PROGRESS REPORT 2019

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Progress Reports must be submitted via email to admin@sagit.com.au as a Microsoft Word document

Project No: UA617	**Project Title: Field testing of sodicity- and salinity-tolerant oat varieties**
Previous Project(s) (If this project is on a similar theme to a previous funded project please provide code , title, years and investment details) UA416: Identification of sodicity tolerant oat varieties: $99,839	
Organisation: University of Adelaide	
ACN/ABN: 61249878937	
Start Date: (This date must be same as in the Funding Agreement) 1/7/2017	**Completion Date:** (This date must be same as in the Funding Agreement) 28/2/2020
Address: Research Branch, The University of Adelaide, Level 4, Rundle Mall Plaza, 50 Rundle Mall, Adelaide, SA 5000	
Principal Investigator: *(Please include name, qualifications, position, organization NB: this person will be responsible for reporting)* Dr Graham Lyons PhD, Research Fellow, School of Agriculture, Food and Wine, University of Adelaide	**% Time** 50
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Other Research Staff: *(Please include name, qualifications, position, organization)*	**% Time**
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1. BUDGET

Please include below a brief description of the main items required within each category for the current application year.

BUDGET			
Category	**$**	**$**	**$**
	Year 1	**Year 2**	**Year 3**
Salaries (incl on-costs)	72383	74554	51194
Travel	2000	2000	2000
Operating	4000	17500	18500
Capital			
TOTAL SAGIT CONTRIBUTION	78383	94054	71694
Host organisation cash contribution			
Host organisation in-kind contribution*	66592	68590	47098
TOTAL HOST ORGANISATION CONTRIBUTION	66592	68590	47098
Other funding bodies contribution			
Other third parties contribution*			
TOTAL NON-SAGIT CONTRIBUTION	66592	68590	47098

*If it is not possible to specify amounts, then a description of the nature of the contribution should be given.

EXPLANATORY NOTES ON BUDGET ITEMS

Including budget variations

Operating costs: Year 1 birdcage trial minimal cost; glasshouse hire, CSIRO leaf mineral analytical costs for glasshouse trials; Year 2 (current): most costs are for glasshouse hire, pots from Plant Accelerator; CSIRO analyses for leaf minerals (field and glasshouse trials), CSBP soil analyses (field trials).

*University of Adelaide uses the standard AVCC/Universities Australia multipliers of 92% (for non lab-based research) to calculate the indirect or "infrastructure" overheads incurred in supporting University research personnel (e.g. office, computer, IT support, library, "birdcage" space, etc) at Level A or above working on the project.

2. PROGRESS STATEMENT

Provide clear description of the following:

Project aims

1. Oat varieties which grew well under sodicity and salinity in the previous SAGIT oat project (UA416), and are hence potentially tolerant to saline/sodic soils, will be validated in field trials, in collaboration with the SARDI oat breeding group.
2. Saline/sodic-tolerant oat varieties will be recommended to farmers, which can extend the range of oat production and increase profitability in marginal areas of South Australia.

Progress against the key performance indicators of the project

No.	KPI	Date to be completed
1	Seed multiplication and adaptation evaluation (in field) of around 80 varieties	As most of the varieties to be field trialled are commercial, there was need to multiply only 30 promising overseas varieties. Completed 10/1/18
2	Season 1 Field Trials planted	15/6/18. Redhill: 15/5/18; Turretfield: 22/6/18
3	Season 1 Field Trials harvested and evaluated	31/1/19. Completed 10/1/19. Further glasshouse screening and seed-priming studies were also conducted (additional to the aims/KPIs in the project document).

Conclusions reached / discoveries made

This must include a dot point summary of progress to date, suitable for use in media articles. Provide more details which add to key findings (eg. tables, graphs) in an attachment of 1-2 pages.

- Once again, we have demonstrated the versatility of oats, this time under salinity/sodicity and moisture stress in the field
- Large differences in grain yield (5-fold under salinity/sodicity and 35-fold under moisture stress) and biomass yield at heading at both trial sites indicate strong genotypic variation between oat varieties/lines for tolerance to these stressors
- The oat grain yields at Redhill, a strongly saline-sodic site with high subsoil boron (see data in Appendix 1), were impressive, especially in view of the low growing season rainfall (170mm, 6.8") in 2019. For example, Bannister, Eurabbie and SARDI 06204-16 yielded 3.6 t/ha, compared with Compass barley 2.7 and Aurora durum wheat 1.2 t/ha. In addition, phosphorus, magnesium and zinc were deficient at both sites
- Ironically, the grain yields at the Redhill site were 2.5 times higher, on average, than the "control" site at Turretfield. This despite higher growing season rainfall (238mm, 9.5"), higher late (Sept/Oct) rain, normal subsoil boron and higher biomass at heading at Turretfield. However, this was a relatively low rainfall for the heavy clay Turretfield soil and resulted in this site effectively becoming a drought tolerance trial
- The highest grain yields at Turretfield were, like Redhill, mostly in milling oats: Bannister 2.4, SARDI 06204-16 1.9, Mitika 1.8, Kowari 1.8, Durack 1.7 t/ha. These wuch higher than Aurora durum wheat: 0.5 t/ha
- The best oats for whole top biomass at heading at Redhill were Kangaroo 7.1, Bannister 6.7, Troy (US) 6.7, Wintaroo 6.6, Williams 5.9 t/ha, compared with Compass barley 4.2 and Aurora durum 3.1 t/ha. The best oats at Turretfield were Bannister 8.0, Mitika 8.0, Mulgara 7.7, Wintaroo 7.5, Drummond (Scotland) 7.1, compared with Aurora durum 4.6 t/ha
- Most pasture/forage oats and most overseas oats (unsurprisingly) were intolerant of salinity/sodicity and moisture stress
- The earlier glasshouse screening trials using 100 mM NaCl in UC potting mix as a model of salinity/sodicity were generally useful predictors of performance and leaf cation levels under salinity/sodicity in the field. Several oats did better in the field than expected (e.g. Kowari, SARDI 03216), while others (e.g. Forester and the grazing/forage varieties) did worse. The glasshouse NaCl method was a more useful predictor than the growth room or glasshouse Na humate method for performance under field salinity/sodicity or moisture

stress. For glasshouse screening, evaluation based on whole top biomass production at 6-10 weeks was more predictive/useful, and much quicker, than growing the plants to grain harvest

- The ICP-OES mineral data of indicator leaves were in accord with the soil Na, B and K levels (Appendix 1) and revealed that oats at Redhill were high in Na (e.g. Kangaroo 12500, Wintaroo 10700 ppm, similar to levels obtained during screening with 100 mM NaCl) and B (e.g. Saia 759, Matilda 675, compared with the B-excluding durum, Aurora with just 88 ppm), but the correlations of these levels with grain yield were low, the high B levels' classification by Reuter & Robinson as toxic notwithstanding. As noted above, deficiencies of P, Mg and Zn were common at both sites, along with Ca at Redhill (especially in pasture varieties). Nevertheless, overt leaf symptoms of either toxicities or deficiencies were absent. Although soil levels of Ca and Mg were adequate to highish (Appendix 1), they are likely to have been depleted in the plants by the high Na levels, as shown in our pot screening trials
- The SARDI Oat Breeding Group has used varieties identified in the preliminary salinity/sodicity tolerance trials in its crossing program: 10 crosses in 2017 (including SARDI 06204-16, Wintaroo, Yallara, Pro-Fi, Hi-Fi, Urano, Huazao 2) to obtain F1s which will be sown in an F3 trial at Turretfield in 2020; and 22 crosses in 2018 (including 06204-16, Mulgara, Wintaroo, Bountiful, Urano, Huazao 2)
- In the 2018 glasshouse oat variety trial that extended our earlier trials, several of SARDI's Pepsi lines yielded well under salinity/sodicity
- In glasshouse seed priming pot studies conducted in 2019, we found that priming *per se* reduced germination % of oats. Of the oats that grew, melatonin-primed plants yielded best under salinity/sodicity. In contrast, barley primed with water or water + sodium selenite grew better than non-primed plants, whether under control conditions or salinity/sodicity. Maize primed with potassium iodate, sodium selenate or water alone yielded best in control conditions or under salinity/sodicity
- I wish to acknowledge the valuable assistance provided to this project by the SARDI oat breeding group, The University of Adelaide durum breeding group, Yusuf Genc and John Harris.

Communication of results to farmers/industry

- Regular updates of this study are provided to the SARDI Oat Breeding Group.
- Interview with Brooke Niedorf, ABC Radio, Port Lincoln on 22/5/18 re findings of controlled-environment screening trials and plans for the 2018 field trials.
- Article in the SARDI oat newsletter, October 2018, based on talk given at the SARDI PRC auditorium (see Appendix 2).
- Main findings of the Redhill trial provided to the farmer, John Wheaton in January 2019. As soon as this SAGIT report is completed, field trial summaries

will be provided to Bruce Winter and Pasture Genetics, who contributed pasture/forage oat seed.

Plans for the coming year
Follow-up field trials to be conducted, ideally at similar locations at Redhill and Turretfield, to provide further validation of the Year 1 trials and the earlier screening studies. Further growth room/glasshouse study to refine the current saline-sodic tolerance screening method.

3. AUTHORISATION OF THE PROJECT REPORT

Name: Mr Simon Brennan
Position: Director, Research Branch, The University of Adelaide
Signature:
Date: