implementing a combination of tactics, for example, competitive varieties sown at higher plant populations on narrow rows into well structured soils.

'Canola combo' – upsize your weed control

Crop topping canola proved very effective last spring as growers took the opportunity to target weeds prior to maturity, particularly high ryegrass populations that had survived an application of clethodim in winter. WeedmasterDST is a glyphosate herbicide registered for canola crop topping, either over the top from 20 per cent seed colour change or under the cutter bar at windrowing.

To upsize their weed control and kill any survivors, many growers in the region undertook the 'canola combo' and followed up crop topping with narrow width burning.

NWB is where chutes are attached to the back of the header to divert straw and chaff into condensed rows; the rows are then burnt prior to sowing to destroy any remaining weed seeds. Although NWB remains the dominant HWSC tool in the eastern states, chaff lining and chaff decks were used by an increasing number of growers in 2016 as part of a 'canola combo'.

The interest in these chaff collection tools (along with the integrated Harrington Seed Destructor (iHSD)) over NWB is driven primarily by time savings and not having to burn. While research is continuing to quantify their longer term weed control benefits, growers are getting on with the job and adapting machinery to suit their integrated weed management systems.

Stack the 'big six'

We've already discussed HWSC, crop competition and crop topping, but there are three other tools that can be employed to maintain a low weed seed bank over the longer term. Known as the 'big six', stacking these tools together over a minimum six year period has the greatest impact on weed seed populations. The 'big six' include:

- **Stopping seed set.** Use crop topping or hay cutting to eliminate seed set. Take no prisoners.
- **HWSC.** Huge range of options based on the capture of weed seeds at harvest then bale, burn, destruct or rot. Header set up is critical to ensure weed seeds can be separated from the straw and stay in the chaff fraction. Windrowing prior to harvest is useful for success with HWSC, as weed seeds are captured in a row prior to shedding. Options ranked in order of cost from lowest to highest: NWB, chaff lining, chaff tramlining (chaff decks), chaff carts, bale direct, iHSD.

  There are more innovations emerging as growers look at all sorts of options to destroy weed seeds including microwaves, LPG gas burners and grazing chaff dumps with sheep.
- **Double knock.** Protect glyphosate – our most important herbicide – by double knocking with paraquat within three days following glyphosate. Aim to double knock every year during seeding and on summer fallows. Optical spot spray technology using the WEEDit or WeedSeeker units allow effective double knocks using a wide range of alternative herbicides at high rates which are only applied to a small percentage of the paddock. Firebreaks are also an area where glyphosate is over used and double knocking with paraquat, cultivation or hay cutting will protect its longevity.
- **Mix and rotate herbicides and crops.** By mixing herbicides at full rates we can buy ourselves extra shots. Diverse crop rotations allow the use of diverse chemistry, for example, double or triple break rotations with pulse/canola/wheat/barley or hay/pulse/canola/wheat/wheat.
- **Crop competition.** Adopt smart agronomy to ensure the crop has the upper hand on weeds at all times from emergence through to maturity.
- **Pasture phase.** Mixed farming is very profitable and the pasture phase has long proven its value with alternative weed management tools such as hay or silage, spray topping or even heavy grazing at key times. Cropping paddocks with high grass weed burdens can be rotated to a lucerne/clover mix to utilise ryegrass for grazing and provide nitrogen before being cleaned up for a return to crop.

To sum up

Weed seed blowouts from the wet year in 2016 were common but it's the ideal opportunity to get aggressive and adopt the alternative weed control options that you've been hearing about lately. Start with the double knock, then get competitive, upsize with the canola combo (or pulse combo), and 'slam it home' with HWSC.

And do it all again next year. The rewards achieved will be worth getting out of your comfort zone.

[1]Grassroots Agronomy, Australian Herbicide Resistance Initiative.
[2]University of Sydney.

Funding for AHRI is provided through GRDC. The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, the author would like to thank them for their continued support.

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ASK AN EXPERT –

HOW DO I DEAL WITH AN EMERGING FEATHERTOP RHODES GRASS PROBLEM?

With Andrew Storrie, Consulting Agronomist, Agronomo

FEATHERTOP Rhodes grass, with its distinctive seed head, is steadily travelling across the country – even being seen along the Eyre Highway crossing the Nullarbor Plain.

Agronomo agronomist, Andrew Storrie says prolific seed production and its ability to withstand herbicides makes this weed difficult, but not impossible, to control.

"The key is to concentrate on preventing seed set," he says. "Feathertop Rhodes grass seed is relatively short-lived in the soil, so with a dedicated approach it is possible to run down the seed bank reasonably quickly."

"Often the first obvious sign of FTR will be a few large plants with the seed head 'skeletons' pointing toward the sky," Andrew says. "FTR grass is moving rapidly along roadsides and most invasions occur from a boundary fence, with seed blown into a paddock. Once on a property it can spread easily on machinery and along irrigation channels."

Feathertop Rhodes grass is an exotic species that first gained a foothold in Australia's northern grain growing region in response to a shift to low tillage production systems. It is now an emerging weed across the southern and western grains regions of Australia.

"FTR grass is an annual plant that flowers within three to

Feathertop Rhodes grass is an annual plant that flowers within three to four weeks of germinating and will keep tillering and producing seed while soil moisture is available.

Andrew Storrie, Agronomo agronomist says growers need to look for the Archilles Heel of hard to kill weeds like sowthistle, flaxleaf fleabane and feathertop Rhodes grass.

four weeks of germinating and will keep tillering and producing seed while soil moisture is available," he says. "Not all the seed germinates with the first rain event so there are usually multiple germinations over summer – but most seed in the seed bank is from a single season of seed production rather than accumulating over years."

Although the light seed is wind dispersed, most seed will fall within five metres of the parent plant, making patch management a viable control option.

What are the herbicide control options for feathertop Rhodes grass?

Short answer: FTR grass is naturally very tolerant of glyphosate and there are several cases of highly resistant populations. Many growers are using Group A knockdown herbicides but this could be a short-lived option.

Longer answer: Although Group A herbicides are currently an effective control for FTR, resistance is inevitable and field observations suggest it could have already occurred in some paddocks.

Group A herbicides are registered for use in various summer and winter broadleaf crops and in fallow ahead of a mungbean crop (Permit 12941). This permit states that a fallow application must be applied to small weeds and followed with paraquat within 10 days.

Group A herbicides are very sensitive to plant stress and, like paraquat, good coverage is essential for reliable results. Given these constraints, it may be prudent to 'save' this herbicide for in-crop grass weed control and look for other ways to control FTR grass in summer fallows.

What patch management methods do you recommend?

Short answer: Physical removal of isolated plants, patch cultivation, burning and optical spray technology.

Longer answer: FTR grass invasion often begins with a few 'mother' plants. The plants have shallow root systems and are easy to remove. If this is done before the seed drops, significant costs can be avoided.

Seed buried below a few centimetres of soil will not germinate and most will be non-viable in 12 months, even if another cultivation returned them to the soil surface. Light cultivation of a patch is a very viable option to stimulate germination and allow effective herbicide control of small plants. Under the right conditions fire is also effective to kill the plants and seed on the surface.

Optical spray technology is the only option for treating plants larger than fist size. Permit 11163 provides a range of herbicide options for use with optical sprayers. There are also products from Nufarm and CropCare registered for application with an optical sprayer.

What can I do to control FTR grass that establishes under the crop?

Short answer: Harvest early following a pre-harvest desiccation and come back immediately with a control tactic to target small FTR grass plants.

Longer answer: Pre-harvest desiccation will allow earlier harvest, particularly in crops like canola that allow more light in toward the end of the season. This is particularly useful if there has been a blow-out in FTR grass numbers.

An application of paraquat plus amitrole soon after an early harvest can provide good control and be followed with a residual herbicide – such as Balance applied ahead of a chickpea crop – to extend the control into the summer months.

FTR grass is sensitive to crop competition. All efforts to increase crop competition through crop and variety choice, narrower rows and stubble management will suppress FTR grass that might otherwise germinate as the temperature rise above 20°C in spring. ■

HOW TO ASK A WEEDSMART QUESTION

Ask your questions about managing herbicide resistant crop plants that establish in non-crop areas on the WeedSmart Innovations Facebook page *https://www.facebook.com/pages/WeedSmart-Innovations/354441941389122*, Twitter @WeedSmartAU or the WeedSmart website *http://www.weedsmart.org.au/category/ask-a-weedsmart-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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Regardless of whether you are looking for a steel building solution for your rural, domestic or industrial property, we can help. Our industry-leading building design system allows our specialists to custom design each and every shed to your particular needs and site design criteria.
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KITS SUPPLIED IN FULL & UNDAMAGED
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SITE SPECIFIC ENGINEERING
STEEL SUPPLIED BY BLUESCOPE
SHEDSAFE ACCREDITED
SHOP LOCALLY OR OVER THE PHONE

Single disc opener does the job

WITH excellent recent rainfall across many grain growing regions and significantly higher stubble loads due to the good season last year – farmers are typically less concerned with moisture seeking and more focused on how to effectively manage stubble loads during the upcoming sowing.

While some machines can handle high stubble loads and other machines are good for moisture seeking, the NDF SA650 Single Disc Opener ticks both the boxes and more. The versatility of the single disc opener used on the NDF range of disc planters goes a long way to explain the uptake of the machines. In the Moree Plains/North West NSW region alone, over 20 NDF disc planters have been delivered to local farmers and contractors since December 2016.

Broad versatility of the machines coupled with low maintenance, translates to increased up-time, efficiency during sowing and maximum yield come harvest time. Watching the NDF SA650 Disc Opener in action is the most effective way to see for yourself what sets these machines apart. NDF will dispatch a unit for you to fit onto your existing disc or tyne planter frame. Compare the results side by side in your soil, under your conditions.

On-farm trial

Daniel and Melissa Wegener trialled a disc opener unit on their Warra property west of Dalby. The NDF SA650 Single Disc Opener was fitted next to a parallelogram tyne unit. Planting at 105 mm depth, the difference in the seed trench really tells the story of how efficient the SA650 Disc Opener is at placing the seed at consistent depth and maintaining seed-soil contact – maximising strike rate.

Operators can effectively use less seed due to the reliability of seed depth, placement and a more predictable strike rate.

NDF are renowned for excellent after sales support and prompt parts dispatch. When you purchase a disc planter from NDF you deal direct with the manufacturer. Should you require a technician on-site, in the unlikely event of a full stoppage breakdown, NDF have capacity to fly a technician and parts directly to their customers. Having their own plane was a no brainer for a company with Australia wide customers and a high commitment to service and support.

"Our machines rarely have issues, but should owners ever have a major problem – they know we're committed to help them. Having our own plane is just another way we support our expanding customer base across Australia," said Dale Foster, NDF founder.

To help customers get the best out of their machines the team at NDF are currently producing updated operator manuals and new spare parts manuals – ensuring users get the best support and up to date resources. The updated operator manuals now include links to instructional videos which users can access via smartphone/tablet simply by scanning a QR code.

Call Dale Foster at NDF to discuss trialling a disc opener on your property today or catch up with a neighbour or local grower in your area. ■

The barley was planted on May 25 at a depth of 105 mm and on the 30th the first seeds were up. The photos show the different strike between a parralelogram tyne (on the left) and the NDF SA-650 disc opener on the right.

The versatility of the single disc opener is a major reason for the machine's popularity.

Press wheels and discs range

MANUTEC has added several new wheels, tyres and discs to its range of aftermarket products. The new range currently includes aftermarket replacement parts for:

- John Deere 1870 air hoe drills (wide range of tyre options);
- John Deere 1830 air hoe drills (3" and 4" high durability tyres);
- John Deere 1860 and 1890 single disc openers (3" and 4" wide gauge wheels, closer wheels and 5–6 mm boron discs);
- John Deere MaxEmerge twin disc openers;
- Ausplow – DBS (hi-flex mud tyre and tyres to suit Stiletto Seeding System); and,
- Serafin single disc openers (gauge wheels and closer wheels).

These parts are in addition to the large range of Manutec's existing range of aftermarket parts to suit, Flexi-Coil 820 (Case PDX), Bourgault, Morris, Ezee-On and most Australian made airseeders and disc machines.

The new range of aftermarket parts have all been re-engineered in conjunction with the farmers who use these machines to optimise the performance of the machinery in Australian climatic and soil conditions. Recent additions to the range include tyres designed to operate with the new generation of splitter and spreader boots. This includes tyres to suit the DBS and the John Deere 1870 to enable them to seed with the new style boots. The range also includes the Manutec Mud Razor products which help to significantly reduce 'plugging' issues on single and double disc openers and parallelograms.

Whether it be sticky clay, sand or rock, Manutec has a press wheel tyre designed to operate in all conditions.

New agri-hub option

Manutec press wheels, press wheel assemblies and Coulter assemblies are also now available with the zero maintenance agri-hub option. The agri-hub option is a completely sealed, maintenance free hub specifically designed for use in tillage. The agri-hub is designed to increase productivity and to cut down the through life costs of running press wheels.

The agri-hub press wheel is available as a standalone wheel or as part of a complete press wheel assembly and will suit those farming larger acreages looking for reduced maintenance costs. The full range of tyre and disc options are available to suit the agri-hub press wheels.

If trash is a problem then Manutec's range of heavy duty trash coulters will help you to get through it. These are also now available with the zero maintenance agri-hub option as well as a large range of disc options to suit many trash and soil types.

For more information give Dan or Mick a call on 08 8260 2277. ■

Seed Sharing

WITH ever increasing input costs pressuring farmers across the country, Australian Grain Technologies (AGT) is encouraging and promoting *Seed Sharing* as a low cost way to diversify, update or simply try some different varieties in their cropping programs in 2017.

An initiative first developed by AGT, *Seed Sharing* is a licensed farmer to farmer seed trading scheme, making it easy for every grain grower to enjoy access to AGT varieties.

With only one simple form to fill in and return to AGT, a farmer can sell seed they have grown to another farmer for use the following growing season, at a price or arrangement negotiated between them.

"*Seed Sharing* is just one of the ways that AGT are supporting farmers to improve their productivity and create a strong, vibrant agricultural industry," said Dan Vater, General Manager Marketing & Seed Production.

"At AGT we want to see farmers growing the best possible varieties for their cropping program and this is a way to make the latest genetics available at an affordable price."

"Traditionally, the option for *Seed Sharing* of AGT crop varieties has been utilised well in South Australia and Western Australia. We believe that the eastern states also have a great opportunity now to review their cropping programs and trial newer genetics in 2017."

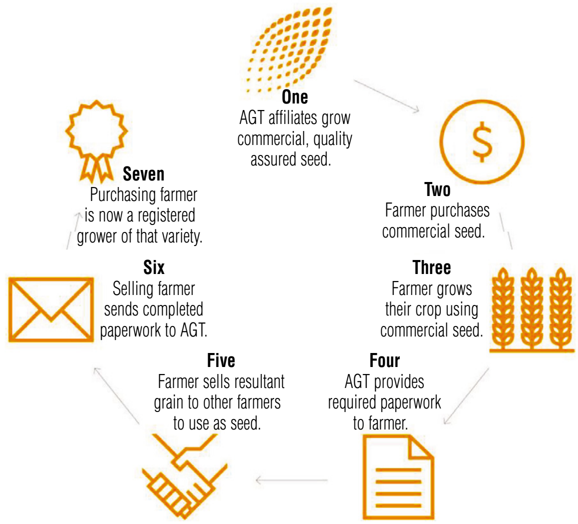
Seed Sharing is allowed in all states of Australia for all AGT wheat, triticale and durum varieties – except Clearfield Plus wheat varieties. End Point Royalties are not charged on seed sold through *Seed Sharing*.

Tim Brosnan, a farmer from Biloela in central Queensland, offered *Seed Sharing* of his Mitch wheat to neighbouring farmers in 2016 and plans to do so again in 2017. Available from commercial growers since 2015, Mitch has a unique combination of high yield and improved crown rot and leaf disease resistance.

"AGT has a simple reporting process for the seed sharing transaction, supplying us with the relevant paperwork for both the grower and the farmer purchasing the grain. All we have to do is fill it in and post it back," said Tim.

"We get a greater profit for a portion of our grain than selling direct to a bulk handler and save on End Point Royalties."

To download the relevant forms please visit agtbreeding.com.au or contact the AGT End Point Royalty Office on (08) 8313 6810. ■



Canola establishment guarantee

THE perceived greater risks associated with producing canola will now be mitigated for Austrakian growers via a popular crop establishment guarantee program being extended across the country for the 2017 season.

The 'Replace MySeed' program from Bayer – the first of its kind in Australia to offer 100 per cent replacement cover on hybrid canola seed – enables seed replacement if a crop has not established at 45 days after sowing.

Under the program, growers are covered for drought, water-logging, mice, bird and insect damage, slugs, disease, sandblasting and frost – but not for failures caused by agronomic or application errors, poor management practices and other factors within their control.

The launch of the program is good timing considering the important value of canola to cropping enterprises.

"Consultants are saying it will be the highest gross margin crop for the coming year," said David Peake, Seeds Agronomist with Bayer.

"Demand for canola seed has been the biggest we have ever seen. We have already sold out of three hybrid varieties and another two lines are now in short supply."

He said growers were automatically enrolled in the Replace MySeed program upon purchase of Bayer hybrid canola seed and by indicating to their agronomist the paddock they plan to sow to the variety.

If the crop has not established after 45 days, the paddock is inspected and the claim verified.

"Growers have said producing canola – and particularly hybrid varieties – can be too expensive or risky, so this program takes that risk component away for them," David said.

In addition to this risk management program, Bayer has further supported growers by reducing the price of its IH30RR hybrid variety and offering delayed payment terms, to effectively after next harvest on December 15, 2017.

David said paying at the end of the year, after harvest, could especially suit those impacted by frosts last season and with tighter cash flows.

Bayer's wider MySeed program also allows growers to test exciting new varieties in their paddocks and offers online tools to help them calculate their seed requirements and the cost, as well as highly accurate and efficient seeding rates.

For further information on the program, growers can visit https://bayergoldenage.com.au/canola/MySeed/ ■

District Reports...

March–April 2017

Western region

NORTH

Summer rain fell across most of the region with the northeast fringe getting above 200 mm. Much of the landscape has had between 100 and 200 mm and some coastal areas are between 50 and 100 mm.

This has provided some confidence-boosting soil moisture but the subsequent need for summer weed spraying also brought with it some sleepless nights.

Most growers have now recovered from a couple of weeks of this nocturnal life. Night spraying has been required to ensure the delta T is 'in the window'. Those who started spraying early did have some paddocks to spray twice – but they now have heaps of stored soil moisture. On the flipside, some of those growers who waited before spraying ended up with summer weeds – particularly button grass – up to 400 mm deep which consumed all soil moisture. This will have big yield and crop growth implications later in the season.

The summer rainfall has created a good opportunity for deep tillage. Some growers are ultra deep tilling down to around 600 mm to bust hard pans in the 350 to 500 mm zone. This process is very slow and there are a few broken tractors dotted around the landscape. The fuel supply companies love it – as do the crops that grow well on deep-ripped paddocks.

All the time spent summer spraying and deep ripping has meant that the weeks are very busy with growers now under the pump to get pre-season planning done, lime applied and machinery ready for the coming season.

No rain for the past couple of weeks has most workloads settling down a little. Growers would like it to now stay dry until mid April to get on top of the jobs list.

In our northern region, the early planting growers will be seeding by mid April.

With a close to average winter, and no major frost losses, 2017 could be a cracker. Bring it on!

Peter Norris, Agronomy For Profit, Geraldton
March 22, 2017

SOUTH COAST

Seasonal conditions on the South Coast for the past two months have been very wet. Over five days in early February the whole region received between 100 to 300 mm of rain – needless to say, soil moisture profiles are now full.

District Reports…

March–April 2017

Around Munglinup, Jerdacuttup, Ravensthorpe and Lake King the heavy rainfall was unprecedented and has caused significant damage to public and private infrastructure such as roads, bridges and fences.

Gully washouts

The heavy rain has also caused widespread soil erosion with significant washouts on headlands and gullies (see photos). Fixing this damage has been a major priority, especially with the commencement of seeding now only days away.

But the rain has brought with it an extremely good flush of summer and winter weeds and most growers have now finished a full knockdown spray on their cropping paddocks.

With the wet conditions many soil amelioration programs such as lime, gypsum and claying/delving programs have been put on hold. Instead, the emphasis has shifted to implementing more surface water drainage where possible.

Waterlogging issues, particularly during the 2016 season, have prompted some growers on the South Coast to implement surface water drainage to try and reclaim inundated arable country.

The heavy rains in early February caused a lot of soil erosion on the South Coast, particularly in the Jerdacuttup area, 140 km west of Esperance. This paddock headland now resembles the cliffs of the Great Australian Bight.

District Reports…

March–April 2017

Positive outlook for 2017

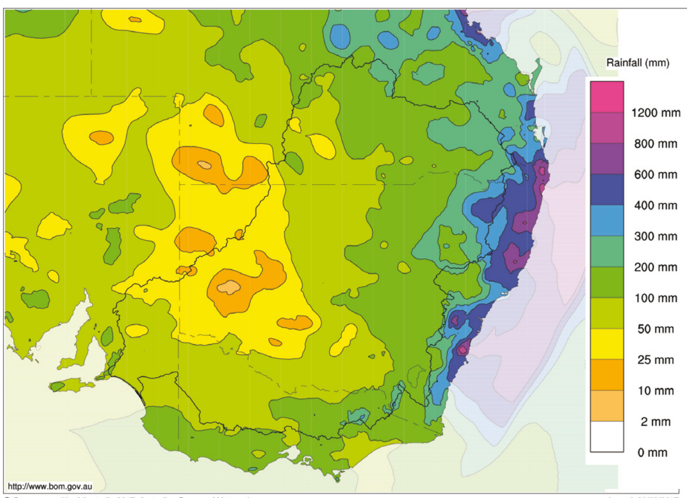
With full soil moisture profiles, many growers – especially in the inland Mallee – are now very positive about the 2017 winter crop. But growers on the coast will be looking for a slightly drier winter than 2016 as the potential for waterlogging will be high.

Some growers anticipate a start to canola seeding around March 27 while most will get going in the April 5 to 15 period.

Quenten Knight
Precision Agronomics Australia, Esperance
March 23, 2017

Southern region

Murray–Darling Basin rainfall totals (mm) – January 1 to March 26
Australian Bureau of Meteorology



SOUTH AUSTRALIA

- There was still around 15 per cent of the 2016 winter crop to harvest by the end of December. Cool conditions, rainfall and heat waves all added to a delayed harvest. Lodged crops also slowed reaping.
- Grain yields were well above average with a new record grain harvest for the state of an estimated 11.13 million tonnes being achieved. In some districts, yields were double the long term average.
- To put this 2016 result into perspective, the 5-year average annual grain production for SA is 7.61 mt.
- There was some downgrading of wheat, barley and pulses due to frost, discolouration and hail damage but generally the crop quality profile was better than expected given the number of rain events during harvest.
- Wheat quality was generally good, although grain protein was lower than average in many districts. This was because of the well above average yields and impact of rain during harvest.
- In many districts a higher proportion of barley than normal was classified as malt.
- Durum grain had been affected by black tipping, resulting in downgrading of some grain.
- Lentil yields were also well above average in most districts, but some crops on clay soils became waterlogged.
- Field peas performed very well, despite many being affected by frost. Many farmers reported that crops unaffected by frost were the highest yielding crops they have ever grown.
- Summer weeds slowed harvesting and caused grain contamination in several districts. Some crops were desiccated or windrowed to aid harvesting.
- Oaten hay yields were high in all districts but quality was highly variable as a result of weather-delayed cutting, weather damage to early-cut crops and a reduction in nutritional value in very high yielding crops.
- With the summer rain came a large germination of summer weeds and volunteer cereals. Many 2017 cropping paddocks have been sprayed to conserve soil moisture.
- For the year to date, most cropping regions of the state have received 50 to 100 mm of rainfall which has boosted soil moisture reserves for the coming 2017 grain season.

Rural Solutions SA for PIRSA
March, 2017

WESTERN MURRAY VALLEY

It has been a long hot summer in the WMV with below average rainfall. Monthy rainfall in both January and February was 25 mm – the average is 34 mm. Small rainfall events prompted summer weed control on some of the lighter soil types whereas on the heavier soils, grazing took care of the weeds.

After the massive harvest of 2016 growers are eagerly planning for the 2017 plant. Soil moisture levels are a concern with the big crops last year pulling most available moisture out

Spray irrigators have enabled WMV farmers to confidently double crop out of winter crops into summer options such as corn.

District Reports...

March–April 2017

of the soil profile – despite the record spring rainfall. Only the heavily waterlogged soils have some reserves left over.

Crop choices for 2017

Crop choice and rotation planning for 2017 will be difficult with a poor price outlook for milling oat and barley. And with the current cereal price outlook below $220 per tonne, growers are investigating and considering alternatives.

Canola is the obvious crop alternative with easy, and cost effective, weed control and it's a proven crop in the region. Some growers are considering more high risk alternatives such as lentils, chickpeas or field peas which, in the past, haven't been overly successful on our soil types.

Armyworms were a problem in rice crops due to the very warm February conditions.

Marketing of pulse crops has also been difficult which is something local growers will need to deal with if they go down the alternative crops' path.

High stubble loads from the massive 4–7 tonnes per hectare cereal crops last season, have prompted some growers to burn paddocks for ease of sowing and more effective pre-emergent herbicide use.

The only stubbles being retained are for paddocks going into legumes (beans, lupins, peas, lentils etc) and where there are very short barley stubbles – a result of harvesting lodged crops.

Pre-irrigating is underway now on the heavy grey/black soil types to fill soil profiles and to enable some weed control.

Growers with red or sandy loam soils are holding off until early April as these paddocks drain faster and allow planting machinery to 'catch' the sowing moisture.

Weed control in 2017 will be a challenge with many winter crop paddocks last season being too wet for boomsprays often resulting in missed opportunities for in crop weed control. At the 2016 harvest that was evident with wild radish, wild oats as well as some ryegrass, standing above the crops.

The current summer crops

Rice crops are looking fantastic! Most are uniform, lush and highly vigorous after the aggressive nitrogen approach by many growers this season (350 to 400 kg urea per hectare). Fortunately, and after a few nervous weeks holding our breath, the grains started filling and very little sterility has occurred.

Most rice paddocks were treated for armyworm infestations as levels increased rapidly over the warm February. This control was essential as we have experienced massive losses (up to 6.0 tonnes per hectare!) in the past by hesitating to get on top of the infestations.

District Reports…

March–April 2017

Currently, rice fields are being drained as growers assess the maturity to maximise yield and minimise milling quality issues.

It has been particularly difficult to assess maturity with secondary tillers creating green heads slow to fill while other sections of the crop are mature and ready to be drained. Many growers will keep water on bays for 4–5 days longer to get crops through to 95 per cent maturity before draining. This increases the risk of wet paddocks at harvest.

Water usage is certainly on the high end this year with many rice growers reporting 14 ML per hectare. But while rice prices stay around $350 to $400 per tonne – and water prices about $50 per ML, this is acceptable. But if rice prices drop and the cost of water increases, growers will again be assessing the best $ per ML return crop. Winter crops or corn will be in that mix.

Corn becoming more popular

Centre pivot and lateral irrigators have enabled many growers to confidently double crop paddocks from winter barley, canola or wheat into corn over summer.

This has been an excellent way to maximise returns off the irrigation infrastructure and to utilise available water.

Two spotted mites are becoming a bigger problem in corn crops and different management strategies are being implemented – with varying levels of success.

This will continue to be a problem as the corn area increases.

Corn crops have matured well this year with little heat stress during the flowering and tassling period.

With the low cereal prices, the value of corn commodities has also reduced. This has prompted many growers to plant gritting corn for potential export. These varieties are longer season than the feed varieties and this will lead to late maturity and dry down costs prior to selling.

Most corn crops have used 7 to 8 ML of irrigation water per hectare. The price for corn for feed is around $250 per tonne while gritting corn is attracting about $290 per tonne.

Here's hoping the BOM outlook is on the conservative side and we get our average rainfall and the dams can deliver a full irrigation season. Lambs are fetching $6 per kg, cattle prices are through the roof, canola prices are still holding and the dams are currently full. It's all go for agriculture in 2017!

Laurence Pearce
Agronomist, IK Caldwell, Deniliquin, NSW
March 23, 2017

VICTORIAN MALLEE

The 2016 season will be an unforgettable one in the Mallee with record rainfall, and record crop and hay yields across most of the region. As a result, harvest for some didn't finish until the first week of January. Some farmers are lamenting that it feels like the 2017 winter crop sowing season has landed on the back of harvest with limited time for a summer holiday.

Summer rain has warranted multiple sprays for a number of farmers but in some instances, rainfall events have not been sufficient to germinate all volunteer cereals. This has the potential to cause in-season issues such as a few 'wharley' crops dotting the landscape.

As part of a GRDC supported *Managing Early Sown Wheat* project, the Victorian Mallee-based Birchip Cropping Group is trialling the long season dual purpose winter wheat, Kittyhawk. The trial was sown on March 15 this year at the BCG Curyo site. This photo of newly emerged Kittyhawk was taken on March 21 by BCG Senior Researcher, Kelly Angel.

Controlling the green bridge over summer has been a priority for farmers with the high levels of disease in 2016 presenting a big threat for the coming season. Farmers are also mindful to capitalise on rainfalls events to conserve precious moisture for in-season crop use.

Due to high yielding crops in 2016 and summer rainfall, farmers are soil sampling paddocks to get an understanding of nutrient and soil moisture status. Analyses of these results is being done now and will provide growers with a good idea of their nutrient requirements as well as provide the information needed for their fertiliser budgets.

Early indications are that more nitrogen will be needed this season but most could do without quite as much moisture as that delivered by the very wet 2016 spring.

Seed cleaning and grading is being done and there's a push to

Summer soil sampling is indicating higher nitrogen rates will be needed this season.

do germination tests because of seed downgrading issues such as bin burn. With low cereal prices and a high yielding year, there is a lot of grain being stored on-farm and grain marketing is an ongoing challenge.

Again, due to the great yields last year, there is a high stubble load in most paddocks which will prove to be a challenge come sowing. In some extreme cases, farmers are talking about the need to burn entire paddocks to be able to effectively sow and manage herbicide efficacy issues.

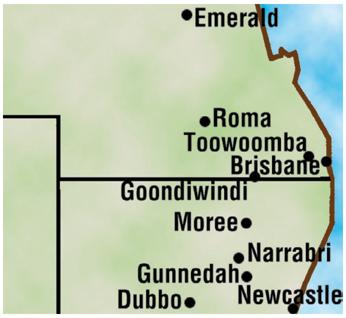
Ciara Cullen
BCG Extension Manager, Birchip
March 23, 2017

NSW OVERVIEW

- Rainfall was below average across much of NSW during February. Daytime temperatures were the warmest since 1926. Many sites recorded their warmest February temperatures on record.
- Welcome rainfall occurred in early to mid-March across areas of eastern, northern and central NSW, though much was as a result of thunderstorm activity.
- High temperatures during January and February damaged and reduced the yield potential of dryland summer crops in northern NSW. Irrigated crops suffered less damage.

NSW Department of Primary Industries
March 20, 2017

Northern region



DARLING DOWNS

The rain has finally arrived in our region but too late for the early and main season crops. The Eastern Downs received between 90 and 180 mm in March, while around Dalby the

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)	2017 rainfall to date (mm)	Summer 25yr Annual Average (mm)	Summer 2016–17	Autumn 25yr Annual Average (mm)	Autumn 2017 to date	Winter 25yr Annual Average (mm)	Winter 2016	Spring 25yr Annual Average (mm)	Spring 2016
Emerald Qld	553	243	255	165	99	141	70	262	122	68
Toowoomba Qld	667	274	277	148	129	159	88	205	177	158
Roma Qld	574	192	254	179	113	63	78	132	131	155
Goondiwindi Qld	615	164	256	185	119	43	103	142	140	163
Narrabri NSW	628	269	226	145	112	151	130	266	165	201
Gunnedah NSW	638	140	224	186	106	49	129	172	181	189
Dubbo NSW	615	172	198	155	122	155	135	307	160	248
West Wyalong NSW	461	66	120	85	80	23	125	287	135	254
Wagga Wagga NSW	554	79	132	116	115	33	153	216	152	260
Swan Hill Vic	321	66	71	37	64	34	87	94	99	140
Bendigo Vic	514	115	108	102	106	43	160	230	143	249
Horsham Vic	379	58	77	86	71	4	122	138	108	154
Lake Bolac Vic	524	79	113	101	102	4	156	189	152	259
Murray Bridge SA	374	65	67	102	81	17	122	136	103	155
Kadina SA	347	81	56	165	82	4	114	158	91	116
Cummins SA	400	97	50	124	94	1	172	197	83	93
Esperance WA	622	197	80	201	146	22	250	233	143	153
Wagin WA	396	225	43	230	98	38	166	133	88	63
Northam WA	399	269	40	262	89	21	188	171	83	55
Mingenew WA	354	100	27	87	93	13	175	208	60	41
Moora WA	383	169	41	165	88	14	185	242	69	52
Mullewa WA	325	184	47	181	97	6	133	162	48	18

Last rainfall reading March 23, 2017.

District Reports…

March–April 2017

range has been 30 to 230 mm for the month. It has certainly benefited the late planted crops of corn, sorghum, mungbeans, soybeans and sunflowers.

Summer crops

The main crop receiving attention at present is mungbeans. The planted area ended up at possibly 80 per cent of last season's record – but not all paddocks made it through the dry and hot January and February. Those crops that did have enough stored moisture to survive have grown well and are between the flowering and dessication stage now. The main issue is timing of dessication as crops try to re-flower and re-pod.

Insect pressure has been generally light but we are now seeing powdery mildew in the crops that haven't received a fungicide. And there has been some phytoplasma in these later crops as well with puffy pod.

Soybeans are at pod fill with dryland crops coping well and enjoying the current rain with little insect pest pressure.

There are a number of sunflower crops just coming into flower.

Late sorghum is at grain fill, having had a good run with very low insect pressure and little ergot so far while late corn is at early cob fill, again responding to the rain.

The yields of spring sown crops have been below average, due to the hot dry conditions, and much of the dryland cotton that is being picked now is only yielding 2.5 bales per hectare.

For some growers, the finish of this summer season cannot come soon enough.

The later planted mungbeans on the eastern Darling Downs have responded well to the recent rain.

2017 winter crop outlook

There is very strong interest again in chickpeas, and especially for the new variety PBA Seamer. We are anticipating another big plant, despite the risk of a heavy disease pressure season.

There is also interest in wheat and barley – both as an early winter plant crop but also to provide stubble cover for the summer fallow.

And fallow spraying is getting underway again after a long break since the last wet period in September.

It's amazing the improvement in growers' outlook that rain can bring about!

Hugh Reardon-Smith
Agronomist, Landmark Pittsworth
March 23, 2017

ANSWER TO IAN'S MYSTERY TRACTOR QUIZ

It is a Swedish Avance powered by a two cylinder two stoke hot bulb engine. This example magnificently restored by Victorian farmer Ian McPherson.

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