NSW GOVERNMENT Department of Primary Industries

Pre-breeders Report

Andrew Milgate (NSW DPI), Kar Chun Tan (Curtin University),
Cassandra Percy (QDAFF), Manisha Shankar (DAFWA),
Grant Hollaway (DEPI), Harbans Bariana (Sydney University)

GRDC Grains Research & Development Corporation

Pre-breeders Report

- How many resistant lines they found?
- Who is using the CAIGE material in their specialised area?
- Have they done any crosses with the CAIGE material?
- What is the value of CAIGE for their program?
- How is CAIGE contributing to their research?
- The pre-breeders / phenotype providers :
  - Richard Oliver & Kar Chun Tan – SNB Toxicity
  - Manisha Shankar – Yellow leaf spot & Stagnospora nodorum blotch
  - Cassandra Percy – Crown rot
  - Grant Hollaway – Yellow leaf spot
  - Andrew Milgate – Septoria tritici blotch
  - Harbans Bariana – Rusts

Stagonospora nodorum blotch

- **Kar Chun Tan & Richard Oliver, Curtin University**
- Project codes; CUR00018 (used to be CUR00011) and CUR00012.
- **How many resistant lines you found**
  - In total 27 lines that showed complete insensitivity to the 3 major effectors (ToxA, 1 and 3).
  - However, have not performed infection assays (ie. measuring SNB resistance) on these lines.
- **Who is using the CAIGE material in your specialised area**
  - The ACNFP
- **Have you done any crosses with the CAIGE material**
  - Not yet
- **What is the value of CAIGE for your program**
  - We have access to novel wheat germplasm that may show enhanced resistance to Australian SNB. Our aim is to essentially deliver these to the GRDC.
- **How is CAIGE contributing to your research**
  - We are close to creating a *S. nodorum* mutant that is deleted in ToxA, Tox1 and Tox3. With this, we can identify CAIGE varieties that are still susceptible to SNB (ie novel effector sensitivity genes?)
- **Active and past projects which have used CAIGE material for prebreeding purposes**
  - None at this stage.

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17th March 2014
Canberra

Yellow spot and Stagonospora nodorum blotch (SNB) assessment of CAIGE lines

Manisha Shankar
DAFWA

Yellow spot assessment of CAIGE lines

- **Project DAW00206 (2010-2015) - Germplasm enhancement for yellow spot resistance in wheat**
- **A total of 862 CAIGE lines assessed from 2010 to 2013**
  - 78 lines identified with seedling resistance (RMR to MR)
  - 18 lines with broad spectrum resistance (MR to MRMS) at various growth stages, environments and national sites
- **Six lines with broad spectrum resistance distributed to various breeding companies**
- **Three of these lines used for crossing to develop mapping populations targeting yellow spot resistance**

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Yellow spot 2010 to 2013 - DAFWA

862 lines assessed; 78 lines with seedling resistance; 18 lines with broad spectrum resistance

GH Seedling Assessment					Ring test - Lines with seedling resistance assessed at various growth stages, environments and national sites				
Year	Qcode	Description	No of lines assessed for seedling resistance	No of lines with seedling resistance (RMR to MR)	Year	No of lines with broad spectrum resistance (MR to MRMS)	Lines with broad spectrum resistance (MR to MRMS)		
2010	ZIZ09	ICARDA Bread	52	2	2011, 2012	1	ZIZ09 QNo 42*		
2010	ZWB09	ICARDA Bread	8	0					
2010	ZWW09	ICARDA Bread	7	0					
2010	ZDA10	CIMMYT Durum	49	6	2012	2	ZDA10 QNo 10	ZDA10 QNo 18	
2010	ZDI10	ICARDA Durum	100	13	2012	1	ZDI10 QNo 85		
2010	ZJN09	SBPN - CIMMYT	29	3	2011, 2012	2	ZJN09 Qno 2*	ZJN09 Qno 27*	
2011	ZIZ09	ICARDA Bread	33	3	2013	2	ZIZ09 Qno 21	ZIZ09 Qno 91	
2011	ZVS09	CIMMYT Bread	198	15					
2011	ZWB09	ICARDA Bread	12	4	2013	2	ZWB09 Qno 55	ZWB09 Qno 57	
2011	ZWW09	ICARDA Bread	9	0					
2011	ZJN10	SBPN - CIMMYT	12	2	2012				
2012	ZWB10	CIMMYT Bread	45	4	2013	3	ZWB10 Qno 53	ZWB10 Qno 127	ZWB10 Qno 128
2012	ZWW10	CIMMYT Bread	46	0					
2012	ZIZ09	ICARDA Bread	6	1	2013	1	ZIZ09 Qno 87		
2012	ZIZ10	ICARDA Bread	37	2	2013	2	ZIZ10 Qno 35	ZIZ10 Qno 36	
2012	ZWB09	ICARDA Bread	1	0					
2012	ZWW09	ICARDA Bread	4	4	2013	1	ZWW09 Qno 149		
2012	ZJN11	SBPN - CIMMYT	23	4	2013	1	ZJN11 Qno 25		
2013	ZIZ11	ICARDA Bread	50	4					
2013	ZWB11	CIMMYT Bread	30	5					
2013	ZWW11	CIMMYT Bread	36	0					
2013	SBP12	SBPN - CIMMYT	35	2					
2013	ZAD13	CIMMYT Bread	40	4					
			862	**78**		**18**			

Lines in blue font have broad spectrum resistance at various growth stages, environments and across all national sites.

Lines in red font have broad spectrum resistance at various growth stages, environments and across all but one national site.

**Lines used in crossing for population development targetting yellow spot resistance*

SNB assessment of CAIGE lines

- **Project : Genetic Analysis of SNB resistance in wheat under AWBMMP (2013-2018)**
- **A total of 164 CAIGE lines assessed from 2010 to 2013**
  - 8 lines identified with adult plant field resistance (MR)
- **Some of these lines will be used for crossing to develop mapping populations targeting SNB resistance**

Year	Qcode	Description	No of lines assessed for APR in the field	No of lines with APR (MR)	Lines with APR (MR)			
2010	ZJN09	SBPN - CIMMYT	25	1	30ZJN09*			
2011	ZJN10	SBPN - CIMMYT	12	4	ZJN10 Qno 3	ZJN10 Qno 8*	ZJN10 Qno 9*	ZJN10 Qno 12
2012	ZJN11	SBPN - CIMMYT	23	0				
2013	SPB12	SBPN - CIMMYT	35	2	ZEE10 Qno 77	ZVS07 Qno 227*		
2013	ZAD13	CIMMYT Bread	40	1	ZWW10 Qno 157			
2013	ZDA10	CIMMYT Durum	3	0				
2013	ZIZ09	ICARDA Bread	5	0				
2013	ZIZ10	ICARDA Bread	2	0				
2013	ZJN09	SBPN - CIMMYT	2	0				
2013	ZJN11	SBPN - CIMMYT	4	0				
2013	ZVS09	CIMMYT Bread	1	0				
2013	ZWB09	ICARDA Bread	4	0				
2013	ZWB10	CIMMYT Bread	4	0				
2013	ZWW09	ICARDA Bread	1	0				
2013	ZWW10	CIMMYT Bread	3	0				
			164	**8**				

**Lines also with seedling resistance to yellow spot*

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Value of CAIGE to DAFWA R&D

- **CAIGE is an important resource that provides additional resistance sources of yellow spot and SNB resistance**
  - Crucial to broaden the genetic diversity for effective and durable improvement of resistance to the two diseases.
- **Several resistant lines have been identified amongst CIMMYT and ICARDA germplasm.**
  - Some of these have been provided to various breeding companies and are valuable donors for developing resistant varieties
  - Some are being used for crossing and population development for identification and mapping novel resistance genes
- **Active and past projects which have used CAIGE material for pre-breeding purposes**
  - DAW00206 (2010-2015) - Germplasm enhancement for yellow spot resistance in wheat
  - Genetic Analysis of SNB resistance in wheat under AWBMMP (2013-2018)
  - Past project - DAV00076 (2005-2008). Synthetic Evaluation Project. Collaborative research with DePI Victoria resulted in the identification of new sources of adult plant resistance to stagonospora nodorum blotch among primary synthetics

Yellow leaf spot

- Grant Hollaway DEPI, No report provided
- How many resistant lines they found – Field ratings
  - 2009 – 4 lines MR
  - 2010 – 37 lines MR or better
  - 2011 – 15 lines MR
- Who is using the CAIGE material in their specialised area
  - Unknown
- Have they done any crosses with the CAIGE material
  - No, not currently conducting germplasm development projects for YLS.
- What is the value of CAIGE for their program
  - Screening of diverse material to provide information to breeders and pre-breeders good phenotype data with relevance to the southern region.
- How is CAIGE contributing to their research
  - No current germplasm development undertaken

Crown rot

- Cassandra Percy, DAFFQ
- Project DAQ00167 (Germplasm enhancement for crown rot resistance in winter cereals)
- **How many resistant lines**
  - 2010 -5 (of 19) lines with resistance similar to Wylie.
  - 2011 -2 (of 42) lines were an MR-MS and 2 lines were an MS.
  - 2012 -1 (of 28) line MR-MS and 2 MS.
  - 2013 34 lines, field material is still currently being rated.
- **Have they done any crosses with the CAIGE material**
  - **AUS 36569** (Kukri Janz DH37) performed the best of the CIMMYT material in 2011 and 2012 and this has been included in our crossing program since 2011. It exists in F3 material screened for CR resistance at Wellcamp in 2013.
  - **AUS 33735** (AUS GS50AT34/Sunco//Cunningham) also showed good resistance in 2010 and 2011. This line has not been incorporated into our program, but it may be in the future.
  - We have also made crosses with **AUS 29529** and one population was included in the F3's screened at Wellcamp in 2013.
- **Who is using the CAIGE material in their specialised area**
  - DAFFQ has been phenotyping material for CIMMYT for several years also under the projects DAQ00119 (Genetic approaches to resistance to Fusarium and Bipolaris in wheat and barley) and DAQ566 (Genetic approaches to resistance of bread wheat to crown rot and common root rot).
- **What is the value of CAIGE for their program**
  - The resistances of the CIMMYT material do not meet the highest levels of resistance that we have available such as that seen in the breeding line 2-49. However, the better agronomic traits in this material make it very valuable to the Australian wheat industry.

Septoria tritici blotch

- Andrew MIlgate NSW DPI
- How many resistant lines they found
  - 2009 – 11 lines MR
  - 2010 – 36 lines MR (discrimination low in nursery)
  - 2011 – 2 lines MR
- Who is using the CAIGE material in their specialised area
  - None
- Have they done any crosses with the CAIGE material
  - No, no current germplasm development projects are funded for STB.
- What is the value of CAIGE for their program
  - Access to diverse material that is selected for STB resistance in an unrelated pathogen population. Valuable source of potential minor gene resistance.
  - Screening of diverse material to provide information to breeders and pre-breeders good phenotype data with relevance to the southern region.
- How is CAIGE contributing to their research
  - Opportunity to select potentially novel material for crossing when germplasm development is funded.

Rusts

- Harbans Bariana Sydney University

No report provided

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