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Focus sessions will provide extended time to tackle the following key issues:

Focus Session 1: Canola diseases

With tightening rotations in WA farming systems, disease issues in canola are on the rise. Sclerotinia stem rot, in particular, became a major economic concern to growers last season, with fungicide application still the major way to control the disease.

Focus Session 2: Frost

Providing a detailed look at the extent of the frosts in season 2016 and a discussion on different strategies that can be used to manage frost risk depending where farms are located across the WA grainbelt.

Focus Session 3: New breeding directions and technologies

Join an interactive discussion with a panel of seven leading consultants and seven senior soil scientists led by Wayne Pluske to learn about managing multiple soil constraints to achieve optimal economic returns on investments.

Focus Session 4: Soil management — unleashing productive potential

The new technologies and methodologies, such as CRISPR will be outlined in non-specialist terms and their potential to impact on new variety development highlighted.

Focus Session 5: Mixed farming

The GRDC's investment in mixed farming R, D&E (Grain & Graze projects) is coming to an end and it is an opportune time to present some of the highlights of this work in this special mixed farming focus session.

What are consumers looking for in grains?

David Hughes, Imperial College London

David Hughes is a highly sought after international speaker at international conferences on global food industry issues, particularly consumer and retail trends.

An Emeritus Professor of Food Marketing at Imperial College London, David has lived and worked in Europe, North America, the Caribbean, Africa and South East Asia. Around the globe, he works with food and beverage supply chain companies to assist them in management training, strategy and board level decision-making. David's views are frequently sought by TV, radio and the printed press.

Drawing on data and keen observations of changing consumption patterns around the world David will draw out trends that will impact on the Australian grains industry and what growers in Western Australia need to know about these trends. David will suggest areas the Western Australian grains industry should concentrate on to remain competitive for future growth.

Notes:

Global trends for the grain exports and what WA growers need to know

David Jackson, LMC International

David Jackson will aim to unravel the complexities facing the grains sector, and provide an answer to the inevitable question of what will happen next.

David studied Economics at Cambridge University in England and spent five years working on agricultural projects in Africa before joining LMC International, where he has worked extensively in many commodity sectors, including oilseeds, sugar and cereals, and their extension into biofuels. He is currently a Director of LMC International, and heads their Oilseeds and Oils and research team.

Agricultural prices went up between 2003 and 2013 and down from 2013 to 2016. A great deal is written about the movements of world prices, but the answers to these questions can be surprisingly simple, based on the unavoidable consequences of global demand and supply patterns across the whole arable complex. Will biofuels and China continue to come to the rescue of our markets, or should we be looking at new sources of demand to consume Australian crops in the next decade?

Notes:

Innovation in practice – two grain farmers' stories

Darrin Lee, Bligh Lee Farms **and Matt Hill,** Beaumont

Darrin Lee, Bligh Lee Farms, Mingenew 'Landcruiser ute now has wheels'

Darrin is pioneering the installation of an intranet network across his entire property and is aiming at making full use of the available and future technology to improve his farming operations. He is focusing on:

- the value proposition
- connectivity interoperability.

Matt Hill, Growing profit from data

The challenge for farmers in the 'Big Data' age is to sift through the enormous amounts of data generated and available on an annual basis, to collate that data which is useful and valuable, and then transform that data into a form that can be applied to the farm to improve profitability.

Variable rate technology will only be a profitable exercise if the data used to produce variable rate maps is accurate.

This presentation will examine the use of yield maps, EM38 and radiometric data and soil sampling to generate variable rate application maps for lime, gypsum, phosphorous, potassium and nitrogen.

Notes:

Big Data — what can it offer Western Australian grain growers?

Bruce Maxwell, Montana State University **and Simon Cook,** Curtin and Murdoch University

In a hyper-interconnected world, agriculture has been left behind by the data revolution and is now in catch-up mode.

The internet and media is full of talk about the promise of big data in agriculture. What is the reality and why is it that we have seen little evidence of adoption of data analytics by industry practitioners in Australia? What experience exists in other regions of the world, and what can be transferred to improve the competitiveness of grains agribusiness in Western Australia? Most importantly, what can growers, their support system and researchers do to accelerate change towards data-enabled agriculture?

Through synthesis of personal experience and review of international contacts, the presenters hope to de-mystify the meaning of data-enabled agriculture and outline a roadmap for a data-rich grains industry in Western Australia.

Bruce Maxwell

Bruce Maxwell is Professor of Agroecology and Applied Plant Ecology at Montana State University, USA. Bruce's research places emphasis on understanding weed population in dryland grain production. Bruce's recent research has focused on synthesising large amounts of field information from sensors to make management decisions maximising economic returns and nutritional quality of the crops while minimising pollution and energy inputs.

Simon Cook

Simon Cook is an expert in applying data science and technologies to agricultural systems and natural resource management, to help solve problems at global, regional and farm levels. Simon is the newly appointed, inaugural Premier's Fellow in Agriculture and Food at Curtin and Murdoch University. Previously, Simon provided strategic and analytical advice to global organisations as well as to nations including South America, Central America, South-East Asia and East Africa concerning food and environmental security, rural landscape development and climate change adaptation.

Notes:

Stubble management recommendations and limitations for frost prone landscapes

Rebecca Smith[1], Ben Biddulph[2], David Minkey[3], Sarah Hyde[4], Chloe Turner[4], Trent Butcher[5], Brad Joyce[5], Sarah Jackson[2] and Karyn Reeves[2],
Living Farm[1], DAFWA[2], WANTFA[3], Facey Group[4] and Consult Ag[5]

Key messages

- Position in the landscape influences temperature variations, frost damage and yield, more than management practices.
- Increasing stubble rates increases the severity and duration of frost events and results in increased frost damage and decreased yield.
- In the absent of frost, once off stubble reductions don't reduce yield or yield components.
- Following multiple, severe frost events, stubble reduction does not increase yield.
- The ability of stubble management to reduce frost damage is site, season and landscape specific.

Aims

To determine if reducing stubble loads through various management practices can reduce the severity, duration and damage from frost in wheat crops in low, medium and high elevation in the low and medium production environments in WA.

Results

Of the 18 trials conducted between 2014 and 2016 it was found that stubble treatments had no significant effect on crop emergence or biomass. In the absence of frost, the once off seasonal effect of removing or reducing stubble loads had no significant effect on crop yield or grain quality.

Results from the York stubble management trial in 2015 showed an effect of landscape on the severity and duration of frost. Low and medium elevation experienced more severe frosts than high elevation and had an increased yield response of 300kg/ha. Stubble treatment, either retained, reduced or removed, had no effect on the severity or duration of frost at this site.

In 2016 in York, there was a significant correlation between the amount of stubble applied compared to the level of frost severity and duration. Stubble loads above 2t/ha significantly increased the severity and duration of frost. This contributed to a yield difference of 600kg/ha between 0 and 4t/ha of stubble.

In the case of multiple, severe frost events, stubble management practices had no effect on severity or duration of frosts at Cunderdin in 2015 or Corrigin in 2016. Significant, but minor differences in sterility and yield were identified, but were irrelevant given the final yield at both sites was >200kg/ha.

Conclusion

1. Landscape variability has more influence over frost severity and duration than any stubble management technique implemented.
2. Reducing stubble rates to approx. 2t/ha will reduce the severity and duration of frost in moderate frost environments.
3. In season with severe frost events, stubble management techniques will not reduce the effects of the frost.

Nitrogen and seeding rates impact on frost susceptibility of wheat

Dion Nicol[1], Tim Colmer[1] and Steve Curtin[2], [1]DAFWA, [2]Consultag

Key messages

- In measurements of leaf water contents and osmotic adjustment which have been found to relate to frost susceptibility, no strong evidence exists for nitrogen 'softening' a wheat crop to frost.
- Applying a range of in-season nitrogen from 0–100kg/ha also did not exacerbate frost damage but clearly the increased costs of more nitrogen (N) would have caused greater financial losses in severely frosted crops.

Aims

Extensive and severe frosts in September and October 2016 caused widespread yield losses across the WA wheatbelt. As part of the GRDC National Frost Initiative, DAFWA research has been investigating effects of in-season nitrogen and varying seed rates in intensive field experiments.

Results

This research conducted at the WA ANFP frost nursery at Dale in 2016 had alternating times of sowing across the eight used for frost phenotyping to set N and seed rate experiments to tease out these aspects.

In general, across the times of sowing, variety choice had a much greater effect than varying nitrogen inputs or seed rates in yield under frost. Altering seed rates from 30, 60 and 120kg/ha could impact on changes in phenology of up to one week in some treatments and vary the pattern of head emergence but there was not a consistent strategy to improve yield under frost by seed rates.

Impacts of low levels of frost damage on grain yield may at times be over-estimated due to crop compensation in grain size and >30% floret induced sterility is generally required.

Frost remains a complex issue and severe seasons such as 2016 often makes people reconsider their management, frost risk management remains a balance between enterprise/crop choice, variety by sowing time and nutrition.

Notes:

Optimising sowing time in frost prone environments is key to unlocking the yield potential of wheat

Brenton Leske[1], Dion Nicol[2] and Ben Biddulph[1], DAFWA, South Perth[1], and Merredin[2]

Key messages

- Matching variety with sowing time is critical to ensure optimal flowering and biomass production occurs to maximise grain yield for what might be considered an 'average season'.
- Growers should be planting longer maturity wheat varieties when early or dry sowing opportunities arise, rather than the currently used mid-season wheats. This will ensure adequate biomass is accumulated both above and below ground so that this can be converted into grain yield, while managing frost risk.

Aims

The aims of this research were to compare the performance of wheat varieties at different times of sowing under frost; better understand the relationship between grain yield and frost damage and to determine appropriate sowing times of varieties to maximise yield, while managing frost risk.

Results

Maturity effects on yield performance under frost were evident in 2015 at Brookton. The highest yields for mid-April sowing were achieved by the winter wheats (3–3.5t/ha – strong vernalisation requirement). Long and mid-long maturity main season wheats (e.g. Yitpi$^{\Phi}$, moderate photoperiod requirement and Magenta$^{\Phi}$, moderate vernalisation requirement) were best suited to a planting window May 5th to May 15th. Mace$^{\Phi}$ (2t/ha, slight vernalisation requirement) and similar maturity varieties were suited to a mid-May planting. Lastly short maturity wheats (e.g. Axe$^{\Phi}$ and Westonia$^{\Phi}$ 1.8–2t/ha – very little vernalisation and photoperiod) were suited to a late May planting date to optimise biomass production and grain yield. Over both seasons there was a sowing window where grain yield was maximised at the Brookton and Dale trial sites in 2015 and 2016 respectively. Flowering of crops when sown within this window occurred from late-August to late-September. Interestingly the highest grain yield across most maturities was during the highest frequency of frost events at flowering.

Analysis of 2016 floret sterility and yield component data is ongoing and future presentations will explore these results in more detail when they are available.

Conclusion

In years with a wide variation in seasonal conditions as experienced in 2015 and 2016, growers in WA should look to add more diversity to the wheat varieties grown, allowing them to take full advantage of early sowing opportunities, while managing their frost risk. Currently there are commercial varieties that differ in photoperiod (day-length) and vernalisation (cold) requirements for flowering. A mix of varieties with different combinations of these traits in an annual cropping program will go some way to helping growers maximise their yield potential for a given season while managing frost risk.

Notes:

Is Australian wheat quality still meeting the needs of South East Asian markets

Roslyn Jettner, Ken Quail, Chris Carter and Larisa Cato, AEGIC

Key messages

- Australian wheat is well regarded in many South East Asian (SEA) markets for its quality and suitability for a wide range of noodles however texture attributes and targets need to be better understood.
- At present, Australia has less opportunity to supply wheat with suitable quality for the growing SEA bread and confectionary markets.
- Depth and breadth of technical market services, training and support provided by the Australian industry compares unfavourably to that provided by the USA and Canada.

Aims

To identify the quality attributes and their preferred levels most valued by key SEA wheat end-users for noodle and bread products that can enhance the demand and value of Australian wheat.

Results

South East Asia (SEA) is the largest and fastest growing market for Australian wheat, importing 42.9mmt over the past five years valued at A$2.6 billion per annum. The understanding of SEA markets and their wheat quality requirements is crucial to supporting demand and prices for Australian wheat and therefore, extremely important for Australian producers.

Investigations conducted with 20 SEA flour milling companies confirm, perhaps unsurprisingly, that price and wheat protein content overwhelmingly dominate the selection by purchasers of wheat for fresh noodles and bread flours in four SEA markets studied.

Noodle texture, colour and colour stability are the key technical attributes influencing the selection of wheat for SEA style fresh noodles. This market recognises that Australian wheat best meets these quality attributes however information is lacking on noodle texture preferences.

The SEA bread market accounts for around 4.5mmt wheat annually. Achieving the ideal loaf volume was the single most valued attribute for mill technicians when selecting wheat for bread. The dough rheological characteristics of greatest importance were water absorption, dough stability time, development time and strength (Rmax), wet gluten and dough and fermentation tolerance; characteristics often associated with water holding capacity and retaining bread shape and volume. This study indicates that Australia has less opportunity to supply wheat with preferred quality targets for baking performance in longer fermentation or sponge and dough processes and formulations high in sugar and fat, as practiced in SEA. Compared to Australian Hard, North American wheat with quality suited to such baking systems commands a premium ranging between US$5 and $100/t.

Conclusion

SEA is by far the largest market for Australian wheat exports with the historically dominant market share held by Australian wheat traditionally underpinned by proximity to market and the wheat's quality attributes. However, recent shift in the makeup of global wheat supply has challenged the status quo and Australia's dominant position in this market is far from assured. The industry can no longer rely on buyer inertia as a substitute for a well-considered national strategy. Identifying the functional quality traits and their target level preferred by flour mills for each distinct market segment and economic value attributed to such traits, together with an understanding of how Australian wheat can achieve these targets is the first phase in formulating a strategic response to maintaining market share and grow value for Australian wheat in SEA markets.

GRDC Project No: AEG00005

Future opportunities for the Western Australian oat industry

Robert Loughman[1] and Munro Patchett[2], [1]DAFWA and GIWA Oat Council, and [2]Gilmac and GIWA Oat Council

Increasing regional demand for food quality oat grain, in response to health awareness and changing diets in Asia and India, is bucking the long term international decline in demand for oats. Oats can be processed into a range of convenient, healthy, flavour adaptable, whole-grain products that are good to eat and provide health benefits.

In the forage sector, export hay oats have an excellent market fit in feedlot dairy and beef production in expanding north Asian markets, with other markets under development.

Established and responsive oat processors in the grain and hay sectors, focussed on export development, have enabled the industry to adapt and respond to increasing international demand for food and hay oats, with a focus on value adding.

Oat production has transformed from low production input systems to specialised cropping activities where producers and processors have established marketing arrangements that include sharing seasonal production and price risks. The industry has potential for further measured growth and development as local processing industries expand and markets continue to develop. Expansion of oat production beyond traditional medium-high rainfall areas are expected to develop as varietal and agronomic systems broaden the adaptive fit of oats in Western Australia.

Confidence in the WA oat industry is being signalled through a range of new investments in oat grain value added processing, both in Western Australia and in oat export destinations. Australian and foreign investment in oaten hay processing and export is also being made to service market growth.

Production and market opportunities in oats continue to be underpinned by investments in oat research by the Grains Research and Development Corporation and their research partners. These investments include pre-breeding, breeding, agronomy and user requirements in new export markets. In 2016 the Rural Industries Research and Development Corporation established an R&D levy on exported fodder which is expected to broaden the scope for Australian export hay R&D.

Potential for further value adding elements to the oat grain industry also exist as European and other oat technology providers look to partner and develop springboard strategies into Asia.

Growth in international demand for food oats, increased processing and on-shore value adding and increased export demand for food oats could generate steady growth in Western Australian annual production, currently around 0.7Mt, to over 1.0Mt over the next five years. When combined with further growth in hay production over the same period, oats is expected to consolidate as the fourth most widely grown crop in WA after wheat, barley and canola.

Notes:

An International benchmarking comparison of Australian crop production and profitability

Ashley Herbert, Agrarian Management

Key messages

Compared to other wheat growing regions in the world:

- Australian wheat production costs and profitability are comparable to that in other grain growing regions of the world.
- Australian wheat yields have the highest level of variation.

Aims

To compare the profitability and costs of wheat production in Australia to other regions in the world through the evaluation of data from the international cash crop benchmarking network, agri Benchmark for the seasons of 2011 to 2015.

Results

When compared to other wheat producing regions, the Australian farms:

- Achieved higher farm gate prices.
- Experienced significantly higher levels of yield variation.
- Comparable costs per tonne of production of $US169/t (Data set average of $US155/t).

The lowest cost of production farms were from Argentina, $US109/t and Eastern Europe $US120/t.

The average margin for the Australian farms was $US73 per tonne of production with a range of $US31 to $US119 per tonne of production.

The average margin for the data set was $US67/t.

The average margin for the EU farms was $US79/t, East European $US61/t, Canadian $US71/t and Argentina $US5/t.

Average total cost to income ratios were 69%, 68% and 70% for the Australian, EU and Canadian farms respectively. The average of the data set was 73%.

Conclusion

In terms of costs and profitability Australian wheat production compares well to that in the other major grain growing regions of the world.

Higher grain prices has been a consistent strength of the Australian farms.

Notes:

Eleven years of integrated weed management: longterm impacts of row spacing and harvest weed seed destruction on annual ryegrass control

Catherine Borger, Glen Riethmuller, Mario D'Antuono, DAFWA

Key messages

- An 11 year study showed that narrow row spacing and harvest weed seed destruction (i.e. residue burning each autumn) reduced annual ryegrass seed production.
- Narrow row spacings also had greater crop yield, although burning residue reduced yield.

Aims

To determine the long-term impact of narrow row spacing and residue burning or retention on annual ryegrass seed production.

Results

Average crop yield was greater in the unburnt plots (1.64t/ha) compared to the plots where residue was burnt each autumn (1.53 t/ha). Average yield also increased at narrower row spacing, with 1.66, 1.64, 1.55 and 1.49 t/ha in the 90, 180, 270 and 360cm row spacing treatments.

Average annual ryegrass seed production at harvest was lower in the burnt plots, with 56 and 296 seeds/m^2 in the burnt plots and unburnt plots. Seed density was greater in the wide row spacing treatments, with 57, 77, 222 and 332 seeds/m^2 in the 9, 18, 27 and 36cm row spacing treatments.

Conclusion

Burning stubble was a highly effective method of weed control, reducing annual ryegrass seed production to close to zero by the end of the 11 year management period. However, burning over the entire plot area caused a yield reduction (possibly due to reduced soil moisture retention). Alternative methods of harvest weed seed destruction (like narrow windrow burning, chaff carts etc.) will destroy annual ryegrass seed without causing a reduction to yield.

Narrow row spacing reliably reduced annual ryegrass seed set, and also increased crop yield. This is partially due to reduced weed competition, but narrow row spacing increases crop yield in the absence of weeds, due to canopy closure at an earlier stage, increased light interception, reduced evaporation and reduced intra-species competition for resources. Very narrow row spacing is not viable in high yielding areas, where the resulting crop residue is difficult to manage during the subsequent seeding operation. While growers may not want to use 9cm spacing, any reduction in their current spacing will increase crop yield and reduce weed seed production.

Notes:

Annual ryegrass viable seed reduced by desiccation and swathing of canola

Glen Riethmuller[1], Abul Hashem[2] and Catherine Borger[2], DAFWA, [1]Merredin and [2]Northam

Key messages

- The viability of annual ryegrass seed can be reduced substantially by desiccation, pre-harvest spraying or swathing of canola depending on the product and timing.
- Pre-harvest spray with greater than 2.0L/ha glyphosate weedmaster® DST® significantly ($p<0.05$) reduced ryegrass seed viability by an average of 96% in 2013 at Katanning.
- On average, desiccation with diquat reduced the viable ryegrass seed production by 65% in 2010 and 88% in 2013 but not in 2011 or 2012, which may be due to the spray timing being too late for the ryegrass.

Aims

To test the effect of desiccation, pre-harvest spraying, swathing and swather spraying on ryegrass seed viability at harvest of canola.

Results

The results from 2010 to 2013 showed that a pre-harvest spray with glyphosate or spraying glyphosate on a swather can reduce the viable ryegrass substantially although in 2012 there appeared to be no effect. Desiccation with diquat had no effect on viable ryegrass seed in 2011 and 2012 but did reduce viable ryegrass seed numbers in 2010 and 2013.

Conclusion

The results showed that desiccation with diquat, a pre-harvest spray with glyphosate or spraying glyphosate on a swather can reduce the viable ryegrass substantially. The ability of glyphosate to reduce seed viability when applied pre-harvest however, may depend on the timing.

The reduction in ryegrass viability can sometimes be greater when the glyphosate is sprayed pre-harvest and not swathed (compared to swathing) but this varied with season.

All desiccation and pre-harvest treatments had no effect on canola yield or oil content in 2012 and 2013 at Katanning although there were some small but variable reductions in yield in 2010 and oil in 2011 at Mt Barker.

Desiccation with diquat had no effect in 2011 and 2012 but in 2010 it reduced ryegrass seed viability to a similar extent as a pre-harvest spray with glyphosate or spraying glyphosate on a swather.

Notes:

Improving adoption of IWM practices for managing emerging weeds in Western Region

Abul Hashem[1], Mohammad Amjad[1] and Catherine Borger[1], and Glen Riethmuller[2], [1]DAFWA, [1]Northam and [2]Merredin

Key messages

- Emerging summer and winter weeds (herbicide-resistant biotype or new incursions) such as African love grass, brome grass, fleabane, windmill grass, wild radish, sowthistle, button grass and tar vine are increasing within paddock and along roadside of WA.
- Continuous application of glyphosate developed glyphosate-resistant ryegrass biotypes and resulted in incursions of new weed species at Merredin.
- Double knockdowns of glyphosate alone or as tank mix with 2,4-D followed by paraquat-based mixture effectively controlled button grass, fleabane, sowthistle and tar vine but higher label rates of glyphosate were required to kill summer weeds during hot summer days than mild autumn days.
- IWM, employing single or double knocks, non-chemical weed control options and application of effective in-crop herbicide mixtures significantly reduced wild radish in three years. Harvesting crop low, windrowing and burning narrow windrows reduced brome grass by 70%.

Aims

Aimed at determining the spread of emerging summer weeds and delivering new knowledge on the biology and management of emerging summer and winter weeds to increase the adoption of integrated weed management (IWM) in the western region.

Method

Seven laboratory experiments, three glasshouse experiments, two small-plot field experiments and 18 field trials (across seasons and locations) were conducted from 2014 to 2016 in WA on the emergence pattern, seed dormancy breaking, weed biology, herbicide resistance and control of emerging weeds. A roadside survey was conducted during the summer/autumn of 2015 and 2016 to determine the spread of emerging weeds within WA grainbelt.

Results

Roadside weed survey across the WA grainbelt during summer of 2015 and 2016 showed that the most common summer weed species were African love grass (87%), fleabane (60%), windmill grass (61%) and wild radish (52%). Sowthistle (26%), button grass (10%) and tar vine (7%) were new incursions. Sowthistle populations were developing resistance to glyphosate and ALS-inhibitors. Long-term continuous application of glyphosate developed glyphosate-resistant biotypes of annual ryegrass and red brome at Merredin in 2011 and 2012 and also led to incursions of many new weed species in 2016. Fleabane, sowthistle, button grass and tar vine can germinate in summer and as well as in other seasons. Persistence of sowthistle and fleabane was longer when buried shallowly than left on the surface. Highly dormant button grass seed germinated well after scarification and short-term hydration. Double knockdowns of glyphosate alone or as tank mix with 2,4-D followed by paraquat-based mixture effectively controlled button grass, fleabane sowthistle and tar vine but higher label rates of glyphosate were required to kill summer weeds during hot summer days than mild autumn days. IWM including effective knockdowns (single or double knock), non-chemical weed control options and application of effective in-crop herbicide mixtures significantly reduced the wild radish population in three years. Harvesting a wheat crop at 10cm high collected 74% of the total viable seed of brome grass into narrow windrows and windrow burning killed 94%, leading to a reduction of brome grass by 70%.

Conclusions

Farmers need to adopt IWM including effective chemical and non-chemical weed control options to manage emerging summer and winter weeds within WA grainbelt.

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GRDC Project Number: UA00149

Notes:

Controlled traffic farming in practice

Bindi Isbister, Wayne Parker and Glen McDonald, DAFWA

Key messages

- Controlled traffic farming (CTF) is not a one size fits all approach as growers develop systems to best suit their business.
- CTF is more than just compaction control and it opens the door for many other agronomic opportunities including inter-row or on-row sowing, chaff lining, better trafficability in wet conditions, easier driving and more accurate input placement.
- Adopting CTF in line with your machinery replacement strategy is a good approach: start by developing a plan then select machinery according to your plan.

Aims

This paper presents examples of successful controlled traffic farming in practice from three farm businesses in different rainfall zones. These examples have been selected as they provide insight into common questions from non-CTF farmers such as how does livestock or hay fit, how can seeders wider than 12m be included, and the benefits of deep ripping and topsoil inclusion plates.

Results

Scott and Lisa Thompson from Broomehill took 11 years to develop a fully matched CTF system based on 12m operating width and 3m wheel tracks. They run a 3:1 machinery matching ratio to crop 2800ha. Scott has noticed the soils getting softer over time; however the main benefit is the extra opportunities CTF allows such as seeding between last year's rows, better trafficability in wet conditions and using a chaff deck for harvest weed seed control. Challenges include setting common run lines, convincing staff to stay on the tramlines and summer grazing reducing water infiltration. Sheep will remain a compromise as they are a very important part of the farm business.

Brian McAlpine from Latham first developed a 12.3m CTF system in 2004. Their system evolved until they ran two 12.5m (41ft) Ausplow DBS bars and two headers with 43ft fronts. In 2011 increasing off farm commitments and a series of dry seasons motivated them to reduce their machinery cost per ha they brought a 27.2m (86ft) Morris seeder bar. After seeing the results of the DAFWA's GRDC funded Soil compaction project in 2015 and talking to other farmers Brian is now re-establishing a CTF system based on 13.1m. This includes deep ripping with topsoil inclusion plates to remove compaction.

Since 2009 the Faulkner Bros from Beacon have run a CTF system based 12.2m headers, 18.3m seeders and 36.6m sprayers to crop 15-16000ha. They also run sheep. For a relatively low cost of matching machinery, benefits they see include more friable soils, good fuel efficiency from machinery and less dust when spraying in summer. In 2016 they brought a new header with an 18.3m front. Happy with the efficiencies gained with a wider front in 2017 they will upgrade the second header to 18.3m. With a new sprayer 55m wide they will have a 3:1 matching ratio.

Conclusion

CTF systems are based on common principles of matching implement widths and wheel track centres but each fleet of machinery is unique based on each farms priorities. Compromises are often made along the way to maintain efficiency and economic benefits. CTF is more than just improving yield from compaction control. There are more agronomic opportunities that present themselves due to more precise operation of machinery. The CTF calculator developed by DAFWA's GRDC funded project DAW00243 is a useful tool to help farmers and their consultants make machinery investment decisions when developing a CTF implementation plan.

Does liming affect potassium fertiliser requirements?

James Easton, CSBP

Key messages

- Liming does not appear to significantly affect yield response to potassium (K) fertiliser — at least within five years of application.
- While lime did not alter availability of soil test K, longer term K requirements are likely to increase with ongoing responses to lime and therefore higher nutrient removal rates.
- Soil test to ensure optimal allocation of lime and K fertiliser.

Aims

To determine whether liming has a significant effect on potassium fertiliser requirements.

Results

At Bolgart, in a field trial established in 2011, potassium fertiliser increased wheat yield by 0.9t/ha in 2011, 1.2t/ha (2012), 1.4t/ha (2013), and 2.3t/ha (2014), and barley yield by 1.1t/ha in 2016. Lime increased yield by 0.14t/ha in 2012, 0.26t/ha (2014) and 0.95t/ha (2016).

There was no significant interaction between lime and K treatments in any year ($P<0.05$), except for 2012 when there was a significant interaction at a lower level of confidence ($P<0.1$).

Conclusion

In the first four years of this trial, annual K fertiliser applications had a much greater effect on wheat grain yield than the application of lime. However, in the last two crops, yields were highest where lime was also applied. In 2012, there appeared to be a greater response to lime where K was not applied. This indicates that lime may have improved access to soil K but this was not supported by plant test results in 2012, or repeated in any of the other years. In two other field experiments (Cascade and Coorow: data not shown) there was also no effect of lime on K response. Therefore, lime should not be used as a replacement for K fertiliser inputs if the soil is K deficient.

Continued yield responses to lime will increase K removal rates and probably longer term K fertiliser requirements.

Notes:

Potassium fertiliser alleviates drought and frost stress in wheat

Richard Bell and Qifu Ma, Murdoch University

Key messages

- In West Australia, low potassium (K) soils are common but rates of K fertiliser application are commonly below rates of K removal in grain and hay.
- Based on 21 K experiments since 2012, we conclude that K fertiliser provides added protection for cereal crops against crop stress from drought and frost.
- Adequate K fertiliser addition is important for reducing the effects of crop stress on yield.

Aims

Our aim was to determine whether crop stress (from drought or frost) determined crop response to K fertiliser.

Results

In the Western Grains region, low K soils represent up to 50 % of the cropping area. Rates of K fertiliser application are commonly below rates of K removal in grain and hay. In this environment with a Mediterranean climate, drought and frost are common crop stresses. Over a 4-year period (2012–2016), 21 experiments were conducted with 3–5 rates of K from 0 to 120kg K/ha. Soil test K by the sodium bicarbonate extraction (Colwell) ranged from 22–140mg/kg in the 0–10cm layer. Response to K occurred in 11 experiments where drought or frost was recorded, but rarely otherwise. The critical soil test Colwell K level in 0-10 cm (40-45mg/kg) depth did not predict which sites gave a K fertiliser response.

To maximise the likelihood of a frost event coinciding with critical stages of pollen development that are sensitive to frost, in 2015 we sowed two cultivars of wheat (Mace, Wyalkatchem) with different flowering dates at 4 times (15 and 29 April, 15 and 30 May 2015) with nil, 80kg K/ha and 80kg K/ha plus micronutrients (Mn, Cu and Zn applied as foliar sprays before anthesis). The initial soil K (bicarbonate extraction) at the East Brookton sites was 49mg K/kg in 0-10 cm depth but dropped to ~30mg/kg at 10–30 cm depth. Only wheat at the final sowing date escaped significant frost events during critical pollen development stages. In sowing dates 1, 2 and 3 the control plants had 20–39 % frost induced sterility (FIS). Added K at 80 kg /ha decreased FIS by an average 8 % at sowing dates 2 and 3 but had no effect on FIS at sowing date 1. At sowing date 1, leaf K at anthesis was 2.8 % in the nil K treatment, while at sowing dates 2 and 3, concentrations dropped to 2.4 and 2.0 %, respectively. K fertiliser increased grain yield only at sowing date 2 and 3 where FIS was also decreased. Yield increases were 0.1–0.3t/ha in sowing date 2 and 0.2–0.5t/ha in sowing date 3. This suggests that alleviation of FIS was the main cause of K fertiliser response in wheat. We conclude that additional K fertiliser increased wheat tolerance to frost if the frost event coincided with pollen development unless shoot K was already high (2.8 % or more).

In 2016 at West Dale on a low K duplex soil with 41 mg Colwell K /kg (0–10 cm depth), we sowed wheat cv. Mace with different flowering dates at 4 times (15 and 29 April, 15 May and 10 June) with nil, 20, 40 and 80 kg K/ha together with foliar micronutrients (Mn, Cu and Zn) and K sprays before anthesis. When frost was extreme (> 95%), K had no effect on FIS. However, at lower less severe frost, K fertiliser at 20–80kg K/ha decreased the FIS by 10–20%.

Conclusion

For the last six years, our experiments showed K fertiliser provides added protection for cereal crops against crop stress from drought and frost. Current rates of K fertiliser on low K soils are generally too low to replace K removal, increase soil K to safe levels, meet demand for high yield crop or achieve ongoing crop protection against stress.

Wheat varieties: Performance in NVT Trials in WA

Christine Zaicou-Kunesch, Brenda Shackley, Dion Nicol, Jeremy Curry, Georgia Trainor and Mario D'Antuono, DAFWA

Aims

- Assess how the environment influences the yield stability of recently released wheat varieties.
- To compare the performance of recently released wheat varieties relative to Mace at selected locations in the National Variety Trial program in 2016.
- Provide knowledge of variety phenology.

Notes:

Capturing early sowing opportunities for wheat in WA

Brenda Shackley[1], Christine Zaicou-Kunesch[2], Jeremy Curry[3] and Dion Nicol[4],
DAFWA [1]Katanning, [2]Geraldton, [3]Esperance and [4]Merredin

Key messages

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

Aims

To determine grain yield and quality responses of long season wheat varieties sown mid-April compared to the more conventional sowing times.

Results

A graph shows the spread of flowering dates representing a range of development times for current varieties that are available to assist with earlier sowings when sown at Mullewa, Merredin, Katanning and EDRS in 2016. A clear gap is evident between the long maturing Wylah$^{\Phi}$ and Forrest$^{\Phi}$ and the mid to long maturing variety which is represented by Cutlass$^{\Phi}$.

The average grain yields ranged from 4.5t/ha for the mid-April and early May sowings at EDRS, to a near total yield wipe-out due to frost at Katanning sown mid-April. 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 ForrestA at Merredin which obtained the highest yield when sown mid-April. Unlike 2015, Mace was competitive with other varieties at all sowing times at Mullewa, but only late May at EDRS.

Conclusion

This research suggests that for early sowings there are commercial mid to long maturing varieties currently available in WA which can yield similar or higher than winter wheats (Whistler$^{\Phi}$ or Wylah$^{\Phi}$) and Mace$^{\Phi}$. The longer maturing variety ForrestA was examined in 2016 and appears to be more adaptable to WA conditions than WylahA. However, 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.

Notes:

Pasture legumes fix enough N for three consecutive crops

Dr Angelo Loi, DAFWA

Reducing input costs for cropping systems is vital if profitability is to be increased.

Nitrogen (N) fertilisers are a large component of expenditure in Australian cropping systems. Reliance on inorganic nitrogen fertiliser sources has increased in recent decades, partly due to lack of resilient well adapted, flexible legumes that can overcome soil and climatic constraints experienced in low and medium rainfall zones.

The presentation will describe the long term nitrogen effect on crops grown in rotation with species such as serradella, biserrula and bladder clover.

Notes:

Objective Grain Marketing – What does the formula say

Emily Dempster and Jerome Critch, Planfarm Marketing

Key messages

- It is said that human beings make all decisions based on emotion, but deciding how to market your grain can be a particularly emotional process.
- In bringing the decision back to three fundamentals – price, production and propensity to sell — we provide an objective framework for making decisions that helps remove some of that emotion.

Aims

We propose combining a price-activated hedge strategy with a time-activated hedge strategy, with the aim to reduce the emotional involvement in decision making through the season. Using this approach, you can set your strategy early in the season when you are relatively emotionally balanced or detached. With the strategy is set, you avoid making emotionally driven decisions later in the season when your emotions may be heightened, such as if prices move suddenly.

We develop a formula based purely on objective and quantifiable factors, which cuts out the emotional pitfalls. We examine its effectiveness in this paper.

Results

Although there were years when a more conservative approach performed better than more aggressive approaches, more benefit was accumulated by the more aggressive approaches over the six years in the study. This is because they include a greater number of opportunities to sell at good prices. Where opportunities to sell are restricted, so are chance to access good prices.

Conclusion

This approach helps remove some of the emotion from the decision. By combining both a price-activated and time-activated strategy, users can reduce the pitfalls of emotionally-driven decisions.

Growers can choose the profile that best suits them. Although the result will vary depending on their profile, they can be confident knowing that they can clearly rationalize their decisions of when to sell, and when not to sell, based on the objective factors.

The results show greater benefit can be accrued where there is a greater propensity to sell throughout the marketing period, but where circumstances restrict the ability to sell, there is still some benefit to be accrued by using this approach.

Notes:

Doppler radar in the grainbelt — more than just pretty pictures

Ian Foster[1] and Grahame Reader[2], [1]DAFWA, [2]Bureau of Meteorology Perth

Key messages

- New Doppler radars will provide much-needed coverage over the WA grainbelt.
- Growers, agribusiness and rural communities will be able to access detailed rainfall and wind information to make more-informed decisions.
- Weather prediction across the grainbelt, especially during extreme events, will be significantly improved.

Aims

There has been a long-standing need to provide radar coverage for the WA grainbelt. While many regions in the eastern states receive Doppler radar coverage, Western Australian coverage has been limited to radars located at Serpentine and Kalgoorlie.

Technology is becoming increasingly important in supporting a range of agricultural decisions and activities, and the new radars will provide real-time rainfall and winds to augment ground-based observations. In turn, this new capacity is likely to stimulate improved integration of weather information with agricultural decisions-support systems, particularly as digital connectivity across the agricultural region is improved.

Results

There will be three categories of products coming from the radar project:

- Map displays of rain echoes, estimated rainfall and winds on the BoM website.
- Information products coming from integration of the radar data with other weather data, or as input to decision-support systems, such as accumulated rainfall levels at a paddock level.
- Improved weather forecasting for the grainbelt, especially for severe events such as thunderstorms and fire weather situations.

Conclusion

Installation of three Doppler radar stations in the WA grainbelt meets a long-standing need for radar coverage in the region. These advanced systems will provide a range of real-time rainfall and wind information via the Bureau of Meteorology's website and be the catalyst for a range of agricultural applications developed by DAFWA and agribusiness providers. Improvements in weather forecasting enabled by the radars will be significant during severe weather events.

Notes:

DIY Precision Agriculture

Nigel Metz, South East Premium Wheat Growers Association (SEPWA)

Aims

Key messages

- The direct economic gains from Precision Agriculture (PA) technologies are often unclear. Do It Yourself Precision Agriculture (DIY PA) helped with a basic understanding which started people on the road to adoption.
- Low yield mapping literacy has not helped adoption as there is not a means to measure potential PA benefits. DIY PA courses directly addressed this and noted improvement in the second half of the project's delivery.
- Previous experience of disjointed difficult software has tarnished the adoption reputation of PA. This project shifted some of this perception however there is still some way to go.
- The need for PA support specialists is growing rapidly. Industry has yet address how PA skills can be developed amongst industry professionals. The most logical path to this is the fostering of young farmers and service providers in PA skills for eventual wide scale industry adoption.
- Good internet connection is required to ensure a smooth experience in PA adoption. Slow connections with limited data cause apprehension to try new technologies.

This GRDC funded project was a 'hands on' integration of mobile device technologies and low cost simple PA methods for grain growers and agronomists. The project aimed to deliver technology skills training to regional industry people with the overall goal of creating a local peer to peer ripple effect in assisting PA adoption.

Results

DIY Precision Agriculture (DIY PA) began in December 2013 and in three years delivered a total of 67 courses to 656 participants within regional Western Australia (WA). Via survey of participants SEPWA could track participants PA and technology characteristics over the course of the project.

Conclusion

DIY PA has exposed a great number of growers and service providers to some of the basics of PA via the delivery of the DIY PA project. This insight into PA provided participants with an understanding as to whether PA fits within their business and if so, allowed them to make a calculated decision as to how they were going to implement it.

SEPWA was pleased to see progress overall in yield data literacy and general PA skills over the duration of the projects delivery. There was however noted a multitude of barriers to adoption throughout the life of DIY PA. The most prevalent including: the time poor status of growers and service providers to upskill; lack of support in regional areas; and less than satisfactory internet

Notes:

How do Canadian growers manage sclerotinia, blackleg and club root in canola crops?

Lone Buchwaldt, Agriculture and Agro-Food, Canada

Lone Buchwaldt will focus on the research and management strategies for Sclerotinia, blackleg and club root management used in the Prairie Provinces of Canada.

Lone is a plant pathologist with Agriculture and Agro-Food Canada in Saskatoon, Saskatchewan. The focus of Lone's research is to identify new sources of disease resistance in agricultural crops. Lone and colleagues investigate the effect of individual defense genes, which could become an acceptable method of disease control in the future. In addition, Lone collaborates with extension specialists and growers to forecast sclerotinia in canola using sclerotia-depots buried in fields across the Canadian Prairies. This real-time data will become a part of a sclerotinia-risk App for smartphones currently being developed to identify fields where fungicide application would result in an economic return.

Notes:

Sclerotinia in canola — ground infections, effect of row spacing, plant density and fungicide. Is it worth spraying after you see the disease?

Ravjit Khangura, Mehreteaab Aberra and Stuart Vincent, DAFWA

Key messages

- Seasonal conditions in 2016 allowed early germination of sclerotes, consequently triggering ground (basal) infection in several canola crops in the central and southern regions.
- Trials conducted in the northern region indicated that all fungicide spray timings targeted at different bloom stages were effective in reducing the disease incidence and improving the grain yield in canola. Net returns with different treatment timings ranged between $41–$148/ha. Disease incidence was also reduced in trials where fungicides were applied soon after detecting the ground infections.
- Wider row spacing (44cm) and lower plant density (15 plants/m^2) had no effect in reducing disease incidence, however, disease incidence was significantly reduced and grain yield improved with the application of foliar fungicide at 30% bloom regardless of row spacing and plant density.

Aims

To evaluate optimum timing of fungicide spray applications, alternative products with new chemistry and cultural practices for effective and profitable management of Sclerotinia stem rot in canola.

To manage secondary spread of Sclerotinia ground infections once disease appears in the crop.

Results

Fungicide timing

Plants sprayed with each of the three fungicides (i.e Prosaro®, Sumisclex® or Product C) had significantly lower disease incidence than that the untreated 'nil'. Disease incidence was significantly lower at all timings of spray compared with the nil. There were significant yield responses to all fungicide treatments. The net return for various treatments ranged between $41 (10% bloom) to $148 (10+50% bloom).

Row spacing, plant density, variety and fungicide effects

Data revealed that row spacing and plant density had no effect in reducing disease levels, however, disease incidence was significantly reduced with the application of fungicide and it was less in GT50 than in IH30RR. Likewise, grain yield was significantly improved with fungicide application, variety and higher plant density.

Managing the spread of ground (basal) infections

Varying levels of ground infection were present at the time of establishing field trials. Trial data indicated that further spread of ground/basal infection was significantly controlled with almost all fungicide applications.

Conclusion

Results clearly indicate that although single fungicide application effectively controlled the disease, two spray applications provided maximum returns particularly in a prolonged season. Wide-row spacing and/or lower plant densities alone didn't provide any advantage in reducing the disease levels indicating fungicide protection is still needed in order to minimise losses from Sclerotinia stem rot. Foliar fungicides applied after detecting ground infections were effective in curbing the further spread of the disease.

Fungicides at seeding for management of cereal foliar diseases including Spot Type Net Blotch (STNB) and Wheat Powdery Mildew

Geoff Thomas Kithsiri Jayasena, Andrea Hills, Ciara Beard, Jason Bradley and Anne Smith, DAFWA

Key message

- Registered seed dressing or in-furrow fungicides are applied prophylactically to address disease risk can delay, reduce or eliminate disease resulting in significant yield responses. In the absence of disease however, they are unlikely to provide yield or economic benefit.

Aims

Spot type net blotch (STNB): Investigate the efficacy of seed dressing, in-furrow and foliar fungicides to reduce STNB severity and provide a significant yield response in susceptible barley varieties sown onto barley stubble.

Wheat powdery mildew: Investigate the effects of seed dressing and in-furrow applied fungicides on the time of onset, rate of development and yield impact of wheat powdery mildew in susceptible varieties.

Results

Spot type net blotch

In five experiments, registered systemic fungicides applied to seed (fluxapyroxad) or fertiliser (azoxystrobin + metalaxyl) provided significant reduction in severity of spot type net blotch (STNB) in susceptible varieties sown into barley stubble. Fungicide application resulting in reduction of STNB severity can result in yield benefit but does not guarantee yield response or economic return from application.

In STNB affected susceptible barley varieties, yield responses from combinations of at-seeding and/or foliar fungicide ranged from 0-24% with the response in majority of trials being less than 10%. Greatest responses occurred at yields >3t/ha.

Wheat powdery mildew

In four experiments in at-risk environments, wheat powdery mildew was evident at three sites but only reached yield limiting proportions at one. Seed dressing and in-furrow fungicides had significant impact on disease severity and incidence at two sites resulting in significant yield responses (>15%) at one site.

Fungicides registered in wheat for management of a range of diseases, including seed dressings containing fluquinconazole, triadimenol and fluxapyroxad and in-furrow applied products containing flutriafol, triadimefon and azoxystrobin, delayed the development of powdery mildew epidemics in susceptible wheat. Product differences were evident between sites with flutriafol in-furrow being consistently in the most effective group.

In three of four sites where wheat powdery mildew severity was not yield limiting, neither foliar nor at-seeding fungicides provided a yield response and would not have provided positive return on investment.

Managing water repellency with minimal soil disturbance

Ramona Kerr[1], Phil Ward[1], Margaret Roper[1], Shayne Micin[1] and Stephen Davies[2],
[1]CSIRO, [2]DAFWA

Key messages

- No-till and residue retention provide an effective management strategy for crop production in water repellent soils, and the techniques can be used either on their own, or to complement amelioration strategies based around strategic deep cultivation.
- Preserved root pathways in no-till systems can by-pass water repellent soil and allow rainfall to infiltrate. The resulting higher moisture contents in the furrows can facilitate crop emergence; growers can take advantage of this by planting near the old crop row.
- Where feasible, water repellent paddocks should be sown last in the seeding program in order to avoid dry-seeding which can worsen the symptoms of water repellency.

Aims

Several growers in WA are successfully managing water repellent soils for crop production using no-till and full stubble retention. In this research we aim to determine the impact of no-till and stubble retention on water repellency and patterns of water movement into the soil, and impacts on subsequent crop production. Aspects of row placement (either between the previous crop rows, or close to previous crop rows), wet versus dry seeding, and the use of a surfactant, were also investigated.

Results

In a no-till system with residue retention, pathways of water infiltration into the soil are preserved, especially along previous stubble rows. This results in higher soil water contents compared with systems where residue removal and soil disturbance are practised. Sowing close to the previous crop row often leads to better crop germination.

Disturbing a non-wetting soil when it is dry can increase the severity of water repellence, and so dry seeding should be avoided where practicable.

Notes:

Improve productivity of canola by deep ripping on acidic yellow deep sand in the Western Australian grainbelt

Shahab Pathan[1], David Hall[1], Glen Riethmuller[1], Greg Shea[1] and Tony Murfit[2],
[1]DAFWA, [2] Warakirri Cropping, South Burracoppin, WA

Key messages

- Canola plant growth and grain yield were increased significantly as a result of deep ripping in acidic yellow deep sand.
- Consider alleviating subsoil compaction to improve soil productivity and crop yield while ameliorating acidic yellow sand with lime.
- On compacted and acidic yellow sand the combination of lime with appropriate deep tillage will potentially minimise multiple soil constraints and offer better return on investment.

Aims

Soil acidity and compaction are the two major subsoil constraints to crop production on yellow deep sands in the Western Australian grainbelt. The aim of this study was to improve knowledge of subsoil constraints and develop better ways of managing acidic yellow sandy soils to improve productivity.

Results

Canola germination, counted at 28 DAS was not affected by the tillage and lime treatments. Plant density was quite high (63–73 plants/m^2) across all treatments, mainly due to the relatively high seed rate (4kg/ha), 144mm rainfall in March-April and favourable soil moisture for germination.

Deep ripping (40cm) reduced soil penetration resistance significantly at the compacted layer between 15 and 35cm and increased the depth to which canola roots penetrated. For example, canola roots were present to a depth of 50 to 60cm in the ripped profile, while in the un-ripped profile roots were present only to a depth of 20 to 30cm. This was also reflected in the visual assessment, plant height and shoot dry matter of the all deep ripping treatments, irrespective of lime incorporation. In addition, canola plant growth and early vigour (NDVI) was significantly higher ($p<0.001$) with deep ripping irrespective of lime rates. At 98 DAS canola plant growth (phenology) was quite distinct with the un-ripped plots being more than four weeks behind the deep ripped plots.

Canola grain yield, grain size and oil content were highly significant ($p<0.001$) between the treatments. Highest grain yield was observed in the deep ripping +/- lime incorporations. Canola grain yield was increased by 250 to 570kg/ha on deep ripping +/- lime incorporations compared to those not ripped. Grain size and oil contents were significantly ($p<0.001$) higher for the deep ripping treatments, irrespective of lime incorporation.

However, grain yield responses to deep ripping were much less than plants shoot dry matter and plant early vigour. For example, canola grain yield increased by around 25% as a result of deep ripping irrespective of lime application compared to the control with no deep ripping, whereas shoot dry matter was more than double. This may be due to the long growing season (222 days), above average annual rainfall (414mm) and high numbers of rainy days (128 days), resulting a soft finish. The canola plant is indeterminate and produces flowers and pods as long as it has the resources to continue.

Conclusion

Improved soil physical properties, plant growth and canola grain yield were evident in acidic yellow deep sand treated with deep ripping. Initial responses are more related to deep ripping than lime.

Alleviating subsoil compaction needs to be considered while ameliorating acidic yellow deep sand with lime. Deep ripping loosened the compacted layer which presumably benefited crop growth performance, access to nutrients and

water down the soil profile. In addition, deep incorporation of lime is likely to work better where subsoil acidity occurs in a compacted layer. Therefore, on compacted and acidic deep sand the combination of lime with appropriate deep tillage will potentially minimise multiple soil constraints and offer better return on investment in the long term.

Notes:

Longevity of deep ripping and topsoil inclusion in soils under controlled traffic farming; evidence from the second season

Wayne Parker[1], Bindi Isbister[1], David Hall[1], Glenn McDonald[1] and Paul Blackwell[2], [1]DAFWA, [2]Soils Consultant (retired DAFWA)

Key messages

- The yield benefit of deeper ripping persists on the sandy soils, in the second season following ripping, although the responses of lupins need further investigation.
- Topsoil slotting when deep ripping continues to increase yields on soils with sodic clay subsoil as well as Morrel soils with saline clay subsoil.
- The current design of the topsoil slotting plates can compact some deep ripping of deep sandy soils at Binnu and Moora. This needs further investigation, especially on other soil types.
- Deeper ripping below 300mm seems to reduce risk of yield loss in extreme conditions including heat shock during grain fill and shallow waterlogging during wetter seasons.

Aims

To test increasing the economic viability of deep ripping by improving its longevity using controlled traffic and the addition of topsoil and ameliorants to the subsoil.

Conclusion

These conclusions are drawn from year two observations of a five year trial monitoring program of eight trials begun in 2015. The trial sites are Binnu (2), Moora, Beacon (2), Broomehill, Ongerup and Munglinup.

Yield responses to deep ripping below the compaction layer at Moora and Munglinup are still evident in the sandy soils two years after the treatment was applied. The response of the lupins in the sandy soil at Binnu was inconsistent and requires further investigation, particularly where lupin yield is reduced with the addition of topsoil slotting.

Deeper ripping below 300mm seems to reduce yield risk in extreme conditions of heat shock and waterlogging. A heat shock presented in during grain fill in 2015 was buffered by deeper ripping where roots had access to deeper moisture. Observations from the 'wetter' 2016 season suggest that ripping and topsoil slotting provides drainage in waterlogged sodic clay and sand over gravel soils as found at Ongerup and Munglinup sites respectively. As such could be used as a management tool in paddocks susceptible to waterlogging particularly where there is a hard compact layer reducing drainage.

These trials have shown positive yield response in sodic soils, Ongerup, with the inclusion of organic matter. Topsoil slotting plates should be fitted if ripping these soils.

On the Binnu yellow sand the topsoil slotting has caused a re-compaction of soil between the tines. It would appear the current shape of slotting plate is not sufficient to allow for soil breakout between plates and the 'inter-plate', inter-row soil is being compressed as the plates pass. Soil particle size distribution, moisture conditions, depth of ripping, depth of topsoil slotting plate, width between plates, plate angle will determine the degree to which this occurs. Design of topsoil slotting plates requires further investigation to ensure inter row compaction is minimised while retaining the capacity to bury topsoil organic matter. The addition of winged points to the tine may be sufficient to increase breakout and loosen a greater volume of soil for the plates to pass through.

It is important to consider economic response to ripping over a number of seasons. At Binnu, in the absence of top dressing manure, the responses from ripping to 550 were great enough to cover the investment in the first year and remains positive in year two. At Munglinup the value of the ripping without topsoil plates investment was realised in year two.

GIWA Breakfast
Sponsored by DAFWA

Department of **Agriculture** and **Food**
GOVERNMENT OF WESTERN AUSTRALIA

Crown Ballroom 1

Keynote Speaker — Geronimo Watson, INDEAR, Argentina

The future for grain exports from Argentina and the current status of wheat breeding research in Argentina

Geronimo Watson will present on the wheat breeding activities his Argentinian company is involved in and provide a first-hand account of the structural changes in Argentina underway and what is expected to bring about a large increase in grain production and exports. He will include progress on GM wheat breeding for drought tolerance, and discuss how long before GM wheats are likely to be being commercially grown in Argentina. Geronimo will provide an update on the far reaching changes in Argentinian Government Policy on grain production and discuss the future potential for wheat and other grain exports from Argentina.

Geronimo is the Chief Technology Officer of Grupo Bioceres a fully integrated biotech company focused on developing products that enhance crop productivity and expand feedstock applications.

Notes:

GIWA
Grain Industry Association of Western Australia

GRDC Interactive Backchat

A question and answer session with GRDC

In attendance will be John Woods[1], Peter Roberts[2], Brondwen MacLean[3], Darren Hughes[4], Roger States[5] and other staff, panellists and board members,
[1]GRDC Board Chair, [2]GRDC Western Panel Chair, [3]GRDC Executive Manager, Research Programs, [4]GRDC General Manager, Farming Systems & Agronomy – West, [5]GRDC Regional Manager, Grower Services – West

A unique opportunity to interact with senior members of GRDC's strategic advisory groups and senior staff, including members of the GRDC Board, Western Panel and Senior Leadership group. Join us to discuss issues and opportunities within the grains Research, Development & Extension sector and the role that GRDC plays within this area, now and in the future. This is your opportunity to discuss any issues relevant to the grains industry and GRDC.

Notes:

GRDC Backchat (cont.)

Investment cycles, applying and reporting and the preferred suppliers list — interacting with GRDC Grower Services

Presented by Roger States[1] and Julia Easton[2], [1]GRDC Regional Manager, Grower Services – West, [2]GRDC Manager, Grower Services

An interactive session with a brief overview of the process behind the development and contracting of projects arising out of the RCSN prioritisation process, the preferred suppliers list, applying for, negotiating and reporting on projects and the expectations of GRDC in these areas. Gain a better understanding of the processes the Grower Services group utilises and clear up any concerns or queries you may have.

Notes:

Barley varieties and agronomy

Blakely Paynter[1], Raj Malik[2], Jeremy Curry[3] and Georgia Trainor[1],
DAFWA, [1]Northam, [2]Katanning and [3]Esperance

Key message

- At the 2017 GRDC Research Update (Perth) Blakely Paynter from DAFWA's barley agronomy team will articulate how nitrogen (N) timing can influence the suitability of barley for receival as malt, introduce the barley module of 'FlowerPower' and talk about some of the new barley varieties in the pipeline including Compass, IGB1305, LG Maltstar, RGT Planet, Spartacus CL that are being evaluated by Barley Australia for a malt and brewing end use. Below are some key, new messages from our agronomic research on N timing, weed competition and barley phenology.

Nitrogen timing

- Low grain protein continues to be a problem for many malt barley growers. A cost effective way to lift grain protein concentration in malt barley is to apply at least two thirds of the target N rate at the beginning of stem elongation. This strategy has been shown to have no effect on the yield potential of the barley.
- In a study with La Trobe barley, N application at stem elongation consistently resulted in grain with a grain protein concentration suitable for Malt1 (between 9.5–12.5%). Applying the same rate of N at seeding or mid tillering or even splitting it did not. Averaged across six trials (two in each of 2013–2015), applying 60kg N/ha at stem elongation averaged 10.1% protein compared to 8.9% if applied at seeding, 9.5% if applied at mid tillering and 9.4% if split evenly as 20kg N/ha applications at seeding, mid tillering and stem elongation.
- Where this strategy may come unstuck for managing grain protein concentration is in seasons with a very dry spring (aka 2015). Averaged across six sites and six malt varieties in 2015, grain that received 45kg N/ha at stem elongation averaged 12.2% protein compared to 10.5% if applied at seeding, 10.5% if applied at mid tillering and 11.1% if split evenly across seeding, mid tillering and stem elongation. Under those conditions, however, screenings were also high (>20% in most trials), limiting the ability to deliver into Malt1 segregations anyway.

Weed competition

- Hindmarsh and La Trobe are perceived by many growers to be less competitive against weeds. A nine trial study evaluated the competitiveness of a range of malt, food and feed grade barley varieties in the presence of under sown ryegrass or under sown oats.
- Despite establishing >100 ryegrass plants/m^2 or >40 oat plants/m^2, the level of barley yield loss measured was less than 10% in each trial. At those levels of weed establishment we would expect the yield loss to be in the vicinity of 20%. The dry starts to the 2012–2015 seasons are postulated to have allowed the barley to be more vigorous than the under-sown, germinating weeds, thereby limiting their competitive ability.
- At this low level of yield loss the barley varieties tested did not differ in their ability to suppress weed tiller production or in their grain yield loss due to the weed competition and we were unable to establish if varieties differed in their competitive ability against ryegrass versus against oats.
- Weed competition studies in eastern Australia using oat as a competitor suggest that barley varieties may differ in their weed competitiveness and that varieties like Compass and Fathom appear to be able to suppress oat production more than other barley varieties whilst maintaining their grain yield.

Barley module of 'FlowerPower'

- The barley module of 'FlowerPower' is a statistical model to predict date of awn emergence (Z49) (as a surrogate to flowering in barley) in Western Australian environments.
- The decision support tool assists growers better understand differences between barley varieties in their relative maturity (as determined by the duration to Z49) when sown at different seeding dates (from late April to early July) and will be running on the DAFWA website before the 2017 seeding operations commence.
- The model has been developed from detailed phenology trials conducted at Northam, Katanning and Esperance since 2009 and validated in 2016 using phenology data collected from 11 GRDC barley NVT trials.

Acknowledgments

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GRDC Project Number: DAW00224

Oat varieties and agronomy

Georgie Troup[1], Mark Seymour[2] and Raj Malik[3], DAFWA, [1]Northam, [2]Esperance and [3]Katanning

Key messages

- Varieties differ in their yield, quality and response to changes in plant density.
- Bannister was the best performing variety in 2016 as it out-yielded the other varieties evaluated and met Oat1 quality standards at all sites. However, Bannister should be sown to achieve a higher plant density than Carrolup.
- Grain quality of newly released, short season variety Durack was not consistent with previous studies.
- Choosing to grow more than one variety will maximise the strengths, and mitigate the weaknesses of oat varieties.

Aims

The aims of this study are to:

- Compare the responses of four milling oat varieties to changes in nitrogen and seeding rates
- Determine if there are significant variety x nitrogen(N) x seeding rate interactions between oat varieties
- Develop variety specific management guidelines for growers and industry on new oat varieties.

Results and conclusion

Bannister was the best performing variety in this study, it consistently out-yielded other varieties evaluated, and met Oat1 quality standards at all sites. Bannister continued to respond to a higher plant density than the current recommended density at 50% of sites, supporting previous research suggesting Bannister should be sown to achieve a higher plant density than Carrolup, Yallara or Durack in these environments (Troup et al 2016). The ability to sow at higher density may assist in alleviating the challenges associated with limited weed control options available in oat crops. Adoption of Bannister should be coupled with a risk mitigation strategy of; a) growing Bannister in low Septoria risk situations and, b) having two oat varieties in the rotation to combat the weaknesses that each variety can exhibit, with the second variety to have improved disease resistance e.g. Williams .

Grain quality of recently released variety Durack (which will undergo commercial milling evaluation in 2017) was not consistent with previous trials in 2014 and 2015. The short season maturity of Durack coupled with the frost events at Varley had a detrimental effect on hectolitre weight at the site, with an interaction between plant density and hectolitre weight evident.

Williams tendency to produce narrower grains than other varieties led to it exceeding the Oat1 screenings limit of 10% <2.0mm (by 1.5%). A conservative approach to applied N will improve the probability of meeting the Oat1 grade with Williams as its screenings % will reduce and its hectolitre weight will improve.

Notes:

Improving spray fallow techniques for better moisture conservation, better winter and summer weed control

Grant Thompson, Crop Circle Consulting and Research

Key messages

- The viability of fallow as a profitable rotational tool depends on seasonal variability and rainfall.
- Oilseeds and grain legumes grown on fallow can be highly profitable.
- Herbicide options for robust summer and winter weed control in fallow are available.
- Tolerant crop types are critical to using residual soil herbicides safely and effectively.

Aims

To investigate the efficacy, safety and persistence of several herbicide actives for spray fallow use in cropping systems in the WA wheatbelt.

Results

Combinations of Imazapic, Imazapyr and Terbuthylazine gave robust and persistent summer and winter weed control in the spray fallow rotation.

Imazapic+Imazapyr + Terbuthylazine provided very good control (90%) of hard to kill summer grass species and Afghan melons (85%) at Wyalkatchem.

Terbuthylazine is a very effective and safe active for many crop species when used at appropriate rates in the spray fallow rotation and was the highest yielding active for Scepter wheat and Latrobe barley at Mullewa.

Glyphosate treated fallow provided the highest yields for all wheat and barley varieties at Mingenew.

Imazapic proved a very handy active at Wyalkatchem where a wet summer caused a large infestation of summer grasses.

Conclusion

Choose herbicide actives to suit weed spectrum, soil pH, rainfall and crop type to make residual spray fallow a success. Herbicides must be registered for this purpose.

Spray fallow as part of a rotation can be more profitable than crop on crop, depending on seasonal variability and rainfall.

Notes:

How well do we understand and manage multiple herbicide resistance in wild radish with the existing chemistries?

Roberto Busi, Mechelle Owen and Stephen Powles, UWA Australian Herbicide Resistance Initiative, School of Agriculture and Environment

Key messages

- Herbicide efficacy on wild radish and TT canola (pot studies) provide insight for improved wild radish control and future research work.
- Three-way herbicide mixtures (herbicide groups C+F+I and C+H+I) appear the most effective options to control multiple resistant wild radish.

Background

Wild radish is the second most damaging weed in Australia which is clearly affecting famers' decisions. Multiple-resistant wild radish is an acute problem in the Western Australian grain-belt. Wild radish has been recently found to have the potential to evolve resistance to all selective herbicides currently available for its control.

Research was conducted to assess the efficacy of two-way and three-way herbicide mixtures on multiple-resistant wild radish and TT-canola plants. Herbicide efficacy data provide insight on how to maintain high-level herbicide efficacy in the early stages of resistance evolution and delay the onset of multiple-resistance.

Conclusion

A major aim of this study is to minimize the risk for evolution of resistance to the existing herbicides that still provide highly effective control of continuously evolving wild radish field populations (e.g. herbicide groups C, F, H, I) before resistance is reported from the field. Thus, we aim to sustain the long-term efficacy of existing and novel herbicide solutions.

From this study it appears that three-way mixtures (for example bromoxynil + MCPA + picolinafen or bromoxynil + MCPA + pyrasulfotole) can achieve the greatest efficacy in wild radish control. Future studies with pot-cultured wild radish plants (followed by field trials) will further investigate these mixtures on well characterized multiple-resistant populations. We aim to answer these important questions: "Can herbicide mixtures provide satisfactory control of stacked multiple-resistant wild radish?" "Can we rank the efficacy achieved with these herbicide mixtures"?

GRDC project code: UQ00080 – New uses for existing chemistries

Improve practices for weed control of multiple-resistant wild radish with current herbicides

Notes:

Important but underestimated fungal and viral threats to the Australian canola industry

Martin Barbetti[1,2], Ming Pei You[1,2] and Roger Jones[2,3], [1] UWA School of Agriculture and Environment, [2]UWA Institute of Agriculture, [3]DAFWA

Key messages

- Despite white leaf spot, downy mildew, powdery mildew and the resistance-breaking strain of Turnip mosaic virus (TuMV) being widespread and severe in some regions, their importance, along with *Alternaria*, is grossly underestimated nationally.
- Canola varieties with resistance against white leaf spot, downy mildew and powdery mildew were identified. These offer unique opportunities not only for their direct deployment in areas where one or more of these diseases is severe, but also for use by canola breeding programs.
- The severe TuMV resistance-breaking strain is widespread in the Liverpool Plains region of eastern Australia. It overcame all the TuMV resistance genes that currently suppress TuMV spread in canola varieties. Its spread to other canola-growing regions is likely to incur major losses nationally.
- Extension and research personnel often misdiagnose or fail to identify different canola foliar diseases.

Aims

To determine the incidence and severity of foliar disease of canola caused by the fungal pathogens white leaf spot, downy mildew, Alternaria and powdery mildew, and understand the threat posed by the new resistance-breaking TuMV strain.

Results

Australia-wide surveys were undertaken in 2015 and repeated in 2016 to establish the incidence of canola fungal foliar diseases, and an in-depth study was made of canola varietal responses to challenge with the resistance-breaking TuMV strain from NSW. These investigations revealed that:

White leaf spot: White leaf spot disease occurred widely throughout canola crops across southern Australia and was at high incidence and severe particularly in WA, northern NSW and western Victoria. Up to 60% of leaves were diseased, with up to 30% of leaf area lost and 20% of leaf area collapsed from lesions.

Downy Mildew: Downy mildew disease was extremely widespread and severe in WA with lower levels in other states. Up to 55% of leaves were diseased, with up to 15% of leaf area lost and 13% leaf area collapsed from lesions.

Powdery mildew: While generally not a problem early in the growing season, as plants approached maturity, very high disease levels were observed in the northern agricultural area of WA and Moree region of NSW.

Alternaria: *Alternaria* caused sporadic disease of canola crops in WA, western Victoria and northern NSW, with up to 10% of leaves diseased and 5% of leaf area lost to lesions.

Turnip mosaic virus: When 19 canola varieties were challenged with the new TuMV resistance-breaking strain, all their resistances were overcome, while other TuMV strains elicited resistance responses that prevent spread. This lack of any effective resistance against this new strain explains the new strain's widespread occurrence annually in the Liverpool Plains region, NSW.

Identification of resistant canola varieties. Canola varieties with effective resistances were identified against white leaf spot, downy mildew and powdery mildew.

Conclusion

White leaf spot and downy mildew diseases were particularly debilitating on younger canola crops. *Alternaria* disease was problematic in wetter years, and powdery mildew disease was a significant issue for northern regions of NSW and WA. The TuMV resistance-breaking strain overcame the resistances present in all canola varieties tested. As its range expands it poses an increasing threat to the national canola industry. Other than identifying blackleg and Sclerotinia diseases, extension and research personnel are missing or misdiagnosing other foliar diseases, grossly underestimating their threat to the national canola industry.

These disease-resistant varieties offer unique opportunities for (i) their direct deployment where any of these diseases are severe, and (ii) canola breeding programs to develop commercial varieties with effective resistance. With resistance-breaking TuMV, a comprehensive search of canola germplasm is required to identify TuMV resistance sources suitable for use in canola breeding. Without such resistance the entire national canola industry is likely to be threatened by its spread.

Notes:

Choosing the best yielding wheat and barley variety under high crown rot

Daniel Huberli, Kris Gajda, Miriam Connor, Andrew Van Burgel, DAFWA

Key messages

- Yield loss from crown rot infection varied among barley and wheat varieties in all three years tested, ranging from 0 to 1.85 t/ha (0–59% yield loss) for barley and 0 to 1.11 t/ha (0–42% yield loss) for wheat.
- An understanding of the crown rot disease history of a paddock and choosing varieties with the appropriate disease resistance ranking can improve crop yield substantially in the presence of crown rot.

Aims

Determine the relative yield loss of new and commonly grown barley and wheat varieties to crown rot infection in Western Australia.

Results

All barley and wheat varieties had reduced yield in inoculated plots, however, significant differences ($P < 0.05$) were evident between varieties in all years and sites tested.

In the barley trials, La Trobe$^{\Phi}$ and Litmus$^{\Phi}$ consistently had the lowest yield reductions from crown rot infection. Yield of Bass$^{\Phi}$ and GrangeR$^{\Phi}$ were consistently the most heavily impacted by crown rot infection losing up to 59% yield to the disease.

In wheat, the yield of Emu Rock$^{\Phi}$ was the least affected by crown rot across most seasons and sites ranging between 0 to 13% yield loss. Justica CL$^{\Phi}$ was the lowest yielding variety under crown rot infection with the highest yield losses of 23 to 42% across all seasons and sites.

Conclusion

These results show that variety choice under high crown rot disease pressure can have an impact on yield. For example, at Wongan Hills in 2016, with added crown rot inoculum, Emu Rock$^{\Phi}$ yielded 0.29 t/ha ($P < 0.001$) more than Mace . However, in the plots without crown rot, Mace$^{\Phi}$ out-yielded Emu Rock$^{\Phi}$ by 0.30t/ha ($P < 0.001$).

Understanding the crown rot disease history of a paddock and choosing varieties with appropriate disease resistance ranking can improve crop yield substantially. It is important to realise that in a year with good rainfall with no or very low levels of disease expression (whiteheads), inoculum levels can build-up substantially in paddocks with a tight cereal rotation and impact of future crops.

Notes:

UAV monitoring of rhizoctonia bare patch

Andrea Hills[1], Phil Goulding[2], Daniel Huberli[2], Geoff Thomas[2] and Lachlan Beveridge[3], DAFWA [1]Esperance and [2]South Perth, [3]ThinkSpatial

Key messages

- Ground-truthing of patches shows that rhizoctonia significantly reduces cereal grain yields and affects grain quality.
- Rhizoctonia patches can be easily identified by both normal and NDVI images captured by UAV.
- Mapping of rhizoctonia patches quantifies the area affected at a paddock scale, bringing damage into perspective and whether treatment is necessary — it is easy to overestimate affected areas otherwise.
- Images can be used to determine the best approach to treatment for susceptible crops – blanket applications vs zoning to optimise economic returns to growers.

Aims

Can UAV images capture where rhizoctonia patches occur? Can we use these images to formulate a treatment approach to use when applying fungicide at sowing in the next wheat or barley crop?

Results

Ten sites sown to wheat or barley (plus one lupin crop) were monitored in 2014–2016 in the Esperance and South Stirlings district to produce 14 site years (not all sites in each year).

Rhizoctonia could be clearly identified in both the normal and NDVI UAV images produced for each paddock. In 2015, sites were flown three times, from July to September and across sites and environments; all images were useful, that is there was no particular time/growth stage that consistently produced better images — weather (wind) at the time of the flight is more important.

A selection of rhizoctonia patches observed on UAV images were ground-truthed with root disease assessments and PredictaB results confirming that patches were primarily caused by rhizoctonia, although nematodes were present at seven out of ten sites.

Grain yield losses within the monitored patches ranged from 9–96% with strong site and seasonal effects; the average yield penalty was 60% in 2015. There was also a decrease in barley grain quality in screenings, grain weight, colour and hectolitre.

Images showed how levels of rhizoctonia varied substantially across paddocks and sites so that zoning for treatment applications at sowing would be useful in some paddocks while in others a blanket application of fungicide is likely to give a better economic return.

Mapping rhizoctonia patches manually in a GIS program is arduous, taking days to do, but good progress is being made in the development of software to automate this process which will give growers and consultants a useful tool. The program uses images to quantify the area of rhizoctonia present and where patches are, simplifying the process of identifying which paddocks are worth treating. The output is a shape file that can be uploaded for zoned treatment applications if desired.

Crop residue dynamics are similar across contrasting crop rotations under no-tillage

[1]Nathan Craig, [1]Ken Flower, [1]Michael Renton, [2]Phil Ward, [3]Gupta Vadakattu,
[1]UWA Institute of Agriculture, CSIRO Agriculture and Food [2]Wembley and [3]Glen Osmond (SA)

Key messages

- Crop residue present under no-tillage is an accumulation of many years' worth of crop residue.
- The amount of crop residue (quantity), rather than the carbon to nitrogen ratio (quality), had a greater influence on the amount of nitrogen released from the crop residue during the season.

Aims

To determine the effect of two contrasting crop rotations on crop residue biomass and biomass nitrogen concentration in a long-term no-tillage farming system.

Results

The amount of crop residue, and concentration of nitrogen, was compared between a 'diverse' rotation of chickpea-canola-wheat and a wheat-wheat-wheat monoculture under long-term no-tillage. It was evident that crop residue accumulates from year to year, making the crop residue under both the diverse rotation and monoculture a mix of different residue types at various stages of decomposition. The annual contribution of crop biomass following harvest to the crop residue ranged in the order wheat>canola>chickpea. Legume residue increased the concentration of nitrogen and lowered the overall carbon to nitrogen ratio of crop residue, but this had little influence in governing the decomposition of the crop residue for the diverse rotation. For both the diverse rotation and monoculture, the carbon to nitrogen ratio of the crop residue was relatively high due to the greater carryover of cereal residue, leading to a potential limitation of available nitrogen in controlling the rate of decomposition of crop residue. Consequently, there was a strong relationship between the amount of crop residue present on the soil surface at sowing and the amount of nitrogen released from the crop residue during decomposition in the growing season.

Conclusion

Crop residue under long-term no-tillage should be considered as a continuum of crop residue, with the addition of individual crop residue types (e.g. legume residue) having little effect on the release of nitrogen from crop residue. The high carbon to nitrogen ratio of crop residue under no-tillage could have implications for nitrogen availability, as immobilisation of nitrogen during the decomposition of crop residue may reduce the availability of nitrogen for crop growth during the growing season.

Notes:

Canola National Variety Trial Results 2016

Matthew Davey, Kalyx Australia and Jackie Bucat, DAFWA

Key messages

- The 2016 growing season was wet across the state. Agzone 1-5 had optimal conditions whereas Agzone 6 experienced extremely wet conditions. The above average rainfall for the state and the long growing season favoured the mid-maturity class over the early maturity class.
- Bayer's new TT hybrid, InVigor T 4510 performed exceptionally well across all sites, surpassing the current benchmark Hyola 559TT by 120kg/ha on average, albeit with 1.4% lower oil. Monola 416TT was the overall highest yielding OP TT variety.
- Roundup Ready varieties Pioneer 45Y25 RR and Nuseed GT-53 were the highest yielding varieties in 2016. Nuseed GT-53 and GT-50 performed particularly well in the trials over 2t/ha. Pioneer 44Y24 performed well across the board. The early maturity Pioneer 43Y23 and Hyola 404 were both top performers again in there maturity class.
- In the IT chemistry group, Pioneer 44Y90 performed remarkably well across all environments.

Aims

To generate independent information to growers about current and newly released crop varieties.

Results

Bayer's new TT variety, InVigor T 4510, performed exceptionally well in the long season of 2016. InVigor had high yields at all 18 trial sites, apart from the lowest yielding trial, at Hyden. InVigor T4510 exceeded Hyola 559 by 120kg/ha on average, but produced 1.4% lower oil. Hyola 650 also out yielded Hyola 559 in 2016, although was only in five trials.

Both ATR Stingray and ATR Mako out yielded ATR Bonito by 90-100kg/ha, when comparing matched trials (where concerned varieties were both grown). The hybrids Hyola 559 and InVigor T 4510 out yielded ATR Bonito by 330 and 440kg/ha, respectively

RR varieties, Pioneer 45Y25 and GT-53 topped the yield leader board in 2016.

The new Podguard variety, InVigor R 5520P, was a marked improvement on IH51 RR Podguard in both yield and oil.

Pioneer 44Y90 (CL) had the best yield and oil for all trials. Yield of Pioneer 45Y91 was (not significantly) above Pioneer 45Y88 yields and outperformed by Pioneer 44Y90 for yield and oil, at both sites where varieties were grown together.

Conclusion

It is advisable not to make recommendations or management decisions on variety replacement or retention based solely on the 2016 NVT data.

The Canola NVT presentation will include;

1. Analysis of the 2012–2016 MET results (yet to be released, at time of writing)
2. Variety recommendations for 2017
3. Data of the most popular canola varieties grown in 2016.

Agronomy for early sown canola

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

Key messages

- 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 40kg/ha/day but this benefit declined when sowing in late March vs mid-April to approximately 10kg/ha/day.
- Climatic and agronomic risks increase with early sowing.

Aims

To consolidate information and provide guidelines for best bet management of canola sown at or before mid-April.

Results

Results of yield, seed quality, nutrition, plant density and pest and disease studies are presented in the paper. There was a large yield benefit from establishing canola in mid-vs late April at Binnu but this declined when sowing in Late March compared to Mid-April at Wongan Hills. The implications of the results on management of canola are discussed.

Conclusion

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 in the time of sowing trials reported in this paper. 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 however there are still significant risks when sowing very early; weeds and pests need to be controlled over a long period and plants may be flowering at high frost risk times.

Notes:

Love them legumes — recent adventures with lentils, peas and beans

Mark Seymour, DAFWA

Key messages

- PBA Bolt is a good first choice for Esperance lentil growers, with PBA Ace and PBA Jumbo 2 as options for early sowing or longer seasons. The new XT line CIPAL1422 performed well and looks like being a valuable alternative to PBA Hurricane XT for those growers wishing to use imazethapyr (e.g. Spinnaker®) or facing SU carryover issues.
- Hurricane XT provides useful tolerance to SU carryover compared to field pea and conventional lentil varieties.
- Hurricane XT tolerated medium and high rates of imazethapyr.
- PBA Samira was the highest yielding released faba bean variety at Wittenoom Hills.

Aims

There appears to be renewed interest from growers and the agricultural community in legume break crops to complement canola and cereals in the rotation. For example, in the Esperance region a number of farmers bulked up lentil seed in 2016 in anticipation of sowing larger areas in 2017. This paper summarises some of the experiments conducted in 2016 by DAFWA in partnership with the GRDC via the Tactical Break Crop Agronomy Project DAW00227 which supports the growing interest in legume crops.

Results

CIPAL1422 which is destined to be the new XT lentil variety (with improved botrytis grey mould resistance) performed well, producing equal or higher yields than Hurricane XT or Herald XT. Of large red varieties Jumbo 2 outperformed Jumbo — which was expected. In the medium red lines, PBA Bolt performed well in 2016, with no variety out-yielding it. CIPAL1301 which is the next conventional variety set for release did not match the yield of PBA Bolt at any site in WA in 2016. The long cool spring appeared to suit the mid-season variety PBA Ace which performed well at all sites ranking No.1 overall and in the top 5 at all sites.

Conclusion

Pulse crops produced excellent biomass and seed yield in the Esperance region in 2016. Frost did damage some grower's crops but our experiments managed to avoid most of the frost and in the cool spring set up excellent yields. The latest lentil varieties appear to provide superior yield potential and we can expect more grower interest in them if prices remain at current levels. Faba beans have consistently produced good yields in the Esperance region for a number of years and currently available varieties have very useful levels of disease resistance. The uptake of faba beans will be reliant on early sowing opportunities, improved price signals and increased seed availability in WA.

Notes:

New pasture legumes for the grainbelt

Phillip Nichols[1,2] and and Bradley Wintle[1], [1]DAFWA South Perth, [2]UWA School of Agriculture and Environment

Key messages

- Tammin$^{\Phi}$ and Forbes$^{\Phi}$ are new early flowering sub-clovers with greater hardseededness than older cultivars and seedling resistance to redlegged earth mites, making them better suited than older cultivars to crop rotations in low-medium rainfall areas.
- Rouse$^{\Phi}$ and Yanco$^{\Phi}$ are new highly productive, waterlogging-tolerant sub clover cultivars of the *yanninicum* subspecies for high rainfall grainbelt areas.
- SA40002 messina, a new annual pasture legume species to world agriculture with salt and waterlogging tolerance, and a special messina *Rhizobium* are available for sowing in 2017.

Aims

This paper describes four new subterranean (sub) clover cultivars bred by DAFWA and the first cultivar of messina (*Melilotus siculus*), a new annual pasture legume for saline, waterlogged soils.

Results

Across six sites and three seasons cvs Tammin$^{\Phi}$ and Forbes$^{\Phi}$ produced 11-12% more biomass than cv Dalkeith, while after a year in crop at Tammin and Katanning cv Tammin$^{\Phi}$ produced 56% more spring biomass and Forbes produced 96% more than Dalkeith. In the May following seed set in Perth Tammin$^{\Phi}$ had 51% and Forbes$^{\Phi}$ had 33% of hard seeds, compared to 16% for Dalkeith. After two years Tammin$^{\Phi}$ still had 19% hard seeds, Forbes$^{\Phi}$ had 9% and all other cultivars had ≤2%, while after years Tammin$^{\Phi}$ had 8% of seeds still hard. In glasshouse trials Tammin$^{\Phi}$ and Forbes$^{\Phi}$ had ~6% cotyledon damage from redlegged earth mites (RLEM), compared to >25% for other cultivars.

Over three years at Mt Barker and Manjimup and two sites in Victoria cvs Rouse and Yanco produced 46% and 27% more biomass, respectively, than cv Riverina, and 29% and 12% more biomass, respectively, than both cvs Gosse and Trikkala.

The high tolerance of messina to both salinity and waterlogging in the field has been confirmed in the glasshouse. SA40002 has been selected as the most productive and persistent messina variety in five trials in WA and SA. Over three years at Darkan and Tambellup total biomass yield of cvs Frontier$^{\Phi}$, Scimitar$^{\Phi}$ and Jota was only 17%, 16% and 3%, respectively, of SA40002 messina, which had a highest annual plot yield of 7.6t/ha. A special salt tolerant *Rhizobium* strain (SRDI554) has been selected to overcome nodulation failure with the commercial annual medic strain.

Conclusion

The high hardseededness and RLEM resistance of Tammin$^{\Phi}$ and Forbes$^{\Phi}$ make them better adapted than other sub-clovers to crop rotations. Tammin$^{\Phi}$ is suited to 300-450mm annual average rainfall (AAR) areas and Forbes$^{\Phi}$ suited to 350-525mm AAR. Rouse$^{\Phi}$ and Yanco$^{\Phi}$ are highly productive waterlogging-tolerant sub-clovers, with Yanco$^{\Phi}$ suited to 450-700mm AAR areas and Rouse$^{\Phi}$ to 550-900mm AAR areas. The new cultivars are estimated to increase the annual value of livestock production by $10-$18/ha and nitrogen (N) input by $12-$18/ha. Seed Force is marketing the four cultivars, with Tammin$^{\Phi}$ and Rouse$^{\Phi}$ available in 2017, Yanco$^{\Phi}$ in 2018 and Forbes$^{\Phi}$ in 2019.

SA40002 messina offers a new opportunity to increase pasture productivity on N-deficient saline, waterlogged soils unsuited to cropping with $pH_{(Ca)}$ ≥5.5 in areas with ≥375mm AAR. The FFI CRC estimated messina can increase productivity by four dse/ha, allowing mixed farmers to increase crop area, while maintaining stock numbers. SA40002 messina will be launched in March 2017. Seed and the special salt-tolerant *Rhizobium* are available through Seednet.

Decay of pre-emergent herbicides in dry soils

David Minkey, Western Australian No Tillage Farmers Association

Key messages

- Results indicate that Sakura®, Boxer Gold® and TriflurX® decay slowly under dry soil and can be applied early under these conditions
- Under wet conditions decay of these herbicides was rapid and was highest under warm conditions (earlier application)
- Sakura had the slowest decay rates followed by Boxer gold and then TrilfurX
- Soil type had little effect on the decay rates.
- Do not rely on pre-emergent herbicides to last under wet conditions when sowing in April.

Aims

To determine the decay curves of pre-emergent herbicides when dry seeding wheat to develop weed management strategies when sowing early.

Results

Under relative dry conditions all herbicides persisted in the soil over the six weeks which makes them all suitable for dry seeding. Under natural wet conditions as experienced during 2014 and 2015 decay of the herbicides trials decayed at different rates with TriflurX being the fastest, followed by Boxer Gold and then Sakura. Results indicate that TruflurX would give you 2–3 weeks protection, Boxer Gold 3-4 weeks protection and Sakura 4–6 weeks protection. However, efficacy was assessed under a non-competitive environment (no crop) which may reduce the protective time frame. The rate of decay did reduce faster under the earlier applications presumably due to the warmer conditions encountered (data not shown). Soil type did not appear to affect decay although bio availability may have been reduced (not significant) in the heavier soil type.

Using the Weed seed wizard to predict germination in Cunderdin in 2015 it shows the major flush of germination of annual ryegrass to be around mid may. If sowing wet in Mid-April, while you will have significant crop competition moist of your herbicide options would have run out with the expectation of possibly Sakura. With a late April sowing you would have protection form the major flush with all options but not later flushes with TriflurX and maybe Boxer Gold. Sakura would give you some protection into early June. Significant risk is therefore a major factor when dry seeding very early. Predicting future rainfall events will be crucial for dry sowing early.

Conclusions

Under dry soil conditions the herbicides used in the study all persisted until the 5th or 6th week. Under these conditions all pre-emergent used would be deemed suitable for dry seeding purposes.

Under natural wet conditions as experienced during 2014 and 2015 decay of the herbicides trials decayed at different rates with TriflurX being the fastest, followed by Boxer Gold and then Sakura. Results indicate that TruflurX would give you 2–3 weeks protection, Boxer Gold 3–4 weeks protection and Sakura 4–6 weeks protection. However, efficacy was assessed under a non-competitive environment (no crop) which may reduce the protective time frame. The rate of decay did reduce faster under the earlier applications presumably due to the warmer conditions encountered. Soil type did not appear to affect decay although bio availability may have been reduced in the heavier soil type.

The risk with early dry seeding wheat is when a rainfall event occurs before dormancy of annual ryegrass is broken and the residual life span is not long enough to last until the major flush of germination occurs — usually mid to late May.

Effect of crop residue and rainfall on the availability of pre-emergent herbicides in the soil

Yaseen Khalil [1,2], Ken Flower[1,2], Kadambot H.M. Siddique[2], Phil Ward[3], Colin Piggin[4], [1]UWA School of Plant Biology, [2]UWA Institute of Agriculture, [3]CSIRO, [4]ACIAR

Key messages

- Most herbicide was leached from stubble into the soil with higher rainfall amounts that occurred soon after herbicide application, and with rain in one event, rather than multiple events. However, the intensity of rainfall had no effect.
- Less herbicide was leached after rainfall when the chemicals were applied to initially wet, compared with dry residue. This was less so for pyroxasulfone.
- Rainfall was very effective in leaching pyroxasulfone from the residue into the soil to provide good weed control, even in heavy residues of 4t/ha when rainfall occurred up to 14 days after herbicide application.
- Rainfall was less effective at leaching prosulfocarb and improved weed control (from the leached chemical) only occurred with rain up to seven days after herbicide application.
- Rainfall was least effective in leaching trifluralin from the residue into the soil, with little improvement in 'weed' control when rainfall occurred one day after herbicide application.

Aims

Determine the effect of rainfall amount, intensity and timing on leaching of trifluralin, pyroxasulfone and prosulfocarb from crop residues.

Investigate the effect of amount of crop residue and its moisture content on retention and leaching of trifluralin, pyroxasulfone and prosulfocarb.

Results

Rainfall effects

Some of the herbicide leached from the residue with as little as 5mm of rainfall, although higher rainfall amounts generally leached more herbicide from the residue. The sooner the rainfall occurred the greater the amount of herbicide leached. There were no differences between rainfall intensities. Multiple rainfall events (four events of 5mm over two days) leached slightly less intercepted herbicide off the wheat residue than a single event of 20mm.

Herbicide effects

Rainfall was very effective in leaching pyroxasulfone from the residue into the soil, even in heavy residues of 4t/ha when rainfall occurred 14 days after herbicide application. Rainfall leached less prosulfocarb and this only occurred with rain up to seven days after application of the chemical. Trifluralin leached the least, with little improvement in 'weed' control when rainfall occurred one day after herbicide application.

Residue effects

Less herbicide leached from the crop residue after rainfall, when the chemicals were applied to initially wet residue, rather than dry residue. Increased amounts of wheat residue intercepted more herbicide, with a large increase in interception from 2 to 4t/ha. However, 100% ryegrass kill was achieved with pyroxasulfone after rainfall, even with 4t/ha.

Conclusion

Crop residues intercept herbicides during application. Some of the herbicide washed off the residue with as little as 10–20mm of rainfall. The sooner the rainfall occurred the greater the amount of herbicide leached. There were no differences between rainfall intensities. Multiple rainfall events of 5mm over two days leached less intercepted herbicide off wheat residue than a single event.

More herbicide was retained on crop residue after rainfall, when the chemicals were applied to initially wet residue, rather than dry residue. When assessing the herbicide availability in the soil underneath the wheat residue, wet residue was intercepting significantly more herbicides comparing to the dry one. More wheat residue presence on soil surface, intercepted more herbicide and stopped them from reaching soil surface.

Notes:

Aphid update — Russian wheat aphid and Green peach aphid. Where are we at with these pests?

Dusty Severtson[1], Rosalie McCauley[1], Nichole Hammond[1], Jeff Russell[2], Sharyn Taylor[3], DAFWA [1]South Perth and [2]Northam, [3]Plant Health Australia

Key messages

- The Russian wheat aphid (RWA) was first detected in Australia in May 2016 south of Tarlee, SA.
- RWA was deemed unable to be eradicated following widespread detections in SA and further detections in Victoria and then NSW during 2016.
- RWA was not detected in WA following extensive surveillance conducted during June–December, 2016.
- Growers and consultants in WA should remain vigilant in the coming season, continue to report presence and absence of RWA and plant damage symptoms in cereal and grass plants, and be prepared to manage this new pest should it be found in WA and unable to be eradicated.

Aims

To provide an update to the WA grains industry on surveillance for RWA in WA and effective management should the pest be found in WA.

Results

Immediately following the announcement of RWA in SA, surveillance was conducted by DAFWA staff, growers and consultants to assess 1) the possibility of RWA being found in WA and 2) whether isolated cases of RWA in WA may be contained and eradicable.

Between 1 June and 31 December 2016, 681 reports were submitted to DAFWA of absence of RWA and presence or absence of other aphids on cereal or grass plants. This included 485 cases where cereal or grass plants were inspected for RWA and none were found. Furthermore, 196 reports were made where other aphid species were found on these hosts in the absence of RWA. Most of these aphid reports (104) were identified as the common oat aphid.

Conclusion

If RWA is found in WA in the coming growing seasons, it is anticipated that it will be manageable with insecticide applications where RWA populations reach damaging levels. However, because RWA seems to be able to cause more damage than the common oat or corn aphids (because of toxins injected into the plants), it is probable that cereal crops will need to be monitored for this pest and more often (than oat and corn aphids) to prevent outbreaks and subsequent economic damage.

Notes:

The invisible threat: Canola yield losses caused by root lesion nematode in WA

Sarah Collins, Carla Wilkinson, Sean Kelly, Helen Hunter, Lucy DeBrincat, Karyn Reeves and Kefei Chen, DAFWA South Perth

Key messages

- Canola yields were significantly reduced (average 16% yield loss) by medium to high root lesion nematode (RLN; *P. neglectus* or *P. quasitereoides*) populations at sowing.
- Variety selection reduces potential yield impacts caused by RLN, but where starting levels are medium to high, substantial yield loss may occur for all varieties of TT canola tested.
- Lupins are resistant (reduce nematode densities) and tolerant (no yield loss in the presence of RLN) to medium to high populations of *P. neglectus* and *P. quasitereoides* and can be used as a break crop to reduce nematode populations in a poor yielding paddock.

Aims

This paper describes the resistance (impact of crop on nematode density) and tolerance (impact of nematode on crop yield) of triazine tolerant (TT) canola varieties to root lesion nematodes *Pratylenchus neglectus* and *P. quasitereoides* in different Western Region Agzones. These are the first yield loss trials of this kind conducted in WA. The field resistance of canola is also compared to other commonly grown crops; wheat, barley and lupins.

Results

Crop and variety resistance to RLN (nematode impact)

Canola was susceptible to both species of RLN tested (multiplication > 1); the *P. neglectus* population increased five-fold (Wongan Hills) to an average of 45 RLN/g soil while *P. quasitereoides* increased three-fold (Gibson) to 12 RLN/g soil during the growing season. All canola varieties increased the RLN levels over the season but the degree of multiplication for *P. neglectus* and *P. quasitereoides* was affected by the variety grown.

Resistance to *P. neglectus* differed for lupins, canola, barley and wheat, with lupins resistant and wheat most susceptible. For *P. quasitereoides*, lupins were resistant, but there was no difference in the resistance of wheat, barley and canola.

Canola tolerance to RLN (yield impact)

Yield impacts caused by RLN infestation were large with an average loss of 16% at both Wongan Hills (398kg/ha) and Gibson (275kg/ha) due to *P. neglectus* and *P. quasitereoides*, respectively. Yields of all varieties were reduced when RLN levels were medium to high at the time of sowing; average of 17 *P. neglectus*/g soil at Wongan Hills and 11 *P. quasitereoides*/g soil at Gibson.

Each canola variety tested sustained yield loss ($p<0.05$) where RLN levels were medium to high at sowing, with 11-21% and 9-22% yield reductions caused by *P. neglectus* and *P. quasitereoides* respectively. ATR Stingray was the highest yielding variety when RLN levels were low. Unfortunately it was the most intolerant variety with a loss of 21% (590kg/ha) when *P. neglectus* levels were high. For *P. quasitereoides*, ATR Stingray had the highest yield, even after 14% (271kg/ha) loss in the presence of medium *P. quasitereoides* at the time of sowing. Varieties with the best RLN tolerance were ATR Cobbler (11%; 270kg/ha) and Telfer TT (9%; 149kg/ha) yield penalty for *P. neglectus* and *P. quasitereoides*, respectively.

Conclusion

Canola experienced substantial yield losses due to root lesion nematodes *P. neglectus* and *P. quasitereoides* in these trials. Unfortunately, this indicates that these RLN species can cause yield loss in all of the broadacre crops most commonly grown in the western region; wheat, barley and canola. In our trial series lupins have been consistently resistant to both *P. neglectus* and *P. quasitereoides* and its yield was not affected confirming that lupin is a reliable break crop for these RLN species. For paddocks infested with *P. quasitereoides*, barley, canola and wheat are equally susceptible and will most likely increase nematode levels. In paddocks infested with *P. neglectus*, canola is less susceptible than barley, which is in turn less susceptible than wheat. For both RLN species there are differences in susceptibility between cultivars which can be utilised by growers to limit RLN build up to prevent potential yield loss in grain crops. Wheat and barley, resistance information can be found in local variety guides and can be used to help growers make rotational choices in infested paddocks.

Notes:

Findings from seven years of grazing crops research in WA

Philip Barrett-Lennard, agVivo

Key messages

- Whole farm profit can be increased by grazing crops
- The value of additional crop and livestock production (through changes to the farming system) can more than offset the small grain yield penalties that commonly occur when grazing crops
- Early sowing with light and early grazing is recommended when grazing crops

Aims

The Grain & Graze 2 (2009 to 2012) and Grain & Graze 3 (2013 to 2016) projects, funded by GRDC, conducted a range of R,D&E activities across southern Australia relating to mixed farming. Crop grazing has historically been used in the medium to high rainfall zones of NSW, but not widely adopted elsewhere. The aim of this research was to determine the profitability, practicality and farming system fit of grazing crops in Western Australia.

Results

The results from a large number of on-farm trials over the last seven years suggest that crop grazing in Western Australia can be profitable, practical and fit with modern mixed farming systems. Research conducted in Grain & Graze 2 indicated that small grain yield penalties typically occur when grazing crops. Grazing crops earlier (June) rather than later (July), and lightly (clip grazing) rather than heavily (crash grazing), reduced the size of grain yield penalties. Research conducted in Grain & Graze 3 indicated that early sowing (April) produced significantly more biomass for grazing than later sowing (May). It also indicated that both fast maturing winter cereals and slow maturing spring cereals can be suitable options when early sowing and grazing. On-farm research showed that sheep rapidly gain weight when grazing crops due to the high feed value and upright nature of the crop which promotes high animal intake. Economic modelling, used in both projects, showed that crop grazing can increase whole farm profits under certain scenarios. The biggest improvements in whole farm profit occurred when crops were sown early and grazed by high value animals in early winter when pasture is scarce. The extra winter feed provided by crops meant the livestock could be run on a smaller area of pasture. As a consequence, crop area was expanded.

Conclusion

Mixed farmers in Western Australia can improve whole farm profit by grazing crops. Care needs to be taken to minimise grain yield penalties, as these can quickly erode any gains made from increased livestock productivity. Grazing crops with high value animals (e.g. twin bearing ewes, trade cattle) is recommended.

Notes:

More Profit from Crop Nutrition — outcomes and achievements — Science and social media — how they can improve your soil nutrition?

Tony Cox and Fleur Muller, NSW Department of Primary Industries

More Profit from Crop Nutrition phase II (MPCN ll) is a National Program that has been operating since 2012. It is active in the North, West and South grain regions and was set up with specific aims.

These aims were to improve investment from fertiliser inputs by;

- Improving the nutrient efficiency of crops
- Improving the capacity of soils to supply nutrients
- Reducing the soil's propensity to lose or lock up nutrients
- Develop improved fertiliser product formulation and design including the use of potentially valuable, low cost and waste inputs

MPCN had goals which were:

- Increased adoption of nutrition knowledge across Australia
- Improved coordination of communication and extension across the grains and fertiliser industries — a need to develop stronger linkages
- Improved tools that are used by grain growers and advisors to improve nutrient use efficiency
- Documentation of emerging ideas and capacity challenges

MPCN was divided into six program themes:

1. Make nutrient use efficiency traits available to plant breeders in adapted backgrounds
2. Better match N, P,K and S inputs to meet crop demand and minimise losses and tie-up
3. Make better use of micro-nutrients to correct deficiencies and enhance crop yield
4. Develop and test new fertiliser products and adjuvants
5. Provide information to growers to make effective fertiliser decisions
6. Coordination of a program with a lasting legacy of analysed, reported and published information

The outcomes of this National research project have contributed to the BFDC II data base. This data base has provided a searchable data base for all grain crops and all soil types across Australia to produce soil test crop response calibration curves. The calibration curves provide critical nutrient ranges for 80 90 and 95% of Ymax. This data is used by the fertiliser industry and is imbedded into DSS tools to provide industry with valid scientific data to make better informed fertiliser decisions and increased farm profitability.

BFDC has developed new functionality and is undergoing updates and changes to provide more value to industry. Getting the BDCD and information data to industry has become a challenge with the downturn in extension services and as such we have looked for new methodologies to extend MPCN outcomes and BFDC information.

The utilisation of online technology and social media in Australian agriculture is expanding rapidly and offers huge potential in terms of connecting growers to evidenced-based information and tools. Online networks may also foster greater collaboration between researchers and research projects. One such relationship between GRDC's More Profit from Crop Nutrition 11 program and eXtensionAUS is giving Australian grain growers and advisors greater access to reliable science-based crop nutrition information and the Better Fertiliser Decisions for Cropping Systems (BFDC) decision support tool.

The BFDC data base and interrogator developed by GRDC's MPCN11 program assists advisors and farmers to make improved and more consistent fertiliser decisions by understanding soil test crop response data contained within the BFDCII data base. With over 5700 trial data sets, it covers the majority of crops grown in Australia and is the largest dataset of its kind.

Linking with eXtensionAUS – an Australia wide online learning network, has help extend the awareness of BFDC to a larger audience. Key messages and events have been promoted to farmers, advisors and agricultural researchers utilising webinars, articles and videos delivered via online channels such as the web, Twitter and YouTube.

These non-traditional extension methods have helped to make the latest crop nutrition information more accessible to growers and advisors who are time poor.

Notes:

Living with fungicide resistance — lessons for WA grain growers

Fran Lopez[1] and Lise Jorgensen[2], [1]CCDM, Curtin University, [2]Aarhus University

Lise Jorgensen

Lise Jorgensen, a leading Danish researcher, will provide timely advice on strategies for managing fungicide resistance for Western Australian grain growers.

Lise is a Senior Scientist at Department of Agroecology at Aarhus University (Flakkebjerg). The areas of her research include disease management, disease forecasting, fungicides' efficacy and fungicide resistance in cereal and other crops, concentrating on the optimisation and minimisation of fungicide use in cereals and fungicide resistance.

Western Australian grain growers are seeing the first signs of fungicide resistance to chemicals used to control plant diseases. Like herbicide resistance, this can lead to rapid escalations in the cost of managing disease in grain crops. Lise will discuss her research and outline the strategies used by European farmers to manage fungicide resistance and offer suggestions on how the Australian grains industry and growers can manage fungicide resistance before it becomes a major problem.

Dr Fran Lopez

Dr Fran Lopez will give a brief summary of the current status of fungicide resistance in Western Australian grain crops, the monitoring and management strategies currently used and outline the current research being undertaken to address fungicide resistance in Western Australia at the Centre for Crop and Disease Management and elsewhere in Australia.

Notes:

Canola diseases

Focus Session 1 – Crown Ballroom 3A

Sclerotinia is now a major issue for WA growers, last season it took hold. If it strikes again this year, how can it be managed?

How can you get ready for the coming season? In this session we will thresh out the issues, taking a global and local look at what other industry members are doing about the problem. To work up strategies for the coming seasons, we will be exploring what has happened in the canola crop over the past few seasons. Together, let's find out.

Featuring Dr Lone Buchwaldt, canola pathologist from Canada, the session kicks off with how Canadians are managing this devastating disease, offering the opportunity for comparison to what we are doing.

Next, be prepared for robust discussion from consultants, growers, researchers, and fungicide suppliers on options for the 2017 season. A panel session will bring together:

Geoff Fosbery from ConsultAg — giving a consultant's point of view on how growers are tackling canola diseases in recent years, with recommendations for the 2017 season based on what he's seen.

Rick Horbury from Bayer — providing insights into fungicide management strategies from his observations of different grower programs and his trial work over the past few years developing new products for the control of sclerotinia.

Timing of sprays and row spacings are important, as are other integrated disease management methods, these will be explored by **DAFWA's Ravjit Khangura**.

Prospects for new tools will be discussed by **CCDM's Matthew Denton-Giles**.

CCDM's director Mark Gibberd and **DAFWA canola agronomist Mark Seymour** will facilitate a series of targeted activities to help get to the bottom of this complex, economic burden on WA's most profitable break crop.

Notes:

Frost: what's in your management tool box for 2017?

Focus Session 2 – Crown Ballroom 3B

Have you done an audit of your frost management tool box for this season?

The 2016 cropping season in Western Australia incurred severe frosts over a protracted period resulting in significant losses for growers in certain regions. The Grains Research and Development Corporation's National Frost Initiative is taking a multidisciplinary approach to providing solutions for growers to manage the impact of frost and maximise profit. These solutions will include tools that growers can deploy before and during the cropping season.

Come along and participate in an interactive focus session where experts will review the climate situation that drove the frost pattern we saw last season and discuss ways in which you can tailor your own frost management tool box for your cropping system.

This focus session will be opened by **Peter Roberts, Chair of the GRDC Western Region Panel and the National Frost Initiative**. It will include the following experts who will provide brief presentations and then be part of an interactive panel.

Ian Foster from DAFWA will provide a review of last year's frost event.

Garren Knell from ConsultAG will discuss the impact of last season's frost and repercussions on a farm business

Ben Biddulph from DAFWA will summarise currently available genetic and management tools for frost.

Nik Callow from UWA will present environmental monitoring tools and

Juan Juttner from GRDC will provide an economic assessment to prioritise research investment in tools to manage frost.

Discussion during the focus session will centre on auditing the frost tool box, highlighting those tools of maximum impact now and identifying gaps.

Notes:

New breeding directions and technologies

Focus Session 3 – Crown Ballroom 3C

Convenors: Dr Greg Rebetzke and Dr Mike Ewing

Yield increases along with maintained or improved tolerance to biotic stresses and product quality remain the main drivers for investment in crop breeding. However, the ways in which breeding is conducted and the technologies available to breeders is changing rapidly. Making sense of these new opportunities is a serious challenge to commercial breeders. In the session we will hear how new technologies are being integrated along with conventional breeding methods to deliver more robust varieties more rapidly and efficiently in our major crop improvement programs.

Understanding each specific breeding technology and the potential for industry impact is a major challenge for the non-specialist and we often latch onto the catchy words used by breeders without really understanding what is behind conventional and molecular technologies such as:

- Molecular markers
- Transgenic breeding or GMOs (Genetically modified organisms)
- Genomic selection
- CRISPR/gene editing
- High-throughput phenotyping
- Novel germplasm and FIGS (Focused Identification of Germplasm Strategy)
- Doubled-haploid and inbreeding
- Hybrid breeding

In the Forum local, interstate and international researchers will describe their technologies of interest in simple language and use local WA examples to demonstrate their application in current and future breeding programs.

Discussion at the end of the session will draw out views on the extent to which new breeding technologies, astutely applied and well integrated, can contribute to faster rates of genetic gain to deliver higher yielding, more resilient varieties for our main crop species.

Notes:

Soil management — unleashing productive potential

Focus Session 4 – Meeting Room 2

Join an interactive discussion with independent consultants and soil scientists to learn about managing multiple soil constraints to achieve optimal economic returns on investments

A panel of leading consultants and senior soil scientists will be led by Wayne Pluske of Equii. In a free-flowing and lively discussion, the panel will be challenged to recommend the best ways to tackle a range of soil limitations to production including acidity, sodicity, compaction, water repellence and nutrition. The focus will be on cost-effective amelioration of multiple soil constraints, taking into account soil type, location and seasonal conditions across the wheatbelt.

The panel will share their knowledge and experiences so the practical aspects of managing soil constraints, and in particular managing multiple constraints, can be considered.

GRDC Soil Constraints West research has demonstrated large benefits from overcoming multiple soil constraints. This session will discuss approaches to profitably manage soil constraints at a farm scale.

Consultant Panel members:

Craig Topham, Agrarian, Northern

Adriaan De Waal, Soil Fertility Management, Central/East

Tim Boyes, agVivo, Upper Great Southern and Central

David Sermon, Consultag, Central/South

Researchers Department of Agriculture and Food, Soil Productivity:

Chris Gazey (acidity), **Steve Davies** (water repellence), **David Hall** (subsoil constraints), **Wayne Parker** (compaction).

Notes:

Mixed farming

Focus Session 5 – Meeting Room 3

The vast majority of Western Australian grain growers still run livestock. And with livestock and wool prices at near record highs, now is an excellent time to be updated on the results of recent mixed farming R,D&E.

This Mixed Farming Focus Session will focus on the outcomes of the recently completed Grain & Graze 3 project funded by GRDC.

The focus session will be broken into three topics with leading contributors to this project all available to answer your questions.

Pastures in the rotation:

Paul Omodei, Planfarm – What are the drivers of mixed farming profitability

Perry Dolling, DAFWA – Nitrogen fixation by pastures, and which rotation for me

Grazing on crop land:

Ed Riggall, AgPro Management – Increasing sheep productivity with crop grazing and chaff heaps

Phil Barrett-Lennard, agVivo – The agronomics and economics of crop grazing

Decision making:

Danielle England, AgInnovate – Making the hard decisions easier

David Cornish, Cornish Consulting – Where does Mixed Farming sit in terms of Risk vs Reward

Notes:

Papers submitted and not presented at the Perth Update

For the 2017 Grains Research Update Series, the Program Committee received over 140 Expressions of Interest (EOIs) to present at the Grains Research Update, Perth. All EOIs were carefully considered and, unfortunately due to time constraints, only 40 papers could be accommodated to be presented at the Research Update, Perth.

All authors who offered to contribute papers to the 2017 GRDC Grains Research Updates Series were still invited to submit their papers for digital publication. All papers provided will be uploaded to the GIWA website at **www.giwa.org.au/2017researchupdates** and the GRDC website at **www.grdc.com.au** as soon as they are supplied and cleared.

Notes: