



# Final Report

## 1. Project Information

GRDC Project No:

Line of Business

Program

Project title

Commencement date

Completion date

Number of years

## 2. Contact Information

### Project Supervisor Contact

Title	Initials	First name	Family name (Surname)
Dr	K	Kathy	Ophel-Keller

Position

Name of organisation

Australian Business Number (ABN) *if applicable*

Mailing address

GPO Box 397			City/Town/Suburb	ADELAIDE	
State	SA	Post Code/Zip Code	5001	Country	Australia

Telephone number (office)

Fax number (office)

E-mail address

### Administration Contact

Title	Initials	First name	Family name (Surname)
Mrs	A	Adrienne	Twisk

Position

Telephone number (office)

Fax number (office)

E-mail address

#### 4. Project Summary

The aim of this project is to expose students to applied grains research. Each year, one full-time 12-month paid traineeship is offered at SARDI, with a major focus in one research area. The research program takes into account SARDI needs and current projects, the ability of the lead SARDI researcher to commit time for supervision and the interests and academic background of the student. The intern implements their own research project from planning to data analysis. They are also exposed to a range of research projects and R & D field days, GRDC updates and links with the private sector. In addition, paid work experience placements are offered to second year B Ag Science students.

#### 5. Outcome Benefits

With support from both SAGIT and GRDC, SARDI is currently undertaking a project to provide R & D internships for Bachelor of Agricultural Science students who are interested in pursuing a career in grains research. The program is in its fourth year.

This is important because the study of agricultural science and careers in agricultural research are not seen as attractive by younger Australians. At the same time, research agencies often find it difficult to attract academically successful students to pursue research careers. The one-year internship aims to give students a broad overview of the fundamentals of applied R & D relevant to the grains industry.

The internship has succeeded in creating interest and attracting high quality graduates as applicants, with 38 applications for the 2017 internships. Feedback from the students who have completed the program (James Walter, Brooke Schofield and Jamie Fortune) is very positive with two of the three interns continuing in grains R & D. The 2017 intern, Danielle Allen is currently working at Port Lincoln with SARDI's Andrew Ware.

A number of the work experience

##### Project Overview

Commencing in February each year, one full-time 12-month paid traineeship (at research officer level) is offered, based at SARDI, with a major focus in one broad research area, and a minor focus in a different discipline. The traineeship is offered in areas likely to attract continued investment, and where SARDI is likely to require staff for succession within the next 3-5 years. The research program takes into account SARDI needs and current projects, the ability of the lead SARDI researcher to commit time to supervise the student, and the interests and academic background of the student. The intern implements their own research project from planning to data analysis. At the same time, they are exposed to a range of research projects within the broader program and encouraged to assist other researchers in the group's broader program. This research internship year also involves broader exposure to R & D field days, GRDC updates and links with private sector agencies and consultants wherever appropriate.

In addition, a number of work experience opportunities (3-4 per year) in applied grains research are offered to second year B Ag Science students at the University of Adelaide. This contributes to the mandatory work experience program that forms part of the degree requirements for 2nd year Bachelor Ag Science students.

#### 6. Pesticide and Herbicide Research

Did this project conduct research on pesticide and herbicide products?

No

Yes  List the active ingredients, rate and timing

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## 7. Outputs

Reproduce any outputs not previously reported against

<b>Output 1</b>	Planned delivery date	Achieved
	31/12/2014	Yes

### Description

By 31 December 2014 manage a program that provides work experience for four students, two summer scholarships and an internship year in applied grains research for agricultural science or science students.

### Achievement prior to this report

Completed

### Achievement for this reporting period

The fourth intern, Danielle Allen is undertaking a 12 month research internship, working across two areas-pulse pathology and soil science.

### Achievement of commercialisation details

Not applicable

### Non-achievement details

<b>Output 2</b>	Planned delivery date	Achieved
	31/12/2016	Yes

### Description

By December 31, 2016, develop recommendations regarding internship programs

### Achievement prior to this report

Completed and submitted with progress report March 2017.

### Achievement for this reporting period

Recommendations for inclusion of regional placements have been actioned with Danielle Allen spending 3 months on Lower Eyre Peninsula.

### Achievement of commercialisation details

Not applicable

### Non-achievement details

**8. Milestones**

Milestone number:	Planned achievement date	Achieved
<b>1</b>	31/01/2014	Yes

**Description**

Advisory committee formed comprised of representatives each of SARDI, University of Adelaide and members nominated by SAGIT and/or GRDC.

**Achievement prior to this report**

Completed. Kathleen Allen was on original advisory committee. Further requests for GRDC involvement were not actioned after Kathleen's departure.

**Achievement for this report**

Not applicable

Milestone number:	Planned achievement date	Achieved
<b>2</b>	31/01/2014	Yes

**Description**

Detailed trainee programs developed and 2014 summer scholarships and traineeship advertised

**Achievement prior to this report**

Achieved. One intern has been employed for 12 months for past 3.5 years with the current intern completing her 12 month placement

**Achievement for this report**

Current intern completing her 12 month internship and will undertake a placement with SAGI (Statistics for the Grains Industry) as part of her 12 month placement.

Milestone number:	Planned achievement date	Achieved
<b>3</b>	31/07/2014	Yes

**Description**

Mid- year meeting and reporting with trainee and summer scholarship holders with advisory committee

**Achievement prior to this report**

Completed. Trainees have presented at a mid-year meeting with SAGIT and SARDI members. It was not possible to involve GRDC due to changes in program managers.

**Achievement for this report**

Danielle Allen presented to the SAGIT trustees in the field and at their upcoming Spring meeting.



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<b>Milestone number: 4</b>	Planned achievement date	Achieved
	31/10/2014	Yes

**Description**  
 Promotion of cuurent and next year's program to undergraduate students

**Achievement prior to this report**  
 The program has been advertised through normal recruitment channels (SEEK, CareerOne) as well as directly presented to undergraduate BAgScience students.

**Achievement for this report**  
 We will advertise an internship for 2018 if GRDC continues funding for this project. At this point, SAGIT have agreed to continue funding 50% of program until, December 2019.

<b>Milestone number: 5</b>	Planned achievement date	Achieved
	31/12/2014	Yes

**Description**  
 Evaluation of effectiveness of program and development of future programs if appropriate

**Achievement prior to this report**  
 Recommendations and evaluation were attached to 2017 progress report

**Achievement for this report**  
 Current discussions regarding the recommendations and future of this program are in progress with SAGIT and GRDC Southern Office.

<b>Milestone number: 6</b>	Planned achievement date	Achieved
	31/12/2016	Yes

**Description**  
 Final Report to GRDC

**Achievement prior to this report**  
 Progress reports submitted annually

**Achievement for this report**  
 Submitted

**9. Delivery Activity— Mentoring/Feedback loops**

What were the proposed target audiences and/or organisations for the activities/outputs? (e.g. Grain growers, agribusiness, researchers, breeders)

Ag science students

Was this activity/output delivered as part of the project?

No   
Yes

Date of delivery (dd/mm/yyyy)

31/12/2014

Was there recurring years for this activity/output?

No   
Yes

Month and year of activities/outputs  
December 2015, December 2016

Did this activity/output include third parties?

No   
Yes

Name of principal contractor

Was this activity/output funded within the project budget?

No  Details of external funding

Yes  **Include in budget and operating notes.**

Was this activity/output national/regional/local?

National   
Regional  Specify region if possible  
Souh Australia

Local  Specify locality if possible

Final summary of the outcome for this activity/output

Students mentored in specific areas of applied research. The interns have also been offered training in presentation skills and scientific writing, and Advanced Excel. The 2017 intern is undertaking specific mentoring in applied statistics as part of this program.

**Delivery Activity— Marketing/promotion**

What were the proposed target audiences and/or organisations for the activities/outputs? (e.g. Grain growers, agribusiness, researchers, breeders)

Students

Was this activity/output delivered as part of the project?

No   
Yes

Date of delivery (dd/mm/yyyy)

31/01/2014

Was there recurring years for this activity/output?

No   
Yes

Month and year of activities/outputs  
November 2014, November 2015, November 2016

Did this activity/output include third parties?

No   
Yes

Name of principal contractor  
University of Adelaide

Was this activity/output funded within the project budget?

No  Details of external funding

Yes  **Include in budget and operating notes.**

Was this activity/output national/regional/local?

National   
Regional  Specify region if possible  
Souh Australia

Local  Specify locality if possible

Final summary of the outcome for this activity/output

Promotion of internship program via social media, websites and personal contacts to attract high quality students. All interns have been given opportunities to participate in field days, farmer meetings and field trips, as well as the GRDC Research Updates.

**Additional Extension Activities/Referred Publications (in bibliographical format)**

'Intern trainee flies high' Precision Ag News Spring/Summer 2015, volume 12, issue 1

'Research Updates-Robotic Paddock Assessments' Ground Cover May-June 2016 p. 18

Brooke Schofield is a co-author on with the University of Sydney on a publication entitled "Field Robotics Pilot Study in South Australia". The paper was submitted to a special issue of the Journal of Field Robotics but has not yet been accepted for publication.

**Delivery/Path to Market**

Of the three interns who have completed the 12 month research internship, two have been retained in applied grains research.

James Walter is undertaking his PhD on new technologies for field phenotyping with AGT and University of Adelaide; Brooke

Schofield is undertaking her PhD with University of Adelaide in the plant phenomics area, also on new technologies for phenotyping. Both maintain an informal research linkage with SARDI and both are already making outstanding research

contributions. The 2017 intern intends to continue in research when her placement is completed in February 2018.

Of the nine work experience placements, three were awarded academic prizes from the University of Adelaide in 2017. Two are currently undertaking Honours, one in agroecology and one in grain pathology with SARDI and University of Adelaide.

## 10. Environment/Economic/Social Analysis

Outline the benefits/risks associated with this proposed investment.

### Benefits

Include an estimate of the benefit and the scale to which the impact will apply (i.e. ha, tonnes).

Also include likelihood of benefit and proposed extent of the adoption by industry in the project timeframes and beyond.

### Risks

Include likelihood of risk and management options.

#### Environmental Benefits

None identified

#### Environmental Risks

None identified

#### Economic Benefits

Researchers with a sound understanding of applied research relevant to grains industry working regionally, and contributing to economy..

#### Economic Risks

None identified.

#### Social Benefits

Young researchers trained with a sound understanding of applied research relevant to grains industry.

#### Social Risks

Difficult to attract high quality students into agricultural science, despite strong employment options and programs such as this.



## 11. Overview of Project Achievements

This program has supported two linked programs: 12-month research internships for recent graduates, and work experience placements for students second year of an agricultural science degree.

Four students have completed 12 month Research Internship. The internships are aimed at recent graduates from a Bachelor of Agricultural Science or Science degree program, providing them with a tailored 12 month paid experience of applied research.

Nine students have completed Work Experience Placements and a further five are still underway (Note-this program is jointly supported by SAGIT and GRDC and SAGIT have committed funding until December 31 2019)

The student reports are attached (4 individual research internship reports and one combined report on the work experience placement program).

2014. The inaugural intern, James Walter completed his internship in June and commenced a PhD at Australian Grain Technologies and the University of Adelaide. James is an outstanding young scientist and his final report on the internship year reflects his sense that the traineeship contributed to his ongoing interest in applied R & D. He maintains strong research and personal linkages with the SARDI pathology group.

2015. The 2015 trainee, Brooke Schofield, completed her internship in July 2016. She was offered a scholarship to undertake a PhD with University of Adelaide. The area of her PhD is in analysis of imagery associated with plant phenotyping. The bulk of this work will be done at the Plant Accelerator. Brooke is maintaining a research connection with SARDI scientists with an interest in plant phenotyping. Her report is attached. Feedback from her PhD supervisor DR Trevor Gamett, indicated he felt she was the strongest PhD student he had supervised. The 2014 intern, James Walter is undertaking a PhD with Australian Grain Technologies, and presented at the 2017 GRDC Research Updates in Adelaide with very positive feedback.

2016 The 2016 trainee, Jamie Fortune, commenced an internship in March 2016. He initially worked with the SARDI Entomology group, in management of snails as well as diamondback moth. He failed to find a focus in the Entomology group and expressed an interest in technology transfer and communication of research to industry. He was given the opportunity to work with Dr Alan McKay and the Molecular Diagnostics group. He assisted with review of the training manual for accreditation of agronomists in using PredictaB and with projects on root disease management in cereals. He resigned on December 9 to pursue a role in the private sector, not related to agriculture.

2017 The 2017 trainee, Danielle Allen, commenced work on February 6 2017. Danielle was initially based at Waite, with the cereal pathology program (Jenny Davidson and Marg Evans), but has spent time during the growing season with Andrew Ware at Port Lincoln. Danielle 's work has added to the SAGIT project 'Using soil water information to make better decisions on Eyre Peninsula' which aims to reconcile plant water use on a range of soil types across the region so that growers can make more informed in season decisions in terms of inputs such as nitrogen rate. By taking more in season measurements at each of these sites and using modelling tools such as APSIM to create a better understanding of the yield potential and specific yield limiting factors at each site, Danielle's research should be a valuable, additional contribution to this project. Danielle will seek employment in grains research after her internship is finished (February 2018).

Of the work experience students, two are currently undertaking Honours in grains research and several other students who are in the third year of their degree have indicated that they are considering undertaking Honours.

It is clear from the student feedback that they have all enjoyed the exposure to applied research and it has opened their eyes to the possibility of further study or work in applied R & D.

## 12. Conclusions

The program has been successful in exposing four recent Agricultural Science and Science graduates to applied grains research in plant pathology, entomology and agronomy. In addition, a total of thirteen second year students will be exposed to grains R & D by the completion of these projects. Two are now undertaking Honours and to date all of the undergraduate students have been really positive about their exposure to applied R & D and are considering research as part of their future options.

The regional placements for interns in 2015-16 (Brooke Schofield) and 2017 (Danielle Allen) have been very well-received although the interns require close supervision and support. These placements have worked well because there is a cohesive team with a range of projects underway, and staff with good mentoring skills

GRDC should continue to support this program, either in the current form or modified to include more regional placements, and/or placements with grower or industry organisations. This program will continue to expose ag science and science students to a career in applied research in the grains industry.

## 13. Recommendations

After evaluation by students and supervisors, a number of recommendations were made:

The following have been actioned:

- Advertise this program to undergraduate agricultural science students (third and possibly second years), so that they know the program exists and that it is a potential option for them once they finish university. Advertising should also extend to Honours students.
- Try to match available positions at SARDI to the specific skills and interests of the interns and support with seeking PhD opportunities, where appropriate.
- The original concept was to have four 3 month placements in the 12-month period. However, based on feedback early in the program, this was revised to two rotations.
- Feedback was received from scientists and students that work experience placements should be offered throughout the year as well as summer placement options.
- There will be an attempt to include regional placements, even short-term, in future programs. This has occurred in 2017.
- Include additional training opportunities: All interns have been given opportunities to participate in field days, farmer meetings and field trips, as well as the GRDC Research Updates. The interns have also been offered training in presentation skills and scientific writing, and Advanced Excel. The 2017 intern is undertaking a 3- week placement with SAGI (Statistics for the Grain Industry).

The following recommendation has not been actioned as it would be a significant shift in the way the program was structured but it may be a model for consideration in future programs:

- Offer an 18-month, rather than 12-month, program. Twelve months has been a tight timeframe to settle into the working environment, undertake a project and complete data analysis.
- Offer more regional placements. This requires strong supervision and support for students.

#### **14. Other Research and Development Opportunities**

There is an opportunity to extend this program, in a coordinated fashion with SA Grains Industry Trust in SA.

SAGIT has separately supported, with SARDI, a regional internship based at Haert Field Site group.

This model has attracted interest from other grower organisations including LEADA and EPARF on Eyre Peninsula. A broader regional internship program of 12-18 months' duration should be considered in conjunction with the Universities, SARDI, private organisations and grower organisations.

#### **15. Attachments**

## 16. Management of Intellectual Property/Commercialisation

Provide a summary of any strategies undertaken or planned to facilitate the protection and / or commercialisation of the project's realised outputs

Not applicable

Provide a list of all scientific or technical papers published, and any patents filed

Provide a list of any confidential information, if relevant and attach details to this report



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- 18.** Please use this area to include any additional text to support your report. Please do not include images. You may also attach a document (e.g. Word, Excel, PDF) limited to a maximum of 5 x A4 pages to this Report. Any additional information will be viewed as supplementary data. The report will only be evaluated on the previous sections of this document.

The individual reports from each of the Reserarch Interns are attached as well as a combined summary of the work experience placement prgram.

## 19. Plain English Summary for Public Release

<p><b>Project Title:</b></p> <p><b>GRDC Project No:</b></p> <p><b>Primary Contact:</b></p> <p><b>Organisation:</b></p> <p><b>Phone:</b></p> <p><b>Fax:</b></p> <p><b>Email:</b></p>	<p><b>Traineeships in Applied Grains Research</b></p> <p><b>DAS00142</b></p> <p>Dr Kathy Ophel-Keller</p> <p>South Australian Research and Development Institute (SARDI) GPO Box 397 ADELAIDE SA 5001 Australia</p>
<p><b>Objectives</b></p>	<p>The aim of this project is to develop and deliver a trainee program in applied research and development, relevant to the needs of the southern Australian grains industries.</p>
<p><b>Background</b></p>	<p>The aim of this project is to develop and deliver a trainee program in applied research and development, relevant to the needs of the southern Australian grains industries. The program targets high-quality agricultural science students who have a demonstrated interest and aptitude for research. This is in response to challenges in attracting students into applied research in the grains industry as:</p> <ul style="list-style-type: none"> <li>• The number of agricultural researchers training to replace the current generation is not adequate; at the same time several key experienced researchers are nearing retirement age.</li> <li>• Careers in agriculture are not seen as attractive by young Australians and agricultural research careers even less so, largely because of the lack of clear career path and relatively low pay.</li> <li>• Agricultural research agencies are finding it difficult to recruit appropriately trained younger researchers, particularly with skills in applied R &amp; D.</li> </ul>
<p><b>Research</b></p>	<p>Three research interns have undertaken 12 month placements at SARDI-one with a focus on cereal disease management and weed management. The second intern had a strong remote sensing background and undertook a 12 month placement assessing the suitability of novel sensing technologies to assess agronomic research trials. The third intern focused on research in applied pathology and entomology, with a focus on technology transfer. A fourth internship is underway with a focus on soil moisture monitoring and agronomy.</p> <p>In addition to the 12 month internships, there are work placement opportunities for second year agricultural science students for shorter term, paid work experience with a range of SARDI research projects</p>

## **Work Experience Program**

This program is aimed at second year AgScience students, to give them an experience of research. Depending on the research area, these may be offered as an ongoing project (1/2 day per week) throughout the university semester or as an intensive vacation placement.

Three of the work experience students-Brody Lock , Melissa McCallum (2016) and Angus Butler (2017) were awarded undergraduate prizes in May 2017 at the University of Adelaide. This included the highest academic award, the Peter Waite medal, being awarded to Brody.

Brody Lock and Melissa McCallum have continued to be ambassadors for the way in which the Graduate Traineeship program fosters links between SARDI, the University of Adelaide and the Grains Industry. Both Brody and Melissa have made major contributions to GRDC and SAGIT funded projects by working in a casual capacity with the cereals pathology group after completing their Traineeships.

Melissa is undertaking Honours in 2017 (University of Adelaide supervisor – Amanda Able; SARDI supervisor – Margaret Evans) on white grain disorder in wheat). As a result, links between the University of Adelaide and SARDI will be strengthened; the GRDC project DAS00154 “white grain disorder in wheat” will benefit from detailed research on a number of milestones; and Melissa will be provided with an opportunity to contribute to Grains Industry outcomes.

### **Summary of Work Placements:**

#### **Year 2015:**

##### **Brody Lock- Placement in Crop Pathology**

In 2015, I worked casually once a week at the SARDI Plant Research Centre at Waite whilst studying in the second year of a bachelor of Agricultural Sciences degree. I worked in the Plant and Soil Pathology area in the Pulse and Oilseed Pathology group and the Cereal Pathology Group.

I worked in the lab where I completed tasks including preparation of samples and fungal cultures that could be later used as inoculum in trials. I helped prepare samples that are tested for presence of viruses. I also had the opportunity to prepare agar plates which is something that I did not get to do at university. Working in a research lab allowed me to gain extra skills and safety knowledge which has improved my confidence when working in the lab, especially useful for practicals at university.

I also did many jobs outside of the lab including planting seeds and moving pots/plants to growth rooms, greenhouses or outside caged growing areas. Pots of plants also need to be moved when inoculation occurs to set up trials and experiments. These activities are much more physical and repetitive but are required as the trials need to be set up in the first place to be able to obtain data later on. Being a farmer, I am used to doing lots of physical work but I have seen in the set up and assessment situations where good organisation and setting out of all the aspects is needed to make the work easier before beginning.

Fieldwork was also a part of my work whilst working with the pathology groups. We visited many different trial sites across the Mid North, monitoring the sites and collecting samples. This was an opportunity to get out of the lab and to see trials first hand and understand how they are set up, maintained and how they fit into research that is being done. It also gave me the opportunity to travel around in the mid north which is an area of the state that I have rarely visited.

I worked with a variety of people which was a good chance to make many new contacts but it also improved my communication skills and ability to adapt to work with a variety of people. Working with

the many different people, it gave me the chance to observe the group dynamics where cooperation is needed and how no one person knows everything, instead knowledge and assistance is sought after or offered when needed to establish a healthy group environment.

Working in pathology groups has furthered my knowledge of the crops grown in South Australia and the many potential diseases and the pathogens that cause them. I have also gained knowledge in lab work and practices that are required to conduct experiments and trials

Overall, working at SARDI in 2015 has allowed me to get a look outside of university to see a potential career path in research and get some hands on experience. It has furthered my knowledge and improved my lab work and teamwork skills and has allowed me to see the research that goes into the information that is delivered to farmers.

### **Melissa McCallum- Placement in Crop Pathology**

From May to October 2015, I was given the opportunity to intern in the cereal and pulse pathology groups at the Plant Research Centre on the Waite campus. This gave me the opportunity as an undergraduate to see the range of research and work involved in the pathology area. It increased my understanding of research methods and procedures from the lab to the field.

Field trips during the internship helped me to understand the process of choosing a field site. I learned there is quite a process involved in choosing a suitable site from the accessibility of the site to the disease level. During other field trips, I was able to help researchers assess trials, attend field days and see the value extension has to farmers and researchers, visit NVT sites and see the different levels of breeding and also see how researchers work and help agronomists and farmers to assess paddocks for their disease levels and the impacts. The field trips were extremely beneficial to me. I found them useful in linking the research and work done in the labs to their practical benefit and their commercial value.

Lab work was a highlight of the internship for me. It was great to be able to see the practical side of things that I learnt in some of my uni courses. I was able to try out the techniques I learnt at uni on a research level and see the reasons behind the techniques in maintaining clean environment and other lab techniques. The lab work was very beneficial to me including learning practical skills like making up agar plates, making up inoculum and maintaining a sterile environment.

Work at the Plant Research Centre also included helping to set up pot trials, washing and cleaning different equipment, planting trials and assessing trials. The internship opened my eyes to the wide variety of tasks undertaken in the research sector. It increased my skills base and helped me to understand that research is in the career path I wish to take.

### **Heather Feetham-Placement in Entomology**

In January 2015, I gained a six week internship with the South Australian Research and Development Institute's (SARDI) Entomology Department. During the duration of my internship, I undertook a variety of tasks and experimental procedures, primarily relating to research investigating the breeding compatibility between two Diamondback Moth species- *Plutella xylostella* and *Plutella australiana*. As part of my internship, I was involved in the research process from experiment establishment to molecular analysis. This research process involved a diverse range of tasks, including moth gender analysis, insect culture cage maintenance, polymerase chain reaction (PCR), a variety of other molecular biology processes, and field work. Throughout every stage of the experimental procedure, I gained new learning experiences that complemented and enhanced my undergraduate study. For example, one of the primary tasks was to establish moth breeding pots, and this process involved identification of moth gender. PCR and other molecular analysis techniques, including electrophoresis, were performed towards the conclusion of my internship, and provided me with the opportunity to improve my skills in this field of research.



Being a part of this research was an invaluable learning experience for me, as the laboratory practices and research enabled me to contextualise my scientific studies to real case-work. The success I achieved through the internship was primarily associated with my growth in scientific research practices. However, other insights such as the importance of a team approach to achieve desired outcomes were invaluable. Having the opportunity to work as a team member in a research environment reaffirmed my commitment to a career in agricultural science research. As a result of undertaking this internship my motivation and confidence to explore and take up new academic challenges dramatically increased. This year, I will be undertaking an Honours project with field research based in Nepal with a focus on agroforestry.

### **Stephen Lang- Placement in Crop Physiology**

Between April and November I worked on an internship with the SARDI wheat physiology project. The project is run by the Climate Applications group at SARDI and aims to establish a benchmark in order to assess the nitrogen status of wheat. To create a dilution curve, trials were established at several NVT sites in the mid-north. These plot trials used different rates of nitrogen treatment across a variety of cultivars. As well as creating a dilution curve, the project benchmarks different wheat crops against the curve. Benchmarking against the curve gives the nitrogen nutrition index (NNI) of the crop. Plant tissue testing can then be used to assess the reliability of the curve in determining the nitrogen status of wheat.

This placement allowed me to be more involved in a research project, opening my eyes to the possibilities of continuing into post-graduate study and research at the conclusion of my degree. Being involved in a project for several months meant that I could see most aspects of the project from the planning stage to harvest. I am thankful for the opportunity to have been a part of this project.

### **Year 2016:**

#### **Caitlin Thompson- Placement in Cereal Pathology**

During the latter half of 2016 I undertook work experience in SARDI with a number of research groups, giving me an insight in to different areas of study. During my work experience I undertook a wide variety of activities, including:

- Wheat head preparation for severity analysis
- Analysed the severity of the white head infection
- Counted infected plants in greenhouse
- Assisted in preparing different inoculums
- Used haemocytometer to determine inoculum concentrations
- Agar plate preparation

This gave me a taste of different research techniques and through this experience I gained new practical skills which will be useful during my future studies. I gained an introduction into research methodology and the use of statistical analysis and statisticians in field study planning. I also gained a better knowledge of major diseases/fungi and some aphids that are affecting the cereal industry currently, making me aware of the importance of the work carried out by SARDI.

This experience has definitely influenced my future career choices. Before undertaking this research experience I wasn't particularly interested in focussing my future studies on plants or plant research, I was more focused on the animal side of agriculture (in particular sheep breeding). However, my opinion of plant research has been changed through my exposure to the different projects being undertaken by SARDI. In fact, I have chosen to concentrate my third year studies on plant based subjects such as plant breeding/genetics and plant biotechnology. I am also now considering doing Honours and perhaps a PhD project in plant genetics

### **Angus Butler –Placement in Pulse Pathology**

The internship with SARDI allowed me to explore my interest in plant pathology, and provided an opportunity to observe practically engaged full time researchers. The teams in pulse and cereal pathology went out of their way to provide exposure to the varied tasks that a plant pathologist undertakes over a period of several months.

I was given the opportunity, with careful and patient instruction to carry out laboratory-based techniques such as isolations of fungal pathogens from infected plant tissue, spore counts using a haemocytometer, preparation of fungal spore solutions for plant inoculations, preparation and extraction of samples for ELISA detection of plant viruses. I enjoyed being able to improve my microscopy skills, and observing the hidden world of microbes that so heavily influences global food production.

The work wasn't all based at Waite, and I visited the Turretfield and Hart trial sites at various times. I was lucky enough to be able to attend a field day out at Hart where researchers presented the results of the latest trial data to farmers, and other interested attendees. It was very rewarding to attend a talk by SARDI scientist Sara Blake which elaborated on results of experiments which the team and been conducting and in which I had contributed if only in a small way.

During all these activities, I was given a constant flow of useful information about the rationale behind the methodology, as well as the characteristics of a multitude of interesting plant diseases such as ascochyta, chocolate spot, powdery mildew of peas, septoria, crown rot and various rusts. I was grateful the team always appeared to make a conscious effort to explain the 'why' of what we are doing throughout the internship.

In summary, I had a hugely rewarding experience, which provided me with a significantly improved understanding of what a career as a plant pathologist, and as a researcher would involve. Not only that, but it has led to my being given an interesting project over the summer with SARDI analysing the differences in the fitness of ascochyta isolates, and whether these differences can be connected to phenotype.

### **Vanessa Seppelt-Placement in Pulse Agronomy**

During the time period whilst I have been assisting Lachlan with his research I have performed the following duties:

- Fortnightly field trial assessments and recording
- Harvesting field peas for data collection
- Pod collection
- Yield component calculation

A deep appreciation for the importance for continual research to provide all facets within the agricultural industry the best tools for successful and sustainable trade outcomes was my motivation to enter into study and continues to drive my learning. The experiences gained during my time assisting Lachlan has confirmed that research is a future career pathway to consider upon completion of all necessary study. I have felt a genuine 'buzz' in working within the Waite research

facilities knowing that there is potentially ground breaking work going on behind each door! I look forward to other work experience opportunities that maybe available during my study period and the hope to potentially contribute to research in the future.

### **Ben Pratt-Placement in Cereal Physiology**

I was fortunate enough to be placed under the supervision of Marianne Hoogmoed researching nitrogen use efficiency and benchmarking in wheat. The program has allowed me to experience first-hand the planning and processes that are involved in grains research. I undertook activities such as irrigation setup, tissue sampling, nitrogen application and sample preparation at locations all around South Australia such as Waite, Roseworthy, Hart and Turretfield.

This program has also assisted me with future career decision making. Although I will return to assist in the management of my family farm at Blyth in South Australia, the insight into how agricultural research is conducted and also the friendly culture associated with it has encouraged me to stay at University and undertake honours research in precision agriculture.

I would recommend the grains traineeship program to any current Agricultural Science student who may think they have future in grains research or even other students such as myself who are looking to a different career path in order gain diversity in the career journey.

### **Year 2017 (placements underway):**

**Research Area:** Ben has been working on characterising physiological differences in current barley varieties that will make them suitable for early sowing.

Student: Benjamin McGorm  
Supervisor: Kenton Porker

**Research Area:** Developing methods and strategies for Nitrogen management in wheat

Student: Bethany Sleep  
Supervisor: Mariano Cossani

**Research Area:** Matthew has been working on lentil and faba bean agronomy using phenological prediction models.

Student: Matthew Cadd  
Supervisor: Lachlan Lake

**Research Area:** Cereal and pulse pathology (Summer 2018)

Students: Mark De Lisio and Katelyn Heinrich.  
Supervisors: Margaret Evans and Jenny Davidson

# SARDI Applied Grains Research Internship Report

Brooke Schofield, 2015-16 Intern

## **The main activities I have undertaken as part of the internship and the associated skills I have developed**

During my time as the Grains Research Intern at SARDI, I had the opportunity to be based with two main groups; the Climate Applications Group based at Waite and the New Variety Agronomy Group based at Clare. I spent the first 10 weeks of my internship with the Climate Applications Group before relocating to Clare to spend a further 9 months working with the New Variety Agronomy team. The Climate and NVA groups were very different in terms of the type of work they carried out. However, I learnt a great deal about agriculture and research from both groups and appreciated spending time in both environments.

### Climate Applications Group, Waite, 10 week rotation

Since the Climate Group is a reasonably small team, I was able to work with and be involved in a variety of projects run by different researchers. My work with the Climate Application group was predominantly computer-based but I still had the opportunity to participate in field work and lab work and to attend relevant seminars and meetings when the chance arose.

The majority of the work I was responsible for in the Climate Group was using 'The Agricultural Production Systems Simulator' (APSIM) to run climate-based scenarios and models with varying inputs. I ran models predicting parameters such as flowering time for different varieties, nitrous oxide release from soils with varying fertiliser applications, and the ideal time of harvest to maximize yield potential. These models required input factors such as crop variety, forecasted weather, soil type, fertiliser, timing etc., all of which I had to understand before I could apply them to a particular scenario. I hadn't done any previous computer modelling work before using APSIM so it taught me a lot about how computer modelling works as well as forecasting and predicting climate scenarios and the associated presumptions and uncertainties.

While based with the Climate Group, I also had the opportunity to work with soil moisture probe data recorded from the New Horizons Project. I had to organise and reduce the data to a manageable size before it could be analysed and compared to recorded rainfall events in the region. My data storage and presentation skills using Microsoft Excel significantly increased during this project as did my ability to interpret and compare data which was presented in different formats.

Although my focus was computer-based, I was also exposed to a range of lab and field work. In the lab, I assisted with seed sourcing and packing and plant sample weighing and grinding. In conjunction with the seed packing, I was also introduced to trial design and learnt what makes a good trial. The appropriate trial design then affected the way the seeds were packed and whether they required any additional treatment or preparation before sowing. The sample weighing and grinding showed me the importance

of drying out material in order to obtain an accurate biomass weight and how to operate lab machinery safely.

I was also able to assist in a variety of fieldwork while located with the Climate Group. I spent time at almond orchards in the Murraylands marking trees to be sampled and helped with grape harvest at a Naracoorte Vineyard. Although this fieldwork isn't directly related to Grains Research, it provided me with a larger overview of the type of research undertaken at SARDI and the range of roles a researcher has.

#### New Variety Agronomy Group, Clare, 9 month rotation

The vast majority of my internship was spent on a regional placement at the Clare Crop Improvement Centre/ New Variety Agronomy Group. The Clare group is responsible for a completely different type of work than the Climate Group. Where the Climate Group focusses on computer-based models and spends the majority of the time working on a computer, the Clare Group are responsible for maintaining a vast array of different trials, including large breeding trials, and spend most of their time working outdoors.

The Clare group was very accommodating to having me onboard and as such, I was given the opportunity to design, undertake and lead my own research project. As well as leading my own research project, I also helped with day-to-day field and lab work when I could. Overall, I spent approximately 70% of my time performing field duties for other projects and 30% of the time working on my research project, whether it was in the field or the office.

I was exposed to the entire extent of field operations that the Clare Group performs throughout the year. Some of the field roles I performed included seed packaging, sowing trials, applying fungicides and herbicides (both pre and post emergent), weeding, biomass cuts and sampling plants in the field. My scientific and observation skills were also refined when I was taught how to visually score and assess individual plots for different traits. I learnt how to score trials for: herbicide damage, disease extent, canopy closure, emergence, height, vigour, maturity, lodging and necking.

Because of my limited background in agriculture, the field and trial work was truly invaluable to my learning of agricultural systems. I learnt a huge deal in all aspects of trial design and management throughout the duration of the season, all the way from trial design and packing to harvesting and post-harvest analysis. I used my new knowledge of agricultural trials and field skills in my own research project.

I chose to centre my research on an area I was already somewhat familiar with from my university studies and incorporate it into a project that would also benefit SARDI. I carried out research into the effectiveness of using field robotics (including aerial UAVs and a ground-based robot) to capture key agronomic data and parameters (e.g. NDVI, plant height, chlorosis etc.). Multiple UAV flights and two ground-based robot (Ladybird) acquisitions were carried out throughout the year in alignment with field campaigns. The purpose of the research was to determine whether the quality of information generated from these external robotic platforms is an improvement compared to current measurement practices

in terms of coverage, resolution, precision, accuracy and repeatability. The work was carried out across multiple sites and at several different intervals throughout the growing season.

It was a collaborative, proof of concept study; researchers at SARDI Waite, FarmingIT, Sydney University, Adelaide University and Victorian Department for Resources were also involved in different aspects of the project. I learnt about the initial set-up and procurement process and the establishment and the execution of performing a research trial. My planning and time management skills improved during the planning and procurement process, as did my professional communication skills. My research skills improved greatly after performing background work as a precursor to the project, and in executing the project itself. My critical analysis and ability to draw conclusions from raw data has improved after examining the datasets created during the project. Most importantly, running my own research has given me the confidence to continue working in a research capacity into the future.

As well as having the opportunity to use the UAV and Ladybird robot, my project also allowed me to use ground-based technology in order to validate the remote platforms. I extensively used two different Trimble Greenseekers, both the handheld and pole-mounted systems. I also had the opportunity to use a ceptometer to measure light penetration in high density bean plots. These tools and technology saw a more 'modern' method brought into the research and offered an alternative to relying on human observation scores.

I became familiar with a range of software after analyzing data from my project, in particular, with the ArcGIS suite of programs. I used ArcGIS to view and analyse all of the captured UAV imagery in order to determine average NDVI and elevation for each trial plot. I had previously been exposed to this program but my knowledge of it has increased dramatically and I now know how to perform more advanced operations.

Being given the opportunity to lead my own research project was a great learning experience for me and was a huge stepping stone for my future research career. Previous to this experience, I had only been involved in research at an undergraduate level or as an assistant and never had the opportunity to create and lead a project in the direction I wanted it to go. In my opinion, this was the most beneficial aspect of the internship. It gave me the best introduction to agricultural grains research and provided me with a range of organisational, professional and scientific skills I'll use to further my research career.

Another benefit of working with the Clare Group was the opportunity to work alongside researchers from other companies. I had the chance to meet researchers from the Mid North High Rainfall Zone Group, Plant Breeders Association Australia, and most extensively, with Sarah Noack from the Hart Field Site Group. This introduced me to other agricultural research companies and other possibilities in agricultural research.

#### Final 6 months at Waite finalising internship

After returning from Clare, my final time at Waite was mainly spent finalising analyses and reports from the Ladybird and UAV work. I compiled two reports (non-scientific) as a way to showcase my research

and findings amongst other SARDI. I also compiled a brief literature review on agricultural remote sensing techniques, previous applications and future possibilities. I found this a beneficial task to summarise and justify the work I had done as well as improving my research skills while learning more about a subject I was interested in. The literature review also provided other SARDI researchers with an introduction to the potential of remote sensing applications for their trials.

While back at Waite, I was supervised by the Pulse Pathology Group. While also finalising my research, I was able to assist the group with their glasshouse and shadehouse experiments. I helped fill pots, sow seeds, interpreted experimental set-ups, inoculate trials and act as scribe during disease ratings. This shadehouse work gave me a well-needed break from sitting at my computer every day reading through material. It also helped me get to know the Pulse Pathology Group better, both the researchers and the technicians.

I knew my days left at SARDI were limited once I returned from Clare so while I was back at Waite I spent some time thinking about what I would like to do in the future. I considered trying to find another job in research or applying as a casual at SARDI but in the end, I decided that I wanted to pursue a PhD in a field related to remote sensing and agriculture. I approached two different universities (UNE and UofA) and discussed potential projects. I decided that the project I could undertake at the University of Adelaide was of more interest to me so I applied for candidature there. The Pulse Pathology Group was very helpful and involved in making my decision to study a PhD. They offered guidance, suggested ideas for topics, and talked through ideas with potential supervisors. The support shown for my future beyond the internship was more than anything I expected and was very grateful for their input and interest in my future development.

#### Additional opportunities

I have been fortunate to attend a variety of different professional development and training courses throughout the year. I attended a scientific journal writing course and a Microsoft Excel training course both held at Waite. The writing course taught me a new method for tackling a journal article while the excel course gave me an overview of the software and taught me many useful keyboard shortcuts. I also earned my certificate for chemical accreditation and driver awareness training. I found the chemical accreditation particularly useful because it improved my understanding of different chemical and herbicide groups, how to calculate correct spray rates, and the correct personal protection required when hand-spraying (particularly useful when working with the Clare Group).

I have attended a number of farmer field days which showcase the trials and research I have been assisting with throughout the year. The most significant of these were the Hart field day and Minnipa centenary field day and celebration but I also got to attend smaller events held at Pinery and Hart. The Minnipa field day was beneficial because I saw how farm-scale research operates; I wasn't aware that Minnipa was a farm-scale research centre before I attended the field day. Travelling to Minnipa also exposed me to some of the low-rainfall areas of the state and how that influences their cropping and research. I was lucky enough to meet the Hart board, local farmers, agronomists and fellow scientists at the Hart field day and learn more about the trials that I had helped maintain throughout the year.

As a member of the Climate Group, I was invited to attend the Goyder Institute Annual Conference-Water Research Showcase where researchers from the Climate Group were presenting their work on using climate change predictions in APSIM. This was a great opportunity to meet climate, water and environmental researchers and to hear about the research they were undertaking and how it linked back to agriculture. Right at the beginning of the internship, I was fortunate enough to attend the 2015 GRDC Update. This gave me an insight into the different agriculture research areas both within and outside of SARDI. The GRDC Update was a huge benefit for me since I wasn't very familiar with agricultural research before working at SARDI. The event also provided a good networking opportunity, for example, I was able to meet the Clare staff before commencing my rotation with them later in the year. Throughout the year, I also had the opportunity to attend SAGIT updates, a 'Showcasing Innovation and Technology in Agriculture' presentation, and Spatial Information Day, all of which furthered my interest in agricultural research.

I felt very privileged to have been asked to speak at this year's GRDC Updates in February. Being nominated gave me confidence knowing that my peers and senior researchers believed in me enough to present my work at a conference. I had the opportunity to present my project I've been working on all year to an audience of farmers, agronomists, and fellow researchers. The talk went well and interest was shown by many. The GRDC talk followed an initial presentation I gave on my project at the SARDI symposium in August last year. Preparing for both the GRDC Update and the symposium helped my presentation skills and taught me how to identify key findings from your research work. I have also reported my work at a grower's group meeting and a PBA pulse pre-breeding meeting.

I was also given the opportunity to travel to Canberra towards the end of my internship to meet with researchers from all over Australia who are using imaging in agriculture (part of the managed Environment Facility forum). This trip broadened my professional contacts and exposed me to the array of imaging work currently underway throughout Australia. It was great to meet the researchers responsible for many of the journal papers I had been reading and to hear about their current and future work in imaging for phenotyping, especially in field conditions.

I have featured in a number of magazine and newspaper article promoting both the internship and my own research project. I have appeared on the PIRSA website and the GRDC's Ground Cover magazine promoting the internship. I also appeared in another story in Ground Cover promoting the future of agriculture because of my work with the Ladybird technology. A full-page article on my research within the internship appeared in the SPAA's *Precision Ag News* magazine. I have also featured in photos in the Stock Journal for the Hart field day.

A journal article was drafted following the collaborative work with the University of Sydney and the Ladybird technology. I was acknowledged as a co-author of the article which was titled "Field Robotics Pilot Study in South Australia". The paper was submitted to a special issue of the *Journal of Field Robotics* but is yet to be accepted and is still in the review/drafting stage.



## **Reflections on the program**

The flexibility that SARDI provided was wonderful. I was able to choose which groups I wanted to spend time with as well as outlining my own research project to undertake. Determining which groups I'd be spending my time with at the commencement of the internship allowed me to prepare myself and become familiar with their research before joining the group.

In my experience, I believe that the best way to make the most of the program is to spend the internship (or an extended time of it as was my case in Clare), with a single SARDI group. This allows you to get to know the researchers and to see all aspects of the work they carry out. If the internship was structured in a way where multiple small rotations were undertaken, I wouldn't have assimilated into SARDI as well as I have. It would also take a substantial time to learn the background of different groups and the trials they are conducting.

The internship provided a large opportunity for training and development. I found the skills I learnt through courses such as the excel course, writing course and chemical accreditation to be very valuable to my role as a researcher and transferrable across different projects.

## **Thoughts on what could be improved or changed for next year**

I believe that the duration of the internship should be increased to 18 months rather than 12 months. I found myself looking for future opportunities/work when I was only half way through the internship. I also believe that the internship should commence in early March each year. Although this may discourage recent graduates who finished in November of the previous year, beginning in April would allow the intern to experience the entire growing season from trial design to harvest (which is especially rewarding for field trials).

I found that during my first 10 weeks with the Climate Group, I was sometimes a bit short on work. This wasn't fault of the Climate Group, just poor timing and adjusted workloads. An individual research project should be decided upon at each stage/rotation of the internship so that when the work load is low, there is always something to fall back upon (as was the case for my project in Clare).

The advertising and recruitment of the role could be further improved. I saw it advertised on the government vacancies website even though I attended the University of Adelaide at the Waite Campus. I think the role needs to be advertised to final year students in all science degrees rather than just agriculture. Students appropriate for the internship would also be found in general science, biology, chemistry, environmental, natural resources, and soil and water degrees.

## Summary on the internship and its structure

- Wonderful flexibility offered by the internship. There are so many different research areas within SARDI that are willing to take on an intern. I was very grateful and humbled when I was allowed to conduct research in an area not well established at SARDI
- A range of different training and development courses offered which honed my skills as a researcher
- Highly enjoyed (and recommend) undertaking a regional placement. In a small group, I was able to get to know everybody at a personal level and was treated with respect and as an equal. You're able to learn all aspects of their operation being such a small group. Clare was an ideal location because you didn't feel too disconnected from the main Waite group since it was still possible to for events and meetings etc. You also have a lot more involvement with farmers
- Appreciative and grateful for the support I received for my options post-internship. I doubt many companies would offer support and guidance for my future plans, so thanks SARDI!
- Long-term rotations work better than multiple short stints with a group. You feel more like a researcher and part of the team and less of an intern once you've had time to establish yourself within a group
- An individual research project needs to be established for each rotation/placement of the internship to fall back on if work load is low. Being responsible for your own project also makes you feel like an established researcher rather than an intern
- I'd suggest extending the internship from 12 months to 18 months. I found myself worrying about my future plans halfway through my contract

## Final comment...

I thoroughly enjoyed the internship offered by SARDI. I didn't envision myself pursuing an agricultural career at the end of my undergraduate studies (having studied geology) but now, I can't see myself doing anything else. I'm very grateful and glad that they took on an intern without an extensive agricultural background! The internship is a fantastic way to expose young people to a career in agricultural research and to get more youth involved in the sector. The internship, and especially my time at Clare, has provided me with a plethora of knowledge and skills related to agriculture and research practices which will undoubtedly assist me as I pursue life as a PhD student. I've made many useful contacts; all the people I've met and worked with at SARDI have all been friendly and ready-to-help. I am sure I will keep in touch with at least some of the SARDI researchers into the future.

**Photos from throughout the internship**



Close-up of the Trimble UX5 used for my research



Example of data acquired by the UAV. RGB image of Turretfield



The UAV being launched at Turretfield



The Ladybird robot (ACFR) in action autonomously imaging lentil plots at Pinery





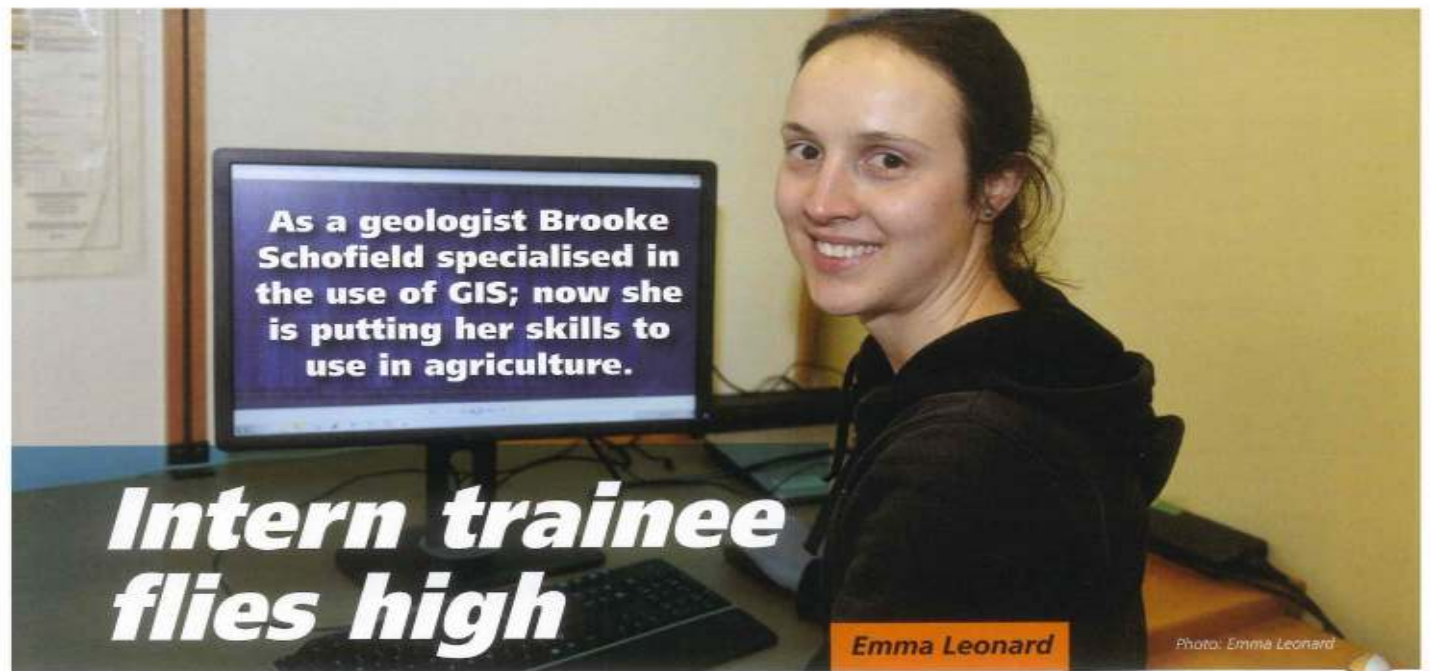
**Young scientists go with the grain**

South Australian grain growers are investing in the future of their \$4.5 billion industry by funding the development of young research scientists.

PIRSA website story published 31/3/15. Photo also appeared in GRDC's Ground Cover Issue 117: July-August 2015 as "A bright view away from city lights"



Photo from Stock Journal, 8/10/2015, page 23. "Networking opportunity for cropping industry" Photo supplied by Gabrielle Hall



**As a geologist Brooke Schofield specialised in the use of GIS; now she is putting her skills to use in agriculture.**

## **Intern trainee flies high**

**Emma Leonard**

Photo: Emma Leonard

**A**s a means of attracting new, young blood into agricultural research, the SA Research and Development Institute (SARDI) has established an internship program. With the support of the SA Grains Industry Trust (SAGIT) and the Grains Research and Development Corporation (GRDC), the program provides a research placement for a recent graduate to work with one of SARDI's established research teams.

Brooke Schofield is the second recipient of the SARDI internship and has joined the Clare-based SARDI New Variety Agronomy (NVA) group which has a strong focus on pulse research. However, Brooke does not have an agricultural or even plant breeding background but studied geology at the University of Adelaide.

"In my honours year I looked at the use of satellite data for soil observations so gained skills in the use of Geographical Information Systems (GIS). I was also working part time in a grain quality laboratory so both of these initiate links to agriculture," explained Brooke.

On completing her studies Brooke was delighted to be able to find a research job that used some of the skills she had developed during her degree. She enjoys the rewards of being involved with agriculture and its direct links to food production and rural communities.

"In agriculture I feel I can really make a difference; the world needs more efficient food production and my research can contribute to achieving that goal."

Brooke's internship research project is primarily investigating the potential use of an unmanned aerial vehicle (UAV) as a method of collecting phenotype data from crop trial plots.

***"Working in agriculture I feel I can really make a difference"***

The NVA group runs large numbers of trial plots each year looking at disease, herbicide tolerance, varieties and the impact of different agronomic practices in pulses. All plots have to be regularly monitored in the search for visual differences which could be due to improved growth, herbicide tolerance or susceptibility to disease.

With colleagues, Brooke has established plots of different varieties of lentils, chickpeas, faba beans and field peas as well as wheat and barley incorporating differences in herbicide treatments, seeding rates and row spacing.

Working with accredited UAV service provider Martin Peters, FarmingIT, Brooke is gathering optical colour images and near infrared images of the plots.

"Initially we flew a bare earth flight in May and then the first crop flight was in late June, then late August and two more flights will occur before harvest."

Visual checks are carried out on the same or consecutive days to the flight and as crops mature, handheld biomass readers are also being used to gather data and ground truth the aerial results. A third set of data is being collected using the University of Sydney's 'ladybird' field robot which is also fitted with a hyperspectral camera and a LiDAR enabling 3D images to be produced.

"In addition to identifying difference, we are also assessing what data produces the best crop surface model. Crop surface is a key indicator of biomass production, crop vigour and health."

Brooke is excited about the long term prospects in agricultural research and is keen to continue developing her skills in the use of spatial technologies and data analysis.

**Details:**  
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## ADELAIDE

## HOW TOMORROW LOOKS

**THE RECENT ADELAIDE GRDC UPDATE SERVED UP A SMORGASBORD OF INSIGHTS FOR THE 370 GROWERS AND ADVISERS WHO ATTENDED. HERE IS AN INSIGHT INTO SOME OF THE NEW AND EMERGING TOOLS AND TECHNOLOGIES THAT ARE INFORMING DECISIONS AND DRIVING CHANGE IN THE CROPPING INDUSTRY**

By Rebecca Jennings

### NOW: NETWORKED FARM DATA COLLECTION

Soil-moisture probes and weather stations are not new to the cropping landscape, but as technology improves these tools are becoming more sophisticated.

Yorke Peninsula, South Australia, agricultural technologist Leighton Wilksch, who runs agricultural sensor technology company Agbyte, says the way data is logged, transmitted and viewed by these technologies is changing.

For example, mobile phone and server-based data now allows for near-real-time information at growers' fingertips. The capability of technology is also changing – probes can be installed at greater depths (down to 1.6 metres) – to better understand how much moisture is in the soil, where plant roots are active and how much moisture is being used by the crop, particularly during the crucial flowering to grain-fill stage.

Modern telemetry systems also provide the ability to log and send data from more than one source. This means growers can link multiple sensors, such as from soil probes, rain gauges, weather stations and even in-paddock cameras, to access data that impacts on farm business decisions.

Mr Wilksch advocates local networks of probes, paired with other data collection tools such as weather stations, as a way for neighbouring growers to value-add to their individual investments.

"The location of a soil-moisture probe is important to get the best out of the data, so neighbouring growers who each have a probe installed in different soil types and in different crops can extrapolate the information from other farms to their own," he said.

The more data growers can collect, the better

they can use it to make decisions. Multiple years of data from probes can give a clear picture of how much soil moisture there is at any point in time compared with previous seasons.

However, in-paddock data collection does not just guide crop-management decisions. Mr Wilksch coordinates weather station data from across the northern Yorke Peninsula and this was used over summer to issue harvest-fire risk alerts.

**Grower tip:** Regardless of the technology, Mr Wilksch says location and correct installation are critical to gain the best value out of the investment. This includes ensuring cabling is vermin-proof, the weather sensors are in a representative location on a farm, and placing the probes deep enough to avoid damage from machinery.

### SOON: DIPSTICK SOIL TESTS AND APPS TO MEASURE HERBICIDE RESIDUES

A GRDC-funded national project is drilling into the potential effects of increased herbicide use on soil biological processes such as organic matter turnover, nitrogen cycling, phosphorus solubilisation and disease suppression.

The five-year project is coordinated by the New South Wales Department of Primary Industries (DPI) with partners in Western Australia, SA, Victoria and Queensland.

NSW DPI researcher Dr Mick Rose shared insights from the second year of the project with growers and advisers at the Adelaide GRDC Research Update, including the findings of a national soil survey. "The soil survey found that residues of certain herbicides, including glyphosate and its metabolite aminomethylphosphonic acid (AMPA), trifluralin and diflufenican, frequently persist at significant levels in soil prior to the winter cropping season," Dr Rose said.

"We know soil biological functions are generally resilient to short-term impacts of herbicide applications at label rates; however, the longer-term impacts are not as well understood. There is evidence that herbicide residues at levels found in the soil survey could contribute to reduced crop performance, most likely through direct phytotoxicity."

This research is developing tools

for growers and advisers to rapidly diagnose herbicide residues in soil.



PHOTO: BROOKE SCHOFIELD

A SARDI research project tested how autonomous and aerial devices could be incorporated into field trials. They used the prototype Ladybird robot (left) and a UAV (right).



PHOTO: BROOKE SCHOFIELD

"We are currently testing rapid in-field dipstick technology – similar to pregnancy-test kits – that can give an indication of herbicide residue levels in soil within 30 minutes," Dr Rose said.

This will be supported by improved computer modelling to account for the effects of weather and soil type on herbicide persistence, so growers and advisers can estimate soil residue concentrations in individual paddocks at a certain time after herbicide application. A handheld tool, such as an app, will package this research output for quick reference in the paddock.

**Grower tip:** Strategies to avoid herbicide residue accumulation and potential damage to soil functions and crops include routine rotation of pre-emergent herbicides, reliable record-keeping to help identify potential residue issues, strategic tillage to aerate soil and stimulate herbicide breakdown, and building organic matter to stimulate microbial activity.

### LATER: ROBOTIC Paddock ASSESSMENTS

Unmanned aerial vehicles (UAVs) and robots seem to be 'all the go' at the moment, but South Australian Research and Development Institute researchers Brooke Schofield, Dr Rohan Kimber and Lam McMurray have shown they are much more than just 'toys' by putting these technologies through their paces to see how they could guide crop management.

The trio looked at how autonomous and aerial devices could be incorporated into field trials by taking rapid measurements of phenotypic traits, such as canopy height and density, in pulse and cereal crops in the Lower Mid North of SA.

The study used a fixed wing Trimble UX5 Unmanned Aircraft System and a ground-based robot called the Ladybird (named after its resemblance to the beetle). The prototype Ladybird was developed at the Australian Centre for Field Robotics (ACFR) at the University of Sydney for use on commercial farms, and was adapted by Dr James Underwood for phenomics applications as part of this study.

Data collected by the UAV and robot were evaluated against visual assessments and manual ground measurements taken by a GreenSeeker® handheld crop sensor.

The Ladybird was equipped with lidar and hyperspectral sensors to collect height data and true-colour imagery. The hyperspectral images contained fine spectral information in the visible and near-infrared electromagnetic spectrum, capturing data at wavelengths that human observers cannot see. These images were used to calculate the crop's normalised difference vegetation index (NDVI) – an indication of its overall 'greenness'.

Ms Schofield told participants at the GRDC Update that although this project was



Yorke Peninsula agricultural technologist Leighton Wilksch explains how soil probes can be networked to weather stations at a 2015 Jamestown, SA, field day.

time the Ladybird technology was applied to a phenotype research trial – it delivered some useful insights into the role automated ground-based and aerial technology can play.

Initial investigation showed that a relationship exists between the UAV and GreenSeeker® NDVI values. The change of NDVI as the plant grows could be used to determine plant developmental stage or overall health – for example, as crops begin to mature and turn yellow a low NDVI is recorded.

"If a solid relationship can be defined between these two methods of measuring NDVI, it may be possible to only use the UAV method," Ms Schofield said.

The Ladybird results are also positive: "The repeatability [self-consistency] of hyperspectral NDVI data and lidar crop height data is very high ( $r^2=1$ ), and the lidar and hyperspectral data measured by the Ladybird is at least as accurate as the manually acquired data sources for measuring NDVI and height," Ms Schofield said.

The Ladybird system was substantially more time-efficient for acquiring, managing and processing data compared with conventional manual practices, especially for subsequent repeat visits at a site.

"This research has achieved a greater understanding of the capacity of autonomous ground-based platforms and UAVs as potential labour-saving devices for agricultural studies and field-based trials, and as a way to remove any observer bias from crop measurements."

**Grower tip:** Watch the Ladybird in action at the University of Sydney's ACFR website (<http://confluence.acfr.usyd.edu.au>).

GRDC Research Codes DAN00180, DAS00142

More information: Leighton Wilksch, [lee1@agbyte.com.au](mailto:lee1@agbyte.com.au); Dr Mick Rose, [mick.rose@dpi.nsw.gov.au](mailto:mick.rose@dpi.nsw.gov.au); Brooke Schofield,



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NSW DPI researcher Dr Mick Rose told growers and advisers at the Adelaide GRDC Research Update that rapid in-field dipstick – similar to pregnancy test kits – will soon be available for in-paddock assessments of soil herbicide residue levels.

# **SARDI applied grains research traineeship 2017-18**

## **Progress Report**

Danielle Allen

During my time undertaking the SARDI applied grains research traineeship (I am currently just over half way) I have had a variety of experiences gained through working with the Pulse and Oilseed Pathology, Cereal Pathology and New Variety Agronomy groups. Through the traineeship I have been predominantly based at Waite and I have also had the opportunity to work in Port Lincoln for 2 months to work with the New Variety Agronomy group and conduct the field work for my own project.

During my first week at SARDI I attended the GRDC annual updates. This was a great way to begin as I was able to hear about the focus of current agricultural research. Below is a summary of what I have been able to achieve throughout the traineeship to date and other opportunities that are still to come.

### ***Pulse and Oilseed Pathology group***

Through working with this group I have gained an understanding of various diseases that affect pulse crops including lentils, faba beans and chickpeas and how disease experiments are conducted. I have had the opportunity to make inoculum for plant disease application, conduct inoculations in controlled growth room and shade house environments, assist with stubble experiments, grow and store isolates, sow into pots, score plant disease levels and conduct basic laboratory tasks such as using aseptic techniques in laminar flow, labelling tubes and pouring agar.

### ***Cereal Pathology group***

With the cereal pathology group I have learnt about various diseases of cereals, particularly for wheat. I have seen how trials can be conducted in field and bird cage settings, helped with sowing in the field, assisted with mouse bating, and also undertaken scoring of various diseases.



I have also assisted with packing and preparing grain for sowing. It was essential to order the packets correctly for field trials as the order can vary depending on trial design. I have also conducted a small experiment on white grain disorder of wheat to determine if the fungicide Legend can eliminate powdery mildew without compromising the white grain infection so that this disease can be effectively screened. This involved removing the wheat heads in the glasshouse (post inoculation), threshing the grain, visual grain inspection for the disease, then plating of a number of grains per variety and treatment for disease expression. After completing the experiment I was able to write a short report on the findings in a journal article format.

I have also been responsible for collecting, sorting and storing a large amount of weather and spore trap data from 2012-2016 for various sites across South Australia and Victoria. I collected the weather data from MEA and sorted it into daily data and 15 minute data that was separated into sites and years. The spore trap data that had been generated at these sites was stored in a folder in the same location. I have begun graphing the spore data at all of the sites for different years and will use the data to also see if there are any obvious links between spore data and weather conditions. Through doing this I have been able to improve my skills in handling and interpreting large data sets. Other tasks I have been involved in include soil sampling, assisting with the placement of a spore trap and weather station in the field, and observing the use of a mobile spore trap.

### ***New Variety Agronomy group – Port Lincoln***

I have had the opportunity to visit Port Lincoln a number of times throughout my traineeship. During the first trip I attended farmer meetings across the lower Eyre Peninsula over a 3 day period. This was a good experience as I was able to hear about some projects being conducted and the manner in which the work can be communicated to farmers in a relatable way. It was also great to hear the comments and questions they had and what they would like future research to focus on. For my second trip to Port Lincoln I was able to see a drill rig in operation and assisted with collecting soil samples.

During my traineeship it is a requirement to complete my own research project that aligns with my interests. It has been a great opportunity to have the sense of ownership of a project and to learn how to best plan and manage my time to ensure successful completion and outcomes of the project. For my project I am working within the New Variety Agronomy group in Port Lincoln. The focus of this project is to use new technology (soil moisture probes and an infrared spectroradiometer) to collect crop canopy and soil information to assist with making yield predictions, helping farmers to market their crops with more confidence. A program called Yield Prophet is available that allows these yield predictions to be made, however to have accurate outputs, it is essential to have accurate input information. The information required includes crop type, variety, sowing date, sowing rate, row spacing, plant density target, actual plant density, previous year crop type, soil type, stubble load at sowing, weather conditions (e.g. forecasted rainfall), and nitrogen application.

For the project I am recording growth stage, commenting on weeds, and collecting NDVI and infrared spectroradiometer data on a weekly basis from stem elongation; taking biomass cuts at stem elongation and flowering for nitrogen analysis; collecting samples for trace element analyses at stem elongation; and storing soil moisture and rainfall data at 5 sites with wheat crops across the lower Eyre Peninsula. Most of this I have never done before and feel as though I have learnt a great deal of new practical skills. After returning to Adelaide I will be able to analyse the data, write up a report on the findings and conduct a presentation on the results.

Due to my past experience with infrared spectrometers I was able to assist with the procurement process to purchase the new spectroradiometer in Port Lincoln. Aside from using this instrument in my project, I am also aiming to classify soil profiles and plant nitrogen content to avoid the necessity of sending samples to the laboratory in the future.

Whilst in Port Lincoln I have also had the opportunity to assist with field work, e.g. emergence counts, and see other trials being conducted in the lower Eyre Peninsula, including fungicide trials, time of sowing trials etc.

### ***Other***

Whilst in Port Lincoln I had the chance to complete my first aid certificate. Once returning to Adelaide I will also be undertaking a 3 week statistics internship in the Biometry hub. This will be very valuable as I would like to improve my skills on analyzing and interpreting data. I will also gain exposure to harvest processes and hope to complete an Excel course before the completion of my internship so that I can handle large data sets in a more effective manner.

### ***Summary***

This internship has been an invaluable experience and a great way to begin a career in agricultural research. I initially had a limited knowledge of agricultural processes but due to the wide variety of experiences including laboratory work, computer work and field work in a variety of groups, I now have a much greater understanding of agricultural systems. This program is great as it is tailored to the individual, allows each new trainee to undertake courses, development programs and placements and provides support from leaders in agriculture that will help to see them succeed as a researcher into the future.

# Year Internship in Applied Grains Research

## Final Report

James Walter

### **Outline the main activities you have undertaken as part of the internship year and the associated skills you have learned:**

Throughout my time at SARDI I have been based primarily with the cereal and pulse pathology programs and have seen a complete cycle of their yearly work, from seed preparation to harvest. I have also spent short amounts of time with groups from the University of Adelaide, these being the molecular marker lab and the weed science lab. The following section will outline the main activities I have been involved with, with each group, over the past year and the skills which I have learnt from them.

#### *Cereal and Pulse Pathology*

My work with cereal and pulse pathology has involved both general work with the two teams, across a variety of projects, and work on a specific project, within cereal pathology, which I was given a large amount of control over. The project I worked largely on was a varietal screening and fungicide efficacy trial for the cereal disease White Grain Disorder. My general work with the cereal pathology team has been spread across projects looking at crown rot, eye spot, pre-breeding for multiple diseases and disease monitoring across the state. Work with the pulse pathology team has revolved around ascochyta blight, beet western yellows virus, downy mildew and disease monitoring. As many of the skills I have learnt have been from both my specific project and the broader work I conducted, I will outline both in the following section.

I have been involved with the planning of field trials, large and small for various types of experiments, and have learnt a great deal about experimental design, and the considerations that must be taken into account depending on the type of trial being planned. I have also seen and learnt about the setup of controlled environment room and greenhouse trials.

From trial planning I have then gone on to help with seed preparation and packing, learning about different types of seeding systems and how samples need to be prepared differently depending on the machinery being used. I was also able to visit a number of field sites as they were being sown, getting to see different types of machinery in action and seeing how the trial planning and seed preparation relate to the physical sowing of the trial. This was particularly enlightening for me, as I had not seen this equipment before and I now have a much better understanding of the practices behind sowing field trials.

I have assisted in and gained an understanding of multiple types of sample collection, culture storage and inoculum development; assisting with tasks such as single spore isolations, creating plates of fungal cultures, monitoring cultures and inducing sporulation, collection of spores and inoculum preparation. I

have learnt a great deal about; the process of creating cultures from samples found in the field, the practical methods used to produce inoculum, the importance of correct sample storage, as well as general lab skills such as a more refined aseptic technique. After inoculum preparation I have been involved with inoculation of trials, and have done this for growth room and small and large field trials, seeing the different methods of inoculation, depending on trial size and learning about optimal application technique and environmental conditions required to achieve a successful inoculation.

Over the year I have been involved with field trial maintenance, such as weed control and roguing of plots, as well as sample collection for a variety of different uses, such as collection of diseases for pathotyping, plant material for virus checking and plant stems for disease scoring. I gained an understanding of the importance of regularly checking field trials, to keep them in good condition and make sure there are no issues, as well as an understanding of the various types of sample collection which can be used, depending on the end use of the samples. Following the collection of samples, I have also learnt how to prepare these samples for scoring or testing, enforcing the importance of selecting the right sampling method for the end use of the sample and final data collection.

As a result of the 2014 outbreak of beet western yellows virus (BWYV) I also got to see firsthand the effects of an epidemic, both on producers and in a research environment. I got to visit sites where large amounts of damage had been caused by BWYV, as well as collect and process samples from sites with possible infection. As the season progressed I observed the process of gathering information on BWYV and then the distribution of that information to advisors and the media.

During the year I have been involved in the scoring of cereal leaf and root diseases across multiple SARDI field trials and National Variety Trial sites. From this I have gained a sound understanding of the main cereal leaf and root diseases, as well as the ability to identify these diseases and identify symptoms which appear similar but are unrelated to pathogens. I have also learnt various scoring scales and how these apply to varietal ratings, and have scored multiple trials over the 2014 season for a variety of diseases.

At the end of the season I assisted in the harvesting of multiple field trials, at both small and medium scale. During this time I saw harvesting at a small scale level, with early pre-breeding populations, my white grain work and small scale disease screening, as well as at a medium level for later generation pre-breeding material and seed increases. Previously I have only encountered large scale plot harvesting, so seeing this small scale selective harvesting and its importance within pre-breeding and small scale trials was very interesting.

After harvest I aided in sample processing, primarily for cereal root diseases and white grain, again learning new scoring scales and broadening my understanding of the effects of these diseases within cereal cropping systems. Further to this I have assisted in taking thousand kernel weights and screening weights for grain samples, before they are stored to be used for seeding the following year.

I have dealt with a large amount of trial data, a large portion of which I have helped gather, and have consolidated and managed this data in different forms. I have expanded my understanding of data management and have been shown a number of ways to store and organise data. I have used these

improved skills to collect and organise the data from the white grain project and then to conduct a rudimentary analysis of this data. I have also entered, organised and consolidated large amounts of National Variety Trial data, both for pulse and cereal crops, improving my understanding of the use of this data nationally to monitor changes in diseases and collaborate on disease ratings.

I have been involved with projects using spore traps to monitor spore release throughout the season to judge potential disease pressure and understand the environmental conditions associated with spore release. Through this I have learnt more about the technology used to monitor spore release and the types of environmental conditions that are conducive for this. As part of this work I have set up spore traps, watched the preparation of spore tapes (placed inside the traps) and processed used spore tapes for molecular analysis, to determine DNA levels of desired pathogens.

#### *Molecular Marker Lab*

The time I spent working with the molecular marker lab was generally spent as a day a week, for a number of weeks. The work I conducted here was running molecular markers across a barley population produced for net form net blotch screening; the purpose of this being to identify crosses which contain improved resistance to net form net blotch.

I learnt a great deal in the marker lab including; the process of running molecular marker assays and the theory of how the process works, how numerous pieces of lab equipment operate, how the data is processed and interpreted, and the method in which molecular marker assays are used within a pathology prebreeding program.

#### *Weed Science Lab*

My time working with the weed science lab was spent on an ad hoc basis and revolved primarily around a small experiment, while also aiding with general tasks. The small experiment I worked on was running a dose response of herbicide resistant sow thistles, to different herbicides. The activities I was involved with were; the application of herbicides (both pre and post emergent) for small scale trials, transplanting of grass weeds for an annual herbicide resistance survey, and the scoring of small herbicide resistance trials.

From this work I improved my understanding of the operation of spray equipment, the different chemical groups and types of treatment and the mechanisms through which weeds gain herbicide resistance.

#### *Other Activities*

During my internship I have had the opportunity to attend a number of events, such as;

Conferences and meetings, these being the Adelaide GRDC updates, the National Pulse Pathology Workshop (Horsham 2014) and the Australian Cereal Rust Control Program Meeting (Waite Campus). These were great opportunities to learn about current research in different areas, expanding my knowledge on a wide range of topics, as well as providing a great opportunity for networking.

The Broadacre Soilborne Disease (PredictaB) Workshop, from which I improved my understanding of soilborne diseases and learnt how to correctly sample and interpret results for the PredictaB service.

The Hart field day, again a great opportunity to learn about current research in the industry, seeing first hand results in some of the trials, and being a good networking opportunity.

During the year I also aided with practical disease identification demonstrations at the Mackillop Farm Management Group Field Day and a University of Adelaide first year undergraduate practical. Both of these were interesting exercises, allowing me to see ways of conveying information to different sets of audiences and the role of SARDI researches in extension to the industry.

I got to do a large amount of travelling visiting field sites across SA, with this including travelling to the Eyre Peninsula to score trials. This was a great experience for me, as I had not been to the Eyre Peninsula before, and from this trip I was able to see the type of environment and farming systems which exist there.

I also had the opportunity to view the facilities and research conducted at Airborne Research Australia, due to their collaboration with one of SARDI's research projects. This was a great experience to see the types of technology available for remote sensing and how these can be used within a research project.

Finally towards the end of the internship I presented a summary of the white grain research I conducted, as part of the SARDI seminar series. This was a good opportunity to look back on my research, decide on the key messages to come from the work and work out the best way to present these to an audience. While I do not relish public speaking, I do believe that this was a useful experience and I am glad that I took the opportunity to present my work.

### **Which parts of the experience have been the most valuable?**

In my mind the most valuable aspect of this internship has been the time of the research and technical staff (especially within the pathology groups). The staff have always been willing to take the time to thoroughly explain every aspect of their research to me, from planning of trials through to analysis of results, and I have really appreciated this as it has allowed me to learn a great deal from them.

### **What have been the main benefits?**

The four main benefits I have experienced from this internship are:

- Exposure to a range of different research
- Gaining experience in these different areas of research
- Understanding of industry big picture
- Networking and making new contacts

Being exposed to such a range of different research over the past year has been hugely beneficial to me and it has allowed me to expand my understanding of the different components that make up the grains industry. I have seen a lot of different research, and even research areas, which I did not know existed and this has increased my enthusiasm to continue working within the industry.

Further to my exposure to this research, the opportunity to gain experience in much of this research myself has been of great benefit; a lot of the work I have been involved with has been new to me and through getting to try so many new things I have learnt many practical skills and new ways to view problems. In particular for me, getting to experience such a wide range in field work has been very beneficial, as it is something I had done very little of in the past, but have now discovered how much I enjoy it.

It has also been of great benefit to see how all of this research slots into the big picture of the agricultural industry, and how this research, in many cases, can be directly used by advisors and producers.

Finally networking and making new contacts throughout the industry has been a great benefit for me. Having come straight out of university I had very few contacts within the industry, with those I did have being lecturers and university staff. Through my internship I have made a number of contacts throughout research bodies (such as SARDI and DEPI), funding bodies (SAGIT and GRDC) and private research companies (contract research, chemical development and plant breeding), which I believe will be of benefit to me throughout my career.

#### **What could be improved in terms of:**

- Advertising and recruiting

Advertising a position such as this internship is quite problematic, as it is hard to reach a large audience of potential applicants. I found out about the position through an email from my Honours supervisor and without that I may have missed out on a great opportunity. As such, I have some suggestions to potentially improve the advertising and recruitment of this position.

I think it is important to advertise this program to undergraduate agricultural science students (third and possibly second years), so that they know the program exists and that it is a potential option for them once they finish university. Advertising should also extend to Honours students, primarily those within the school of agriculture food and wine, though this could be broadened out to receive more applicants; it is also important here to make sure that advertisements for the position reach both start of year and mid year enrolled Honours students.

I think one of the best possible solutions for advertising this position is to work together with the university to try and put together a list of recent agricultural science and Honours graduates. I see this as an opt-in list where graduating students could leave their contact details, to be informed about relevant vacant positions over the following years (e.g. the next five years). This would allow SARDI, the



university, and potentially private companies, to advertise positions not just to immediately recent graduates, but also to graduates from 2-3 years prior, who may now have some industry experience and be interested in going into a research role. Potential contacts in regards to setting this up may be the Bachelor of Agricultural Sciences course coordinator, the Honours coordinator and the Adelaide University Agricultural Students Association.

- Working Conditions

The working conditions I have experienced at SARDI have been great. I have always felt comfortable, whether on campus or in the field, and have felt a part of the team. Appropriate safety measures were always taken and explained to me when using any equipment or chemicals etc. I can offer no suggestions for improvements here as I have had only good experiences.

- Post-internship options

Post-internship options also seem a bit problematic to me as these will really vary depending on the intern in question. It would be great if the opportunity was there to allow internship recipients to continue on in a position at SARDI, should they be suitable, though I understand that this will not always be possible due to funding.

Providing the opportunity for interns to continue on with a PhD is also a good post-internship option. While I was considering PhD opportunities, multiple SARDI staff were willing to discuss potential projects with me and offer advice, which was greatly appreciated, and I hope this continues for future interns.

Personally I would have liked it if the internship had been an 18 month program, rather than 12 month, though that may partially be because I have enjoyed the experience so much. My reasoning for an 18 month program, is that within a few months of starting I was already considering PhD options and thinking what my next step would be after the internship. Personally, I would have benefited having a longer time to settle in at SARDI before thinking about my next step, though I can understand that this may not necessarily apply or appeal to future candidates.

- Number of rotations

From my experience I believe that maintaining a strong role within a single group (or research area) over the internship is the most effective way to run the program. My reasoning for this is that, being based in one spot allows you to see all aspects of that program over the year, allowing you to follow each trial etc. from start to finish (especially rewarding with field trials). Starting in a new research area is quite difficult, as it takes a great deal of time to learn what is happening within the group and understand the research that is being conducted. I think that in the case of multiple rotations a lot of time would be spent trying to work out what is happening within the program, then by the time you gain some understanding and learn some skills, it is time to move to the next group and the opportunity to apply the new skills and knowledge is missed. I found it worked very well to maintain a solid base with the pathology teams, while doing small amounts of work with other groups. This allowed me to have a

dedicated workstation and maintain my work with the pathology groups, while experiencing different types of research happening within other groups.

In terms of the intern's placement within rotations, it is important that they are within a group where there is a reasonable amount of work happening (i.e. work across multiple different projects) which the intern can help with. This worked out well for me as there was a lot of work I could help with in the pathology groups, however, I can see how this could easily be an issue if i) there is physically not enough work in the group and/or ii) work is not suitable to be conducted by multiple people at once.

- Additional opportunities offered during the internship

I have outlined previously the opportunities which I was offered during my internship and I hope future interns receive the same (and more) opportunities. There were some events I would have liked to attend, but unfortunately was not able to, due to timing and occasionally last minute planning. I think events such as the Eyre Peninsula (and other) field days, farming system/local farming group meetings and relevant conferences/meetings to the internship placement are all great opportunities for future interns, and hopefully they will be able to attend a greater number of these events.

## **Summary**

I have greatly enjoyed my year at SARDI and am very grateful to have received this opportunity. I have learnt an enormous amount over the past year and have increased my enthusiasm for research within the agricultural industry. This internship has been a fantastic kick start to my career and I have made a wide range of contacts which I'm sure will come in handy in the future. I hope that this internship and others like it continue in the future, as I think it is a great way to get recent agricultural science graduates enthused about research. Hopefully it will be viable to fund more positions (and possible multiple positions per year) over the coming years, to help build a solid base of young researchers to take up positions within the field of applied grains research.

## **SARDI Internship Notes 2016**

**Jamie Fortune**

### **Outline of the main activities undertaken as part of the internship year and the associated skills you have learned:**

#### Entomology Notes

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My first activities at SARDI were based in the Entomology department. Previously I have spent significant time in a laboratory setting. While with the entomology department I really enjoyed taking on many opportunities to begin experiencing applied research in the field. In addition I spent a great amount of time familiarizing myself with entomology, reading and researching around the subject matter and what is involved with professional research and development-specifically in the entomology sector.

This learning process included reading and learning about what has gone in to the production of documents like the snail guide, various field work reports, lucerne seed wasp research proposal and a number of other research proposals, outbreak reports including the aphid vector outbreak report (concerning BWYV and GPA). It was a fun challenge to learn about how various projects are taken from an idea all the way through to receiving funding, meeting milestones, reporting and completion with a constant background of learning and familiarizing myself with insects in a more general sense.

My first exposure to entomology field work was during one of my trips to York Peninsula. This involved visiting various trial and collection sites, alongside using and checking on the equipment required for insect experiments and monitoring. The equipment used in entomology ranges from the familiar (weather stations and time-lapse cameras) through to the unexpected (special snail cages and some novel insect collection and tagging techniques).

Around this time, a set of snails that I collected at one of the field sites showed inexplicably high levels of fly parasitism. This curious result kick started a set of field sampling experiments to determine the distribution

and prevalence of the parasitic fly and an attempt to determine if the results were an outlier or perhaps an indication that the parasitic fly was finally having an increasing impact on the SA snail population. Results of this study were varied, and ongoing research is still taking place. It was really exciting to make an interesting field discovery and be able to follow it up with additional sampling and dissection.

Another area of field work involved a week-long trip around South Australia, up through Whyalla, to Streaky Bay and on to the Gawler Ranges as part of some final PhD research around diamondback moth habits, movement across seasons and gene flow. My involvement included trapping (light and pheromone traps) and sampling for diamondback moth and its predators (sweep netting, bashing, manual searching) during ongoing investigation of the relationship between the moth and a number of summer host weeds and other potential plant hosts.

The firsthand experience with realities of entomological field research opened my eyes to the many challenges faced by researchers in this area. Often I would find myself thinking “why not try X, or maybe Y”, only to come to the realization that “X” was not feasible for reasons of time, labour, expense and a lack of technology and that “Y” was more of the same. Combine all these limitations with an overarching reality that the insects you are researching are both difficult to see and find and also actively move, hide and respond in varied and various ways to all sorts of changes in weather patterns and more. Ongoing talks with entomologists during this time left me with a new and significant appreciation for their ability to answer research questions about insects at all. The depth of knowledge about insects, host plants, landscapes and environmental interactions across seasons that is required off the top of the head to be an effective entomologist is especially impressive to witness first hand and a testament to the degree of professionalism and experience in that department.

It was a great opportunity to be a part of these field trips. I now have experience with a number of trial set up methods for entomological research, and have an improved understanding of both limitations of the field work and possible projects with a greater appreciation for the difficulties establishing required controls.

In addition to the field work, I also took part in some of the laboratory side of entomology. This involved learning about quarantine facilities, the

difficult task of maintaining insect cultures, and some specific lab skills. These specific tasks in the lab included DNA extraction from whole insects, identification of male and female moths, microscope work to identify and sort aphids and identify specific aphids from bulk trap samples and some of the finer details of snail dissection.

An ongoing entomology project that I remain personally involved in has been insect smart-trapping. This joint project is run by the entomology department and Rohan Kimber of the University of Adelaide. All trapping methods are similar in terms of trap → detection → validation, but the modern technologies involved with the smart trapping mean that the detection and validation stages can potentially be done at exponentially faster rates than previously with the use of DNA and markers to identify and count which specific insects have been caught. This is really exciting for entomology because traditional trapping methods are usually a combination of time consuming, expensive and prone to the possibility of error. Being able to introduce a new technology to this space would be an excellent step forward to more efficient and non-cost prohibitive insect monitoring.

I was glad that I could facilitate some of the beginnings of this project as I had the ongoing availability to carry out monitoring of the traps and collection of the samples. Initially the use of the smart traps was intended to act as a monitoring effort for Green Peach aphid, but, by sheer chance and lucky coincidence, the smart traps were also involved in the early detection of Russian Wheat Aphid. In part, the presence of these traps contributed to the mapping of the foreign aphid after its initial detection and the ongoing trapping is contributing to these aphid monitoring efforts.

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## Molecular Diagnostics Group

I joined Alan McKay's team to take on a project reviewing and updating the Soilborne disease manual and accompanying training courses accompanying the Predicta DNA based soilborne disease testing service. At over 300 pages long, the soilborne disease manual is an excellent learning and reference guide for agronomists and researchers when developing practical management techniques to minimise economic losses to soilborne diseases. Every year the guide is updated

to include the latest research, recommendations and management strategies for a wide range of diseases. This year the review project would be significant as the manual had not received a major overhaul in a number of years.

Usually a lack of experience with soilborne disease would pose a problem with reviewing, however in this instance my ability to bring an outsider's viewpoint to the review proved beneficial. With many of reviewers having reviewed similar manual content for many years, it had become difficult for them to tell how effectively a message was conveyed. Due to the highly familiar nature of the content often an experienced person will fill in any blanks or missing pieces with their own prior knowledge and familiarity with both soilborne disease and the Predicta services. In many ways this project has been one of the most enjoyable for me as it allowed me to work independently and build an increased enthusiasm for this type of development and communication.

While the review was taking place I took a number of opportunities to participate in various field work, including soil sampling, field trial monitoring and maintenance and an extensive annual tour of many field trial sites around SA and Victoria. This tour was a highlight for me and included an opportunity to network and talk with people from many different branches of research and development from WA, Qld and more. Learning about the various roles available nationally, especially communications and extension roles. This field trip really helped me visualise the bigger picture of R&D, the importance of updates and extension and the many of the ways in which updates and progress are communicated and bridged across to farmers, agronomists and other researchers in the industry. Seeing first-hand so many different people from different sectors (research, education, commercial) all coming together for a similar update really gave me a deeper appreciation for ongoing communication and collaboration with a new appreciation for the complexity of the task in a broader sense.

As the soilborne disease manual progressed, I was also involved with progress on the interactive Predicta accreditation courses. All agronomists and researchers intending to use the Predicta soilborne testing program are required to complete a training course. These courses are designed to outline how to use the service, where the service can be useful how results can be interpreted and effective

management strategies put in place depending on the results. These courses also focus on the ways in which results can be misinterpreted or misleading and how to avoid making mistakes. These courses try to be an interesting mix of presentation and speakers with a more interactive element of networking, assessment questions and practical demonstrations. I really enjoyed taking on a side project of getting an interactive, real time multiple choice assessment tool TurningPoint up and running. While it had been used in the past, the system was not functional when I took on the role of getting it up and running in time for the courses. It was nice to see it through and to be able to run the interactive questions during the training course successfully. Throughout this experience I really enjoyed thinking about the interactive side of things and was exposed to just how intricate and involved setting up adult learning courses and workshops can be.

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### **Which parts of the experience have been the most valuable?**

In my opinion the most valuable aspect of this internship has been the support and time dedicated by the research, technical and management staff at SARDI. Throughout the entire internship, all of the staff have been wonderful with keeping me involved, going out of their way to allow me to participate in many varied activities. The SARDI staff have gone above and beyond to explain many different aspects of their research and have really helped me to learn a great deal about both their research and how it fits into the wider picture of Australian agricultural R&D.

### **What have been the main benefits?**

There are a number of benefits that I have experienced during this internship.

- Understanding the wider industry picture
- Exposure to an enormous range of projects and areas of research & building experience in a number of these areas
- Building a wide range of contacts

- Learning about the significant variety of roles available

This internship has offered me a unique and very special opportunity to explore agricultural research and development for the grains industry. I have come to realise that not only are there significantly more areas of research that I was previously unaware of, there are also significantly varied roles. Different researchers have much more widely varied day-to-day roles that I had anticipated. This is really exciting to me and meant that as I explored various opportunities, I increasingly understood that there would be a place for my particular interests and passions.

Being involved with so many new and interesting research projects has left me with a new appreciation for the enormity of the puzzle that is agricultural research, but has also left me with a deep respect for those who are currently heavily involved with overcoming research into what initially appear to be insurmountable problems and challenges.

### **What could be improved in terms of:**

- **Advertising and recruiting**

I had not personally seen this position advertised. I was told about it while interviewing for another, similar, role. I believe that this position is a fantastic opportunity for students who are finishing degrees or postgraduate positions.

Potentially involving the agricultural students association and getting the word out about this opportunity through them, especially year on year, would lead to more people having this type of role at the back of their mind when thinking about what to do after they have finished studying, particularly if they are at all interested in an R&D type role.

While studying I think it would be fantastic to offer a number of shorter placements, perhaps over summer, where students are able to carry out a similar internship style position, but perhaps more attached to just one researcher or one research group. During the shorter placement they could perhaps be more focussed on physically helping, while attending any special events, research updates and so on. With some research groups this would be a great way to get some more practical assistance



and serve as a small, ongoing exposure to the interesting and enjoyable realities of a career in R&D. Having many students enjoy a placement would potentially raise the profile of the internship and plant seeds of interest in many as they discuss the placements and positions with their peers throughout the year.

- **Working Conditions**

The working conditions have been fantastic- I have always felt comfortable, accepted and safe during all work at SARDI or in the field. I do not have any concerns or suggestions other than to continue the excellent, supportive nature of the internship in to the future.

- **Post-internship Options**

While working at SARDI, for me personally, there was never a highly clear pathway to continue for the future from the internship. While I really enjoyed the journey and explored as many different options as possible, some may prefer more direction. Perhaps having specific instructions about the application process for a PhD or applying for a further career or funding for research positions would be useful.

Having no experience with these types of applications before coming in to the internship position, I didn't really understand the overall processes and had no reference point for what would be involved in applying for these types of roles or continuing with them after the internship.

- **Number of rotations**

The number of rotations (2) for me has been fantastic- I have always felt involved, able to make significant contributions and have been able to be involved in multiple areas at one time which has meant that when one department is particularly busy or unavailable I have been able to shift my focus to the other. With a significant period of time at each main rotation, I have been able to take the time to learn and understand the types of research being carried out in each group. Being around for many months also provides an opportunity to participate in many occasional activities such as field days, workshops and field trips that would not have added a lot of value had I not been involved for long enough to appreciate the work that had gone in to making them happen.

I really appreciated being able to be exposed to a wide variety of projects and work types and really appreciated feeling able to contribute throughout the year.

- **Additional opportunities offered during the internship**

It has been a pleasure to participate in many of the additional opportunities that I have previously outlined during my internship. I sincerely appreciated being included in many events, field trips, workshops and grower meetings. These opportunities were one of the absolute highlights of the year and really give a first hand feeling for where the research and development ties in to the bigger picture. It is really fascinating seeing how, for example, 3 years of research can be condensed down into an actionable message at a farmer group meeting. These types of experiences really provide fantastic perspective on the industry and the internship significantly benefits from them.

## **Summary**

My internship at SARDi has been a fantastic opportunity that I am extremely grateful for. I have learnt a great deal over the year and have significantly increased my understanding of the types of work that I have a passion and enthusiasm for. This internship has given me a new perspective on research within the agricultural industry and I have grown a wide range of contacts for the future. This opportunity is an excellent position and a way to get graduates heavily involved in a career in agricultural research and development without them needing to commit to one particular area if they are undecided or unsure. SARDI, SAGIT and GRDC's commitment to providing this sort of experience for young graduates has resulted in producing an incredibly rewarding internship.

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