Office Use Only	
Project Code	
Project Type	

FINAL REPORT 2018

Applicants must read the *SAGIT Project Funding Guidelines 2019* prior to completing this form. These guidelines can be downloaded from www.sagit.com.au

Final reports must be emailed to admin@sagit.com.au as a Microsoft Word document in the format shown ***within 2 months*** after the completion of the Project Term.

PROJECT CODE :	**UA317**

PROJECT TITLE (10 words maximum)
Development of wheat population using speed breeding for salinity tolerance

PROJECT DURATION

*These dates **must** be the same as those stated in the Funding Agreement*

Project Start date	**July 1 2017**					
Project End date	October 31 2018					
SAGIT Funding Request	2017/18		2018/19	$	2019/20	$

PROJECT SUPERVISOR CONTACT DETAILS

The project supervisor is the person responsible for the overall project

Title:	**First Name:**	**Surname:**
Dr	Allison	Pearson
Dr	Stuart	Roy
Organisation:		
The University of Adelaide		
Mailing address:		

Telephone:	**Facsimile:**	**Mobile:**	**Email:**

ADMINISTRATION CONTACT DETAILS

The Administration Contact is the person responsible for all administrative matters relating to the project

Title:	**First Name:**	**Surname:**
Ms	Chelsea	DuBois
Organisation:		
The University of Adelaide		
Mailing address:		

Telephone:	**Facsimile:**	**Mobile:**	**Email:**

PROJECT REPORT

Provide clear description of the following:

Executive Summary (200 words maximum)

A few paragraphs covering what was discovered, written in a manner that is easily understood and relevant to SA growers. A number of key dot points should be included which can be used in SAGIT communication programs

In South Australia it has been estimated that approximately 50% of farms are at risk of showing signs of transient salinity. The development of a wheat mapping population that has been created specifically for salinity tolerance will enable us to determine the mechanisms that allow one of the parents Mocho de Espiga Branca to not only be able to accumulate large levels of NaCl but also determine how it can survive.

A new mapping population has been developed using speed breeding and embryo rescue techniques, with a set of F_6 recombinant inbred lines being available for new glasshouse experiments in approximately 12 months rather than the 3-4 years it would take using traditional breeding methods.

Project Objectives

A concise statement of the aims of the project in outcome terms should be provided.

The aims of this project were to develop an F6 mapping population using the salinity tolerant bread wheat line Mocho de Espiga Branca and the Australian wheat cultivar Gladius using speed breeding.

Speed breeding and embryo rescue is significantly quicker and cheaper than traditional breeding methods with a wheat population being developed in approximately 12 months compared to 3-4 years.

Overall Performance

A concise statement indicating the extent to which the Project objectives were achieved, a list of personnel who participated in the Research Project including co-operators, and any difficulties encountered and the reasons for these difficulties.

Overall we have been successful in achieving our outcomes of developing a new wheat population through to the F6 stage. People that were involved in the project were Dr. Allison Pearson, Assoc. Prof Stuart Roy, Parminder Sidhu (barley pre-breeding program at The University of Adelaide).

As this method hasn't been applied regularly here at the Waite Campus and on such a large scale a number of difficulties were encountered due to the number of plants involved, however fortunately all were overcome to achieve a positive outcome.

In addition to the initial plan for the project we added in an extra KPI at the beginning deciding to start the population development from F_2 seed rather than F_3, due to this seed having better quality.

The initial round of speed breeding and embryo rescue that was performed was the first time it had been completed here at the Waite Campus and hence some initial teething problems arose. For the first round of embryo rescue (F_2 to F_3) there was a larger than expected attrition rate of the plants, due not being fully aware of the exact lighting and spacing and logistics around watering etc of the plants. For the first round of speed breeding we had 1800 plants, however this reduced to 1250 being moved to the next round of speed breeding. For the subsequent rounds of speed breeding these parameters were adjusted and there was no more significant loss of lines with there being a final count of 1199 lines that were grown through to the F_6 stage. This is still a good size for a wheat mapping population, as usually only a few hundred lines are typically phenotyped at one time.

Other difficulties that we faced was the slowing down of the growth of the final generation plants due to cooler and more overcast weather. This meant that they couldn't be harvested when predicted and there was an additional delay to the final end date of the project due to this.

Key Performance Indicators (KPI)

*Please indicate whether KPI's were achieved. The KPI's **must** be the same as those stated in the Application for Funding and a brief explanation provided as to how they were achieved or why they were not achieved.*

KPI	***Achieved (Y/N)***	***If not achieved, please state reason.***
Embryo rescue and first generation of RIL lines from F_2 to F_3	Y	
Embryo rescue and generation of RIL lines from F_3 to F_4	Y	
Generation of RIL population to F_6 stage using embryo rescue and final collection of leaf and seed material to be used in fine mapping studies	Y	
Handover of seed material to next project to perform fine mapping experiments and find genes	Y	

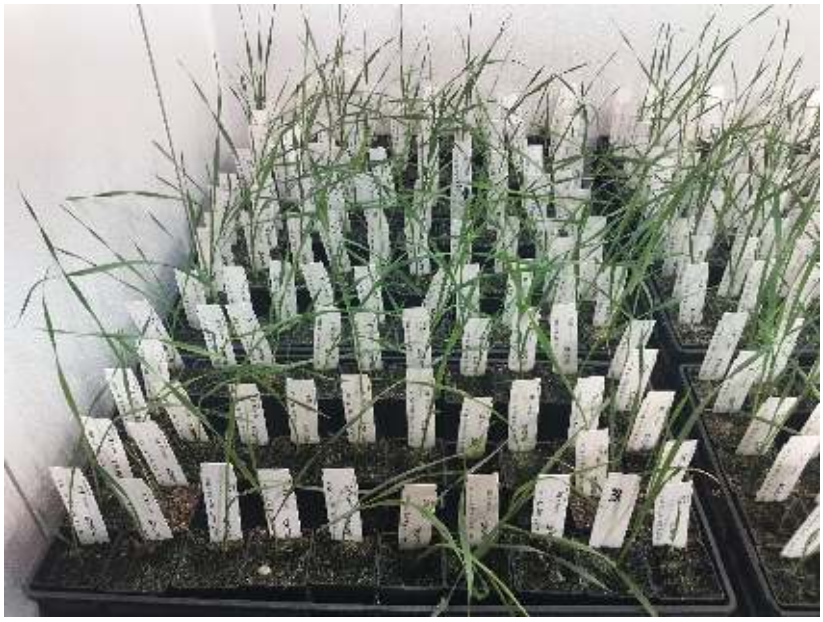
Technical Information (Not to exceed **three** pages)

Provide sufficient data and short clear statements of outcomes.

Speed breeding is a process of developing an advanced mapping population for glasshouse and field studies which will allow us to determine genetic mechanisms which give the wheat landrace Mocho de Espiga branca its ability to withstand barley

levels of salinity. Plants are grown in soil for a day length of 20hrs and night of 4 hrs with seeds removed 15-18 days post anthesis and the embryos transferred to culture media before moving back to a growth chamber.

1. Beginning of Speed breeding with young plants growing in controlled growth chambers for collection of immature embryos.



2. Approx 12 weeks after planting the plants in the controlled growth chambers are ready for removal of immature embryos for the next round of embryo rescue.

3. Final growth of F_5 plants in greenhouses for collection of mature F_6 seeds of Mocho de Espiga Branca × Gladius lines

Conclusions Reached &/or Discoveries Made (Not to exceed <u>one</u> page)

Please provide concise statement of any conclusions reached &/or discoveries made.

Through the development of this population we have successfully been able to develop a speed breeding tool here at the Waite campus which we will be able to implement for development of future populations.

The Mocho de Espiga Branca × Gladius F_6 RIL population will now be ready for use in 2019 for a glasshouse experiment to determine what mechanisms are involved in the salinity tolerance of Mocho de Espiga Brance and use this to breed into Australian germplasm so that we can have improved growth of our elite varieties under saline field conditions.

Without the development of this technique here at the Waite campus it would have taken three to four years to develop this population rather than 15 months and this has been possible due to the funding provided by the South Australian Grains Industry Trust.

Intellectual Property

Please provide concise statement of any intellectual property generated and potential for commercialisation.

This project has developed a RIL mapping population of almost 1,200 lines which can be made available to other researchers.

Application / Communication of Results

A concise statement describing activities undertaken to communicate the results of the project to the grains industry. This should include:

- *Main findings of the project in a dot point form suitable for use in communications to farmers;*
- *A statement of potential industry impact*
- *Publications and extension articles delivered as part of the project; and,*
- *Suggested path to market for the results including barriers to adoption.*

Note that SAGIT may directly extend information from Final reports to growers. If applicable, attach a list of published material.

- A new bread wheat mapping population has been developed to investigate mechanisms for enhancing the tolerance of wheat to saline soils
- Salinity stress has been estimated to result in $1.3B loss to agriculture. A 10% increase in salinity tolerance in crops would result in a saving of $130M.
- The development of this population will not only be of benefit to our research on salinity but it will also be accessible to other groups such as Glen McDonald and his sodic trials.

This year I travelled to New Hampshire, USA where I was able to present the work being conducted on this project to a large audience of leading scientists in the field of salinity. I was able to show the work that we have done in developing this new population as well as talk about the future work that has been funded by SAGIT.

POSSIBLE FUTURE WORK

Provide possible future directions for the research arising from the project including potential for further work and partnerships.

The future directions of this work is to perform glasshouse based experiments which will enable us to identify novel mechanisms of salinity tolerance and identify traits which are linked to its enhanced growth.

As well as this we will be able to determine the genetic regions (regions of the plants DNA) underpinning these salinity tolerance traits, which will allow us to select lines for field evaluation at a later date.

Currently the next stages of this work looking at the plant growth in the glasshouse has been funded by SAGIT (UA418) and the DNA sequencing of these lines for QTL analysis has been funded by the YIPTI foundation.

AUTHORISATION	
Name:	Simon Brennan
Position:	Executive Director, Research Services
Signature:	
Date:	

Submit report via email to admin@sagit.com.au as a Microsoft Word document in the format shown ***within 2 months*** after the completion of the Project Term.