PERTH
WESTERN AUSTRALIA
MONDAY 24TH
TUESDAY 25TH
FEBRUARY 2020

GRAINS RESEARCH UPDATE, Perth
Program Book

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

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#GRDCUpdates

Proudly convened by:

GIWA
Grain Industry Association of Western Australia

2020 GRAINS RESEARCH UPDATE, Perth

24th and 25th February 2020

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#GRDCUpdates

Update Papers: grdc.com.au/resources-and-publications/grdc-update-papers

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#GRDCUpdates **Grains2020**

Welcome – GRDC Western Panel Chair

GRDC Western Region Panel Chair, Darrin Lee

Welcome to the 2020 Grains Research and Development Corporation (GRDC) Grains Research Update, Perth.

The Updates continue to be an important forum for growers, advisers, researchers and industry service providers to connect and share insights and knowledge to help further Western Australia's thriving $6.5 billion export-focused grain industry.

In order to remain competitive, we must continually adapt and change, which means updating our knowledge on current farming practices at forums such as this one.

The Updates organising committee fine tunes the program each year to ensure it is of maximum relevance to growers and 2020 is no exception, with more than 50 presenters set to share the latest research results and innovations to assist on-farm profitability over the next two days.

A key theme of the plenary sessions to kick off day one will be 'Grains RD&E in the United Kingdom', a very pertinent topic given the UK's official departure from the European Union only a few weeks ago.

It is fantastic to have two speakers make the trip over from the UK to give their perspective on grains RD&E in the UK in a post-Brexit environment and the impact Brexit will have on agriculture both in the UK and in Australia.

NIAB Crop Science chief executive Tina Barsby will provide insights into the funding and practice of small grain cereal R&D and knowledge exchange in the UK with a focus on who the main players are, how funding works, and how research outcomes reach the grower and lead to on-farm change. She will also discuss the UK's Plant Variety and Seeds Act and its impact on grains in the context of Brexit.

The UK farming sector is subject to some of the world's strictest pesticide use regulations and environmental controls on farming. With that in mind, UK agricultural consultant Keith Norman will provide the audience with an understanding of how regulatory controls can impact on grain producers' freedom to operate in our modern farming systems.

He will explain how UK growers have adapted and are operating in a practical way within that regulatory framework, which is perceived by much of Australia's agricultural sector as onerous.

The Updates will be rounded out on day two with a focus on technology innovations to improve crop research and grain enterprise management.

Tammin grower Brad Jones, Bungulla, will share his experiences using a complete annual workflow and farming system.

It will also be a great privilege to hear from BioScout co-founder and chief executive officer Lewis Collins. BioScout builds real-time airborne disease detection sensors for agriculture which allow growers to track and monitor disease in their paddocks in real-time via disease sensors.

Another international speaker in Jean Ristaino, of North Carolina State University, will outline the ground-breaking work her team is doing in the development of a portable technology, dubbed the 'Plant Sniffer', that allows growers to identify plant diseases in the paddock.

Professor Ristaino and her team have developed the handheld device, which is plugged into a smartphone, and works by sampling the airborne volatile organic compounds that plants release through their leaves.

The concurrent sessions are filled with some highly engaging presenters discussing important topics such as soil constraints, weed, disease and pest management, agronomy, grain markets and farming systems.

Despite the full program, there will be plenty of opportunities for you to network with people from across the industry and I strongly encourage you to do just that. Please also take the chance to chat to GRDC staff and Western Region Panel members while you are here. The GRDC values your feedback and input on any issues impacting on grower profitability.

A big thank you must go to the GRDC western region staff and the Grain Industry Association of WA for their hard work in coordinating and delivering this flagship event on behalf of the GRDC.

I hope you enjoy the 2020 GRDC Grains Research Update, Perth, and take plenty of useful and inspiring knowledge home with you.

Darrin Lee

GRDC WESTERN REGION PANEL CHAIR

2020 Grains Research Update, Perth

Hosted by:

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

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Need Information?

Registration Desk

The Registration Desk will be manned during the entire two-day program. Please feel free to approach members of the GIWA team with any questions or assistance you may require.

Presentations and papers

This Program Book contains abstracts of presentations at the 2020 Grains Research Update, Perth to enable you to select which presentations you wish to attend and provide key messages for each presentation.

Attendees are able to access all papers in support of presentations at the Perth Update via the GRDC website (**grdc.com.au/resources-and-publications/grdc-update-papers**) when available.

Late papers will be made available on the GRDC website immediately following the event, unless not approved for online publication.

Speakers Corner

Speakers Corner is a feature at the Grains Research Update, Perth. Located in the Grand Ballroom 2. During the catering breaks, you can catch up with speakers who presented during the immediate previous sessions. Come along to ask the questions you did not get time to ask in the session.

Focus Sessions

A feature of Tuesday's program is the opportunity to attend one of three Focus Sessions. These sessions are designed to enable a more in-depth discussion with experts in these fields than is possible during the concurrent sessions. Further details can be found towards the back of this Program Book.

Event App

Hopefully by now you would have checked out the Event App via the link provided below.

- To access the 2020 GRDC Grains Research Update app, search and download the Eventbrite portal app from the Apple App Store or Google Play Store on your device.
- Launch the EventPortal and click Tap to Start
- Enter the event code **Grains2020**

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List of Attendees

Included in the Event App is a List of Attendees and Event supporters for the 2020 Perth Update. This list will help you network and follow up on valuable contacts.

Wifi

Complimentary WiFi is available for all attendees.

- Select 'Crown Public Access'
- Access code: **GRAINS2020**

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Charging Station

Nufarm

A mobile device Charging Station will be available at the Nufarm Booth in the Exhibition Space. Visit the Nufarm team to give your device an added boost.

Fuel your body and mind — Catering breaks

The Exhibition Space is located in Grand Ballroom 2 and will be your home away from home during the two days. This is where catering for morning tea, lunch and afternoon tea will be served.

Please note, if you have any dietary requirements you have already made us aware of, there will be a special dietary catering station at the very back of the Exhibition Space.

Coffee Break

AGT

Nothing beats a caffeine boost, the 2020 Coffee is proudly sponsored by AGT. Coffee Carts are located at the front and back of the Exhibition Space in Grand Ballroom 2. There is a wash station located next to the AGT booth with hot water for rinsing your coffee cup throughout the two days.

Networking Event – Day 1

CBH GROUP

The networking event on Monday evening is kindly sponsored by CBH Group and will be held in the Exhibition Space (Grand Ballroom 2). Take the time to chat with the exhibitors, old friends and make some new ones.

Speakers and Sponsors Thank You Refreshments – Day 2

Following the last Plenary Session on Day 2, join us for thank you refreshments from 4.30pm to 5.30pm to thank all the Research Updates speakers and sponsors. Join some craft brewers and the team after the Focus Group Sessions for the final wrap up.

We value your Feedback

We aim to continually improve each Research Update event by listening to your thoughts. Help us by completing the Report Card located in your satchel bag and on your Event App.

2020
GRAINS RESEARCH UPDATE, Perth

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

Program DAY 1 — Monday 24th February 2020

8.00 am	**REGISTRATION & COFFEE**			
9.00 am	**PLENARY 1 – Crown Ballroom 1**			
	9.00 am **Welcome and opening of Updates** — Darrin Lee, Chairman, Western Panel			
	GRDC INVESTMENT DIRECTIONS			
	9.10 am **Opening and future directions for GRDC investments in grains RD&E** — John Woods, Chairman GRDC			
	'Seed of Light' presentation — John Woods and Darrin Lee			
	GRAINS RD&E IN THE UNITED KINGDOM			
	9.30 am **The Grains RD&E landscape in the United Kingdom** Tina Barsby, NIAB Crop Science, UK			
	10.10 am **Cereal production in the UK with regulation, resistance and climate change** Keith Norman, UK Farm Management Specialist			
11.00 am	**MORNING TEA**			
11.30 am	**SESSION 1 — The big picture**	**SESSION 2 — Management of soil constraints**	**SESSION 3 — Agronomy**	**SESSION 4 — Crop protection – Weeds**
	Farming in the digital age Andrew Slade, grower from Kendenup, Western Australia	**West to South: a regional comparison of sandy soil constraints and yield responses to amelioration** Stephen Davies, DPIRD	**2019 canola NVT results and variety choices for 2020** Jackie Bucat, DPIRD	**Update on herbicide resistance in the WA grainbelt and future management challenges** Hugh Beckie and Mechelle Owen, AHRI
12.05 pm	**5 Min Moving**			
12.10 pm	**Improving soil health using animal manure and/or cover cropping** Grant Pontifex, grower from Paskeville, South Australia	**Re-engineering subsoils of pale deep sands** Tom Edwards, DPIRD	**Exploring the effects of seed size and target plant densities on the yield of hybrid canola across Australia** Justin Kudnig, Pacific Seeds	**The continuing evolution of Harvest Weed Seed and Chaff systems** Peter Newman, AHRI
12.40 pm	**LUNCH**			

This program may be subject to change.

(Program for Day 1 continued following page...)

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GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

Program DAY 1 — Monday 24th February 2020 *(continued)*

1.40 pm	SESSION 5 — The big picture for wheat	SESSION 6 — Nutrition management	SESSION 7 — Agronomy	SESSION 8 — Crop protection – Weeds
	A glimpse into the future for the Western Australian wheat industry Richard Simonaitis, CEO, Australian Export Grains Innovation Centre	**Soil sampling and variability – what does this mean for your nutrient decision?** Yvette Oliver, CSIRO	**Barley varieties and agronomy tips for 2020** Jeremy Curry, DPIRD	**Preemergent herbicide: a review of what we know and need to know** Roger Mandel, BASF
2.10 pm	5 Min Moving			
2.15 pm	**Gains in grains – is Australia producing the most profitable quality of wheat?** Luke Mathews , Grain Growers Limited	**Near-infrared spectroscopy for real-time in-field nutrient analysis of fresh plant material** Doug Hamilton, CSBP Fertilisers	**Pulse agronomy and breeding update** Mark Seymour and Stacey Hansch, DPIRD	**What do we know of new herbicides for annual ryegrass and wild radish control?** Roberto Busi, AHRI
2.45 pm	5 Min Moving			
2.50 pm	**Market differentiation opportunities for the WA wheat industry – a series of case studies** Tress Walmsley, InterGrain	**Can crop sensors help make a nitrogen management decision?** Jonathan Richetti, CSIRO	**Can double break crop rotations be effective AND profitable across the wheatbelt?** Nathan Craig, West Midlands Group **Sowing flexibility of chickpea and lentil in the WA farming system** Sarah Rich, CSIRO	**Pre-emergence herbicides and crop competition for effective management of annual ryegrass** Facundo Cortese and Roberto Lujan, AHRI
3.20 pm	AFTERNOON TEA			
3.50 pm	SESSION 9 — The big picture	SESSION 10 — Crop protection	SESSION 11 — Agronomy	SESSION 12 — Crop protection – Weeds
	Progress on GRDC projects from the Australia-China Joint Centre for Wheat Improvement Wujan Ma, Murdoch University	**“Give me a break!” – Options for paddocks infested with both root lesion nematodes and Rhizoctonia solani AG8** Sarah Collins, DPIRD **Targeting improved partial resistance using yield loss response curves for foliar diseases of wheat** Manisha Shankar, DPIRD	**The National Paddock Survey – what causes the Yield Gap in Western Australia?** Roger Lawes, CSIRO	**The Weed Chipper – mechanical site-specific fallow weed control** Andrew Guzzomi, UWA
4.25 pm	5 Min Moving			
4.30 pm	**The future for plant protein** Michelle Colgrave, CSIRO	**Chemical residues/MRLs – impact, understanding and trade issues** Gerard McMullen, National Working Party on Grain Protection	**Maintaining wheat yield and quality at high temperatures** Richard Trethowan, University of Sydney	**Great brome grass and barley grass – understand the enemy** Catherine Borger, DPIRD
5.00 pm	Networking Event — Crown Towers Foyer (outside Plenary)			

This program may be subject to change.

Crown Ballroom 1 (Session 5, Session 9) · Crown Ballroom 3A (Session 6, Session 10) · Crown Ballroom 3B (Session 7, Session 11) · Crown Ballroom 3C (Session 8, Session 12)

2020 GRAINS RESEARCH UPDATE, Perth

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

Program DAY 2 — Tuesday 25th February 2020

Time	Session (Crown Ballroom 1)	Session (Crown Ballroom 3A)	Session (Crown Ballroom 3B)	Session (Crown Ballroom 3C)
8.30 am	WELCOME COFFEE			
9.00 am	SESSION 13 — Agronomy	SESSION 14 — Crop protection – Pests	SESSION 15 — Farming systems	SESSION 16 — Disease management
	Wheat variety performance and insights from the 2019 season Dion Nicol, DPIRD	**Where to now with redlegged earth mite resistance** Svetlana Micic, DPIRD **Snail management – slowing the snail menace** Sarah Belli and Svetlana Micic, DPIRD	**Regen Agriculture – a grower's perspective** Stuart McAlpine, grower from Buntine	**A tale of two wheat diseases – new research could change our understanding of the impact of Yellow Spot and Septoria Nodorum Blotch in WA** Ayalsew Zerihun and Mark Gibberd, Centre for Crop and Disease Management
9.30 am	5 Min Moving			
9.35 am	**What are the optimal flowering periods for wheat across WA and how will they change with potential climate change?** Andrew Fletcher, CSIRO	**Consultant experience implementing IPM programs with growers** Iain Macpherson, Macpherson Agricultural Consultants	**Can we double water use efficiency with 'Strip and Disc' farming?** Peter Newman, Planfarm	**Azole Resistance in spot form of net blotch in Western Australia** **Battling net blotch in barley – when co-innovation goes to work in WA's south – resistance detection and in-field solutions** Fran Lopez-Ruiz, Centre for Crop and Disease Management
10.10 am	MORNING TEA			
10.45 am	SESSION 17 — Farming systems	SESSION 18 — Research snapshots	SESSION 19 — Management of soil constraints	SESSION 20 — Crop Protection – Disease management
	Crop type, sowing date, nitrogen and seeding rate which is the biggest frost risk management lever? Ben Biddulph, DPIRD	**Impacts of liming and pasture rotations on wheat yield in the low rainfall zone** Daniel Kidd, University of Western Australia **What trials are telling us about the nutrition piece of the optimum returns puzzle after soil amelioration?** Mark Gherardi, Summit	**WA standing on subsoil compaction management: outcomes of five years of research** Wayne Parker, DPIRD	**National Blackleg Report** Angela van de Wouw, University of Melbourne
11.15 am	5 Min Moving			
11.20 am	**The potential role of companion and intercropping in Australian grain farming systems. Should we be considering them?** Andrew Fletcher, CSIRO	**Faba beans on south-coast sandplain after soil amelioration** Carla Milazzo, DPIRD **Pulse performance in a poor season** King Yin Lui, DPIRD **The impact of dry sowing on the nodulation and N2 fixation of chickpea** George Mwenda, DPIRD	**Lessons learnt from soil amelioration bloopers** Bindi Isbister, DPIRD	**Fungicide strategies for oats to maximise profit** Trent Butcher, ConsultAg **Strobilurin fungicides protect oaten hay from weather damage – myth or fact?** Kylie Chambers, DPIRD
12.00 pm	LUNCH			

This program may be subject to change.

(Program for Day 2 continued following page...)

Crown Ballroom 1 | Crown Ballroom 3A | Crown Ballroom 3B | Crown Ballroom 3C

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

Program DAY 2 — Tuesday 25th February 2020 *(continued)*

12.40 pm	FOCUS SESSIONS			
	Research snapshots	Focus Session 1	Focus Session 2	Focus Session 3
12.40 pm	**A new approach to managing loose smut on barley** Kith Jayasena, DPIRD	**Whacky weather for wheat – growing crops in WA under today's and tomorrow's climate** **Convenor:** David Bowran	**External crop protection challenges** **Convenor:** Stephen Powles	**Taking back control of pest management** **Convenor:** Iain Macpherson
1.10 pm	**Managing Spot Type Net Blotch in the medium rainfall zone** Trent Butcher, ConsultAg			
1.45 pm	**Taking on the toxins – how we're working to better understand the mechanisms of yellow (tan) spot on wheat** Catherine Rawlinson, CCDM			
2.00 pm	**Hydroxyphenylpyruvate dioxygenase (HPPD) resistance in wild radish** Huan Lu, UWA			
2.15 pm	**Longevity of deep ripping on deep white sands** Emma Pearse, DPIRD			
2.30 pm	**Understanding the scenarios where on-farm lime sources are more cost effective than coastal lime sand in the Kwinana East Port zone** Ashleigh Donnison, DPIRD			
2.45 pm	PLENARY 2			
	TECHNOLOGY INNOVATIONS TO IMPROVE CROP RESEARCH AND GRAIN ENTERPRISE MANAGEMENT • **Experiences using a complete annual workflow and farming system** — Brad Jones, Bungulla Farms • **BioScout** — Lewis Collins, BioScout • **Plant sniffer** — Jean Ristaino, North Carolina State University			
4.30 pm	Close			
4.30 – 5.30pm	**Sponsors and speakers thank you refreshments — Crown Towers Foyer (outside Plenary)**			

This program may be subject to change.

Crown Ballroom 1 | Crown Ballroom 3A | Crown Ballroom 3B | Crown Ballroom 3C

2020 GRAINS RESEARCH UPDATE, Perth

Day 1 – Contents

PLENARY 1 – *Crown Ballroom 1*

PLENARY 1 – Grains RD&E in the UK – *Crown Ballroom 1*

HANDY CONTENTS

SESSION 1 – The big picture – *Crown Ballroom 1*

SESSION 2 – Management of soil constraints – *Crown Ballroom 3A*

SESSION 3 – Agronomy – *Crown Ballroom 3B*

SESSION 4 – Crop protection – Weeds – *Crown Ballroom 3C*

SESSION 5 – The big picture for wheat – *Crown Ballroom 1*

Note: Presenters are listed. Where there are multiple authors of papers full authorship should be taken from the final papers, located on the GRDC website at **grdc.com.au/resources-and-publications/grdc-update-papers**, as and when they become available.

2020
GRAINS RESEARCH UPDATE, Perth

Day 1 – Contents *(continued)*

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2020
GRAINS RESEARCH UPDATE, Perth

Day 2 – Contents

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Day 2 – Contents *(continued)*

FOCUS SESSIONS

Research Snapshots – *Crown Ballroom 1*

Focus Session 1 – *Crown Ballroom 3A*

Focus Session 2 – *Crown Ballroom 3B*

Focus Session 3 – *Crown Ballroom 3C*

PLENARY 2 – Technology innovations – *Crown Ballroom 1*

Note: Presenters are listed. Where there are multiple authors of papers full authorship should be taken from the final papers, located on the GRDC website at **grdc.com.au/resources-and-publications/grdc-update-papers**, as and when they become available.

THE 2017-2020 GRDC WESTERN REGIONAL PANEL

JANUARY 2020

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

CHAIR - DARRIN LEE

Darrin Lee is Managing Director and partner in Bligh Lee Farms, a mixed cropping and livestock farming operation, north-east of Mingenew. He has a keen interest in digital agriculture, implementing a wifi network across the farm, adopting moisture probes, weather stations, remote sensing devices and digital analytics. Darrin has a value-adding project with Albus lupins through a 'paddock to plate' joint venture initiative. He has a background in banking and finance, and is a past member of the CBH Group Growers Advisory Council and previous Board member of Mingenew Irwin Group.

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DEPUTY CHAIR - JULES ALVARO

Jules Alvaro is involved in all aspects of the family's involved in all aspects of the 5,400-hectare cropping business she operates with her husband at Merredin in WA's central grainbelt. She was a WA sub-coordinator of Partners in Grain and a founding member of Agricultural Women Wheatbelt East. Jules was a recipient of the 2019 Growing Leaders Scholarship Program. Jules is a firm believer in farm businesses keeping up with technology while keeping an eye on the bottom line.

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GEMMA WALKER

Gemma Walker and her husband run a 4000 hectare mixed cropping and sheep property near Munglinup, in the state's south-east. In addition, she has worked for many years managing farming systems groups to deliver development and extension activities. These included Mallee Sustainable Farming and the South East Premium Wheat Growers Association. Gemma is on the Board of Partners in Grain, and on the Southern Biosecurity Group, and on the Esperance Organised Purchasing Power Board, and has a Bachelor of Agribusiness (Hons) from Curtin University.

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DR GREG REBETZKE

Greg Rebetzke is a wheat geneticist with CSIRO, and is committed to delivering traits and germplasm for improving crop variety water productivity. He works closely with commercial breeders to understand the relative benefits of one trait over another, and how to integrate new genetics more efficiently in the development of higher-yielding, more robust cereals.

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ANDY DUNCAN

Andy Duncan is business partner in a mixed broadacre family farming business in the West River area on the south coast of WA, producing wheat, malt and feed barley, canola, lupins and field peas. He has been involved with several organisations including the Grains Industry Association of WA (GIWA) Barley Council, the South East Premium Wheat Growers Association, the GRDC Esperance Regional Cropping Solutions Network, and the Ravensthorpe Agricultural Initiative Network.

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MICHAEL LAMOND

Michael Lamond is an experienced hands-on agronomist who started his career in discovery and innovation related to agricultural systems, including herbicide resistance, herbicide systems with minimum tillage, legume rotations, pasture systems, soil acidity and crop variety evaluation. He has run or been a partner in contract research organisations conducting or managing projects for many of the companies that operate in Australia. Michael has worked with many talented agricultural graduates from universities around Australia and has a passion for capacity building for the future in agriculture.

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ROHAN FORD

Rohan Ford farms east of Binnu with his wife Carol, growing wheat, lupins and canola in a low rainfall zone with highly variable precipitation. They have been control traffic farming for more than 15 years, and involved over many years in trial work and projects related to a variety of areas that help improve farming outcomes and increase knowledge in what is an ever-evolving industry. Rohan is also involved closely with the local grower group.

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DR FIONA DEMPSTER

Dr Fiona Dempster is an applied economist with The University of Western Australia, School of Agriculture and Environment, and a farmer at her family's crop and livestock operation in Mingenew. Her expertise is in designing decision tools for environment and agricultural management and identifying the adoption drivers of management practices in agricultural landscapes. Fiona is an active member of Mingenew Irwin Group and the Australasian Agricultural and Resource Economics Society, and sits on the Board of Management for the Mingenew Midwest Expo. Fiona has a Doctorate and Bachelor of Science.

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JULIET MCDONALD

Juliet currently works as an Area Manager for Summit Fertilizers in the North Midlands and provides agronomy based support for nutrient recommendations and conducts R&D to integrate nutrition applications with current farming systems. Juliet lives on a family farming enterprise west of Marchagee and produces grains, meat, wool and PD stud rams. Juliet was previously an Elders Sales Agronomist for Elders, a Grain Pool Area Manager, and started as an Extension Officer with DPIRD. She holds a Bachelor of Science in Agriculture and is qualified as a Fertcare Accredited Adviser. Juliet is passionate about sustainably profitable agriculture and is committed to improving the understanding of agriculture in the wider community.

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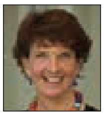
LUCY BROAD



Lucy Broad is the General Manager of the Grains Research and Development Corporation's (GRDC) Grower Communication and Extension business group. Lucy holds a Bachelor of Science in Agriculture, majoring in agronomy, and prior to working at the GRDC spent the last 13 years as Director and then Managing Director of Cox Inall Communications and Cox Inall Change, Australia's largest and leading public relations agency working in the Agribusiness and Natural Resource Management arena. Her entire career has been in communications, first with the Australian Broadcasting Corporation and then overseeing communications and behaviour change strategies for clients across the agriculture, natural resource management, government and not-for-profit sectors.

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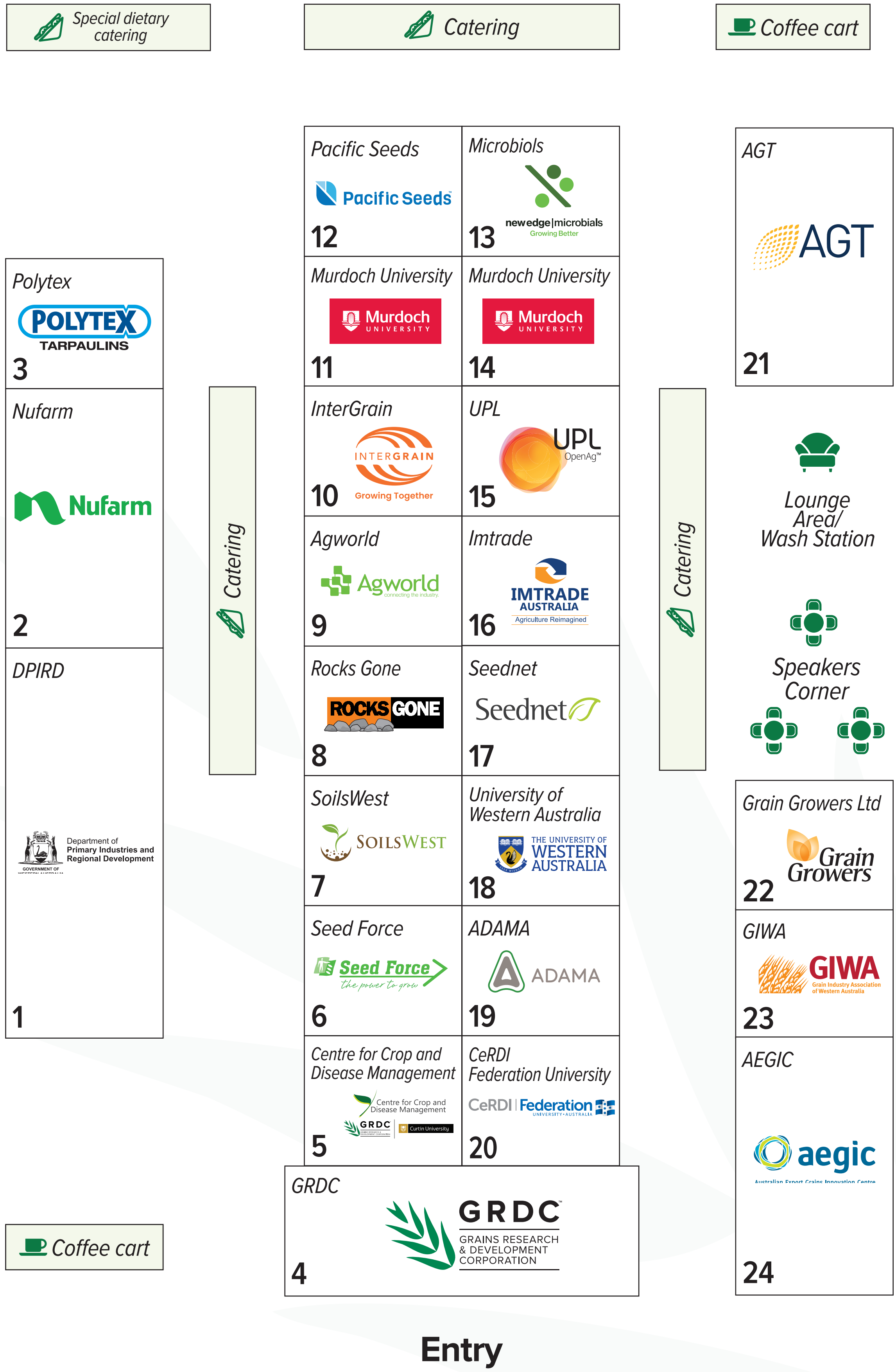
Exhibition Space (Grand Ballroom 2)



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The Grains RD&E landscape in the United Kingdom

Tina Barsby, NIAB Crop Science, United Kingdom

Tina is a plant geneticist with significant experience in the agricultural crop sector. With a PhD from the University of Nottingham, she spent several years working in North America, including five years with the Canadian technology company Allelix, before returning to the UK. After almost 20 years working on biotechnology applications in crop breeding for seed companies of the Limagrain Group, she spent two years co-ordinating cereal and grass genetics and genomics for the UK research council, the BBSRC. She became CEO of NIAB (previously the National Institute of Agricultural Botany) in 2008. NIAB celebrated its' Centenary in 2019 and today is an internationally recognised and innovative organisation, operating under the tagline 'Plant Science into Practise'. NIAB provides information and practical advice to improve the yield, sustainability and resilience of crop production across the arable, forage and horticulture sectors. Tina is committed to the translation of plant science into products and services of value to industry and to society at large. She was awarded an OBE in the 2018 New Year's Honours List for services to Agricultural Sciences and Biotechnology.

Tina's presentation will provide insights into the funding and practice of small grain cereal R&D and knowledge exchange in the UK. Who are the main players, how does funding work, and how do research outcomes reach the grower and lead to change on farm? What are the pros and cons of the UK system?

Notes:

Cereal production in the UK with regulation, resistance and climate change

Keith Norman, UK Farm Management Specialist

Farmers in the United Kingdom face some of the strictest environmental and social licence controls in the world. Keith will discuss the constraints affecting grain farmers in the United Kingdom to provide insights for Australian grain growers into these developing common issues here in Australia.

Keith graduated from Newcastle University and then followed a career in practical farm management for six years, and then changed to a technically based role as Velcourt's Technical Director, supporting Velcourt's UK team of 45 farm managers in crop production technology and managing Velcourt's in-house research and development activity for 30 years. Keith is now a freelance, independent consultant.

Keith has worked on various overseas farming activities in Spain, France, Germany, Zambia, Russia and the Ukraine.

Keith has led and participated in many collaborative research projects, and has worked with all the major Agrochemical manufacturers, providing independent evaluation of new and existing active ingredients.

Keith is actively involved with many world-leading research institutions; he is a trustee of the John Innes Foundation, is a John Innes Centre Council member, a member of the AHDB Wheat committee and has served on the Research and Knowledge Transfer Committee for six years.

Keith was awarded the Farm Advisor of the Year in the Farmers Weekly Awards in 2013.

Notes:

Notes:

Farming in the digital age

Andrew Slade, Grower from Kendenup, Western Australia

Andrew will discuss his experiences in investigating how different sources of farm data can be integrated into common management platforms to develop better decision support tools and facilitate the uptake of new ag tech. He believes in order to improve profitability and remain competitive on a global level we need to not only look at the productivity gains that ag tech can provide but also how the data captured can be leveraged to provide a greater return for our commodities.

Andrew is the cropping and feedlot manager of his family's 6000ha broadacre cropping and mixed livestock enterprise near Mount Barker, Western Australia. Andrew was awarded a 2018 Nuffield Scholarship, supported by CSBP and Integro Private Wealth, looking into the digitisation of agriculture and how best to integrate new and emerging digital technologies into existing farming systems.

Notes:

Improving soil health using animal manure and/or cover cropping

Grant Pontifex, Grower from Paskeville, South Australia

Grant is a fifth generation grain producer based in Paskeville, SA. He jointly owns and operates 7000ha with his brother, between two properties at Paskeville and Kangaroo Island in SA. He is a director and shareholder of Kangaroo Island Pure Grain (KIPG), a grain accumulation business. In 2018, Grant was awarded a Nuffield scholarship to study improving soil health with manure and cover cropping.

Grant will give a brief outline of his family cropping business and involvement in KIPG.

He will give an account of his Nuffield travels, including learnings and take-home messages from the travels.

Covering the sustainability of family farms, the challenges of regenerative farming systems and what he has changed since returning from his travels.

Notes:

West to South: a regional comparison of sandy soil constraints and yield responses to amelioration

Stephen Davies, Department of Primary Industries and Regional Development

ABSTRACT:

Stephen Davies, Lynne Macdonald, Craig Scanlan, Wayne Parker, Therese McBeath, DPIRD

Soil constraints including soil acidity, compaction, soil water repellence and poor water and nutrient retention are common across the sandy soils of the Western and Southern Australian cropping regions. Considerable research into how to ameliorate these constraints has been undertaken by DPIRD, PIRSA, CSIRO, industry and grain growers often with funding support from GRDC, research and natural resource management agencies. Combining and comparing crop yield response to strategic tillage from the research that has been completed across regions can improve our understanding of how different environments, practices, seasons and crop types may impact on the outcome. The aim of this work is to provide growers and advisors with greater confidence in what strategic tillage and soil amendment practices might suit their system and environment while also gaining greater value out of the research investment that has gone into these projects and the resulting datasets.

Preliminary findings from the analysis of the database include:

- Increasing the depth of ripping to depths of 500 to 600+mm on sands typically improved the size and reliability of the yield response for both Southern and Western regions. The distribution of ripping responses indicates that the yield response to ripping is not dependant on the yield of the control.
- Undertaking deep ripping in addition to rotary spading and mouldboard ploughing is an advantage further increasing grain yields by an average of 300 and 230 kg/ha, respectively, and increases the likelihood of getting large yield responses of 1 t/ha or more. For example, 24% of sites achieved a yield response of 1 t/ha or more for soil inversion with a mouldboard plough, but with addition of deep ripping post-ploughing this increased to 44% of sites. Deep ripping of one-way disc ploughed soils had limited response.
- Application of chicken manure as a soil amendment in addition to strategic deep tillage significantly increased yield over tillage only by an average of 500 kg/ha in the Southern region. Responses to application of N-rich organic matter and clay-rich subsoil were more variable. Additional grain yield response form lime application in the Western region averaged 300 kg/ha, though larger yield responses are likely at sites where soil acidity is more severe.

As further site details and additional data is added to the database there is ongoing opportunity to extract more data on how response to amelioration is related to soil type, seasonal factors, crop type, constraint type and constraint severity.

Notes:

Re-engineering subsoils of pale deep sands

Tom Edwards, Department of Primary Industries and Regional Development

ABSTRACT:

Tom Edwards, David Hall, Stephen Davies, Wayne Parker and Chad Reynolds, DPIRD, Grains, soil management and nutrition

Key messages

- Pale deep water repellent sands are often prone to further constraints in the subsoil, such as compaction and low cation exchange capacity.
- Significant yield improvement resulted when plots that had been clayed and spaded were deep ripped to reduce the subsoil strength and so increase the depth of root growth.
- Further yield improvement and deeper roots were recorded when fertiliser was incorporated with the use of topsoil inclusion behind the ripper.

Aims

- Determine if deep tillage improves root growth and yield of crops on pale deep sand that has previously been ameliorated with the incorporation of clay rich subsoil to a depth of 300mm.
- Assess the effect of tillage and nutritional treatments in combination and in isolation to increase root growth.
- Evaluate methodologies and technology designed to incorporate amendments deep into the subsoil (>400mm).

Results and Discussion

Ripping to remove the subsoil strength significantly increased the yield 2019. Reduced soil strength and increased root growth beyond a depth of 300mm were also recorded for all treatment combinations that included ripping. However, no extra yield benefit was observed when 5 t/ha of chicken manure or fertiliser applied to match the same nutritional input of the manure spread prior to ripping.

Trenching effectively incorporated these amendments down to 600mm into the soil profile and this improved the root abundance that was measured. However, this benefit appeared to be quite localised and although the implement also reduced soil strength it failed to create break out and increase the area of soil that was influenced. Instead it created localised slots of low soil strength and increased root abundance interspersed between areas of unaffected soil. Incorporating the matched rate fertiliser still significantly improved yield compared to the control.

Ripping with inclusion plates was as effective at reducing subsoil strength as the ripping treatments. This method also had the potential to incorporate some the spread amendments deeper in the profile. This incorporation of chicken manure did not significantly increase the yield compared to ripping with the spread of chicken manure. Conversely the yield for the inclusion of the match rate fertiliser was the highest yield increase recorded and was significantly higher than ripping and fertiliser alone.

Conclusion

The volumetric water content measured at 50cm in the soil profile was inversely related to the yield average for each treatment and showed a strong correlation. This supports the hypothesis that to improve the longevity of the yield benefit after amelioration we need to increase the abundance of roots at depth. There is strong evidence that deep ripping to remove the soil strength improved the crops production. Additionally, there is partial evidence that indicates that the incorporation of nutrient rich amendments into the subsoil through inclusion plates further improved crop production in 2019.

Notes:

2019 canola NVT results and variety choices for 2020

Jackie Bucat, Department of Primary Industries and Regional Development

ABSTRACT:

Canola NVT and phenology trials and variety choices for 2020

Jackie Bucat, DPIRD

Summary information will be provided to assist with decision making about suitable canola types and varieties.

This presentation highlights the results from NVT trials conducted in 2019 and the multi-year analysis (MET) data provided by NVT. This includes data for TruFlex varieties and the new OP TT variety.

The model of relative profitability of hybrid and open pollinated TT canola varieties (Zhang, 2016) is updated, using the long-term MET data. This is compared with density treatments from DPIRD trials, where we have used the common farm practice of lower density for hybrid varieties, compared with open pollinated varieties.

Flowering phenology data from DPIRD is presented and used to discuss the relative suitability of varieties for different sowing times.

The 2019 canola crop statistics will be included, showing the proportion of GM varieties grown in WA in 2019 and the most widely grown canola varieties, using CBH data.

Notes:

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Primary Industries and Regional Development

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- Our research is targeted at finding solutions to cropping system challenges faced by Western Australian grain growers.
- Our focus is crop science and grain production, soil science and crop nutrition, disease, pest and weed management, and genetic improvement.

147/20

Exploring the effects of seed size and target plant densities on the yield of hybrid canola across Australia

Justin Kudnig, Pacific Seeds

Key messages

- G X E X M interactions are very complex and dynamic. Genetics (G) is the biggest controllable factor, i.e. varietal choice; Environment (E) is the most significant factor by far. Management (M) will influence to a small degree in some environments.
- Smaller seed size resulted in lower population densities than targeted with all technologies.
- Most importantly, the percent of plants established vs target populations varied substantially across different seed lots and environments, and seed size did not have a statistically significant effect on plant count.
- All seed lots with the larger seed sizes showed higher observed biomass at the 4-6 leaf stage.
- There were a limited number of environments where we observed any significant differences in grain yield (t/ha) between hybrids, regardless of achieved plant populations.

Aims

To determine differences in plant establishment (p/m^2), visual subjective plant vigour or biomass, windrowing maturity, plant height (cm) and grain yield (t/ha) production of four different hybrids across 11 different canola growing environments in Australia.

Results

This research demonstrated that site environmental conditions, variety and seed-lot source had larger effects on final established percentage of plant numbers than seed size and target plant populations. Highlighted with all these 2019 individual trial results, hybrid genetic background and associated adaptability along with strong environmental influences (e.g. rainfall frequency and amounts, soil type, frost events, time of sowing) played a more substantial role or influence on the final yield responses than did seed size or actual plant population.

Conclusion

This study highlights that a canola 'seed size range' that optimises canola emergence and grain yield potentially exists and that larger seed has been found to provide higher observed biomass accumulation and percentage establishment in some environments. However, G X E interactions often override (M) management decisions based around seed size and population targets and the resultant grain yields. Another finding was seed size does impact percent of plants both emerged and established to varying levels in different environments, and larger seed at lower plant populations leads to final plant maturity being delayed. Higher plant populations irrespective of seed size and variety genetics often showed decreased observed maturity and sometimes plant height.

In 2020, Pacific Seeds will continue this important industry research by focusing the evaluation on the relationships between TT and CT hybrids vs three OP TT varieties (actual farmer prepared retained samples) at different plant populations and seed sizes. This research will help growers and advisors have more information around determining any potential grain yield and gross return $/ha value of grading OP TT varieties to larger seed sizes and planting at higher rates versus high yielding TT and CT hybrids.

Notes:

Update on herbicide resistance in the WA grainbelt and future management challenges

Hugh Beckie and Mechelle Owen, Australian Herbicide Resistance Initiative, University of Western Australia

ABSTRACT:

Herbicide resistance: future management challenges

Hugh Beckie, AHRI, UWA

Key messages

- Herbicide resistance is a continuing challenge for profitable input-intensive grain cropping in Australia and globally.
- Five continuing or future challenges are (1) maintaining or enhancing crop rotation or weed management diversity; (2) managing multiple-resistant weed populations; (3) using existing and new pre-emergence herbicides for optimal performance and longevity; (4) implementing economical and user-friendly precision weed management; and (5) controlling weeds effectively for profitable and sustainable grain crop production with likely increasing use restrictions or potential future loss of key herbicides.

ABSTRACT:

Update on herbicide resistance status in the Western Australian grainbelt

Mechelle Owen and Hugh Beckie, AHRI, UWA

Key messages

- High levels of resistance to Group A and B herbicides for ryegrass and wild radish.
- Resistance in wild oat, brome grass and barley grass is low for most commonly used herbicides.
- Resistance levels vary across and with-in cropping regions for different species and herbicides.

Aims

To monitor the frequency and distribution of resistance in key weed species to commonly used herbicides in cropping paddocks in WA.

Results

Random surveys conducted in Western Australia reveal that herbicide resistant weeds are common; however, the incidence of resistance varies significantly for weed species in cropping regions both within a cropping zone and across the wheatbelt. For annual ryegrass, resistance to the group A and B herbicides is common with most fields having some level of resistance, while resistance to pre-emergent herbicides such as trifluralin varies significantly. Group B resistant brome and barley grass populations, and Group A resistance in wild oat, are evident across most regions while resistance to other herbicides for these species is generally low. In Western Australia, wild radish is a common weed in the northern agricultural region, with most populations showing resistance to the commonly used herbicides Glean (group B), 2,4-D (group I) and Brodal (group F). Resistance levels have remained stable over the past 5-year survey period for all common weed species.

Conclusion

Herbicide resistance is widespread in annual ryegrass populations in most agricultural fields for commonly used herbicides although resistance levels vary across regions and between species. Other grass weeds, namely wild oat, brome grass and barley grass are not as widespread as annual ryegrass and tend to be associated with rainfall regions or agronomic factors. Despite these species being less abundant, resistance to the ACCase- and ALS-inhibiting herbicides commonly used to control these species was identified. It is important to document the distribution and herbicide resistance frequency in these minor species to establish baseline data for continued surveillance to help mitigate their adverse economic impacts through increasing farmer awareness. Continual monitoring of the distribution, incidence and frequency of herbicide resistance will aid management decisions by farmers and agronomists for successful, sustainable weed control using a wide variety of cultural, mechanical and chemical options, including weed seed management techniques at harvest which prevent weed seeds from replenishing the seed bank. The challenge is to use a wide range of integrated weed management options that help achieve herbicide sustainability and thus productivity of cropping systems.

Notes:

The continuing evolution of Harvest Weed Seed and Chaff systems

Peter Newman, Australian Herbicide Resistance Initiative, University of Western Australia

ABSTRACT:

Michael Walsh, Peter Newman, George Lehman, John Broster, AHRI, UWA

With the majority of Australian growers now using some form of Harvest Weed Seed Control (HWSC) there is demand for new and refined more user-friendly systems. At present the most popular systems are chaff lining and chaff tramlining as they are relatively cheap and simple to install and there is no requirement for after-harvest treatment. Similarly, impact mill systems for chaff processing are also increasing in popularity. Over the last five years industry research and development efforts have focussed on the refinement of current impact mill systems and the development of new systems.

Chaff line research from NSW

Very high numbers of annual ryegrass seed were collected and concentrated in narrow chaff lines during harvest. There was an average of 2,237 annual ryegrass seed per m chaff row. In autumn at the end of the trial annual ryegrass seed numbers were reduced to 364 and 302 seeds m/chaff row in the grazed and ungrazed treatments respectively. With little or no rainfall recorded over this period in this region it is likely that seed predation and not seed decay was the most likely responsible for these seed losses (Spafford Jacob *et al*., 2006). Ryegrass emergence in crop was greater on the grazed chaff lines due to the removal of chaff material. Annual ryegrass emergence of 84 plants/m^2 in the grazed chaff lines was substantially higher ($P<0.05$) than the seven plants/m^2 recorded in the ungrazed chaff lines.

iHSD and seed terminator evaluation

The efficacy of the Seed Terminator mill was slightly greater than the iHSD mill with both systems producing very high (>95%) levels of annual ryegrass seed kill. Annual ryegrass seed kill was 95% for the iHSD mill and slightly higher for the ST mill at 99%. However, there were differences in the amount of dyed seeds recovered due to slight differences in harvester set up and the possibility that the seed terminator processed the chaff into a very fine fraction that could not be recovered.

Single mill system

The single mill system maintained high levels of annual ryegrass seed kill during wheat crop harvest. Annual ryegrass seed kill was consistent (94 to 96%) across three harvest speeds indicating that mill performance was not severely affected by harvester load

Vertical mill system

When tested under differing wheat harvest loads the vertically mounted iHSD maintained high efficacy. Across all three operating speeds the vertical mill maintained high (~98%) levels of annual ryegrass seed kill

The increasing interest in HWSC systems in general continues to drive the research and development on new and existing HWSC systems in line with grower preferences. These efforts now appear to have resulted in the development of new and more durable impact mill systems. With the adoption of impact mill systems now reaching significant levels there is a need to establish a recognised standard testing approach towards providing with confidence in their efficacy.

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A glimpse into the future for the Western Australian wheat industry

Richard Simonaitis, Australian Export Grains Innovation Centre

ABSTRACT:

Key messages

- Australia's grains industry will experience important structural change towards 2030 due to population growth and climate change.
- Increased domestic demand for feed and food grain, predominately in eastern Australia, will account for most of the predicted production increase in these states. The main sources of additional exportable surpluses of grain will be Western Australia (WA) and South Australia (SA).
- Changing consumption patterns in key markets need to be reflected in the diversification and regionalisation of planting conducted by growers.

Aims

- Understand Australia's forecast capacity for production and exports in 2030 in the context of predicted global supply and demand.
- Examine the drivers of growth in key markets and how to shape Australian wheat production to best suit market demand.

Discussion

An additional 5.7mmt of grain is expected to be produced in Australia by 2030, with the majority of this being wheat. More than half of this will be consumed domestically and the additional surplus, available for export, will come mainly from WA and SA.

Good opportunities exist for WA growers to tap into the discretionary spending habits of South East Asian consumers who are developing more sophisticated quality requirements. Strong competition will continue from low-cost producers who are also improving the quality of their wheat exports. This means Australian wheat will need to meet consumer needs at a competitive price.

Maximum value will be derived through a collaborative approach to breeding, classifying, growing and supplying grain for these markets. Australia can help defend its position in current markets and open new markets by providing increased customer servicing including technical information and training to end-users to maximise the understanding and value of Australian wheat.

Notes:

Gains in grains – is Australia producing the most profit table quality of wheat?

Luke Mathews, Grain Growers Limited

ABSTRACT:

Luke Mathews, GGL

Key messages

- GrainGrowers has a released a report that assessed whether Australia is producing the most profitable quality of wheat and how our industry structures and systems deliver against this desired outcome.
- Wheat grower profitability is influenced by many factors. Yield (or volume) is deemed the most significant driver of profitability, however striking the right balance between higher production and lower quality is important.
- There are opportunities to enhance grower profitability and deliver quality, via:
  - a) Leveraging potential genetic gain delivered by breeders through flexibility changes to Australia's wheat classes
  - b) Refined trading standards reflective of evolving global competitive landscape
  - c) Review of the impact of pricing structures and blending on protein
  - d) Ongoing refinement of industry's collaboration on promotion of Australian wheat quality
- The full report is available at https://www.graingrowers.com.au/gains-in-grains-is-australia-producing-the-most-profitable-quality-of-wheat/

The views expressed in this presentation and accompanying paper reflect the views of Grain Growers Limited and not the Grains Research and Development Corporation.

Notes:

Market differentiation opportunities for the WA wheat industry – a series of case studies

Tress Walmsley, InterGrain

ABSTRACT:

The presentation will show case a range of industry opportunities for market differentiation, including:

- Udon noodle – lessons learnt and what's next
- Hard wheat – the challenge of servicing two end uses (baking and instant noodle)
- Soft wheat – revitalising a market and what can we do differently
- Whole wheat – exploration of a brand new market
- Feed wheat – market segmentation opportunities and removing the negative stigma

Industry call to action will be identified for each case study.

Notes:

Soil sampling and variability – what does this mean for your nutrient decision?

Yvette Oliver, Commonwealth Scientific and Industrial Research Organisation

ABSTRACT:

Yvette Oliver, Phil Ward and Karen Treble, CSIRO

Key messages

- Nutrients (N, P, K, S) can vary within even a small transect on the same soil type. This variability is measured using the coefficient of variation (CV%) which range from 10-80%.
- Using the tool 'NPK' decide we demonstrate the economic impact of applying an average fertiliser rate to a paddock when the soil test values are either higher or lower than the average. We then use this economic impact to determine an optimal sampling strategy for the paddock.
- At low nutrient variability (CV of 20% or less) the optimal number of cores that should be taken are around 8-10 while at higher variability (CV of 50% or higher) the optimal number required was 20-30.

Aims

- To determine the variation of nutrients across a small spatial scale
- To explain how the soil test value is not a single value but a range which depends on the sampling strategy and paddock management.
- To show what the economic impact using the average fertiliser rate on the range of values the soil test represents. This can then estimate the optimal soil sampling strategy depending on the variability (%CV) and the different prices for grain and fertiliser.

Results

Soil nutrient levels varied by as much as 20-50% (CV) across a paddock even without large soil disturbing processes like amelioration. Variability increases the range of soil test values and the chance of either over-fertilising or under-fertilising based on the average soil test value. Using NP decide (Burgess *et al* 1991) we estimated the cost of over-fertilising or under-fertilising Phosphorous when the grain yield was 2500kg/ha, grain price was $250/t and price of P was 3.5/kg.

If a site is highly variable, then more samples are required to improve confidence in the soil test value and reduce the $ loss from over or under fertilising. At a CV of 50% fertiliser decisions can be made more accurate by taking 20-30 cores. Such an approach improved the accuracy of fertiliser application and reduced the cost to less than $10/ha for a soil test value of 10mg/kg. When the sites are more uniform and CV <20% then 10 cores was near optimal for soil sampling.

Conclusion

The level of nutrient variation coupled with the number of sample cores taken will affect how closely soil test values represent the actual nutrient level of a soil. By using an approach that calculates the economic impact of under- or over-fertilising, the optimal soil sampling strategy can be determined.

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Near-infrared spectroscopy for real-time in-field nutrient analysis of fresh plant material

Doug Hamilton, CSBP Fertilisers

ABSTRACT:

Key messages

- Cost effective near-infrared (NIR) spectrometer hardware shows strong potential for in-field real-time estimation of total nitrogen content for wheat and barley.
- Gaining a better understanding of a crop's nitrogen status in real time is expected to lead to economic benefits to growers.
- Validation of the nitrogen model based on the current wheat and barley dataset will be performed in 2020, along with testing of commercial options and investigation of other avenues for these findings, such as optimising nitrogen to meet a cereal protein grade.
- The focus to date has been on developing a solution for nitrogen on wheat and barley, where canola and other nutrients will be the subject of future efforts.

Aims

The aim of this work is to develop a solution that provides real-time in-field nutrient analysis of fresh plant material that can enable growers to make more profitable decisions about fertiliser applications.

Results

A handheld device, mobile application and cloud-based analysis service that can provide real time estimates of total nitrogen and associated nitrogen status have been developed for wheat and barley. The solution has been tested in-field on these crops across a range of growing conditions, growth stages and geographic regions. Efforts to date have focussed on nitrogen for these crops.

The solution is enabled by the handheld device, a cost effective NIR spectrometer, in combination with data science. Plant NIR spectra were collected across Australia throughout multiple growing seasons and the plants were sent for laboratory analysis. Calibration models were then trained to predict nutrient content based on the NIR spectra.

Performance metrics used to assess the calibration models included correlation of determination (R^2) and Mean Absolute Percentage Error (MAPE). The latter is a measure of the accuracy of a prediction expressed as a percentage of the absolute prediction error. The following sets out the current performance of the calibration model in estimating total nitrogen in cereal crops across the regions and growth stages that were sampled in 2019.

Nutrient	No. samples	Min value	Max value	Average value	R^2	Average MAPE
Total N	> 10 000	0.45	7.12	3.02	90.30%	12.70%

Conclusion

Cost effective NIR spectrometer hardware can enable real-time and in-field nitrogen estimate of wheat and barley based on plants that have been sampled to date. The performance of the nitrogen estimation model used by this analysis will be validated in the 2020 season. This will be done in conjunction with testing of commercial options and research into other avenues for the projects findings that will provide an economic benefit to growers. Analysis and testing for canola and other nutrients will be the subject of future efforts.

Notes:

Can crop sensors help make a nitrogen management decision?

Jonathan Richetti, Commonwealth Scientific and Industrial Research Organisation

ABSTRACT:

Jonathan was born in Brazil where he obtained a bachelor's degree in Agricultural Engineering with honours and awarded as the third best student of the year at the State University of West Parana. At the same institution, he obtained his master's and PhD degree in Agricultural Engineering, during his doctoral studies he specialised in remote sensing and machine learning applied to agricultural systems.

In 2017 he was a visitor research scholar at the University of Florida in Gainesville – US, where he developed his crop modelling skills and improve his understanding of remote sensing and machine learning. In the US he was awarded 'Best oral presentation – Graduate Student Competition' by the Airborne and Satellite Remote Sensing Community of the American Society of Agronomy.

Currently, he is a postdoctoral research fellow at CSIRO Agriculture & Food in Floreat WA. He is involved with Future Farm Project developing new methods to optimize nitrogen management for wheat in Australia.

Notes:

Barley varieties and agronomy tips for 2020

Jeremy Curry, Department of Primary Industries and Regional Development

ABSTRACT:

Barley agronomy in Western Australia in 2020

Jeremy Curry[1] and Blakely Paynter[2], DPIRD, [1]Esperance and [2]Northam

Western Australia is the largest barley producing state in Australia, accounting for around 40 per cent of national production (five year average up to 2018-19 financial year, ABARES). Western Australian barley is primarily exported into brewing and feed markets in Asia (particularly China), with smaller quantities exported as malted barley or used domestically. As a result, over 80% of WA's barley area is sown to varieties with a malt accreditation. Given barley varieties are received into separate segregations, cultivar choice has significant consequences throughout the supply chain. Western Australian growers and industry need to ensure profitable production of a stable supply (both in quantity and quality) of barley that meets market demands and preferences.

DPIRD and GRDC investment into barley agronomy (Management of barley and barley cultivars in Western Australia, DAW00224) from 2013-2019 saw 186 research trials conducted in Western Australia across these seven seasons. These trials explored the interaction of management and cultivar within the greater context of maximising profitability of growers and providing an adequate supply of premium barley within an efficient supply chain. Based on this research, management recommendations on optimum plant density, nitrogen timing, cereal choice for early sowing, phenology predictions for WA environments, and other recommendations for optimising production and meeting grain receival standards for barley cultivars have been produced. This presentation will cover some of these key messages, as well as relevant trial results from 2019.

Notes:

Pulse agronomy and breeding update

Mark Seymour and Stacey Hansch, Department of Primary Industries and Regional Development

ABSTRACT:

Mark Seymour, DPIRD

Key messages

- CICA1521 is an exciting desi chickpea set for release in 2020 – combining class leading yield with a taller canopy which allow for easier harvesting.
- WA lentil growers should aim to test PBA Highland XT⦹ on their farm in 2020.
- PBA Bendoc⦹ provides faba bean growers improved broadleaf weed control options.
- PBA Amberley⦹ is well suited to high yielding/high disease pressure situations.

Aims

Provide industry with a summary of the performance of recently released pulse varieties; highlight some of the exciting lines evaluated in early generation experiments, and update growers and consultants on the some of the useful products and agronomy that maximise pulse production in WA.

Results

Faba bean

PBA Amberley and PBA Bendoc have similar yields to PBA Samira at sites yielding less than 2 t/ha (Figure 1 in paper). At sites yielding 3 t/ha or more, PBA Amberley and PBA Bendoc have on occasions produced higher yields than PBA Samira.

Lentil

PBA Highland XT is on average 5% higher yielding than PBA Hallmark XT and 2% higher yielding than PBA Bolt in WA.

Chickpea

In 2020, Kristy Hobson from NSW DPI and PBA plan to release a new desi chickpea CICA1521, which has an erect plant type, early to mid-flowering and maturity, with medium seed size. To date CICA1521 has produced equal or higher yield than chickpea varieties in WA NVT and Stage 3 breeding trials.

Conclusion

Growers in Western Australia now have access to pulse varieties that overcome some of the barriers to adoption. New varieties offer improved herbicide tolerance, improved disease resistance, higher yields and/or improved harvestability.

Notes:

Notes:

Can double break crop rotations be effective AND profitable across the wheatbelt?

Nathan Craig, West Midlands Group

ABSTRACT:

Nathan Craig[1] and Veronika Crouch[2], [1]West Midlands Group, and [2]Corrigin Farm Improvement Group

Key messages

- Double break crop rotations can provide effective weed and disease control if well managed.
- The profitability of double break crop rotations was lower compared to growing continuous wheat.

Aims

The aim of this study was to evaluate the use of double break crop sequences to reduce the impact of biological constraints to wheat grain yield and profitability.

Results

Replicated field site (Merredin)

The grain yield of wheat tended to be higher where fallow (spray-top pasture), canola, or balansa clover were grown as one of the break crops in the crop sequence, and lowest where for fallow/chickpea, fallow/lentil, and fallow/fallow sequences. Ryegrass panicles were significantly higher for fallow/chickpea and fallow/lentil compared to all other treatments (which had similar numbers of ryegrass panicles).

The profitability of double break-crop sequences evaluated in this study was mostly negative compared to a positive profit for continuous wheat. The impact of severe frost events in 2016 and low growing season rainfall in 2017 had a large impact on the growth, yield, and profitability of the break crops.

Demonstration sites (Bencubbin, Corrigin, Calingiri, Miling)

An effective chemical fallow as the first break-crop allowed for the successful growth of lupin, chickpea, lentil and field pea that yielded 0.97-1.42 t/ha 0.67-1.1 t/ha, 0.3-0.97 t/ha, and 1.2 t/ha respectively in a year with low growing season rainfall. The yield of wheat following a legume tended to be higher than either canola or wheat planted in the remaining paddock area.

At the Corrigin site, all break crops were not as profitable as a fallow/wheat/wheat crop sequence, but at Bencubbin, fallow/chickpea/wheat was more profitable than fallow/canola/wheat.

Conclusion

The use of a double break crop rotation in the Eastern Wheatbelt can be successfully used where the first crop is a clean chemical fallow. This can allow for the growth of high value legumes with lower production risk and the opportunity for N fixation for increased break crop benefit.

The use of canola (with effective weed control) as the first break crop in the central wheatbelt may be an effective way of offsetting the potential issue of reduced weed control options in chickpea and lentil. Further research to de-risk the adoption of high value legumes such as chickpea and lentil will give growers a greater chance of implementing a profitable and effective break-crop rotation. This includes the demonstration of effective weed control strategies and the equipment and management practices needed to reduce harvest losses and maximise grower returns.

Notes:

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Sowing flexibility of chickpea and lentil in the WA farming system

Sarah Rich, Commonwealth Scientific and Industrial Research Organisation

ABSTRACT:

Sarah Rich and Roger Lawes, CSIRO

Key messages

- Chickpea and lentil can be successfully grown on sands outside the traditional WA growing areas for these crops.
- Chickpea and lentil can be sown to depths of up to 200mm, with minimal delay to emergence and no significant impact on establishment, phenology and yield.
- In the low to medium rainfall areas earlier sowing produces higher yields in chickpea and lentil.
- On an ameliorated sand, sowing position (edge- vs inter-row) makes no difference to establishment and yield, however, continued seasons of edge row sowing may offer a benefit.

Aims

At present, few break crop choices are available to WA growers. We are attempting to increase the number of viable break crop choices for growers through evaluation of novel planting strategies. We are interrogating various sowing options for high value pulses in the medium- and low-rainfall areas, with a hope that we can present easy to implement options that de-risk these crops enough for growers to consider incorporating them into rotation.

Results

In all our trials we found that depth of sowing did not significantly impact on either lentil (PBA Bolt) or chickpea (PBA Striker) emergence time, establishment, phenology, dry matter production and yield, even at depths as extreme as 200mm. Sowing time however, did effect yield, with higher yields being achieved by both crops with earlier sowing at both Dandaragan and Merredin. There was no significant difference in yield between sowing position (edge- vs inter-row) for either crop.

Conclusion

With only one year of data these findings need further validation and we intend to continue to use both modelling and field trials to ascertain the relationship between depth of sowing and variety, season and soil and how these relationships impact growth parameters.

Our finding that early sowing is beneficial to yield in the low- to medium-rainfall supports earlier studies and offers options to growers wanting the try these high value pulses but not interfere with their main sowing program. Early sowing and deep sowing could be stacked in the right season to offer added benefits of stored soil moisture capture.

Notes:

Pre-emergent herbicide: a review of what we know and need to know

Roger Mandel, BASF

ABSTRACT:

Farmers and agronomists make pre-emergent herbicide decisions based on numerous factors including compatibility with their sowing program, control spectrum and price. Larger farm programs are potentially forced into dry sowing without knock-downs, which puts added pressure on pre-emergent herbicides.

The aim of this paper and presentation is to provide a better understanding of how to interpret the phys-chem properties of these chemicals to maximize control. In order to make informed decisions we need information but more importantly we need to understand what the information means. As herbicide systems become more complex, our understanding of how they interact with soil, water and biological materials becomes more important. Incorporation by sowing (IBS) has inherent risks. We are placing a chemical capable of killing germination weeds within centimetres of our sown seeds. Selectivity of control for most pre-emergent herbicides is based on physical separation rather than crop tolerance and that is why understanding the phys-chem properties is so important.

Notes:

What do we know of new herbicides for annual ryegrass and wild radish control?

Roberto Busi, Australian Herbicide Resistance Initiative, University of Western Australia

ABSTRACT:

- The efficacy of the mix clethodim + butroxydim is significantly greater than either clethodim or butroxydim.
- The efficacy of the mixture trifluralin and prosulfocarb is significantly greater than either trifluralin or prosulfocarb stand-alone.
- There is no resistance to some herbicide mixtures of pre-emergent herbicides in annual ryegrass.
- A comprehensive test of old and new herbicides (stand-alone and mixtures compared) helps to identify effective solutions for weed control and resistance management.

Notes:

Pre-emergence herbicides and crop competition for effective management of annual ryegrass

Facundo Cortese and Roberto Lujan, Australian Herbicide Resistance Initiative, University of Western Australia

ABSTRACT:

Herbicide mixtures and crop competition provide excellent control of annual ryegrass and mitigate herbicide resistance

Facundo Cortese, Dr Roberto Busi, Prof. Hugh Beckie and Dr Danica Goggin, AHRI – UWA

Key messages

- A herbicide mixture of pyroxasulfone and prosulfocarb was the most effective treatment on resistant annual ryegrass, controlling 96% of the plants and reducing the seed production of the surviving resistant plants by 88% when compared to the untreated control.
- Crop competition helps to reduce annual ryegrass seed production. The effect of a competitive wheat crop at 150 plants m^{-2} reduced seed production of resistant plants by 56%, with no further reduction in seed set and production at a crop density of 300 plants m^{-2}.

Aims

Assess the effect of combined pre-emergence herbicide treatments and wheat competition on the survival and seed production of annual ryegrass plants resistant to pre-emergence herbicides.

Results

The mixture of prosulfocarb and pyroxasulfone was the most effective treatment, increasing annual ryegrass control by 11% (vs prosulfocarb) and 29% (vs pyroxasulfone). Moreover, it reduced seed production by 88% when compared to the control, from 67,850 to 8,415 seeds m^{-2}.

Prosulfocarb also showed high efficacy and resulted in survival of less than 20% for both parental resistant and F1 (resistant × susceptible) populations. In contrast, the F1 crosses had fewer plants surviving pyroxasulfone (24%) when compared with the resistant parents (44%).

The 150 wheat plants m^{-2} treatment reduced ryegrass seed production by 56% when compared to the control with no wheat present. Doubling the wheat density to 300 plants m^{-2} did not make any further reduction.

There were no significant differences in wheat yield among the herbicide treatments. The effect of the herbicides was reduced by the irrigation effect, limiting the competition for water.

Conclusion

This trial showed that by mixing two pre-emergence herbicides of different sites of action, the survival and seed production of pyroxasulfone-resistant populations can be significantly decreased.

Notes:

TOP 10 TIPS

FOR REDUCING SPRAY DRIFT

01 **Choose all products in the tank mix carefully**, which includes the choice of active ingredient, the formulation type and the adjuvant used.

02 **Understand** how product uptake and translocation may impact on coverage requirements for the target. Read the label and technical literature for guidance on spray quality, buffer (no-spray) zones and wind speed requirements.

03 **Select the coarsest** spray quality that will provide an acceptable level of control. Be prepared to increase application volumes when coarser spray qualities are used, or when the delta T value approaches 10 to 12. Use water-sensitive paper and the Snapcard app to assess the impact of coarser spray qualities on coverage at the target.

04 **Always expect** that surface temperature inversions will form later in the day, as sunset approaches, and that they are likely to persist overnight and beyond sunrise on many occasions. If the spray operator cannot determine that an inversion is not present, spraying should NOT occur.

05 **Use weather forecasting** information to plan the application. BoM meteograms and forecasting websites can provide information on likely wind speed and direction for 5 to 7 days in advance of the intended day of spraying. Indications of the likely presence of a hazardous surface inversion include: variation between maximum and minimum daily temperatures are greater than 5°C, delta T values are below 2 and low overnight wind speeds (less than 11km/h).

06 **Only start spraying** after the sun has risen more than 20 degrees above the horizon and the wind speed has been above 4 to 5km/h for more than 20 to 30 minutes, with a clear direction that is away from adjacent sensitive areas.

07 **Higher booms increase drift**. Set the boom height to achieve double overlap of the spray pattern, with a 110-degree nozzle using a 50cm nozzle spacing (this is 50cm above the top of the stubble or crop canopy). Boom height and stability are critical. Use height control systems for wider booms or reduce the spraying speed to maintain boom height. An increase in boom height from 50 to 70cm above the target can increase drift fourfold.

08 **Avoid high spraying speeds**, particularly when ground cover is minimal. Spraying speeds more than 16 to 18km/h with trailing rigs and more than 20 to 22km/h with self-propelled sprayers greatly increase losses due to effects at the nozzle and the aerodynamics of the machine.

09 **Be prepared** to leave unsprayed buffers when the label requires, or when the wind direction is towards sensitive areas. Always refer to the spray drift restraints on the product label.

10 **Continually monitor** the conditions at the site of application. Where wind direction is a concern move operations to another paddock. Always stop spraying if the weather conditions become unfavourable. Always record the date, start and finish times, wind direction and speed, temperature and relative humidity, product(s) and rate(s), nozzle details and spray system pressure for every tank load. Plus any additional record keeping requirements according to the label.

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Progress on GRDC projects from the Australia-China Joint Centre for Wheat Improvement

Wujan Ma, Murdoch University

ABSTRACT:

Towards a sustainable wheat industry in a new era: Research progress in wheat nitrogen use efficiency, frost tolerance, and wheat gluten intolerance

Wujun Ma, Australia-China Joint Centre for Wheat Improvement, State Agriculture Biotechnology Centre, Murdoch University

Key messages

- An expressed HMW glutenin subunit Glu-Ay showed positive impacts on a range of wheat processing quality and yield traits. The grain protein compositions are significantly optimised for baking, resulting in a better breadmaking quality;
- The causal factor for increased prevalence of gluten intolerance has been discovered
- A number of genetic factors/QTLs have been identified for wheat frost resistance/tolerance in WA.

Aims

The Australia-China Joint Centre for Wheat Improvement of Murdoch University is carrying out a series of projects that are jointly funded by the GRDC and MU. This report summarises three key discoveries made in the centre over the past year.

Results

The silent 1Ay HMW-GS allele, present in most bread wheat cultivars, was replaced by the expressed 1Ay21* allele, which was introgressed into Australian bread wheat cultivar Lincoln.

Reproductive stage frost poses a major constraint for wheat production in Australia. A severe frost event hit two large-scale field trials consisting of six doubled haploid wheat populations in Western Australia, leading to the identification of 30 robust frost QTL. Results showed that frost damage is associated with dominant alleles of VrnA1a, VrnD1a, Rht-B1b, Rht-D1b, and the copy number of Ppd-B1.

The worldwide farmland soil sulphur deficiency is getting severer. The S-dependent wheat gluten biosynthesis network was made clear through a series of field trials in S deficient farmland and glasshouse experiments combined with transcriptomics analysis, protein-DNA binding assay, and amino acid metabolomic pathway study.

Conclusion

The 1Ay21* gene from an Italian wheat line has the potential of simultaneously increasing protein content and grain yield under certain environment. The qualitative improvements of the grain also led to a reduction of the energy required during the baking process in addition to the significant positive effects on bread quality

Two early-flowering genes VrnB1a and TaFT3_1B are compatible with frost tolerance and thus can be utilised in breeding. Also, wild-type or recessive alleles Rht-B1a (rht1) and Rht-D1a (rht2) can be used when breeding for frost-tolerant varieties without delaying flowering time.

Sulphur deficiency is associated with an enhanced level of biosynthesis of the substances responsible for the prevalence of wheat gluten intolerance. Alleviating the soil S deficiency can significantly reduce the amount of allergen/antigen (toxic gluten). Different gluten components had different levels of reduction, the higher toxicity, the more reduction. The clinically proven most toxic gliadins, ω5-gliadins, had a highest reduction by up to 82.3%.

Notes:

LOOK AROUND YOU.

1 in 5 people in rural Australia are currently experiencing mental health issues.

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The GRDC supports the mental wellbeing of Australian grain growers and their communities. Are you ok? If you or someone you know is experiencing mental health issues call *beyondblue* or Lifeline for 24/7 crisis support.

beyondblue
1300 22 46 36
www.beyondblue.org.au

Lifeline
13 11 14
www.lifeline.org.au

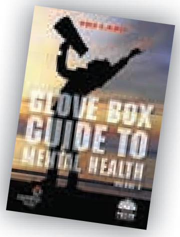
Looking for information on mental wellbeing? Information and support resources are available through:

www.ifarmwell.com.au An online toolkit specifically tailored to help growers cope with challenges, particularly things beyond their control (such as weather), and get the most out of every day.

www.blackdoginstitute.org.au The Black Dog Institute is a medical research institute that focuses on the identification, prevention and treatment of mental illness. Its website aims to lead you through the logical steps in seeking help for mood disorders, such as depression and bipolar disorder, and to provide you with information, resources and assessment tools.

www.crrmh.com.au The Centre for Rural & Remote Mental Health (CRRMH) provides leadership in rural and remote mental-health research, working closely with rural communities and partners to provide evidence-based service design, delivery and education.

Glove Box Guide to Mental Health
The *Glove Box Guide to Mental Health* includes stories, tips, and information about services to help connect rural communities and encourage conversations about mental health. Available online from CRRMH.



www.rrmh.com.au Rural & Remote Mental Health run workshops and training through its Rural Minds program, which is designed to raise mental health awareness and confidence, grow understanding and ensure information is embedded into agricultural and farming communities.

www.cores.org.au CORES™ (COmmunity Response to Eliminating Suicide) is a community-based program that educates members of a local community on how to intervene when they encounter a person they believe may be suicidal.

www.headsup.org.au Heads Up is all about giving individuals and businesses tools to create more mentally healthy workplaces. Heads Up provides a wide range of resources, information and advice for individuals and organisations – designed to offer simple, practical and, importantly, achievable guidance. You can also create an action plan that is tailored for your business.

www.farmerhealth.org.au The National Centre for Farmer Health provides leadership to improve the health, wellbeing and safety of farm workers, their families and communities across Australia and serves to increase knowledge transfer between farmers, medical professionals, academics and students.

www.ruralhealth.org.au The National Rural Health Alliance produces a range of communication materials, including fact sheets and infographics, media releases and its flagship magazine *Partyline*.

ifarmwell growing farmers' wellbeing | Black Dog Institute | Centre for Rural & Remote Mental Health | CORES™
Rural & Remote Mental Health | Heads up Better mental health in the workplace | National Centre for Farmer Health | National Rural Health Alliance Ltd

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The future for plant protein

Michelle Colgrave, Commonwealth Scientific and Industrial Research Organisation

ABSTRACT:

Sustainable production of protein is needed to meet the food gap for human nutrition, as well as to address feed demands within the food chain (animal and aquaculture). Current estimates predict that approximately 70 per cent more food will be required for the growing global population, which will reach 9.6 billion by 2050 and for increasing consumption per capita.

We need to meet this food gap while maintaining planetary health. With global resource constraints putting limits on animal-derived protein production, alternative sources of protein offer an opportunity to fill this gap. Alternative protein products derived from sources such as seeds, pulses, nuts, bacteria, fungi, microalgae, and insect-based protein are in high demand to complement traditional sources of protein in our diets.

The CSIRO-led Future Protein initiative aims to provide protein security in the face of a growing global population and protein for health to alleviate the global burden of chronic disease by increasing the diversity of healthy and sustainably produced protein in Australia. Value-added premium protein ingredients represent an opportunity for Australian breeders, growers, processors and producers to capitalise on the rapid growth of the protein-based sector and give access to new (export) markets for wealth creation. This presentation will cover the drivers, opportunities and challenges in future protein production.

Notes:

“Give me a break!” – Options for paddocks infested with both root lesion nematodes and *Rhizoctonia solani* AG8

Sarah Collins, Department of Primary Industries and Regional Development

ABSTRACT:

Bec Swift[1], Sarah Collins[1], Carla Wilkinson[1], Daniel Hüberli[1], Carla Milazzo[1], Alice Butler[1], Sean Kelly[1] and Garren Knell[2],
[1]DPIRD and [2]ConsultAg

Key messages

- It is imperative to understand which soilborne pests and diseases are present before making decisions on the best rotation to reduce yield loss risks.
- Weed free fallow, pulses and pastures can be the best options where root lesion nematodes (RLN) and *Rhizoctonia solani* AG8 co-exist in a paddock.
- Canola is not an effective break crop for RLN.
- Cereals substantially increase RLN and *R. solani* levels in one cropping season.

Aims

Two-year rotation trials were implemented in Calingiri, Dumbleyung and Grass Valley to investigate the most effective and profitable break crops in rotation with cereals (wheat) for growers with RLN and *R. solani* in the same paddock.

Results

Grain Yields

At Grass Valley in 2019, the highest yields of wheat were found in plots sown to serradella or kept fallow in 2018; yields were 79% and 98% higher, respectively, than 2018 barley plots. Wheat grain yields in 2019 were significantly higher in all legume treatments compared to cereal treatments. 2019 wheat yields after canola was also higher compared to plots where barley and Calingiri wheat had been sown. Regression analyses demonstrated that low levels of *P. quasitereoides* (p=0.02) or high nitrate levels (p=0.001) at the start of the season correlated to higher yields.

RLN and R. solani *qPCR analyses in 2019*

Visual symptoms of RLN and R. solani were obvious in cereals at all three trials during the 2019 season. Symptoms included chlorotic plants, stunting and patching.

At Grass Valley, the lowest amount of *P. quasitereoides* at harvest in 2019 was in the plots sown to serradella, subclover and lupin in 2018 and the highest levels was from 2018 canola plots. *R. solani* was significantly lower under wheat in 2019 at harvest where lupin was grown previously compared with 2018 chickpea, canola, fallow and cereal plots. Serradella plots had variable levels of *R. solani* at the end of the 2019 season. At Calingiri, where break crops were sown in 2019, *P. quasitereoides* levels were significantly lower at harvest in chickpea, pasture legumes and fallow plots. For *R. solani*, levels were significantly higher in the cereals than the other treatments by the end of season. Lupin and subclover had the lowest levels of *R. solani* at the end of season.

The dominant RLN species at Dumbleyung, *P. neglectus*, was at least three times higher at sowing and end of the wheat crop in plots that had been sown to canola the previous season compared with the faba bean and lupin plots. There were no differences in *R. solani* levels between the four treatments in the 2019 growing season.

Conclusion

In general, subclover and lupin rotations were the most consistent break options where *R. solani* and RLN were present in the same paddock. Serradella consistently performed as a suitable break to reduce *P. quasitereoides* but was more variable in reducing *P. neglectus* and *R. solani* levels. Fallow, pulses and pasture rotations had the highest yields in the subsequent wheat crops. Canola is not a suitable break where RLN and *R. solani* occur together.

Notes:

Targeting improved partial resistance using yield loss response curves for foliar diseases of wheat

Manisha Shankar, Department of Primary Industries and Regional Development

ABSTRACT:

Manisha Shankar[1], Karyn Reeves[1,2], Jason Bradley[1], Ryan Varischetti[1], Greg Platz[3], Lisle Snyman[3], Grant Hollaway[4], Melissa Cook[4], Nick Poole[5], Tracey Wylie[5], Andrew Milgate[6], Zhanglong Cao[2] and Robert Loughman[1],

[1]DPIRD, South Perth; [2]SAGI-West, Curtin University, Bentley; [3]Department of Agriculture Fisheries and Forestry; [4]Agriculture Victoria; [5]Foundation for Arable Research; [6]NSW Department of Primary Industries

Key messages

- Current resistance categories were well reflected in the yield responses observed for various wheat foliar diseases; however, yield losses for particular resistance categories varied by disease and disease intensity.
- Disease expression increased with the susceptibility of varieties, resulting in correspondingly higher yield loss.
- Partially resistant varieties differed in the extent of their yield loss corresponding with lower disease expression.
- Partial resistance was effective in reducing losses from all diseases depending on the type and severity of disease and the yield potential.
- An online model has been developed so growers and consultants can make more informed decisions about variety and paddock selection by being able to compare yield responses to various resistance categories of individual diseases.

Aims

To generate response curves describing the change in yield due to changing intensity of five key wheat foliar diseases (yellow spot, nodorum blotch (*syn*. septoria nodorum blotch), leaf rust, stem rust and stripe rust) across a range of partial resistances.

Results

Wheat expressed different rates of yield loss depending on the type and pressure of the disease. More susceptible varieties expressed higher levels of disease and correspondingly higher yield loss as compared to partially resistant varieties. Partial resistance reduced yield loss to around 40-47% of losses observed in susceptible varieties for nodorum blotch, 46 to 50% for yellow spot, 65 to 89% for leaf rust, 50 to 57% for stem rust and 59% for stripe rust, contributing significantly to protecting yield in disease-conducive situations.

Conclusion

This study provides the first set of definitive results demonstrating yield loss responses to wheat foliar diseases as influenced by variety partial resistance, epidemic intensity and environment. Partial resistance was effective in reducing losses from all diseases for current commercial wheat varieties. Growers and consultants can now make more informed decisions about variety and paddock selection by being able to compare yield responses to various resistance categories of individual diseases.

Notes:

Notes:

Chemical residues/MRLs – impact, understanding and trade issues

Gerard McMullen National Working Party on Grain Protection

ABSTRACT:

Key messages

- It is a legal requirement to follow all Label Directions when applying any chemical to the crop.
- There are different perceptions and legal/contractual requirements of key domestic and export markets for chemical residues.
- There are market access implications when using chemicals – applying a chemical according to Label Directions does NOT necessarily mean that grain will meet market requirements.
- There is a need for advisers and growers to understand your market and seek advice on the MRLs that apply. Talk to your marketer if possible before you intend to apply chemicals to a crop.

Aims

The aim of this project is to monitor changing market maximum residue limits (MRLs) and determine the impact on the Australian grain industry.

Discussion

Each market has their own MRL regulations. Applying chemicals in Australia according to regulated Label Directions does not mean that grain will meet the MRL requirements of all markets. Provision of grain above an MRL risks market access into that country.

It is the responsibility of all growers to apply chemicals as per Label Directions. Failure to do so may result in additional costs to exporters, e.g. sampling and testing. Those costs may be passed onto the grower.

Markets are monitored for any changes in their MRL regulations. Where significant impacts arise on the ability of growers to produce a crop profitably, liaison occurs with all sectors of industry to agree on the need to seek changes to those proposed MRLs. Where a submission is not successful or adequate, advice to industry is provided on the implications of those MRL changes and what actions may be available to minimise risks of non-compliance when supplying grain.

Conclusion

Markets are increasingly focussed on ensuring grain supplies have minimal chemical residues. Increasing adoption of chemical regulations and lowering of MRLs places pressure on grain suppliers to ensure any chemical residues on the crop comply with market requirements.

Those export market MRLs may differ from those that apply in Australia and it is the responsibility of all growers to ensure not only that chemicals are applied according to legal requirements, but advice to the post farmgate sector is correct when information on chemicals used is sought via measures such as Commodity Vendor Declarations.

Notes:

Notes:

The National Paddock Survey – what causes the Yield Gap in Western Australia?

Roger Lawes, Commonwealth Scientific and Industrial Research Organisation

ABSTRACT:

The yield gap calculator and implications of the national paddock survey for Western Australia

Roger Lawes[1], Harm Van Rees[2], Jeremy Whish[1], Gupta Vadakattu[1], David Gobbett[1], Jackie Ouzman[1], Chao Chen[1], Noboru Ota[1],
[1]CSIRO, [2]Cropfacts Pty Ltd

The GRDC national paddock survey project (BWD00025) of 250 paddocks for four years was designed to understand the basis behind the yield gap. The yield gap is the difference between the actual crop yield achieved by the grower and the water-limited yield potential, determined by a crop model.

- Yield gaps in wheat were infrequent, with one in three paddocks having a yield gap of 0.8t/ha or more. The yield gap in wheat averaged 20% of yield potential.
- The most important driver of the yield gap was the nitrogen (N) unlimited yield potential, with the higher the yield potential, the greater the likely yield gap. Growers are less likely to achieve yield potential in favourable seasons.
- Nitrogen was the next most important variable, and crops with higher yield potentials were most likely to be under-fertilised and therefore N limited.
- Crop rotation was also an important driver of the yield gap, but only in some situations. Break crops were often beneficial but did not automatically solve all problems. Occasionally pathogens such as Fusarium, Rhizoctonia or Pythium were present after a break crop was grown, and these pathogens contributed to the yield gap.
- Thirteen groups or 'types' of yield gap were identified nationally. For Western Australia, four of these groups dominated and in addition to variables described above, Rhizoctonia, Pythium, Pratylenchus and yellow leaf spot also contributed to the yield gap.
- The yield gap calculator is presented as a decision tree and is designed to help inform when a yield gap could occur.
- Conventional wisdom suggests achieving a yield potential of 80% is good. However, the challenge for the industry is to find ways to economically capture that additional 20% of yield potential that is biologically available with our current genetics.

Acknowledgments

We thank the consultants and growers who engaged with the National Paddock Survey. The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, the authors would like to thank them for their continued support.

Notes:

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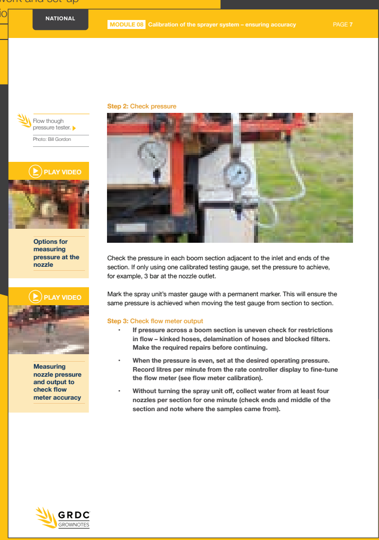
SPRAY APPLICATION GROWNOTES™ MANUAL



SPRAY APPLICATION MANUAL FOR GRAIN GROWERS

The Spray Application GrowNotes™ Manual is a comprehensive digital publication containing all the information a spray operator needs to know when it comes to using spray application technology.

It explains how various spraying systems and components work, along with those factors that the operator should consider to ensure the sprayer is operating to its full potential.

This new manual focuses on issues that will assist in maintaining the accuracy of the sprayer output while improving the efficiency and safety of spraying operations. It contains many useful tips for growers and spray operators and includes practical information – backed by science – on sprayer set-up, including self-propelled sprayers, new tools for determining sprayer outputs, advice for assessing spray coverage in the field, improving droplet capture by the target, drift-reducing equipment and techniques, the effects of adjuvant and nozzle type on drift potential, and surface temperature inversion research.

It comprises 23 modules accompanied by a series of videos which deliver 'how-to' advice to growers and spray operators in a visual easy-to-digest manner. Lead author and editor is Bill Gordon and other contributors include key industry players from Australia and overseas.

Spray Application GrowNotes™ Manual – go to:
https://grdc.com.au/Resources/GrowNotes-technical
Also go to https://grdc.com.au/Resources/GrowNotes
and check out the latest versions of the Regional Agronomy Crop GrowNotes™ titles.

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Maintaining wheat yield and quality at high temperatures

Richard Trethowan, University of Sydney

ABSTRACT:

Maintaining wheat yield under high temperatures: How do current cultivars compare with what's coming?

Richard Trethowan[1], Rebecca Thistlethwaite[1], Sang He[2], Reem Joukhadar[2], Daniel Tan[1] and Hans Daetwyler[2], [1]The Plant Breeding Institute, The University of Sydney; [2]Agriculture Victoria, AgriBio, Bundoora

Key message

- Recent Australian wheat cultivars are heat tolerant. However, new materials developed from extensive diversity using field-based phenotyping and genomic selection suggest that levels of heat tolerance can be significantly improved.

Aims

The work was conducted to improve the heat tolerance of Australian wheat. Heat tolerant germplasm, protocols for high-throughput screening and molecular tools to assist commercial wheat breeders were developed.

Genomic selection is a breeding method that requires a reference population of wheat lines that are phenotyped for the trait of interest and genotyped using many DNA markers distributed across the whole genome. Statistical methods are then used to estimate the effect of each DNA marker on the phenotype; the collection of all these DNA marker effects provides a prediction of genomic breeding value. This information can then be used to predict new plants that are only genotyped and do not have a phenotype. This allows early selection of plants/lines without phenotyping which decreases the breeding cycle leading to increased genetic gain.

Results

Extensive field-based phenotyping over a six-year period identified lines with superior adaptation to terminal heat stress. The tolerance of these materials was then confirmed in field-based heat chambers. The heat chambers were calibrated over a three-year period in replicated, triplicate plots. Heat shock at anthesis significantly reduced yield compared to an ambient chamber and the uncovered plot. The ambient and uncovered plot were not significantly different from each other; therefore, all future screening was conducted as paired plots (with and without heat chambers). The developed genotype-by-environment interaction genomic selection model increased genomic prediction accuracy for yield by up to 19%.

Conclusion

Some recent Australian cultivars combine both high yield and heat tolerance. However, new pre-breeding materials developed using genomic selection offer commercial wheat breeders' new sources of diversity for both yield and heat tolerance that can be used to mitigate the effects of a warming environment. The strategy of selecting for heat tolerance at Narrabri for other regions of Australia was validated by the relatively high correlations between GEBVs and yield under heat stress at Merredin and Horsham.

Notes:

The Weed Chipper – mechanical site-specific fallow weed control

Andrew Guzzomi, University of Western Australia

ABSTRACT:

Andrew Guzzomi[1], Carlo Peressini[1], Michael Widderick[2], Adam McKiernan[2], Bhagirath Chauhan[3] and Michael Walsh[4], [1]UWA, [2]Queensland Department of Agriculture and Fisheries, [3]The University of Queensland and [4]University of Sydney

The 'Weed Chipper' is a targeted tillage system developed for precision fallow weed control based on a hydraulically driven response tyne. The mechanical nature of this system enables greater flexibility and opportunity for its use in environmental conditions that prevent the application of herbicides.

The response tyne has the demonstrated capacity to control weeds across a wide range of growth stages and sizes with the potential to reduce the number of passes compared to current herbicide practice. A pre-commercial scale rig has been constructed and on-farm commercial scale testing/evaluation has demonstrated high weed control efficacy and low soil disturbance. Excellent weed control efficacy (>95 per cent) on small through to very large (>50cm diameter) weeds has been demonstrated.

The periodic tilling action required for low-density weed populations will also permit the Weed Chipper to be coupled to low horsepower tractors. With no direct need for chemical use for this system there are likely to be significant cost savings to growers using the Weed Chipper system. The Weed Chipper is now being commercialised.

Notes:

Great brome grass and barley grass – understand the enemy

Catherine Borger, Department of Primary Industries and Regional Development

ABSTRACT:

Catherine Borger[1], Abul Hashem[1], Daniel Petersen[2] and Gurjeet Gill[2], [1]DPIRD; [2]The University of Adelaide, Waite Campus, South Australia

Key messages

- Three to four years seed set control was needed to remove a great brome or barley grass soil seed bank. Great brome had high seed production in Western Australia and South Australia. Barley grass had much higher seed production in South Australia than Western Australia.
- Great brome grass and barley grass reduced crop yield to a greater extent than sowthistle, doublegee and wireweed.
- Modelling indicated that harvest weed seed control is a valuable tool in the management of these species, even in the years where most weed seed is shed prior to harvest.

Aims

Brome grass and barley grass are ranked as the fourth and ninth most detrimental weeds nationally, with an annual revenue loss of $22.5 and $1.7 million respectively. Understanding the ecology of these species is the vital to developing a successful weed management plan. A five-year GRDC project produced results on emergence patterns, seed bank persistence, seed shedding and competitive ability of great brome and barley grass, in Western Australia and South Australia ('Seed bank ecology of emerging weeds' UA00156). This data was used to update a decision support tool; the Weed Seed Wizard (WSW). The updated model was used to investigate harvest weed seed control (HWSC) as a potential management technique for great brome grass and barley grass.

Results

Both great brome and barley grass produced dormant soil seed banks that lasted 3-4 years. Both species had staggered emergence throughout the season, indicating late season weed control is important. Great brome was the most competitive weed species in wheat, with a high density of plants reducing crop yield by 43% in 2019. Barley grass reduced yield by 29%. Seed shedding for both species was early (compared to annual ryegrass) and variable due to seasonal conditions.

Modelling results indicated that great brome grass was difficult to control with herbicide alone over a six year wheat-wheat-lupin rotation. When the initial soil seed bank started with 100 seeds/m^2, there were 10954 seeds/m^2 in the soil seed bank at the end of six years. However, harvest weed seed control (HWSC) of 20% of great brome seed per year reduced the soil seed bank to 5925 seeds/m^2 at the end of 6 years, and HWSC of 60% of seed per year reduced the final weed seed bank to 86 seeds/m^2. Harvest weed seed control also reduced barley grass seed production, but this species was less competitive in crop and more easily controlled by herbicide.

Conclusion

The seed bank of great brome and barley grass can last at least four years, depending on the population (ecotype). Staggered emergence of both these species make it difficult to control all plants, but both species will reduce crop yield if they are not successfully controlled.

Modelling indicated that HWSC was worthwhile for great brome, even if most seed had shed at harvest. Even an annual destruction of 20% of great brome grass made a large difference in the long term seed bank of this species. Long-term barley grass control also benefited from HWSC, but barley grass was much easier to control in crop than great brome. Further research is required to determine if HWSC is feasible for barley grass in the field, given that the plants can be much shorter than great brome.

Note that this information can be found in the following papers:

- C Borger, A Hashem (2020) Weed Seed Banks – How Long Do They Last?
- C Borger, D Petersen, G Gill (2020) Great Brome and Barley Grass – Modelling the Long-Term Value of Harvest Weed Seed Control.

Notes:

Wheat variety performance and insights from the 2019 season

Dion Nicol, Department of Primary Industries and Regional Development

ABSTRACT:

Dion Nicol, Jeremy Curry, Brenda Shackley, DPIRD

With most of the Western Australian wheat NVT's not germinating until the 7th June and many areas receiving very little rainfall after July, it would be expected that the shortest maturity wheats would dominate in 2019.

NVT single site yield data shows the new short maturity Vixen⁽ᴾ⁾ averaged 121 per cent of trial mean yields as the top yielding variety. However, there were poor and high yielding varieties in each maturity. For example, Vixen⁽ᴾ⁾ out-yielded other short maturity wheats Emu Rock⁽ᴾ⁾ (very similar phenology) by 20 per cent (101 per cent average) and LRPB Cobra⁽ᴾ⁾ (by 39 per cent (82 per cent average). The top short-mid varieties were consistent with Devil (112 per cent) and Scepter (111 per cent) performing very similarly in relative yield to previous years. Most surprisingly, the two new release mid-long maturity varieties Catapult⁽ᴾ⁾ (AGT) and Rockstar⁽ᴾ⁾ (InterGrain) have yielded exceptionally well (104 and 106 per cent) for their maturity in the 2019 season with significant yield advantage over Cutlass⁽ᴾ⁾ (94 per cent), Magenta⁽ᴾ⁾ and LRPB Trojan⁽ᴾ⁾ (both 87 per cent) and therefore demonstrate lower risk of reduced yields if germination is delayed.

The insights from 2019 will be put into context with past seasons to ensure the upside of a variety in an earlier season-break or wet-finish is balanced against a varieties risk during conditions like 2019.

Notes:

What are the optimal flowering periods for wheat across WA and how will they change with potential climate change?

Andrew Fletcher, CSIRO Agriculture and Food, Floreat

ABSTRACT:

Chao Chen, Andrew Fletcher, Noboru Ota, Roger Lawes, CSIRO

Key messages

- There were clear geographical patterns in the optimal flowering periods for wheat across the wheatbelt of Western Australia, with earlier opening and closing dates (23 Jul – 30 Sep) in the northeast and later opening and closing dates (23 Aug – 21 Oct) in the southwest.
- Optimal flowering periods for wheat in WA would be expected to occur earlier under future climate scenarios, especially under a drier climate.
- Provided flowering occurs within the optimal flowering period, long-duration cultivars sown early would achieve higher yield under both current and future climates, but early-sowing opportunities will be limited under dry scenarios.

Aims

The aims were to: 1) identify the spatial patterns of the optimal flowering periods of wheat across the wheatbelt of Western Australia for current climate; 2) explore the potential changes in optimal flowering period for future climate; and 3) explore the combination of cultivar choice and sowing date to achieve the optimal flowering period.

Results

Due to the spatial variation in climate, the opening and closing dates of the optimal flowering periods showed large spatial variation across the wheatbelt. The opening dates of the optimal flowering periods ranged from 23 Jul to 8 Oct and closing dates ranged from 23 Aug to 21 Oct from the northeast towards the southwest. The duration of the optimal flowering periods varied between 11 and 25 days in most of the wheatbelt.

The potential changes in future climate were predicted to affect the optimal flowering period of wheat. Optimal flowering periods would occur earlier under future climate scenarios. The opening dates of the optimal flowering periods were advanced by 6-23 days among three locations under the wet scenario and by 13-37 days under the dry scenario.

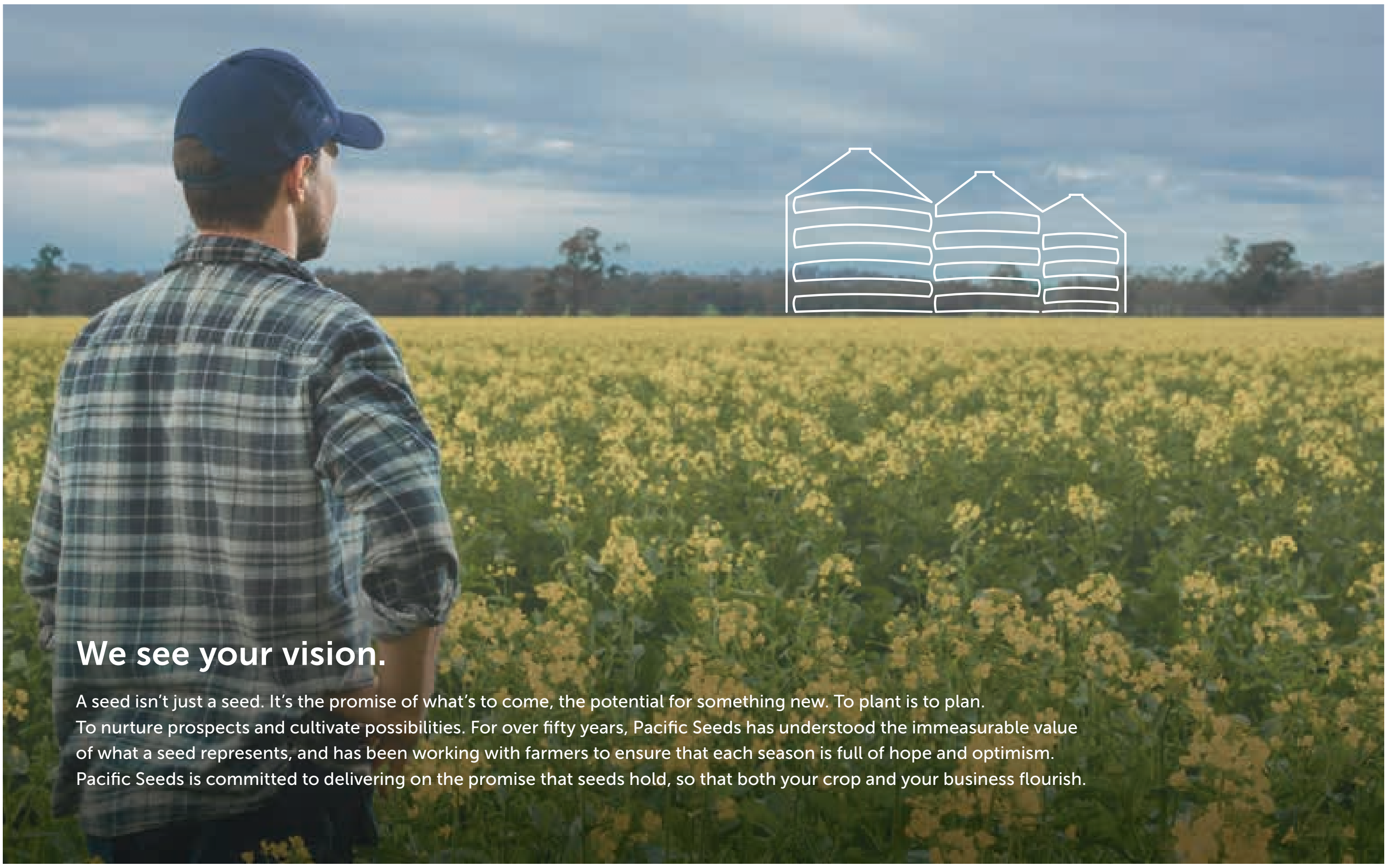
To achieve the optimal flowering period, a short-season cultivar should be sown later than a long-season cultivar for both current and future climates. In terms of yield, early sowing of long-season varieties is preferable to achieve the optimal flowering period in both current and future climate scenarios.

Conclusion

There were clear geographical patterns of optimal flowering period occurred across the wheatbelt, with opening and closing flowering dates being earlier in the northeast and later in the southwest under the current climate. The duration for the optimal flowering period was relatively narrow across most areas of the wheatbelt. Under future climate scenarios, the optimal flowering period is likely to occur earlier, indicating farmers need to target earlier flowering. Farmers will need to match sowing date and cultivar to achieve the optimal flowering periods.

Notes:

Notes:



Where to now with redlegged earth mite resistance

Svetlana Micic, Department of Primary Industries and Regional Development

ABSTRACT:

Key message

- Redlegged earth mites (RLEM) that have developed resistance to organophosphates and synthetic pyrethroids are becoming more common in broadacre farming in WA. As a consequence, the industry will need to look at alternatives to spraying insecticides to control RLEM.

Aims

To determine the extent of RLEM insecticide resistance in the Western Australia grain belt.

Results

Mites were collected from the high to medium rainfall areas of WA, from Gingin to Esperance and as far west as Cowaramup. Mites were bioassayed from a total of 73 sites and over half of these sites had RLEM that survived field rates of insecticides.

Of concern is that 13 sites had RLEM with resistance to synthetic pyrethroids and to more than one insecticide in the organophosphate range: chlorpyrifos, omethoate and malathion. This indicates that organophosphates are no longer an effective long-term solution for RLEM control.

Conclusion

Organophosphate (e.g. omethoate; Group 1B) and synthetic pyrethroid (e.g. bifenthrin; Group 2A) insecticides cannot be relied on to effectively control RLEM long term. Alternative control measures need to be considered such as:

- Use of crop rotations that fit with the farming system to suppress RLEM. For example, grow crops susceptible to RLEM mite damage, such as canola, after crops that do not support large RLEM populations, such as a cereals.
- Heavy grazing of pasture paddocks to a residual of 1400kgDM/ha through spring in the year prior to sowing crops susceptible to RLEM such as canola.
- Control weeds. Weeds provide habitat for mites. A weed free crop will have few mites and less over-summering of eggs to carry through to the following season.
- Use insecticidal seed dressings
- Use alternative insecticides. If sprays need to be applied for the control of other pests (e.g. aphids), consider using insecticides not in the SP or OP group.

For further information refer to the Resistance Management Strategy for RLEM at: https://grdc.com.au/FS-RLEM-Resistance-strategy.

Notes:

Snail management – slowing the snail menace

Sarah Belli and Svetlana Micic, Department of Primary Industries and Regional Development

ABSTRACT:

Will anything repel snails?

Sarah Belli, DPIRD

Key messages

- None of the four treatments in this trial repelled small conical snails, i.e. No snails on whole of plant for a period of 21 days after application.
- Products should not be used if they are not registered for that specific purpose.

Aims

The aim of this trial was to test the snail repellence of some of the products being promoted or anecdotally observed in broad acre crops to repel snails without supporting data or being registered for this use in crops for snail repellence.

Results

The treatments had statistically less snail activity compared to Nil over the first 24-hour period. Pyroligneous acid and urea had no repellence effect on small conical snails.

Even though Saponins had statistically less activity on the stems during the first 24 hours and the maximum height of the snails was lower than the Nil treatment (for at least the first three days), the total number of snails on the stubble was not statistically different to Nil at any assessment time in the three weeks after application.

Carbendazim did not prevent the snails from moving onto the stubble and there was no statistical difference between Nil and Carbendazim at any assessment timing for the number of snails on stubble. There was no initial difference in maximum snail height between Carbendazim and Nil however the later assessments from 13 DAA onwards show the snails being located lower on the stubble below approximately 20cm from the base whereas on the Nil treatments the highest snail was at approximately 36cm. Carbendazim appears to have kept snails lower however it did not repel the snails completely from of the crop. Therefore in a paddock scenario depending on how low the harvester is set then you may or may not be harvesting these snails.

A spray application prior to harvest of any of the products tested to repel snails from the crop was not successful. No foliar application caused significant mortality 24 days after application.

Conclusion

No foliar spray treatments applied in this trial were found to effectively repel snails from barley plants for any period up to three weeks. Use existing management techniques such as timely baiting, cabling stubbles and keeping the green bridge to a minimum are some of the most effective management tools for controlling snails. Grain cleaning and rolling harvested grain are further options to lower snail contamination. Products should only be used at registered rates, times and methods of application in crops for which they are registered.

Notes:

Consultant experience implementing IPM programs with growers

Iain Macpherson, Macpherson Agricultural Consultants

ABSTRACT:

Key messages

- Pest resistance and pesticide MRL's will necessitate innovative change to IPM.
- The cheapest chemistry could be the dearest.
- Pest management in crops is a fine balance between obtaining the optimum yield with the least impact on the biological control agents.
- Changing practice has seen reduced pest incidence in some species.

Aims

This presentation is aimed to show agronomists and farmers that there has been successful implementation of IPM in other crops and many of these principles are relevant in grains.

Results

Pest sampling data showed a reduction in late season pest pressure and an increase in natural enemies once softer chemistries were introduced.

Cultural controls are an important part of IPM and can significantly reduce pest populations.

Benchmarking was a useful way to demonstrate the economic sustainability of IPM.

Conclusion

In any IPM system it is critical to delay the use of disruptive broad-spectrum chemistries for as long as possible.

In a lot of farming systems we are exacerbating some of the pest issues through our cultural practice and product selection.

Preserving natural enemies can significantly reduce the reliance on pesticides.

Acknowledgments

The IPM results presented are the result of a lot of work and dedication from the consultants and growers of the Macintyre valley. Wick's consulting for the Benchmarking analysis.

Notes:

Regen Agriculture – a grower's perspective

Stuart McAlpine, Grower from Buntine

ABSTRACT:

Stuart McAlpine, Managing Director, Farmbiosis/McAlpine Farms

Stuart will share his experiences and practical examples on what regenerative agriculture is and show there are many opportunities to rebuild our soil health by utilising soil biology along with addressing the chemical and physical constraints across all landscapes.

Stuart McAlpine is a fourth-generation farmer who owns and manages a 5,000-hectare farm at Buntine, Western Australia with his wife Leanne. Stuart is a co-founder of the Liebe Group, one of Australia's premium grower groups, and was its inaugural President in 1997. Stuart has cofounded the Regional Regeneration Alliance, a cross regional impact, not for profit organisation aimed at developing and supporting sustainable land, economic and community regeneration projects utilising collective impact.

Stuart has expert knowledge in soil and regenerative agriculture practice and regularly presents at the University of Western Sydney's Soil Biology Masterclass. Stuart is a committee member at RegenWA, a network of committed West Australian farmers and industry stakeholders who are identifying, implementing and sharing innovative land management practices that other farmers can adopt. Stuart is a non-executive Director and part of the team that has seen the first four return regenerative agriculture company in Australia, Wide Open Agriculture Ltd., become listed on the ASX.

Notes:

Can we double water use efficiency with 'Strip and Disc' farming?

Peter Newman, Planfarm

ABSTRACT:

Strip and Disc – It's all about moisture

Peter Newman[1] and, Greg and Kirrily Condon, [1]Planfarm and [2]Grassroots Agronomy

The strip and disc farming system represents a step wise increase in grain production and is in desperate need of research to verify the gains made by leading farmers, and to fine tune the system for application in other areas. This farming system has been developed by pioneering Australian farmers who have a clear focus on reducing risk in dry seasons but are also aiming to lift water efficiency in all seasons. We are very fortunate that these growers and supportive agronomists such as Greg and Kirrily Condon from Grassroots agronomy, are continually developing an emerging, efficient, highly productive farming system, and we should ignore it at our peril. To date there has been no research focused on this farming system.

In brief, the system involves harvesting cereals with a stripper front that leaves tall standing stubble. This tall stubble shades the soil surface, reducing soil temperature and reducing evaporation of soil moisture in both summer and winter. To enable trash flow at seeding with this very tall stubble, the crop must be sown with a disc seeder, hence the name (coined by Kirrily Condon), strip and disc farming. However, perhaps it should be called disc and strip farming as the disc seeding system is generally implemented first by growers and the stripper front follows later. Narrow row spacing (often 6" to 7") is a necessity for this system to increase crop competition with weeds and improve the action of the stripper front, as are diverse crop rotations. Crop rotation underpins the success of the system for weeds, soil water and nitrogen. For example, a double break sequence of faba beans then canola is followed by wheat then barley. Diverse rotations are implemented by strip and disc farmers to get weed numbers down before sowing cereals with limited pre-emergent herbicide options.

To give an example of what is possible, in 2018 a southern NSW grain grower who has been disc seeding for 11 years and used a stripper front for three years grew a 5.75t/ha barley crop with just 120mm of in crop rainfall. He had 210mm of summer rain at harvest and in early February, then virtually no rain until he sowed his crop on 1 May. It came up!! No rain from early February until May and he seeded into moisture. This is one of the big opportunities with this farming system. I ran this through the Sadras and Angus water use efficiency equation (i.e. updated French and Schultz) and he has achieved 190% of his potential yield. Keep in mind that the national average is 55%. Impossible you say. Essentially, he has used nearly every drop of rainfall that fell with almost none lost to evaporation. Long term zero-till with a disc seeder is improving soil structure which combined with full stubble retention is lifting soil water holding capacity. He uses pre-emergent herbicides strategically and is beating ryegrass through diverse rotations, narrow rows and croptopping.

In my experience, the great gains in agriculture come from pioneering farmers and agronomists trying new things then the research follows. Strip and disc farming will be no different.

Notes:

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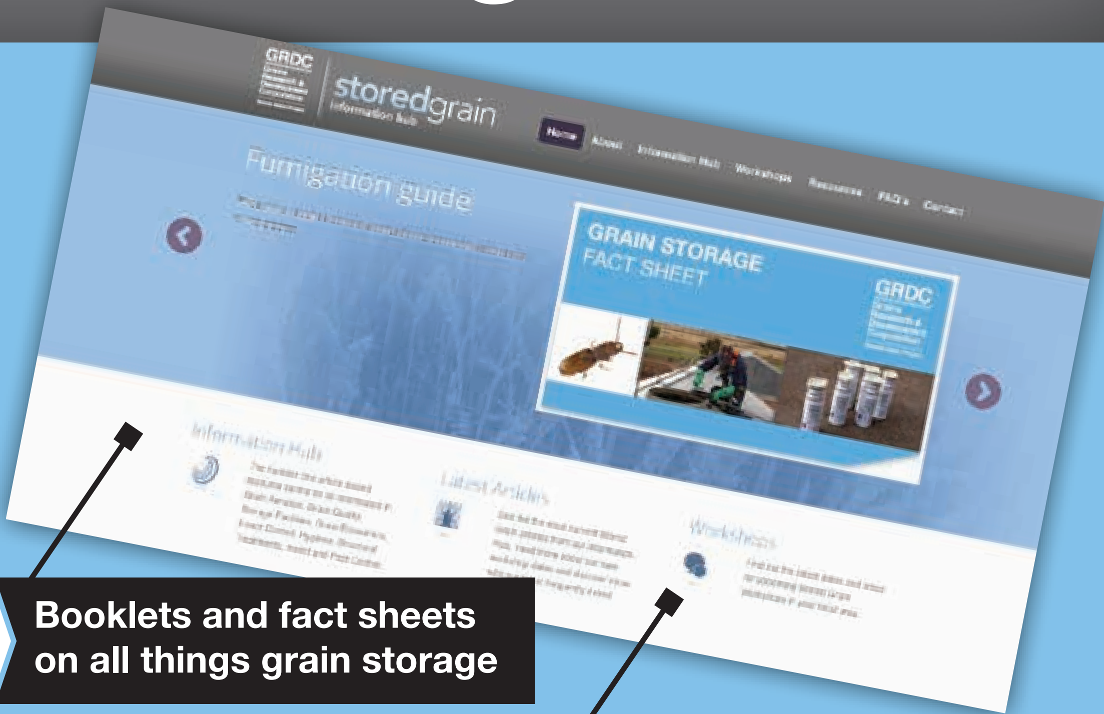

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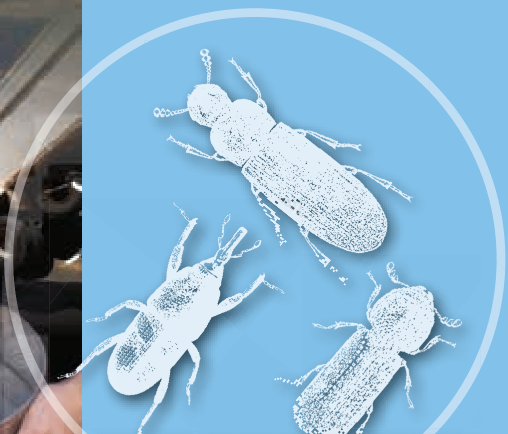

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A tale of two wheat diseases – new research could change our understanding of the impact of Yellow Spot and Septoria Nodorum Blotch in WA

Ayalsew Zerihun and Mark Gibberd, Centre for Crop and Disease Management

ABSTRACT:

A tale of two wheat diseases: co-occurrence of the yellow spot and Septoria nodorum blotch diseases of wheat in the WA wheatbelt

Chala Turo, Ayalsew Zerihun, Linda Thomson, King Yin Liu, Mark Gibberd, CCDM, School of Molecular and Life Sciences, Curtin University

Key messages

- In the WA wheatbelt, yellow spot (YS) and Septoria nodorum blotch (SNB) diseases of wheat are thought to be widespread and collectively they cause $247M annual losses1. The attribution of these losses is thought to be nearly evenly split between the two pathogens; however, because of their co-occurrence, they are difficult to distinguish visually.
- Extensive sampling and detailed analyses, from two seasons of field experiments with six varieties across four ag-zones in the WA wheatbelt show that there are clear differences in the relative abundances of the two pathogens: *Parastagonospora nodoum* (Pn) the causal agent of SNB was present at a much lower level than *Pyrenophora tritici repentis* (Ptr), the YS causal agent, particularly at the southern and eastern sites.
- The relative abundance of Ptr and Pn also changed with crop development such that as the wheat crops developed, and particularly in the upper canopy leaves, Ptr progressively dominated the total Ptr-Pn load.
- This extensive study highlights the highly dynamic nature of Ptr and Pn co-infections of wheat across the WA grain belt and crop development.

Aims

Contribute to a better understanding of the epidemiology, and extent of, co-infection of wheat by the Ptr and Pn in the WA wheatbelt.

Results

Results from the multisite, season and variety epidemiological study show that while the two pathogens do co-infect wheat, this is more likely in the northern than in the southern regions. Further, co-infection was generally more common during the earlier phases of wheat development than at the late stages whereby Ptr was dominant.

In the grain-filling upper canopy leaves, often only Ptr was present in detectable and quantifiable amounts across the sites and varieties.

Conclusion

In the WA wheat belt, over the period studied, Pn was generally a minor component of the Ptr-Pn pathogen load, particularly in the upper canopy leaves. The study highlights the highly dynamic nature of YS and SNB (co-infection) epidemiology and the importance of genetic analysis to determine which pathogens are dominating at any given time.

These findings indicate a reassessment of the existing estimates of crop loss attributions due to Ptr and Pn in WA is warranted.

Notes:

Azole resistance in Spot form of net blotch in Western Australia

Fran Lopez-Ruiz, Centre for Crop and Disease Management

ABSTRACT:

Fran Lopez-Ruiz[1], Wesley Mair[1], Geoff Thomas[2], Kith Jayasena[2], Andrea Hills[2], Anke Martin[3], [1]CCDM, School of Molecular and Life Sciences, Curtin University; [2]DPIRD; [3]Centre for Crop Health, University of Southern Queensland

Key messages

- Fungicide resistance to Group 3 (DMI) fungicides in spot form net blotch is spreading in the southern region of WA.
- Overuse of fungicides with the same mode of action will speed up development of fungicide resistance.
- We can limit the development of fungicide resistance by using the lowest effective label dose, appropriate fungicide group rotations and employing IDM practices including crop rotation, stubble management and selection of more resistant cultivars (if available).

Aims

In 2017, the Department of Primary Industries and Regional Development (DPIRD) reported a barley paddock near South Stirling in which, despite the application of a strong DMI program, SFNB was found at extremely high levels. The efficacy of some Group 3 fungicides has been impacted by the development in WA of a resistant hybrid that shares many similitudes with SFNB. This paper provides an overview of the current knowledge on this fungicide resistant hybrid and the spread of the resistant populations in WA.

Results

Three different Group 3 fungicide sensitivity groups have been found in samples of SFNB: sensitive, reduced sensitive and resistant. Resistant isolates (19.4%) were only found from the 2016 season onwards and limited to the southern region of WA. Two main gene changes were found to be correlated with resistance to Group 3 fungicides in SFNB, mutation F489L in the target gene and a major modification in a region of the gene that controls the levels of the target in the fungus. Hybridisation analyses revealed that all fungicide resistant isolates were hybrids between Ptm and Ptt. In addition to this, population marker analysis showed that all hybrids were clones.

Conclusion

Fungicide resistance has developed in SFNB in WA. The analysis of the isolates collected showed that resistance has spread across the south of WA from the 2017 season onwards. Most of the hybrid resistant isolates have come from Oxford samples. Results suggests that improved knowledge of host susceptibility may allow for the selection of varieties with lower susceptibility to this hybrid isolate.

In the high rainfall areas of Esperance and Albany zones where the resistant type has been detected, tebuconazole and propiconazole use should be avoided in solo formulations and limited when any of these two compounds are mixed with a different fungicide, especially from Group 3. In areas where only the reduced sensitive type has been detected (central and northern regions), propiconazole use should be limited to once per season to avoid placing extra pressure on this active. Other fungicide modes of action (Group 11 and Group 7) remain effective at controlling these hybrids and should be incorporated into the spray programs.

Notes:

Battling net blotch in barley – when co-innovation goes to work in WA's south – resistance detection and in-field solutions

Fran Lopez-Ruiz, Centre for Crop and Disease Management

ABSTRACT:

Lorenzo Covarelli, Mark Gibberd, Megan Jones, Fran Lopez-Ruiz, Azin Moslemi, Ting Tang, Linda Thomson,
CCDM, Curtin University

Key messages

- Co-innovation initiative, pilot project.
- Growers/researchers working together to tackle net blotch, resulting in up-to-date snapshot of net blotch issues in cohort area and development of regionally-relevant solutions.
- Greater engagement and alignment between researchers and growers, with timely and effective management practices made available.

Aims

A pilot project to directly engage and work with growers to find local, regionally relevant solutions to manage fungicide resistant pathogens on barley. The project focuses on spot form net blotch (SFNB) (*P. teres f. maculata* (Ptm)) and net form net blotch (SFNB) (*P. teres f. teres* (Ptt)).

Method

In mid- 2019, CCDM enlisted 173 barley growers from the South of the WA Wheatbelt to take part in the Barley Disease Cohort Project, a pilot project designed to use a co-innovation approach. The growers collected and sent in diseased leaf samples from 330 paddocks for fungicide resistance detection.

The research process included submission of samples which were then logged, photographed and scored. A composite (multiple leaves and isolates) sample was selected, oven dried, milled and sub-sampled. DNA was then extracted from the sub-sample for three levels of analysis:

1. Molecular analysis for the presence of Ptt (net form net blotch) and Ptm (spot form net blotch).
2. Molecular analysis for *highly and moderately* DMI-resistant Ptt or Ptm detected.
3. Isolation tests for *highly and moderately* DMI-resistant Ptt or Ptm detected.

Results

Results were finalised in mid-February 2020 and an overview will be presented for the first time at the Perth Grains Research Updates 2020.

A map has been produced showing the occurrence of *P. teres f. Teres* and *P. teres f. maculata* across the Cohort region and their resistance status. This will be presented at Updates along with an up-to-date snapshot of net blotch in the cohort area, disease resistance status, as well as efforts to develop practical, regionally-relevant disease management advice to growers/agronomists.

Results and management strategies have been shared with the grower and the cycle repeats annually. Cohort growers with resistance were notified and advised on how to approach the 2020 season. CCDM researchers will work with the Cohort growers to carry out field trials in 2020 to address the shortage of research into evidence-based solutions for managing fungicide resistant pathogens. Glasshouse trials are also being organised. Meanwhile, growers in this area are advised to reduce their risk of fungicide resistance by rotating their fungicide mode of actions, choosing resistant varieties, rotating their cropping programs and managing their stubble appropriately.

A description of the project structure and methodology will be given.

This is a three year project with results from one year being used to advise management practices of growers for the subsequent season.

Notes:

Crop type, sowing date, nitrogen and seeding rate which is the biggest frost risk management lever?

Ben Biddulph, Department of Primary Industries and Regional Development

ABSTRACT:

Conservative nitrogen and seeding rates in frost prone landscapes reduces frost severity and duration but; the opportunity cost outweighs the rewards

Ben Biddulph[1], Rebecca Smith[2], Chloe Turner[3], Trent Butcher[4], Steve Curtin[4], Brad Joyce[4], Ben Whisson[4], Richard Maccallum[5] Kelly Angel[6], Karyn Reeves[7], Sarah Jackson[1] and Dean Diepeveen[1], [1]DPIRD South Perth, [2]Living Farm, [3]Facey Group, [4]ConsultAg, [5]NSW DPI, [6]Birchip Cropping Group and [7]Curtin Uni/SAGIWEST

Key messages

- Reducing nitrogen (N) and seeding rate to half of farmer practice can reduce frost severity and duration but not frost damage.
- Under nil and light frost damage (0-20%) increasing N inputs increased grain yield and gross income.
- Under moderate frost damage (20-60%) increasing N inputs increased grain yield and gross income or had no effect.
- Under severe frost damage (>60%) increasing N inputs did not increase grain yield or gross income.
- In frost prone landscapes maintaining normal grower practice of seeding rate and nitrogen for local yield potential gave the greatest return without frost, some financial advantage with moderate frost, and most importantly was never worse off with severe frost.

Aims

To evaluate the role of canopy management in frost prone landscapes through nitrogen and seeding rate on frost severity and duration and subsequent frost damage.

Results

At most sites and seasons that where nitrogen responsive (biomass increased with N application) increasing nitrogen increased either frost severity (minimum temperature), frost duration (hours below 0, -1, -2, -3 or -4°C) or both. However, the increase in frost severity and duration was not associated with an increase in frost damage except in one treatment in the 12 trials ran. Only one of the 12 sites was responsive to seeding rate and over half were responsive to nitrogen, (anthesis, maturity biomass and/or grain yield). With nil and light frost damage (<20%) increasing N, increased grain yield, protein and gross margin (gross income- variable input costs of N and seed); with moderate frost damage (20-60%) there was either an increase in grain yield, protein and gross income or no change, while under severe frost damage (>60%) there was no change in grain yield, protein or gross income.

Conclusion

Growers should continue to maintain high seeding rates and standard nitrogen inputs for local yield potential in frost prone landscapes. Late nitrogen applications may be managed to offset financial risk, but growers need to carefully consider the opportunity costs.

Notes:

The potential role of companion and intercropping in Australian grain farming systems. Should we be considering them?

Andrew Fletcher, Commonwealth Scientific and Industrial Research Organisation

ABSTRACT:

Andrew Fletcher[1], John Kirkegaard[1], Greg Condon[2], Tony Swan[1], Ken Greer[3], Eric Bremer[3], James Holding[4], [1]CSIRO Agriculture and Food; [2]GrassRoots Agronomy; [3]Western Ag Innovations, [4]FarmLink

Key messages

- There is increasing interest in the use of companion and intercropping systems in Australia.
- There are productivity benefits from intercropping, but farmers are seeking other systems benefits such as rotational benefits, risk management, soil improvement and reduced input costs.
- Most of the challenges can be met with perseverance and innovation.

Aims

Examine the potential benefits and limitations of companion and intercropping in Australia.

Results

We reanalysed historical data of published and unpublished intercropping experiments in Australia. These found yield improvements of 12% for cereal legume intercrops and 49% of canola-legume intercrops. These experiments also showed reduced yield risk and improved profitability.

We also undertook 20 case studies from selected farm businesses across Australia that were currently trying or have previously tried intercropping or companion crop mixtures at commercial scale.

For most farmers the yield benefits of intercrops and companion crops were secondary motivations compared to the farming system benefits they were trying to achieve (e.g. rotational, risk management, soil improvement and reduced input costs).

There has been a recent resurgence in the adoption and research of intercrops in Canada. This has been driven by farmer interest. The area of intercrops has increased rapidly in the prairie provinces of Canada. For example, the area has doubled in Saskatchewan from 2018 to 2019 (from 15,600 to 29,300ha). In 2019 there were a total of 140 growers with insured intercrops.

Conclusion

There is increasing interest in the use of mixed species systems (both intercrops and companion crops) in both Australia and overseas. There are potentially large yield benefits from growing mixtures of two species. However, any future adoption of these approaches is likely to be driven by the farming systems benefits associated with intercrops and companion crops.

Notes:

Impacts of liming and pasture rotations on wheat yield in the low rainfall zone

Daniel Kidd, University of Western Australia

ABSTRACT:

Daniel Kidd[1], Dion Nichol[2], [1]UWA, [2]Department of Primary Industries and Regional Development Merredin

Key messages

- Improved soil pH can increase wheat grain yield up to 25%.
- Pasture legumes are an effective rotation and can improve subsequent wheat yield by a further 25% on the increase in yields achieved through liming.
- Where liming is not economically viable, acid soil tolerant varieties remain an important tool for maintaining yields in acid soils..

Aims

- To investigate what impact a liming induced soil pH change has on soil and measure changes in above and below ground crop growth and yield.
- To examine the effect of a pasture legume, fallow and cereal rotation on wheat yield (± lime).

Results

The historical application of 6.5 t/ha lime sand in 2008 and 2012 at Merredin, increased soil pH from 4.6 to 6.5 at 0 – 10cm and from 4.2 to 4.6 at 10 – 20cm. In 2018, wheat grain yield improved in limed treatments from 2.0 – 3.1 and 2.4 – 3.2 t/ha for CVs Mace and Scepter, respectively. Liming did not influence grain yield of wheat CV Westonia, cereal rye or the pod yield of yellow serradella. Grain protein improved for all wheat varieties in limed treatments. Legume nodulation decreased in limed treatments. There were greater quantities of organic acids in the root zone of legumes and these were further increased within limed treatments.

In 2019, with no N inputs and below average rainfall, grain yields of CV Scepter, following a wheat rotation (W/W) were, on average, 22% greater in limed treatments, compared to unlimed. Grain yield was increased by a further 25% (on lime improved yields) when following a pasture legume (P/W). Average yields for W/W were 1.1 and 1.0 t/ha; wheat on cereal rye 1.0 and 0.7 t/ha and P/W, 1.5 and 1.3 t/ha for limed and unlimed treatments, respectively. Chemical fallow treatments averaged 1.4 and 1.0 t/ha respectively. Grain protein was again improved in limed treatments. Differences in yield could not be attributed to stored soil moisture, soil nitrogen, soil pathogens or previous years N removal in grain or pod.

Conclusion

A pasture legume rotation improved subsequent wheat yields at this site, beyond what could be achieved from simply liming or having a chemical fallow. Acid soil tolerant varieties are still important tools for maintaining yields in acid soils. However, the long-term effects of lime applications in the LRZ and subsequent improvements in grain yield of less acid tolerant varieties should not be overlooked.

Notes:

What trials are telling us about the nutrition piece of the optimum returns puzzle after soil amelioration?

Mark Gherardi, Summit Fertilizers

ABSTRACT:

Maximising return on investment in soil amelioration – determining optimal nutrient applications

Mark Gherardi, Summit Fertilizers

Key messages

- Relative to the cost of extensive mechanical soil cultivation actions, small investments in supplementary nutrition can have an additive effect on post-amelioration crop production.
- Reassessment of all resource inputs to cropping programs after amelioration is very important.
- Matching the improved yield potential with appropriate nutrient rates at establishment:
  1) enables the achievement of higher yields and greater rainfall use efficiency than those attained from amelioration alone;
  2) provides adequate base nutrition to allow maximum efficiency of in-season nitrogen when the opportunity arises; and
  3) improves pay-back to cover and exceed costs of amelioration operations in a short timeframe.

Aims

Examine the building amount of field trial data of crop responses to varying nutrient applications following extensive soil amelioration operations.

Results

Amelioration of subsoil constraints by liming accompanied by significant mechanical physical disturbance operations has become commonplace through the agricultural zones. These operations have a large impact on soil profile conditions.

Crop response to amelioration is well researched and well documented. Numerous field trials from small plot to paddock scale in size have measured crop growth following amelioration operations and the benefits to improved production capacity. However, research addressing the role of supplementary nutrition post-amelioration is not extensive.

Current research projects are revealing detailed crop and sequence mechanisms of nutrient addition to support improved yield potential.

We present data from a number of privately managed field trials to complement the knowledge base, including simple economic analysis of nutrient contribution to gross margins.

Conclusion

Following sizeable operations that produce quantum changes in soil physical and chemical conditions, it is prudent to reassess all aspects of resource inputs to cropping programs. Establishing a new benchmark for plant root exploration of the soil profile means significant change in yield potential and rainfall use efficiency for crops on these soils. Access to the soil nutrient pool most certainly also changes, but evidence strongly points to associated increases in nutrient demand. Addressing the demand through moderate increases in nutrient application substantially improves economic returns from these crops and reduces pay-back time from expensive amelioration operations in a wide range of environments and cropping conditions.

Notes:

Faba beans on southcoast sandplain after soil amelioration

Carla Milazzo, Department of Primary Industries and Regional Development

ABSTRACT:

Carla Milazzo and Jeremy Lemon, DPIRD, Albany

Key messages

- Soil amelioration, particularly liming with incorporation to depth, increases break crop options.
- Faba beans can be successfully grown on light soil types if pH is managed.
- Subsequent nitrogen fertiliser programs should take account of residual nitrogen to optimise the benefits of pulse crops.

Aims

To demonstrate that soil amelioration, particularly liming with incorporation to depth, is a tactic to broaden profitable break crop options as well as improve long-term productivity in general. Through this case study we show that faba beans can be successfully and profitably grown on light country not considered suited to high-value pulses.

Results

A Kojaneerup grower has ameliorated several paddocks on their sand-plain farm by applying lime at 2t/ha and incorporating by deep ripping from 500-700mm with inclusion plates, then spreading a further 2t/ha. They have also spread 250t/ha clay to particularly light areas. At the sites measured, topsoil pH ($CaCl_2$) increased from levels at 4.7-4.9 to 5.4-6.2 within months after liming. At 30cm depth pH ranged from 5.2 to 5.8. Faba beans yielded on average 2t/ha in 2018 and 2.4t/ha in 2019 on ameliorated paddocks.

Based on enterprise gross margins constructed from variable costs (including freight to Fremantle and liming and ripping discounted over ten years), if yields are maintained at just over 2t/ha, the 'breakeven' bean price needed is $300/t. Therefore, favourable prices in recent years have made faba beans a very profitable break crop. Beans also fix nitrogen for the following cereal, and barley grown on bean stubble in 2019 yielded on average 5.8t/ha. Unfortunately, the extra nitrogen was not converted into yield when compared to barley grown on canola stubble adjacent (yielding 6.9t/ha), instead it boosted grain protein levels from 10.8% to 11.9%. This may be attributed to frost events and the hard finish and meant that barley grown after beans was downgraded to feed due to the high protein levels. In future, matching fertiliser N inputs to cereal crop requirements following beans will save money and inputs.

Conclusion

Faba beans have been grown successfully on deep sand, country not typically suited to high-value pulses. This case study demonstrates that with appropriate soil amelioration, faba beans can serve as a much needed break crop in the dominant canola-barley rotation in this area. While price volatility remains a concern for pulse growers, gross margin analysis shows that faba beans can be profitable in their own right, as well as increasing the profitability of the rotation.

Notes:

Pulse performance in a poor season

King Yin Lui, Department of Primary Industries and Regional Development

ABSTRACT:

King Yin Lui and Emma Pearse, DPIRD

Key messages

- Even in a dry season, root lesion nematode (RLN) (*P. neglectus*) and rhizoctonia multiplied in wheat
- All break crops had reduced multiplication rate of RLN except chickpea (PBA Striker) which was similar to wheat
- Beans were the lowest risk non-cereal option to manage a late start or dry finish especially if you can take advantage of high prices
- Wheat outperformed all crop types in the 2019 season although the rotational value of pulses after a dry season will be examined in 2020.

Aims

To investigate the fit of high value pulse crops (faba bean, lentil, and chickpea) in the sowing program and their rotational benefits to following cereal crop.

Results

The poor season experienced in Grass Patch was a result of a combination of dry summer, late break, decile-1 April to October rainfall (170mm), and a frost event on 6 September followed by high temperatures and low rainfall through to October. Faba beans, lentils, and chickpea outperformed canola in terms of yield and gross margin under both low and high price scenarios. Wheat performed the best. All crop types tested had higher yield when sown on 2 May 2019 (canola = 0.25 t/ha (±0.03), faba bean = 0.53 t/ha (±0.02), lentil = 0.51 t/ha (±0.02), wheat = 1.63 t/ha (±0.04)), except chickpea (0.33 t/ha (±0.02)) which was higher when sown on 12 June 2019.

Rhizoctonia and root lesion nematode (*Pratylenchus neglectus*; RLN) were able to multiply under wheat (multiplication rate was 23.5 and 3.0 respectively). Multiplication rate of RLN was stable for faba bean (0.5), lentil (1.22), and canola (1.29), but similar to wheat for chickpea (2.49). Multiplication rate of rhizoctonia was significantly reduced for all crop types other than wheat (canola = 2.6; chickpea = 1.64; faba bean = 3.51; lentil = 1.12).

Conclusion

Performance of pulse crops needs to be measured in terms of productivity in the year grown as well as the value to the farming system in following seasons. This will be examined in 2020 in terms of efficacy as a disease break and nitrogen benefits to wheat.

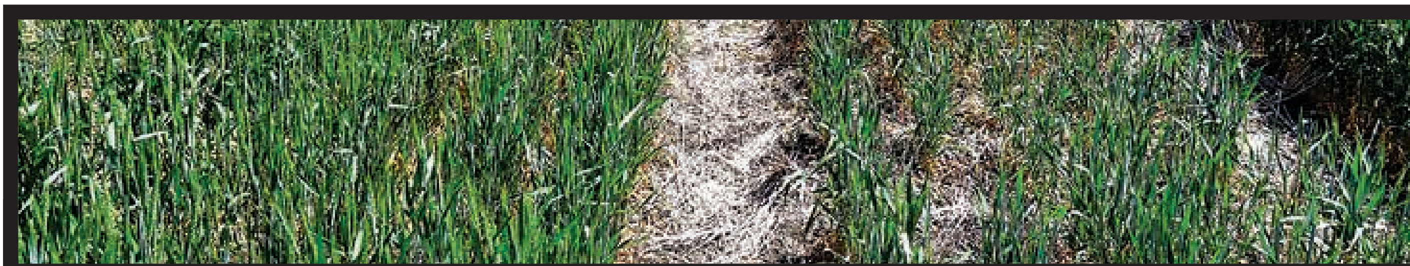
Notes:

SOUTHERN/WESTERN REGION*

PREDICTA B
DNA Soilborne disease tests

PREDICTA® B
KNOW BEFORE YOU SOW

*CENTRAL NSW, SOUTHERN NSW, VICTORIA, TASMANIA, SOUTH AUSTRALIA, WESTERN AUSTRALIA



Cereal root diseases cost grain growers in excess of $200 million annually in lost production. Much of this loss can be prevented.

Using PREDICTA® B soil tests and advice from your local accredited agronomist, these diseases can be detected and managed before losses occur. PREDICTA® B is a DNA-based soil-testing service to assist growers in identifying soil borne diseases that pose a significant risk, before sowing the crop.

Enquire with your local agronomist or visit
http://pir.sa.gov.au/research/services/molecular_diagnostics/predicta_b

Potential high-risk paddocks:

- Bare patches, uneven growth, white heads in previous crop
- Paddocks with unexplained poor yield from the previous year
- High frequency of root lesion nematode-susceptible crops, such as chickpeas
- Intolerant cereal varieties grown on stored moisture
- Newly purchased or leased land
- Cereals on cereals
- Cereal following grassy pastures
- Durum crops (crown rot)

There are PREDICTA® B tests for most of the soil-borne diseases of cereals and some pulse crops:

- Crown rot (cereals)
- Rhizoctonia root rot
- Take-all (including oat strain)
- Root lesion nematodes
- Cereal cyst nematode
- Stem nematode
- Blackspot (field peas)
- Yellow leaf spot
- Common root rot
- Pythium clade f
- Charcoal rot
- Ascochyta blight of chickpea
- White grain disorder
- Sclerotinia stem rot

Government of South Australia
Primary Industries and Regions SA

SARDI
South Australian Research and Development Institute

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

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The impact of dry sowing on the nodulation and N_2 fixation of chickpea

George Mwenda, Department of Primary Industries and Regional Development

ABSTRACT:

George Mwenda, DPIRD, Merredin

Key messages

- Dry sowing did not reduce nodulation and nitrogen fixation.
- The performance of the peat slurry inoculant was similar to that of the granular inoculant in dry sowing conditions.

Aim

To investigate the impact of dry sowing and inoculant type on nodulation and nitrogen fixation in chickpeas grown in Merredin, WA.

Results

The dry-sown chickpea was inoculated and planted five weeks before the break of season while the wet-sown treatment was inoculated and planted three days after the start of the rains. Both dry and wet sown plants displayed good nodulation and no significant differences in nodulation were observed.

The pattern of root nodulation arising from inoculation with peat slurry was different to that from the granular inoculant. Plants from seed inoculated with peat slurry had more nodules on crown roots while those inoculated with the granular form had more nodules on the lateral roots. However, the mass of the root nodules were not significantly different indicating that the quantity of nitrogen fixed in both instances was similar.

Inoculated plants were well nodulated while un-inoculated plants had no root nodules. However, the grain yield from inoculated and un-inoculated plots were similar (0.56-0.64 t/ha) due to relatively high levels of soil nitrogen and a dry finish to the season.

Conclusion

This study shows that good nodulation can be achieved in dry-sown legumes with both granular and peat slurry inoculants. These findings are consistent with recent findings from South Australia. Future studies are to focus on clearly defining conditions under which different inoculant formulations can be used for dry sowing of legumes since outcomes may vary depending on the genotype of the rhizobium, legume species, soil type and other environmental factors.

Notes:

WA standing on subsoil compaction management: outcomes of five years of research

Wayne Parker, Department of Primary Industries and Regional Development

ABSTRACT:

Subsoil compaction management: outcomes of five years of research in WA

Wayne Parker and Bindi Isbister, DPIRD

Key messages

- Deep ripping to the depth of the hardpan in yellow sand, sand over gravel duplex soils and gritty grey clay provided positive yield responses for up to four years when paddocks were managed under a controlled traffic farming system.
- There was no benefit to deep ripping a calcareous loamy earth.
- Deep ripping in controlled traffic farming had a return on investment of $1 to $29/ha over four years depending on depth or the addition of topsoil slotting plates.

Aims

Seven trials were begun in 2015 with the primary aim to evaluate the economic viability of new deep ripping methods. It was hypothesised that the economic return from ripping would be increased by ripping to a greater depth, with topsoil slotting, and managing within a controlled traffic farming system to improve longevity of the ripping effect on root growth and crop yield.

Results

The results from four years of observations indicate that increased rooting depth influences crop yield and return on investment. Deep ripping beyond 300mm has increased root numbers to the depth of ripping. Topsoil slotting at Moora has significantly greater root numbers beyond 500mm than ripping without plates. At Binnu ripping to 550mm with and without slotting plates have the similar root numbers to depth though numbers are not increased beyond the depth of ripping.

Conclusion

The project found deeper ripping, >400mm, plus or minus topsoil slotting, in combination with controlled traffic farming produced a positive yield response in sand, loamy earth and gritty grey clay soil. Over four seasons the cumulative return on investment was between $1–29 for every dollar invested. These trials were conducted within a controlled traffic farming system which confines compaction to consistent wheel tracks, minimising re-compaction and helping to protect this soil health investment for up to four years.

Deeper ripping was required to manage the hardpan that was below 350–450mm. Shallow ripping of sandy soil at 300mm or less was insufficient to alleviate compaction for improvement of crop yield. The deeper ripping gave greater access to moisture deeper in the profile.

Controlled traffic, deep ripping and topsoil slotting plates are necessary features of future farming systems that require healthy soils and continued return on investment. The use of each is dependent on soil type as indicated during the last five years of research. Traffic management will help improve soil health to those not suited to ripping.

Notes:

Lessons learnt from soil amelioration bloopers

Bindi Isbister, Department of Primary Industries and Regional Development

ABSTRACT:

Bindi Isbister, Wayne Parker, Gaus Azam, Stephen Davies, and Glenn McDonald, DPIRD

Key messages

- Knowing your soil properties below 10cm is critical to selecting the right amelioration technique to maximise your return on investment
- Duplex soils are challenging for strategic tillage methods particularly where depth to clay is highly variable and nutrient toxicity status is unknown.
- Soil amelioration bloopers are not always permanent.

Aims

Using a combination of grower case studies and research trials investigate situations where soil amelioration has had a negative impact on productivity and determine how failures can be avoided or the risk can be minimised for the future.

Results

Many of the problems that come from paddock scale amelioration, such as poor plant establishment, arise when the treatment isn't suitable for the whole paddock. This is a common scenario in southern regions where the depth of duplex soils can vary across the paddock. This presentation will discuss unexpected results of soil amelioration. Techniques including mould board ploughing, deep ripping, and one way ploughing have had negative consequences when applied to duplex soils, calcareous loamy earths and acidic sand across WA.

Conclusion

The key to success with amelioration is to understand the soil properties at depth as well the spatial variation of soil types across the paddock. Better diagnostics are required for duplex soils that are highly variable over short distances (10-100m) as the implications of bringing hostile clay to the surface can still be seen 10 years on.

Not all soil amelioration bloopers have long lasting yield penalties. The incorrect technique may have been selected to manage the constraint. Spending time upfront for soil testing and thorough diagnosis will save you more on unnecessary amelioration costs and negative impacts.

Notes:

National Blackleg Report

Angela van de Wouw, University of Melbourne

ABSTRACT:

Blackleg — new seed treatments, stubble management and fungicide resistance

Angela Van de Wouw[1], Steve Marcroft[2], and Susie Sprague[3], [1]University of Melbourne, [2]Marcroft Grains Pathology, and [3]CSIRO

Key messages

- Blackleg crown canker results from infection during early seedling growth. Prior to sowing, use the BlacklegCM decision support tool to identify high risk paddocks and explore management strategies to reduce yield loss.
- New succinate dehydrogenase inhibitor (SDHI) seed treatment fungicides have higher efficacy, increased longevity and improved seed safety.
- The improved efficacy of SDHI fungicide may result in a reduced need for early foliar application of fungicide (4–10 leaf applications).
- Modern farming systems that enable earlier sowing/germination may result in reduced damage from blackleg crown cankers.
- Blackleg pathogen populations with resistance to the triazole fungicides fluquinconazole, flutriafol and a tebuconazole + prothioconazole mixture have been detected. No resistance has been detected for new SDHI and quinine-outside inhibitor (QoI) chemistries.
- Blackleg upper canopy infection (UCI) is the collective term for flower, peduncle, pod, main stem and branch infection, but does not include crown canker.
- UCI can cause yield losses of up to 30%. Yield loss is reduced by selecting cultivars with effective major gene resistance and using crop management strategies to delay the commencement of flowering to later in the growing season, especially in high disease risk areas.
- Fungicide applications at 30% bloom often controls UCI but does not always result in yield gains. Thirty per cent bloom fungicide application is unlikely to control pod infection.

Notes:

Fungicide strategies for oats to maximise profit

Trent Butcher, ConsultAg

ABSTRACT:

Key messages

- In wet spring conditions fungicide applications can improve grain yield and quality.
- In dry spring conditions fungicide applications have no impact on yield or grain quality.
- Strobilurin based fungicides offer additional yield and grain quality benefits in wet spring conditions.
- Fungicide applications can reduce but not eliminate the risk of grain staining.

Aims

- Determine the best fungicide strategy to reduce leaf infection in oats.
- Identify economic merits of fungicide strategies in low and high disease pressure scenarios.
- Evaluate the economic return from foliar applications of fungicides on oats and whether the additional cost of premium products increase yield, grain quality and subsequently grower returns.

Results

In Highbury in 2014 Ashton Gray was able to demonstrate yield benefits and grain staining reduction benefits from the use of propiconazole at different timings.

In 2017 the work evolved from the 2014 work to look at the effectiveness of premium strobilurin based fungicides and their impact on yield and grain staining in Highbury. There was a moderate disease burden in 2017 which resulted in a positive yield response to fungicide and a reduction in grain staining. No impact on grain quality was identified.

In 2018 there was a high disease burden driven by October rainfall events in Highbury. Significant yield gains were achieved by strobilurin fungicides over DMI based products which also gave significant grain quality improvements and staining reduction.

The 2019 season differed from the previous two as it targeted more conventional rotations of oats on pasture and canola. With the dry finish to the season and low disease burdens there was negligible grain staining present and fungicide had no impact on grain quality and yield at either Highbury or Tarin Rock.

Conclusion

There is a need to deploy fungicide applications in oats strategically. Disease movement in the canopy should dictate the need for an application. This remains difficult with Septoria Avenae due to its aggressive expression late into the season and will likely involve prophylactic spraying.

Assessments should be made on the lower canopy to identify the potential risk of the spread of the disease into the upper canopy. The impact that disease control will have will be determined by the timing of applications and the finish of the season.

Notes:

Strobilurin fungicides protect oaten hay from weather damage – myth or fact?

Kylie Chambers, Department of Primary Industries and Regional Development

ABSTRACT:

Kylie Chambers, Geoff Thomas and Georgie Troup, DPIRD

Key messages

- Green leaf area loss and weather induced fungal staining can reduce hay quality, impacting on suitability for export markets, and return ($/ha).
- Fungicides and antimicrobial chemicals applied according to label recommendations reduced saprophytic fungal colonisation of senescent tissue but did not improve green leaf retention or reduce overall microbial population in oaten hay.
- Following label recommendations for rates and withholding periods is vital to avoid chemical residue in hay which could jeopardise export hay markets.

Aims

Can strobilurin chemistries applied in-crop increase green leaf retention and/ or microbial suppression in oaten hay?

Results

The application of DeMethylation Inhibitor (DMI) or strobilurin foliar fungicide treatments had no effect on oaten hay yield in a trial where foliar disease, such as septoria blotch, was not yield limiting. The quality of the hay deteriorated post-cutting regardless of in-crop treatments. At one site (Muresk), the application of a strobilurin based fungicide improved hay quality, when tested pre-weathering, however there was no enduring difference in hay quality between treatments post-weathering.

Strobilurin fungicides did not increase green leaf retention in oaten hay.. The application of fungicide did not improve any hay colour parameters. Using a visual assessment method to determine saprophytic fungal growth from samples on top of, and within the windrow there was a significant reduction in saprophytic colonisation observed with some of the fungicide treatments. In contrast, using NATA accredited testing, there were no differences in yeast or mould colony forming units with any of the treatments.

Conclusion

The hay quality of all treatments were adversely affected by post cutting rainfall, demonstrating the importance of timely baling. Application of strobilurin chemistries at the Muresk site improved hay quality parameters at the time of cutting, in some cases resulting in a higher hay grade for the NDF and WSC parameters. However these differences did not endure in the swath and no hay quality differences were observed in post-weathering samples (at baling time).

There is anecdotal evidence that strobilurin fungicides increase green leaf retention in oaten hay when applied at the withholding period; however, this research does not support that. It is possible that in a high septoria blotch disease pressure season, the application of a fungicide could potentially improve hay colour by reducing leaf necrosis resulting from disease. Mixed results were observed for the impact of fungicides on saphrophytic fungal growth post-weathering, however on senesced leaf tissue saprophytic colonisation was reduced by all fungicides. Further investigation of the effect of strobilurin fungicides is required over several seasons to understand their impact on *Septoria avenae*, green leaf retention and saphrophytic fungal growth post cutting.

It is important that fungicide groups are rotated and that chemicals are only applied when there is an associated disease pressure at the time of application. Following label recommendations for rates and withholding periods is vital to avoid chemical residue in hay which could jeopardise export hay markets.

Notes:

A new approach to managing loose smut on barley

Kith Jayasena, Department of Primary Industries and Regional Development

ABSTRACT:

Kithsiri Jayasena[1], Geoff Thomas[2], Andrea Hills[3], Laurie Wahlsten[1] and Mirjana Banovic[2], DPIRD, [1]Albany, [2]Perth, [3]Esperance

Key messages

- Loose smut is a seed borne disease in barley, generally controlled using seed dressings that prevent infected seed from expressing the disease in-crop.
- This study demonstrates that another effective way to reduce loose smut in subsequent seasons is to apply foliar fungicides from ear emergence to anthesis to prevent seed infection occurring. This approach can significantly reduce seed infection rates compared to the unprotected crop.
- An added advantage is that these fungicides are registered in barley and used for management of other fungal diseases. Therefore, this approach can be integrated into current disease management practices or used specifically in seed production crops to maintain highest quality seed.

Aims

This study investigated possible use of a foliar fungicide in control of barley loose smut.

Results

Application of foliar fungicide in 2017 and 2018 between Zadoks growth stages Z53 and Z65/Z69 significantly reduced loose smut embryo infections compared to unprotected. The per cent embryo infection on unprotected crop varies from 4.3 and 0.2 in 2017and 2018 respectively. Embryo infection reduced between 20% to 84% with foliar fungicide application in 2017 and 84% to 87% in 2018 compared to unprotected.

Conclusion

Applications of systemic foliar fungicide containing the active ingredient tebuconazole at ear emergence to late flowering can reduce loose smut infection in the seed that forms. While spore trapping in the region provided information on when the loose smut spores are in the air, foliar fungicide spraying should be based on when the crop is at the most vulnerable stage such as ear emergence to flowering. Since foliar fungicide can reduce loose smut levels in the following barley crop this application method could be integrated into the loose smut management plans for barley. When using fungicide at late foliar stages, the minimum withholding period of the product should be considered to avoid residue violations in delivered grain or applied only to the portion of crop to be retained for seed.

Furthermore, we should also be mindful in fungicide resistance issues on certain foliar fungal pathogens on barley. If the fungicide applied to the crop before flowering contained different fungicide groups, such as an SDHI or QoI, then the use of tebuconazole is less likely to select for fungicide resistance in other diseases. We recommend that growers restrict the use of this practice to seed crops only.

Notes:

Managing Spot Type Net Blotch in the medium rainfall zone

Trent Butcher, ConsultAg

ABSTRACT:

Key messages

- Significant yield responses can be gained from the burning of stubbles in a barley on barley rotation.
- If disease expression occurs later in the season, then a flag-1 spray can be as effective in control as a two-spray strategy (Z32 + flag-1)
- Flag-1 applications of propiconazole are more effective than a Z32 application in controlling disease in the upper canopy
- Flag-1 applications of SDHI and strobilurin based fungicides can give positive yield responses in a range of seasonal finishes.

Aims

- Identify the best strategies and timings for fungicide applications to control Spot Type Net Blotch (STNB) in the medium rainfall zone.
- Determine where the fit of premium strobilurin and SDHI based products is for the medium rainfall zone
- Identify whether there is an economic solution to the largely DMI focused strategies to control STNB in the medium rainfall zone for resistance management.

Results

Optimal STNB control is achieved using two spray fungicide strategies. Some single late applications of SDHI or strobilurin fungicides can provide comparable control to two spray strategies employing DMI chemistry.

Flag-1 applications of propiconazole were more effective at controlling disease then Z32 applications in three of the four seasons measured (there was no difference in the other year). This difference in disease control did not translate into a significant yield gain as a result of timing in any season.

In high disease pressure scenarios yield gains can be achieved even when rainfall does not occur in spring which was observed in Corrigin in 2015 and 2019.

Positive economic responses were able to be achieved at Corrigin in 2018 and 2019 from SDHI and strobilurin based products compared to propiconazole..

Conclusion

Burning generally has a positive impact on yield even when disease control is comparable to retained areas.

In very high disease pressure scenarios flag-1 applications of SDHI and strobilurin fungicides provide additional yield benefits over DMI chemistry, in some instances even when spring rainfall conditions aren't favourable

Assess disease levels prior to the application of fungicides to identify the risk of disease spread. The leaves lower in the canopy will give a good indication of the amount of inoculum present. Fungicide strategies in the medium rainfall zone need to be tactically driven motivated by seasonal conditions, disease burden, logistics and cost. .

Notes:

Taking on the toxins – how we're working to better understand the mechanisms of yellow (tan) spot on wheat

Catherine Rawlinson, Centre for Crop and Disease Management

ABSTRACT:

Catherine Rawlinson[1], Pao Theen See[1], Paula Moolhuijzen[1], Hang Li[2], Caroline Moffat[1], Yit-Heng Chooi[2] and Richard Oliver[1],
[1]CCDM, Curtin University; [2]School of Molecular Sciences, University of Western Australia

Key messages

- Several small molecule toxins were purified from an Australian yellow spot pathogen and characterized for toxicity on a range of commercial wheat cultivars. Importantly, we identified how the fungus creates it and can now identify which strains produce it in the fungal genome.
- Understanding how a pathogen interacts with its host contributes to our understanding of the disease and suggest mechanisms of control including the potential development of more resistant varieties.
- This approach could be applied to other crop diseases to better understand their attack mechanisms.

Aims

Examine the small molecular weight compounds produced during yellow spot infection that enhance the disease.

Results

The fungus behind yellow spot disease produces a class of small molecular weight compounds called triticones. The main compound called triticone A causes necrosis when applied to wheat cultivars. How and why the fungus produces these compounds was determined.

Conclusion

Yellow spot is a significant disease in Australian wheat with substantial yield and economic impact. Discovery and identification of small molecules produced by pathogens that cause disease symptoms on plant hosts will ultimately yield tools to select germplasm better capable of withstanding these pathogens. Understanding the mechanisms of disease attack will help pinpoint the way in which the host is vulnerable and provide breeders with markers of disease susceptibility.

Notes:

Hydroxyphenylpyruvate dioxygenase (HPPD) resistance in wild radish

Huan Lu, University of Western Australia

ABSTRACT:

Evolution of resistance to HPPD-inhibiting herbicides in a wild radish population

Huan Lu, Qin Yu, Heping Han, Mechelle Owen and Stephen Powles, Australian Herbicide Resistance Initiative, University of Western Australia

Key messages

- A wild radish population has evolved resistance to HPPD-inhibiting herbicides.
- This resistant wild radish population had no HPPD herbicide use history.
- Resistance in this population is conferred by enhanced herbicide metabolism.

Aims

- Confirm and quantify resistance to HPPD-inhibiting herbicides.
- Reveal the underlying resistance mechanism(s).

Results

Dose-response experiments showed the resistant (R) population exhibits 4 to 6.5-fold resistance to the HPPD-inhibiting herbicides mesotrione, tembotrione and isoxaflutole, compared to the susceptible (S) population. This resistance is not target-site based as cloning of full coding sequences of the *HPPD* genes from S and R plants did not reveal resistance-endowing single nucleotide polymorphisms (SNPs). The *HPPD* gene expression levels are similar in S and R plants. In addition, no differences in [^{14}C]-mesotrione uptake and translocation were observed in the S and R plants. However, [^{14}C]-mesotrione metabolism in the R plants are greater than the S plants with the time required for R plants to metabolise 50% [^{14}C]-mesotrione being 7.7-fold faster than the S plants.

Conclusion

We confirm evolution of resistance to HPPD-inhibiting herbicides in a wild radish population, selected by using herbicide of different modes of action. The resistance is due to non-target-site based enhanced rate of herbicide metabolism (metabolic resistance).

Notes:

Longevity of deep ripping on deep white sands

Emma Pearse, Department of Primary Industries and Regional Development

ABSTRACT:

Emma Pearse and Jeremy Lemon DPIRD

Key messages

- Ripping below the compacted layer to 60cm, at this south coast sandplain site, alleviates the compacted layer and has continuing effects into the second year after ripping.
- Average wheat yield increased significantly in the first year after ripping when ripped to 60cm but did not increase when ripped to 40cm.
- Increased canola yield in the second year after ripping was limited to lower yielding areas.

Aims

To investigate the longevity of deep ripping below the depth of compaction on deep white south coast sands in a CTF system.

Results

Penetrometer readings from August 2018, six months after deep ripping, show that soil compaction at 40cm depth was significantly reduced from 2.2MPa in nil plots to 1.6MPa in 40cm ripped plots and 0.97MPa in 60cm ripped plots. At 50cm depth ripping to 60cm continued to alleviate compaction with an average soil strength of 1.25MPa compared to 4.02MPa in the nil plots. Penetrometer readings from September 2019 at 40cm down the profile indicate that ripping to 60cm maintained a significant reduction in soil strength (1.58MPa) compared to nil plots (3.05MPa) but ripping to 40cm did not.

Average wheat yield in 2018 was significantly greater when ripped to 60cm (5.1t/ha), compared to 40cm ripped plots (4.4t/ha) and nil plots (4.3t/ha). When the site is broken up into poor, average and good yield zones there are significantly higher wheat yields across all zones in 60cm ripped plots compared to 40cm ripped and nil plots. Average canola yield at the site in 2019 indicated limited yield improvements from the deep ripping treatments, average canola yield was 2.05t/ha when analysed across the whole site. When broken up into poor, average and good yield zones increases in yield from ripping to 60cm were observed in the poor yielding areas. In a poor yielding area average canola yield was 1.27t/ha compared to 1.02t/ha when ripped to 40cm.

Conclusion

Deep ripping on deep white south coast sands must be below the compacted layer to significantly increase cereal yields in the first year after ripping. There was a limited benefit to canola yields in the second year after ripping. Two years after deep ripping soil strength was still lower but there is evidence of re-compaction. It will be important to review cereal yields and penetrometer data in future years.

Notes:

Notes:

Understanding the scenarios where on-farm lime sources are more cost effective than coastal lime sand in the Kwinana East Port zone

Ashleigh Donnison, Department of Primary Industries and Regional Development

ABSTRACT:

Where are on-farm lime sources more cost effective than coastal limesand in the Kwinana East Port Zone?

Ashleigh Donnison[1], Caroline Peek[1], Andrew Van Burgel[2], and Cameron Wild[1], DPIRD [1]Merredin and [2]Albany

Key messages

- Quality of on-farm lime and distance from coastal limesand sources are important factors in determining economic advantage over coastal limesand.
- iLime simulations indicate that incorporation increases the economic benefit of limesand and on-farm limes when used in recovery liming scenarios.

Aims

To investigate the cost-effectiveness of on-farm lime for ameliorating soil acidity in Kwinana East Port Zone and to validate the iLime application (developed by DPIRD and Desiree Futures with funding from GRDC) by comparing simulations with field trial results.

Results

Application of cultivation and lime sources, resulted in significant increases in yield. There was also a significant interaction between cultivation and amelioration with a lime source. This was indicative of application of lime sources having a larger effect when also combined with cultivation. There were no significant differences from the nil when lime treatments were uncultivated. iLime predicted yields close to the observed yields for the uncultivated treatments, however under predicted yields for the cultivated treatments.

iLime simulated pH trends where the medium rates of lime adequately brought the pH up to recommended levels at both topsoil and subsoil depths when cultivated. When uncultivated the subsoil had a lag over the 20 years in pH increase.

Cultivated treatments of the same rates of lime had higher return on investments and overall higher net present values after 20 years (NPV) compared to the uncultivated treatments. Of the medium rates of lime the cultivated local depositional morrel source had the highest NPV, followed by cultivated limesand. Lower rates of the dolerite had higher NPV's compared to the medium dolerite rate, though they did not increase pH to the same level.

Conclusion

On-farm lime sources would preferably be of a high quality to produce an economic benefit compared to limesand, but as distance increases from the coast, poorer quality lime sources and higher costs associated with extraction and processing of on-farm lime may become viable options. Particle size distributions and NV's associated with the different particle fractions are important when considering using an on-farm lime source. This needs to be assessed for each situation and source. Across all treatments and costings incorporating lime was consistently more economic compared to the same lime source and rate. The economics, as well as physical changes in the soil, such as pH, need to be weighed up against farm business goals and timelines.

Utilising iLime and relating it to the trial results did produce similar results and it is a good tool when it comes to comparing liming decisions. However, some caution is also necessary when utilising iLime with on-farm sources with high percentages of course (<2mm) material. Trial pH analysis will be carried out in 2020.

Notes:

Whacky weather for wheat – growing crops in WA under today's and tomorrow's climate

Focus Session 1

Convenor: David Bowran

This focus session will help you explore what's different weather wise compared to yesterday, what weather we might see in next two to five years, adaptation practices and risk reduction strategies that could help mitigate the worst of weather changes on crop production and marketing, varieties and new genetics packages and how these help grow more resilient crops, and what experiments with higher CO^2 in a warmer drier environment tell us about future crop production in WA.

The panel has a wide range of experience in the weather and climate space, plant breeding and adaptation to environment and includes:

- Neil Bennett from the Bureau of Meteorology in Perth;
- Professor Richard Trethowan from Sydney University;
- Dr Fiona Evans from the Department of Primary Industries and Regional Development based at Murdoch University;
- Dr Roger Lawes from CSIRO Perth;
- Dr Dion Bennett from AGT in Northam;
- Dr Ed Barrett-Lennard from the Department of Primary Industries and Regional Development; and
- Dr Peter White from the Australian Export Grain Innovation Centre.

Coordinator: *Dr David Bowran.*

David spent 30 years at the Department of Agriculture and Food WA based in Northam where he worked in Weed Science for 15 years before becoming the Grains Program Leader for 10 years. David was strongly involved in climate adaptation and mitigation strategies in DAFWA and represented WA on the Climate Change Research Strategy for Primary Industry for a number of years.

Notes:

External crop protection challenges
Focus Session 2

Convenor: Stephen Powles

As if herbicide, insecticide and fungicide resistance isn't enough to deal with, growers are facing increasing constraints on using existing chemicals and are concerned about the prospects of being able to access new effective alternative crop protection chemicals into the future.

This focus session will provide a unique opportunity to hear from panellists at the coalface of these issues and to reflect on planning crop protection for upcoming cropping programs and industry strategies.

Panellists include:

- Craig Dunlop, Global Regulatory Policy Manager at Syngenta Crop Protection Basel Switzerland– providing a look at the issues facing chemical use by the grain industry across the globe.
- Jason Craig, General Manager Marketing and Trading, CBH Group – how marketers adjust to changing customers' requirements in the marketplace
- Emma Colson, Crop Protection Manager, GRDC. Emma will discuss GRDC investments aimed at helping grain growers have access to crop protection chemicals for profitable grain production.
- Gordon Cumming, Manager Chemical Regulation, GRDC who is responsible for the work GRDC does in helping industry get permits for chemical use, including minor use permits.

With special guest Gerard McMullen, the Chair of the Australian National Working Party on Crop Protection.

Coordinator: *Professor Stephen Powles.*

This focus session will be coordinated by Professor Powles. Stephen has an international reputation in herbicide resistance, weed and crop science. He developed and led large research programs at the Waite Agricultural Research Institute and University of Western Australia. Now a GRDC board member, Stephen has served as Managing Director of the Australian Weed Management CRC and Director of the Australian Herbicide Resistance Initiative.

Notes:

Taking back control of pest management
Focus Session 3

Convenor: Iain Macpherson

With increasing pesticide resistance, reducing pest control options and the potential impact on the farming system profitability growers and consultants need to take back control of pest management.

This focus group will be an interactive discussion between researchers, consultants and participants and will be looking at pest management issues, IPM adoption and limitations, and what pest management could look like in 2030.

Guest speakers and panel members will be:

- Resistance overview – Svetlana Micic (DPIRD).
- Local experience with IPM – Brent Pritchard, Farmanco.
- Natural enemies, sampling and sampling constraints – Iain Macpherson.
- Sampling, Thresholds and future sampling technologies – Dusty Severtson (DPIRD).
- An agronomist's perspective – Grant Thompson, Crop Circle.

As leading decision makers in pest management you are invited to participate in this group discussion.

The focus session will be coordinated by Iain Macpherson. Iain has run his own agronomic consultancy business based in northern NSW and Southern Qld for 32 years. He has been an agronomist for 38 years working in cotton, winter and summer grains, oil seeds, pulses, and tropical pastures. Iain has advised on crops from central NSW too far north Qld and the Ord River.

Notes:

Christmas
BY CROWN

Experiences using a complete annual workflow and farming system

Brad Jones, grower from Tammin

Brad Jones will outline his experiences in implementing an annual workflow and farming system where all decisions are based on data from sensors, remote sensing and a standardised soil testing regime. Brad has established a complete workflow and farming system where all decisions are based on data from sensors, remote sensing and a standardised soil testing regime. The data is organised in spatial data layers and formalised. On-farm sensor data is based on a data sampling grid, which enables conversion from point data to spatial data, where, for example, rainfall distribution is used in the decision-tree. Brad will show how data is used to manage variability with the aim of maximising profitability and sustainability in good and bad years, never aiming at the average.

Brad is respected in the industry as a lateral thinker and leader for driving industry improvement. Core to his business philosophy is a focus on business processes that lead to sustainable margin expansion with a focus on efficiencies of inputs and profits relative to risk. Brad has successfully executed this philosophy at his 11,000 hectare broadacre property (Bungulla) located in Tammin. Upon taking over the property in 2005, Brad recognised the limitations of a traditional broadacre cropping system built around yield maximisation against a background of changing climatic and market conditions. Over the last 15 years he has transitioned and grown this asset by focussing on decisions relative to the farm systems profitability over time adjusted for the amount of execution risk associated with those decisions.

Brad's track record in developing business processes and using technology that enhance cost management and productivity is widely respected by the industry having been awarded 2016 Coles Australian Grain Farmer of the Year and the prestigious 2018 Piper Prize by the Council of Grain Grower Organisations for technological innovation.

Notes:

BioScout

Lewis Collins, CEO, BioScout

BioScout allows growers to track and monitor disease on their fields in real-time via disease sensors. The patented sensors automatically collect and detect disease-causing particles in the air. By detecting these disease vectors BioScout allows growers to gain information on the best intervention and protection practices for their crops based on the location and type of disease detected in their field.

BioScout uses a combination of biological air sampling, mapping and data analytics to track disease spread, the sensors are placed throughout the field collecting disease data 24~~x~~/7. Collected disease data is combined with onboard weather station outputs to give growers a comprehensive view of past, current and future disease pressures on the farm.

Lewis will be presenting on how BioScout has been developed and tested through initial scientific validation through to commercial applications. He will also be discussing BioScout's experiences in East Coast and South Australian horticulture and early work in expanding to broad-acre cropping.

Lewis Collins is one of the founders and CEO of BioScout a company which builds real-time airborne disease detection sensors for agriculture. He is also currently a PhD student at the University of Sydney developing similar sensors for wheat stripe rust spore capture and rapid identification.

Lewis gained his bachelor honours degree in mechatronic and biomedical engineering during which he assisted in developing electro-therapeutic techniques for Alzheimer's Disease. He has also worked numerous roles in systems engineering at companies such as Coca-Cola and UGL.

In his current role, Lewis is responsible for developing the BioScout air sampling sensor and its applications to farming across Australia. Lewis also currently serves as Australia's Agripreneur of the Year promoting the world-class Australian ag-tech industry.

Notes:

Plant sniffer

Professor Jean Ristaino, North Carolina State University, North Carolina, USA

Professor Ristaino will outline the ground-breaking work her team at North Carolina State University is doing in the development of portable technology that allows farmers to identify plant diseases in the field, dubbed the 'Plant Sniffer'.

The handheld device, which is plugged into a smartphone, works by sampling the airborne volatile organic compounds (VOCs) that plants release through their leaves.

All plants release VOCs as they 'breathe', but the type and concentration of those VOCs changes when a plant is diseased. Each disease has its' own signature profile of VOCs. So, by measuring the type and concentration of VOCs being released by the plant, you can determine whether a plant is diseased and – if it is diseased – which disease it has.

The 'Plant Sniffer' can be plugged into a smartphone and used to make those VOC measurements quickly in the field.

Current disease identification techniques rely on molecular assays, which take hours to perform and – most importantly – have to be done in a lab. Getting a sample to the lab, where the sample may have to wait to be tested, can delay disease identification by days or weeks. Our technology will help farmers identify diseases more quickly, so they can limit the spread of the disease and related crop damage. We are now ready to scale up the technology.

Professor Jean Ristaino earned her B.S. degree in Biological Sciences and M.S. degree in Plant Pathology from the University of Maryland, and her Ph.D. in Plant Pathology from the University of California-Davis. Upon graduation she joined the Department of Plant Pathology at North Carolina State University, advancing to full professor in 1998. She was named a William Neal Reynolds Distinguished Professor in February of 2012. Much of Dr. Ristaino's work has been on the Oomycete pathogens in the genus Phytophthora. She works on the population genetics of historical potato famine epidemics and studies the population structure of present day late blight outbreaks. Dr. Ristaino's late blight research has been featured on CNN, Discovery Channel, radio (NPR, BBC, Voice of America) and in newspaper and magazine articles. Dr. Ristaino' research has not only impacted the understanding and direction of plant pathology, it has also influenced how the general public and policy makers view science and scientists. She serves as a Senior Science advisor and Jefferson Science Fellow at USAID Washington in the Bureau of Food Security.

Notes:

Papers submitted and not presented at the Perth Update

For the 2020 Grains Research Updates events, the Program Committee received over 100 Expressions of Interest (EOIs) to present at the Grains Research Update, Perth. All EOIs were carefully considered, and unfortunately due to time constraints, only half of these could be accommodated to present at the Perth Update.

All authors who presented at the Update were invited to submit papers for digital publication in support of their presentation. All papers provided will be uploaded to the GRDC website at **https://grdc.com.au/resources-and-publications/grdc-update-papers** when they are supplied and approved for public access.

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