LEADA
Lower Eyre Agricultural Development Association

Spring Field Walk

30 August 2016

PROGRAM

Time	Place	Presenter	Topic
8.30am	Meet at the: Ramblers Football Clubrooms		Meet and arrange bus travel
9.30am	Andrew Green	Andrew Ware, SARDI and George Pedler, LEADA	Lupins – Time of Seeding Site
10.15am	Andrew Green	Liz Farquharson, SARDI	New Pea Rhizobia
11.30am	Ramblers Football Clubrooms	Peter Boutsalis- University of Adelaide	Herbicide Resistant Weeds – Survey Results
12.15pm	LUNCH – Ramblers Football Clubrooms – Cummins		
1.15pm	Chad Glover	Jeff Paull – University of Adelaide	Beans – Time of Seeding Site
2.30pm	John Modra	Steve Marcroft – Marcroft Grains Pathology Kurt Lindbeck – DPI - NSW Jenny Davidson - SARDI	Canola – Time of Seeding Site – Sclerotinia
4.00pm	Finish – Ramblers Football Clubrooms		

This day would not be possible without the valued support of all our sponsors and funders.

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Contents

WEED RESISTANCE IN THE EYRE PENINSULA IN 2014

October 2015

Peter Boutsalis, Gurjeet Gill & Christopher Preston

Summary

A random weed survey was conducted in the Eyre Peninsula (EP) in 2014. Ryegrass, brome, wild oats, barley grass, wild turnip, Indian hedge mustard (IHM) and milk thistle seeds were collected. Changes in herbicide resistance between the previous 2009 survey and the current survey are presented. The most notable changes in ryegrass was trifluralin resistance, a 10-fold increase in the upper EP and a 5-fold increase in the lower EP. This is the first confirmation of Boxer Gold and Triallate resistance in ryegrass on the EP. Resistance to Group A Fop and Group B sulfonylurea herbicides was also detected in brome, barley grass and wild oats. Atlantis resistance in brome was the most prevalent resistance (52%). Group B resistance was also detected in wild turnip and IHM with the latter species exhibiting resistance to sulfonylureas, imidazolinones and sulfonamides. Additionally, a number of IHM, samples exhibited resistant to 2,4-D, atrazine and diflufenican. The survey has revealed that there are considerable opportunities to control weeds with older type chemistries such as Group A and B herbicides, particularly in the upper EP.

Since 2005, the GRDC has funded the University of Adelaide's Weed Science team to conduct random weed surveys across SA and Vic. Different regions are surveyed every year (Figure 1). Each region is surveyed every 5 years. In the 2014 survey, 170 paddocks were randomly chosen and surveyed for weeds every 10 km in the upper EP and every 5 km in the lower EP in early November at the start of harvest. At each location, the weed and crop species present were recorded. Samples of ryegrass, brome, wild oats, barley grass, Indian hedge mustard, sowthistle and wild turnip were collected from at least 1 ha, with sampling occurring at least 10m in each crop. Only one wild radish was collected.

Seeds from plants that were present at sampling were collected. These seeds can originate from resistant survivors, herbicide misses, or late germinators. Where resistance was confirmed, it indicated that a particular paddock contained resistant individuals. The results gathered don't provide information as to the distribution of resistance in the remaining paddock. The seed samples were tested in an outdoor pot trial in May and June 2015. Recommended field rates were applied with a twin nozzle boom cabinet sprayer. A weed sample was scored as resistant if 20% or greater survival was scored in the pot test. Samples with less than 20% survival were not classed as resistant.

Figure 1: Regions surveyed across south-eastern Australia since 2005

Figure 2: Paddocks surveyed in the 2014 survey.

Resistance in ryegrass

Ryegrass was encountered in 85% of paddocks. 34% of paddocks in the 2014 survey contained trifluralin resistant ryegrass compared to 5% in 2009 (Table 1). Strong selection with trifluralin is the most likely cause of this increase. Resistance to triallate was also detected in 3% of samples from the lower EP. This is the first confirmation of triallate and Boxer Gold resistance in the EP. No resistance to field rates of propyzamide or Sakura was identified. One of the triallate resistant samples was also resistant to Boxer Gold.

Minor increases in the incidence of ryegrass resistant to Hoegrass, Glean and Intervix between 2009 and 2014 were observed. Resistance to Axial and clethodim was lower in 2014 than 2009 suggesting that resistance has not increased. It is likely that as a result of increased awareness of resistance to Group A and B herbicides from the 2009 survey, growers have reacted by switching to other mode of action herbicides such as trifluralin, triallate, Sakura, Boxer Gold and atrazine thereby avoiding further increases in resistance.

Although glyphosate resistance in ryegrass has been confirmed in numerous EP farmer samples tested by Plant Science Consulting where resistance was suspected, in the random survey, resistance was detected in only 1% of paddocks. Detecting glyphosate resistance in a random survey is nevertheless concerning due to the importance of this herbicide.

Table 1. Extent of resistance in annual ryegrass collected in random surveys across the Eyre Peninsula in 2009 and 2014 and treated with recommended field rates. Populations were considered resistant if survival was ≥ 20% in outdoor pot trials conducted in the winter of 2015.

	2009 (179 paddocks surveyed)			**2014** (170 paddocks surveyed)		
	Total	Upper	Lower	**Total**	Upper	Lower
Trifluralin	**5**	1	10	**34**	10	51
Propyzamide	**-**		-	**0**	0	0
Triallate	**-**	-	-	**2**	0	3
Boxer Gold	**-**	-	-	**1**	0	1
Sakura	**-**	-	-	**0**	0	0
Hoegrass	**30**	2	66	**47**	10	73
Glean	**78**	71	87	**80**	75	85
Intervix	**47**	30	70	**47**	39	53
Axial	**30**	3	64	**18**	0	32
Select 250ml/ha	**11**	0	25	**8**	0	15
Select 500ml/ha	**-**	-	-	**4**	0	7
Glyphosate	**-**	-	-	**1**	0	1

'-' indicates no test.

Large differences in the biology of ryegrass compared to brome, wild oats and barley grass exist. Ryegrass is an obligate outcrossing species whereas the other three species are self-pollinating. Pollen mediated transfer of resistance therefore occurs more readily in ryegrass. Ryegrass is diploid whereas the other species have greater ploidy levels. Expression of resistance is usually greater in diploid than in tetraploid or hexaploid species. Seed production in ryegrass is greater than the other three species. Ryegrass is also more widely distributed than the other three species. These features contribute to the complex herbicide resistance patterns that ryegrass exhibits.

Resistance in brome

Brome was encountered in 28% of paddocks. Control of brome in conventional wheat is dominated by Atlantis, Crusader and Monza. Resistance to these Group B herbicides in brome is now prevalent across south-eastern Australia. Laboratory studies have shown that the most common resistance mechanism in Group B resistant brome is enhanced metabolism with resistant survivors stunted. In the 5 years between the surveys, resistance to Atlantis increased from 5% to 52%. The increase in no-till seeding has increased the incidence of brome. Continued Group B selection has contributed to the large increase in resistance to Atlantis. Despite the high incidence of Atlantis resistance, no resistance to Intervix was detected.

No resistance to Group A herbicides was detected in 2009 and a small increase (4%) was observed in 2014 suggesting that resistance is unlikely to increase rapidly. Although three cases of brome resistant to glyphosate have been detected in SA through complaints of poor control, the incidence of resistance remains low and is confirmed by the fact that no resistance was detected in the random survey.

Table 2: Percent resistance in brome (*B. diandrus* & *B. rigidus*) collected in 2009 and 2014 in the Eyre Peninsula. Resistance represented by the percent of individuals with ≥ 20 % survival in pot trials.

BROME	2009	2014
Verdict	2	-
Targa	-	4
Atlantis	5	52
Intervix	-	0
Glyphosate	-	0

A dash represents no testing with this herbicide.

Resistance in wild oats

Wild oats was encountered in 18% of paddocks. Resistance to Group A herbicides such as Topik has been increasing slowly, 2% in 2009 and 4% in 2014. Possible reasons include being self pollinating, less seed production per plant and reduced incidence within fields compared to ryegrass. Wild oat resistance to Atlantis increased from 0% in 2009 to 3% in 2014 indicating increased selection.

Table 3: Percent resistance in *Avena fatua* & *Avena sterilis* (wild oats) collected in 2009 and 2014 in the EP. Resistance represented by the percent of individuals with ≥ 20 % survival in pot trials.

Wild Oats	2009	2014
Topik	2	4
Atlantis	0	3

Resistance in barley grass

Barley grass was prevalent in 37% of paddocks. 16% of the samples were resistant to Atlantis. This is the first confirmation that Group B resistance in barley grass is widespread in the EP. Resistant survivors showed little herbicide damage unlike Group B resistant brome and wild oats that were stunted. None of the samples exhibited cross-resistance to Intervix and 4% were resistant to Targa.

Table 4: Percent resistance of 63 *Hordeum spp.* (barley grass) samples collected in 2014 in the EP. Resistance represented by the percent of individuals with ≥ 20 % survival in pot trials.

Barley Grass	**2014**
Targa	4
Intervix	0
Atlantis	16

Resistance in Indian hedge mustard (IHM)

IHM was encountered in 18% of paddocks. Resistance to the Group B's increased in 5 years. Additionally, large increases in the incidence of resistance to other mode of action herbicides such as 2,4-D, atrazine and diflufenican was observed. Prior to this survey, Group I resistance in IHM had only been detected in the mid-North, SA. Increased reliance on other mode of action herbicides due to failing control with Group B's has resulted in biotypes with cross-resistance to alternative mode of action herbicides. This will make control in broadleaf crops difficult.

Table 6: Percent resistance in *Sisymbrium orientale* (Indian hedge mustard) collected in 2009 and 2014 in the EP. Resistance represented by samples with ≥ 20 % survival in pot trials.

IHM	2009	2014
Glean	52	64
Eclipse	57	74
Intervix	nt	14
Atrazine	nt	7
Diflufenican	nt	36
2,4-D	0	7
Glyphosate	nt	0

Resistance in milkthistle (Sonchus)

Sonchus was encountered in 11% of paddocks in 2014. In the 2009 survey Sonchus was not collected. Resistance to the Group B herbicide Glean was identified in 75% of samples whereas no resistance to atrazine, glyphosate or 2,4-D was detected. Such high levels of resistance to sulfonylureas in this species are present in all cropped areas throughout southern and northern Australia.

Table 7: Percent resistance in *Sonchus oleraceus* (milkthistle) collected 2014 in the EP. Resistance represented by samples with ≥ 20 % survival in pot trials.

IHM	2014
Glean	75
Atrazine	0
2,4-D	0
Glyphosate	0

Acknowledgement: Funding for this research was provided by the GRDC.

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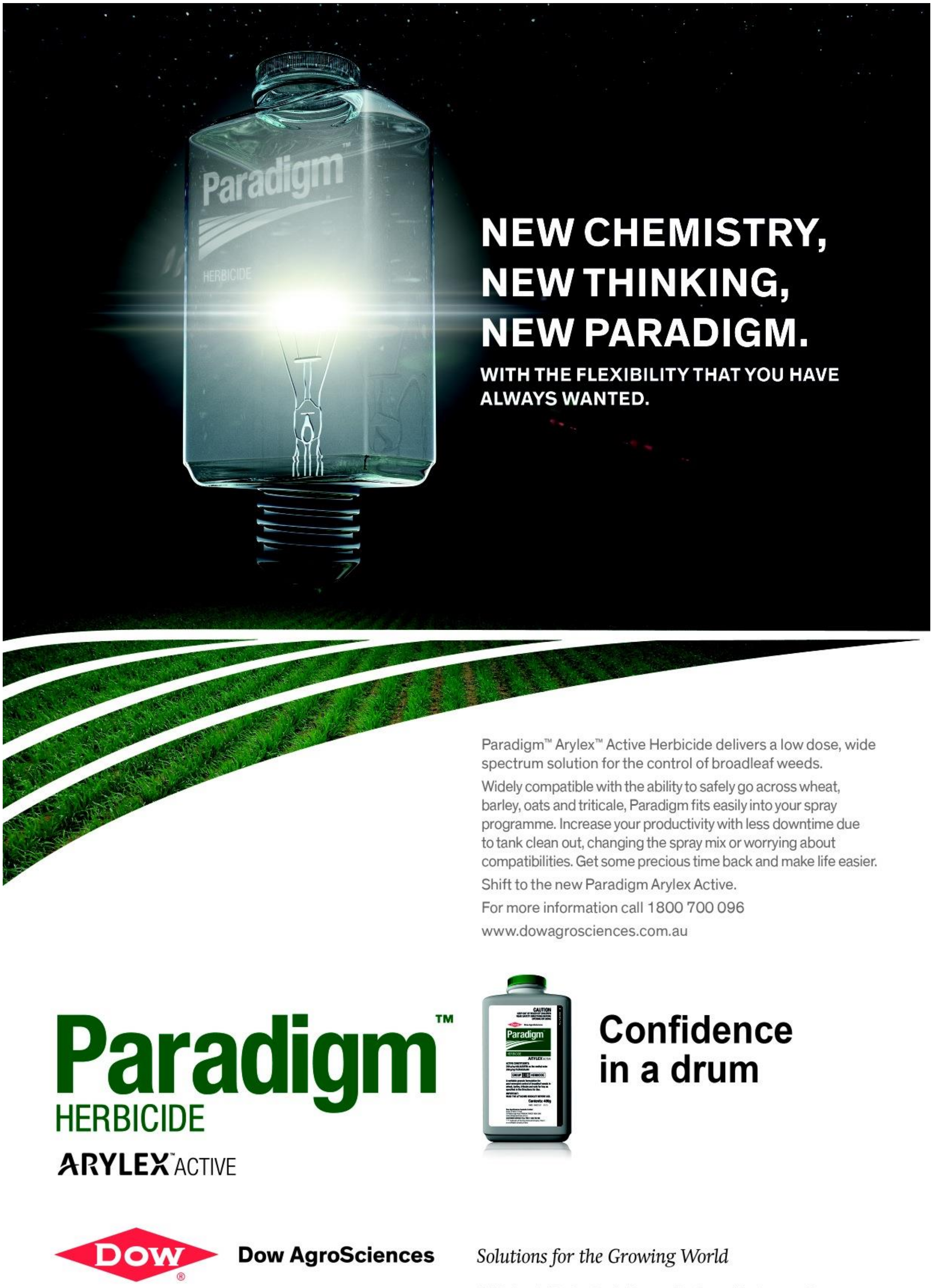
BEANS – TRIAL SITE

Jeff Paull – University of Adelaide

An information handout will be provided on the day.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SOIL MODIFICATION ON LOWER EYRE PENINSULA ACCESS TO SOIL MOISTURE.

This is an extract from the Soil Modification on Lower Eyre Peninsula Access to Soil Moisture booklet – Please see Megan Low for a copy of the booklet which includes the Case Study and much more information.

Summary of Results and Key Messages (refer Case studies for more detailed analysis)

- The soils most at risk of a changing climate also offer the greatest opportunity to increase agricultural production through better use of the available soil moisture and this can be increased through soil specific modifications
- Current crop water use efficiency is the greatest indicator of the likely response to implementation of soil modification treatments – crops with low water use efficiency are more likely to provide the greatest response
- The greatest benefits to production have resulted where amelioration of the major constraint in the subsoil has been achieved
- The deep incorporation of organic matter accelerates changes to soil properties following claying of sandy soils
- Shallow mixing of ameliorants delivers some benefits only where constraints are also shallow
- Clay application increased soil pH and exchangeable cation exchange capacity
- Spading delivers mixed results depending on the nature of the soil and the amount of mixing of soil horizons involved in the spading process. Changes to soil chemical properties may not persist and the major constraints and the depth of influence needs to be understood prior to implementing spading programs. However, spading is a cheap option to mix soil horizons addressing low soil carbon in bleached A2 layers and potentially water repellence in the short term.

Introduction

There are an estimated 160,000ha of soils on Lower Eyre Peninsula that have known soil constraints that negatively impact on agricultural production that can be addressed through current soil modification techniques. These include soils with poorly structured subsoils and sandy soils with low water holding capacity and poor fertility.

In the past 2 or 3 decades research organisations and farmers have conducted trials and have applied various soil modification techniques in an attempt to address these constraints. There has been limited review of the success or otherwise of these operations in the long term. As a result there is little understanding of the benefit of treatments or of their longevity. Responding to increasing levels of interest in soil modification by group members the Lower Eyre Peninsula

Agricultural Development Association (LEADA) developed a project to undertake a review of soil modification in the district. The outcome was to develop some guidelines to support farmers in making decisions on which soils can be modified, the best treatments and likely benefits. Funding was obtained from the Eyre Peninsula Natural Resource Management Board to assist in this work.

Method Discussions within the LEADA Committee determined that a minimum of four previously modified sites would be revisited with production data collected and soil analysis to identify changes to soil physical and chemical characteristics. Feedback was invited from members on potential sites that could be revisited and the sites were selected based on:

- Ability to confidently locate the site and distinguish individual treatments
- Time since modification
- Soil type and historic evidence of differences resulting from treatments

Unfortunately due to limitations on the availability of baseline data and certainty of locating treatments only sites on sandy soils were selected (Table 1)

Biomass data was collected on sites in August/ September 2015 and yield data was collected in December, except for the Modra site that was in crop with canola that made data collection difficult. Soil sampling was undertaken in February 2016 and samples were sent for laboratory analysis. All samples were analysed for soil organic carbon (SOC Walkley Black) and based on carbon results a subsample of treatments were sent for more detailed nutrient and chemical analysis. Results were then subject to statistical analysis.

Site summation:

Terry Young BuAg:

There appears to be on-going production benefits from spading a previously delved site, the addition of organic matter grown on the site has enhanced these benefits delivering over a 1t/ha yield increase. There also appears to be improvements to soil properties including increases in soil organic carbon stocks. This benefit is supported by analysis conducted on another trial site in a nearby paddock.

Peter Treloar, Edilillie:

There appears to be on-going increases to plant production on this site but variability in data (potentially resulting from a combination of differences in depth to clay, treatment application and seeding patterns) have made interpretation difficult. Soil data is also questionable and requires further analysis.

John Housten, Ungarra:

Consistent with the findings of the initial year of the trial there were no differences in plant production on this site in 2015. However, yields on this site were close to district average of the "better" soil types so this site does not appear to have the soil constraints found in many soils on Lower Eyre Peninsula.

Leon Modra, Karkoo:

Plant performance data was not collected at this site as the paddock was under canola. Soil analysis has given some mixed results that are being further investigated.

Conclusion

The objective of this study was to determine ways to increase agricultural production and resilience in the face of a changing climate. The study focused on poorly performing soils on Lower Eyre Peninsula as it was considered that while these soils are most at risk of a changing climate and they also offer the greatest opportunity to increase agricultural production through better use of the available rainfall. This was done by examining previous trials conducting soil modification techniques to determine if any of these technologies delivered long term changes to production and soil characteristics.

Although a one year study can only provide a snapshot of production two of the three sites where production data was collected demonstrated that previously observed production benefits were still apparent some years after soil modification.

The site that did not show any production increases in 2015 from soil modification conducted previously was also the most inherently fertile of the sites delivering the largest yields. Soil data collected on five sites showed increases to soil pH and cation exchange capacity following soil modification on all sites. Soil organic carbon data however was highly variable with 3 of the five sites showing higher carbon levels on modified treatments but the other two sites delivered unexpected results with the unmodified controls delivering values similar to the modification treatments. This data is being considered more closely as the levels from the analyses in 2015 are much higher than those previously measured.

Despite these questions there are some clear findings from this work including:

- The addition of clay to sandy soils on Lower Eyre Peninsula does increase soil inherent fertility, pH and generally soil organic carbon levels. These factors do deliver substantial increases in production over the long term.

- The addition of clay appears to be a "one off" treatment with differences in clay levels on treated sites observed up to twenty years post application.
- The incorporation of organic matter enhances soil organic carbon for at least 3 years following application. Increases are greater than the amount of carbon applied in the treatment suggesting that carbon input from another source is occurring (probably carbon from increased root mass at depth).

Although there were no benefits to production observed from mixing of soil and organic matter into a heavier soil type that has no identified soil constraints there may be improvements to soil organic carbon. These need to be confirmed but if they have occurred the benefits to production may only be seen in challenging seasonal conditions. In any case the long term benefits to offsetting greenhouse gas emissions through increasing soil organic carbon are worth considering.

This study has been constrained through only conducting a review over one season. However, this is still important information that is adding to the overall knowledge and interest in soil modification. This has implications for both sustainable agricultural production and offsetting greenhouse gas emissions. There is no doubt that this work will be further developed into the future.

Acknowledgments

The author wishes to thank all the farmers for their assistance in developing the case studies.

Funding

This project is supported by the Lower Eyre Agricultural Development Association (LEADA) with funding through the EPNRM Board, NRM Adapt grants.

See Megan Low for a full copy of the booklet including the Case Studies information.

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Call for GRDC Southern Region Cropping Solutions Network members

New or Continuing member Expression of Interest, 2016

The Grains Research and Development Corporation (GRDC) is calling for expressions of interest for members for its Southern Region Cropping Solutions Networks (RCSN).

These 3 Regional networks, covering the principal cropping zones – the high rainfall, medium rainfall and low rainfall zones of South Australia, Victoria and Tasmania, will provide advice to the Southern Panel on local grain production constraints, opportunities and how best to tackle them. In addition they will critically assess the effectiveness and impact of existing RD&E activities in the Southern Region and provide recommendations for continual improvement.

Nominations will be accepted from grain growers, researchers, farm advisers, members of agribusiness (including resellers) and consultants.

Applications are now open, closing on 2nd September 2016. The RCSN are an advisory committee under the GRDC's Southern Panel, reporting to the Manager Regional Grower Services – South.

Network members need to be able to commit approximately 4 days per year to the Network. Members are recompensed for their time spent on these activities at rates set by the Remuneration Tribunal and agreed to by the GRDC Board. Appointments are for a two-year term, commencing November 2016.

Further information and application forms can be found at https://grdc.com.au/Apply/Current-Tenders.

All applications are to be sent electronically to email: denni.greenslade@grdc.com.au.

All applications are to be sent electronically to email: denni.greenslade@grdc.com.au Closing date for applications is 2nd September 2016.

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CBH GROUP

LEADA Future Directions

Research & Extension

1. What we want to do to address weeds in farming systems

1.1 Manage emerging weeds

1.2 Develop farming systems that are not reliant on herbicides

1.3 "Cultural use" of herbicides

1.4 Dealing with the emerging issue of glyphosate resistance

1.5 What do we do for grass weed control in canola when Clethodin doesn't work?

2. What we want to do to address research and extension capacity in the region

2.1 There is capacity available if LEADA wants to / can pay.

2.2 LEADA committee needs ideas to be developed and implemented

2.3 Utilising the expertise and capacity of SARDI

2.4 Use local agronomists

3 What we want to do to address break crops in farming systems

3.1 Conduct a literature review on break crops for the region

3.2 Improve returns from bean crops

3.3 Revisit the ley farming system / role of fodder crops and pastures in rotations

3.4 Improve returns of peas on limestone

3.5 Need to grow lupins in lower EP farming systems, what will make them profitable?

3.6 Snails & Slugs are still a major issue in farming systems on the lower EP and require further research

4 What we want to do to address soil issues in farming systems

4.1 Subsoils constraints still the biggest issue on lower EP

4.2 Develop an extension program to raise awareness of issue and how to resolve it.

4.3 Examine options for weaker (sandy) soils that can't sustain intense rotations without a legume break

4.4 Examine the role of multi species cover crops on the lower EP

4.5 Why are farmers around Cummins deep ripping heavier soils?

5 What we want to do to address nutrition issues in farming systems

5.1 How much nitrogen do we need in our cropping systems - this still remains unanswered

Skill Development

6 What we want to do to address business skills

6.1 Access to farm business expertise

6.2 Role of benchmarking farm businesses

6.3 Using farm management software

6.4 Improve farmer confidence in on farm decision making

7 What we want to do to address transitioning of farming systems

7.1 Creating an environment to open people to the challenge/change

7.2 Identify problems with system and develop research options to solve these problems

7.3 Organise tours to areas with high adoption of new technologies, options to create new thinking

8 What we want to do to address communications

8.1 Provide training to improve communications skills with a range of stakeholders

8.2 Develop closer links with universities and multinationals

9 What we want to do to address workforce development

9.1 Options for workforce and time management

Leadership and Engagement

10 What we want to do to address engaging with young farmers

10.1 Understand who is being targeted

10.2 Develop strategies to engage young farmers

10.3 Develop a proper structure to engage agricultural students.

10.4 Investigate the Role of twitter and other social media to engage young farmers

11 What we want to do to address committee engagement

11.1 Employ a research officer for group

11.2 LEADA needs to sell itself by implementing the vision

11.3 Identify what is the next 'big thing'

11.4 Conduct an annual trail planning day

12 What we want to do to address taking on leadership roles

12.1 Need to provide greater support to current leaders and executive

12.2 Need to provide greater support to new leaders and executive

13 What we want to do to expand LEADA's influence

13.1 Create a LEADA web site

13.2 Tweet from trial sites regularly on progress and issues

14 What we want to do to ensure we have succession for the committee

14.1 What is the next 'big' thing to engage; the biggest problem / issue facing farmers

LEADA MEMBERSHIP REGISTRATION

($20 for membership till April 2017)

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A tax invoice will be forward soon.