



PROGRESS STATEMENT 2016

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

Project No: UA1415	Project Title: Genetic Characterisation and Exploitation of Heat Stress Tolerant Durum Germplasm	
Previous Project(s) (If this project is on a similar theme to a previous funded project please provide code, title, years and investment details) N/A		
Organisation: The University of Adelaide		
ACN/ABN: 61 249 878 937		
Start Date: (This date must be same as in the Funding Agreement) 1 st July 2015	Completion Date: (This date must be same as in the Funding Agreement) 30 th June 2017	
Address: Research Branch, Level 7, 115 Grenfell Street, The University of Adelaide, SA, 5005		
Principal Investigator: A/Professor Jason Able		5% Time
Location: PMB1, Waite Campus, School of Agriculture, Food & Wine, Glen Osmond, SA, 5064		
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Facsimile: -	Email: jason.able@adelaide.edu.au	
Other Research Staff: AGT Research Staff contracted through this project (specifically led by Paul Telfer)		As required
Administrative Contact: Ms Chelsea DuBois		
Telephone: 08 8313 3716	Mobile: -	
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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			
Travel	500	500	
Operating	21,000	21,000	
Capital			
TOTAL SAGIT CONTRIBUTION	21,500	21,500	
Host organisation cash contribution			
Host organisation in-kind contribution*	13,950	14,150	
TOTAL HOST ORGANISATION CONTRIBUTION	13,950	14,150	
Other funding bodies contribution (SADGA)			
Other third parties contribution*			
TOTAL NON-SAGIT CONTRIBUTION	13,950	14,150	

*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

No budget variations requested. However, the travel allocation for 2015 was not used. This is requested to be carried forward. A/Professor Able took the opportunity to visit the chamber trials when teaching and/or visiting his own Roseworthy breeding trial so travel costs in 2015 were not incurred. Carry over of unspent funds is requested to ensure there are adequate funds for the remaining season should the required travel to Roseworthy be more than last year.

2. PROGRESS STATEMENT

Provide clear description of the following:

Project aims

This project aims to:

1. Screen elite, selected entries (in addition to recently released varieties) from Durum Breeding Australia's (DBA) Southern Node Breeding Program against leading bread wheat varieties in heat stress trials conducted with the AGT-SAGIT Heat Chamber;
2. Compare and evaluate the relative heat stress tolerance and the physiological responses of the selected durum entries to the benchmark bread wheat varieties;
3. Identify elite heat stress tolerant durum parents for further exploitation through breeding by using these materials in future crossing blocks; and;
4. Disseminate the heat chamber trial results by updating growers (and consultants/advisors) at appropriate forums and field day events.

Progress against the key performance indicators of the project

Progress against all four listed KPIs has been completed or will be completed by the set dates.

No.	KPI	Date to be completed
1	Screen selected elite durum entries, benchmarking against lead bread wheat varieties. <i>Completed and on-track.</i>	31/12/2015, 2016
2	Validate chamber methodology in durum. <i>Completed.</i>	31/12/2015
3	Publish trial results for the SADGA website. <i>On-track.</i>	31/03/2016, 2017
4	Annual progress report submitted to SAGIT. <i>Completed.</i>	31/01/2016

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.

For notes on the experimental design, the data measurements recorded and the analysis conducted, please refer to UA1415 Supplementary File.pdf.

GERMPLASM SCREENED

- 31 selected entries from Durum Breeding Australia's Southern Program (S4 and S3 – all advanced germplasm potentially ready for progression to pre-variety release trials).
- 7 durum varieties including the latest variety released – DBA-Aurora. Other varieties were Yawa, WID802, Tjilkuri, Tamaroi and the two released AGT varieties, Hyperno and Saintly.
- 2 bread wheat varieties as checks (Halberd – identified by AGT as heat tolerant, and Wyalkatchem – identified by AGT as heat intolerant).

GENERALISED SUMMARY OF HEAT TRIAL RESULTS

- Recorded measurements for traits including grain number, grain weight, head weight, spikelet number and thousand grain weight (TGW) resulted in significant differences being identified.
- These differences were either identified between genotypes and/or between the treatments (control vs heat/wind stressed).
- The results from year 1 (2015 trial) suggest that selected durum germplasm will be identified as either heat tolerant or heat intolerant by the end of this project (for an example of contrasting material see UA1415 Supplementary Image File 1, with two durum entries showing clear significant spike differences in their response to the heat/wind treatment; the entry on the left shows significant desiccation/dis-colouration when compared to the entry on the right).
- Results of several key indicators for heat tolerance in varieties such as the recently released variety DBA-Aurora and advanced entries including UAD1151101 and UA1152020 look encouraging after the 2015 trial.
- The research findings from this SAGIT sponsored project will play an important role in selecting suitable parental combinations for future crossing blocks, which may lead to the development of new heat tolerant durum varieties 8-10 years from now.

TGW HIGHLIGHTS

- The latest variety, DBA-Aurora, which under non-limiting conditions (control) has exceptional TGW; recorded a 22% loss (68.25 g control vs 53.28 g heat/wind stress).
- However, older varieties such as Tamaroi (when under non-limiting conditions also has very good TGW) recorded a 46% loss between the control (63.43 g) and heat/wind stress (34.12 g) treatments.
- Several advanced breeding lines (listed below as examples) were identified that show lower reductions than DBA-Aurora or even small increases (not significant) when comparing treatments (control vs heat/wind stress).
- UAD1152020 showed a 11% loss between the control and heat/wind stress treatments while UAD1153177 showed only an 8% loss.
- While the average TGW of UAD1152020 (55.5 g in the control treatment) is not as large as varieties such as DBA-Aurora, UAD1152020 is potentially the next durum variety to be released from the DBA program (anticipated release will be during spring 2017 if it progresses).
- UAD1151101 (57.18 g control vs 58.43 g heat/wind stress) and UAD1151112 (46.15 g control vs 47.40 g heat/wind stress) are two other entries that look promising with respect to their TGW performance.
- A total of 42% (or 13) of the 31 advanced S4/S3 entries recorded values for TGW that were less than 40 g (post heat/wind stress). Varieties such as Yawa and Tamaroi also displayed very low TGW. Such S4/S3 advanced lines, if results are replicated during the 2016 heat chamber trial, will be avoided as potential parents for future crossing blocks.

FERTILITY HIGHLIGHTS

- Regardless of treatment, and as expected, significant differences were identified between the durum germplasm evaluated.
- The percentage loss between treatments for some entries clearly highlights the impact that heat/wind stress can have on the performance of some varieties.
- Varieties such as Yawa lost approximately 47% fertility with heat/wind stress.

- Several entries within the S4/S3 selections also recorded similar percentage reductions (for example, UAD111151046 and UAD1151112 had fertility reductions of 49% and 42% respectively). For UAD1151112, this result is in contrast to the TGW performance observed.
- Of interest and significance is that the recent variety DBA-Aurora and UAD1151101 did not show a reduction in fertility when subjected to heat/wind stress.

HEAD HARVEST INDEX HIGHLIGHTS

- Significant differences between the control and heat/wind stress treatments were identified for head harvest index (grain weight divided by total weight of the intact head) across several entries.
- Advanced lines such as UAD1151054, UAD1151056, UAD1151096 and UAD1154192 showed greater than 50% loss in the head harvest index when comparing treatment values. If replicated for these entries during the heat chamber trial in 2016, some consideration in not using these lines as potential parents in future crossing blocks would be given.
- Many entries, including the recent variety DBA-Aurora, displayed only minor-moderate reductions in the head harvest index between treatments.
- One entry (UAD1151101) showed a small (2%) increase between the head harvest index obtained for the control (0.648) vs heat/wind stress (0.6633) treatments, implying that grain weight and the other physical attributes of the spike (e.g. awns, glumes, etc.) were not affected by the heat/wind stress.

Communication of results to farmers/industry

The heat chamber trial results will be sent to SADGA for uploading to their website. During Spring 2015, the Durum Grower's Association visited the Heat Chamber Trial as part of one of their 'crop walks'. There was excellent attendance at the field event with >50 growers and sponsors attending (which also included visiting the trial site which is part of UA415 – Roseworthy Site only). It is intended that this visit will also form part of the crop walks during the 2016 season.

Plans for the coming year


Selected durum germplasm (38 entries) and bread wheat (2 entries) will be screened in 2016 through the controlled environment assay at Roseworthy as it was in 2015. The same entries will be used to validate across years. To keep the trials manageable these 38 entries will be replicated three times across two treatments. The trial will be conducted using a split plot design and the pots will be blocked by replicate.

AGT are contracted to:

- Design the experiment for the second year,
- Plant and maintain plants (pots, potting mix, weekly nutrient fertigation, fungicide and insect management and irrigation),
- Record observations for heading and flowering date (twice weekly scores during relevant periods),
- Complete the heat stress treatment of plants for 10 days after the main tiller reaches GS69,

- Label the growth stage of the secondary tiller (last year AGT identified a secondary tiller during flowering GS60-69, which is a second important growth phase targeted in the heat stress response),
 - Record observations of viable leaf area on the flag leaf immediately before the heat stress is applied, immediately after the heat stress and 10 days post the start of heat stress (1-9 score proportional to damaged and unviable leaf area),
 - Harvest individual plants,
 - Process samples in the lab measuring:
 - Tiller weight *
 - Spikelet weight
 - Spikelet number per head
 - Grain weight per head
 - Grain number per head
 - Peduncle length *
 - Flag leaf length and width *
- * These items are usually only measured on the main tiller*
- Provide a full data set of greenhouse and lab data to A/Professor Jason Able for analysis,
 - Absorb all foreseeable operating overheads and miscellaneous costs.

3. AUTHORISATION OF THE PROJECT REPORT

Name: A/Professor Jason Able
Position: Head, Department of Agricultural Science , School of Agriculture, Food & Wine
Signature: 
Date: 28/01/16