

CIMMYT CAGE meeting

Update : Identification and utilization of novel sources of resistance against soil borne pathogens in wheat

presented at CIMMYT CAGE GRDC Australia/CIMMYT Germplasm Meeting

By Dr Julie Nicol CIMMYT Pathologist in collaboration with Dr Yann Manes Spring Wheat Breeder.
Adelaide, 5th March 2009



**Grains Research &
Development Corporation**

Specific objectives of new GRDC project

- ◆ **Further confirmation and validation of newly identified novel sources of soil borne pathogen (SBP) resistance in high yielding advanced germplasm, with specific emphasis on multiple SBP resistance.**
- ◆ **Breeding of these sources into Australian and CIMMYT bread wheat backgrounds, and delivery of SBP disease resistance germplasm through CIMMYT International Nurseries.**
- ◆ **Molecular characterization of most promising novel sources of resistance for specific SBP with key linkages of useful populations with the AWBMMP.**
- ◆ **Production of new mapping populations for Root Lesion Nematode and Crown Rot.**

Methods used for first two objectives

- ◆ **At least 2 years of field or greenhouse data are required for the SBP trait of interest to promote the line for distribution.**
- ◆ **Key objective is the identification of multiple SBP resistant materials**
- ◆ **Emphasis is placed on screening the high yield advanced lines from both the SW and WW international programs.**
- ◆ **Australian colleagues are welcome to share germplasm for screening SBP in Turkey**

Germplasm for SBP sent Dec 2008

	NURSERY SENT TO AWCC DEC08 FROM TURKEY							
Nursery Name sent to AWCC Dec08	1. SBPSW 0809 Soil Borne Pathogens Spring Wheat	2. SBPWW 0809 Soil Borne Pathogen Winter Wheat	3a. RRDURSW 0809 Root Rot Durum Spring Wheat	3b. RRDURWW 0809 Root Rot Durum Winter Wheat	4. CRFHS 0809 Crown Rot Fusarium Head Scab	5. F6RLN 0809 F6 Root Lesion Nematode	6. RLNHDPARENT 0809 Root Lesion Nematode Mapping Parents	
Total entries	8	7	4	6	5	18	2	TOTAL 50
No entries already multiplied by AWCC	6	7	0	0	2	0	0	Total -15
quarantine 2009 for distribution in 2010	2	0	4	6	3	18	2	Total - 35

- ◆ 50 entries sent in Dec08
- ◆ Currently under increase with AWCC
- ◆ All pedigree lists and trait data on the CIMMYT-CAGE website

Spring wheat SBP materials

NURSERY FOR AWCC 0809	OE 0809	CNAME	TK GREENHOUSE (GH) & FIELD (FLD) DATA CONFIRMS RESISTANCE TO CCN (Cereal Cyst Nematode - <i>Heterodera filipjevi</i>) PT (Root Lesion Nematode <i>Pratylenchus thornei</i>), PN (Root Lesion Nematode <i>Pratylenchus neglectus</i>), CR (Crown Rot - <i>Fusarium culmorum</i>)
SBPSW 0809	1	AUS GS50AT34/SUNCO//CUNNINGHAM	CCN GH, PT GH
SBPSW 0809	2	CANADIAN/CUNNINGHAM//KENNEDY	CR FLD, PN GH
SBPSW 0809	3	CROC_1/AE.SQUARROSA (224)//OPATA	CR GH FLD, PT GH
SBPSW 0809	4	SLVS//BAU/MILAN	PT GH, PN GH
SBPSW 0809	5	SUNCO/FRAME//PASTOR	CCN GH, PT GH, CR GH FLD
SBPSW 0809	6	SUNCO/PASTOR	CR GH FLD
SBPSW 0809	7	T.TAU.83.2.29/3/PRL/SARA//TSI/VEE#5/4/CROC_1/AE.SQUARROSA (224)//OPATA	CCN GH, PT GH, PN GH
SBPSW 0809	8	T.TAU.83.2.36/ATTILA	PT GH

Winter Wheat SBP materials

NURSERY FOR AWCC 0809	OE 080 9	CNAME	TK GREENHOUSE (GH) & FIELD (FLD) DATA CONFIRMS RESISTANCE TO CCN (Cereal Cyst Nematode - Heterodera filipjevi) PN (Root Lesion Nematode Pratylenchus neglectus), CR (Crown Rot - Fusarium culmorum)
SBPWW 0809	1	ALTAY 2000	CR GH FLD
SBPWW 0809	2	BILINMIYEN96.7	PN GH, CR GH FLD
SBPWW 0809	3	BURBOT-6	CR GH FLD
SBPWW 0809	4	F130L1.12/ATTILA	CCN GH, CR GH FLD
SBPWW 0809	5	LOV41//LI7/LE2062	CCN GH, CR GH FLD
SBPWW 0809	6	MVR27-82//LI7/LE2062	CCN GH, CR GH FLD
SBPWW 0809	7	SONMEZ	CCN GH, CR GH FLD

Progress in understanding the chromosomal location of resistance to *P. thornei*

	<i>P. thornei</i> resistance	Chromosomal location							Group	Source actively used in breeding programs
		1	2	3	4	5	6	7		
1	Sythetic hexaploid CPI 133872		DS				DS, AL, AS		QDPI - Zwart et al.	limited LRC
2	2 middle eastern landraces - Iraq 43 (AUS4926) and Morocco 426 (AUS13124)	B	BS	B			DS		CSIRO - Schmidt et al.	unknown
3	GS50a wheat line						DS		CSIRO - Lagudah et al.	extensively in Northern Region and CIMMYT Int.
4	CIMMYT synthetic hexaploid CROC_1/AE.SQUARROSA (224)//OPATA	B							CSIRO/CIMMYT - McIntyre et al.	moderately in CIMMYT Int.
				B						
					D					
5	CIMMYT Iraqi landrace AUS4930 7.2	B							CSIRO/CIMMYT - McIntyre et al.	extensively in CIMMYT Int. and to a limited degree in Southern Region
		B								
			B							
							D			

F6 RLN Spring Wheat

NURSERY FOR AWCC 0809	OE 0809	CNAME	No. Root Lesion Nematode /plant (Greenhouse TK 04)	Quality of Root Lesion Nematode Phenotypic Data	seed colour 220806 - 1 big, 2 med, 3 small size - R red, B white. S - soft. + good seed seed variable	Phenotypic Score Tk Izmir 2006 - 1 - highly adapted phenotype
F6RLN 0809	1	AUS4930 6.5/JANZ	8.25	HIGH	2R	1
F6RLN 0809	2	CROC_1/AE.SQUARROSA (224)//OPATA/JANZ	0	HIGH	3B-	1
F6RLN 0809	3	CROC_1/AE.SQUARROSA (224)//OPATA/JANZ	0	HIGH	2B	1
F6RLN 0809	4	CROC_1/AE.SQUARROSA (224)//OPATA/JANZ	18	HIGH	2B-	1
F6RLN 0809	5	CROC_1/AE.SQUARROSA (224)//OPATA/JANZ	0	HIGH	3B-	1
F6RLN 0809	6	CROC_1/AE.SQUARROSA (224)//OPATA/JANZ	3.75	HIGH	2B	1
F6RLN 0809	7	GS50a/PASTOR	0	AVERAGE	2B	1
F6RLN 0809	8	AUS4930 6.5/PASTOR	0	AVERAGE	1B	1
F6RLN 0809	9	AUS4930 6.5/PASTOR	0	AVERAGE	2B	1
F6RLN 0809	10	CROC_1/AE.SQUARROSA (224)//OPATA/PASTOR	0	GOOD	3B	1
F6RLN 0809	11	CROC_1/AE.SQUARROSA (224)//OPATA/PASTOR	0	GOOD	2B-	1
F6RLN 0809	12	CROC_1/AE.SQUARROSA (224)//OPATA/PASTOR	0	GOOD	3B-	1
F5RLN 0809	13	CROC_1/AE.SQUARROSA (224)//OPATA/PASTOR	0	GOOD	2B+	1
F6RLN 0809	14	AUS4930 6.5/GS50a	0	GOOD	3R	1
F6RLN 0809	15	CROC_1/AE.SQUARROSA (224)//OPATA/AUS4930 6.5	0	AVERAGE	2R	1
F6RLN 0809	16	CROC_1/AE.SQUARROSA (224)//OPATA/AUS4930 6.5	0	AVERAGE	2B	1
F6RLN 0809	17	CROC_1/AE.SQUARROSA (224)//OPATA/AUS4930 6.5	0	AVERAGE	1B	1
F6RLN 0809	18	AUS4930 6.5/PASTOR	0	AVERAGE	2B	1

Requests for germplasm sent Dec 08

NURSERY SENT TO AWCC DEC08 FROM TURKEY							
Nursery Name sent to AWCC Dec08	1. SBPSW 0809 Soil Borne Pathogens Spring Wheat	2. SBPWW 0809 Soil Borne Pathogen Winter Wheat	3a. RRURSW 0809 Root Rot Durum Spring Wheat	3b. RRDURWW 0809 Root Rot Durum Winter Wheat	4. CRFHS 0809 Crown Rot Fusarium Head Scab	5. F6RLN 0809 F6 Root Lesion Nematode	6. RLNHDPARENT 0809 Root Lesion Nematode Mapping Parents
TOTAL PATHOLOGISTS	5	3	5	5	5	4	5
TOTAL BREEDER AND PRE-BREEDER	5	5	6	6	5	5	0
TOTAL PHYSIOLOGY	1	1	1	1	1	1	1
TOTAL REQUESTS	11	9	12	12	11	10	6

- ◆ Present request for SBP germplasm from Australian collaborators.
- ◆ Germplasm planned for distribution in 2010 after seed increase.

Essential to obtain multiple data (Greenhouse and field) over years

TURKEY ACC. No.	CNAME	SWMW/BW/TWT/S/DW/DSS	OCCURRENCE	MULTIPLE SOIL BORNE PATHOGEN RESISTANCE DATA	GREENHOUSE SCORES OVER YEARS	FIELD SCORES FROM VARIOUS OBSERVATION PLOTS OVER CONSECUTIVE YEARS										SCORES FROM YIELD TRIALS IN CUMRA KONYA OVER YEARS																							
				TK GREENHOUSE & FIELD DATA CONFIRMS RESISTANCE TO CCN (Cercaria Cyst Nematode - Heterodera filipjevii), PT (Root Lesion Nematode - Pratylenchus thornei)and CR (Crown Rot - Fusarium culmorum)	0506 Fc GH	03047 Fc GH	0405 Fc GH	1st HISEL RRS 2 05061 year	1st RREL RRS 2 0405 1 year	1st RREL RRS 2 0506 1 year	2nd RREL RRS 2 0405, 0506 2 year	3rd RREL RRS2 2 year 0203 0405	RRCN BS RRS2 2 yr 0203 0405	RRCN FC RRS2 0203 0405	1st HISEL RRS3 0506 1 year	1st RREL RRS3 0506 1 year	2nd RREL RRS 3 0405, 0506 2 year	2nd RREL Yr 2 RRS3 0506 1 year	1st RREL RRS3 0405 1 year	1st RREL RRS3 0506 1 year	RRYT Cumira 0405 0506 2 year RR Score (1 resis, 2 mod resis, 3 mod sus, 4 sus, 5 very sus)	RRYT Cumira 0405 0506 2 year Yield - inoc 5 1-1.25t/ha, 4 1.25 1.5, 3 1.5 1.75, 2 1.75-2, 1 >2	RRYT Cumira 0405 0506 2 year Tolerance 1 VI, 2 MIT, 3 II, 4 VII, ? Inconsistent over years	CR Growth reduction score 020707 (tolerance) Konya Merkez 2007	Crown Score (0-5) from 10 crowns of each entry, Konya Merkez 2007	RRYT Cumira 0405 0506 2 year RR Score (1 resis, 2 mod resis, 3 mod sus, 4 sus, 5 very sus)	1.8	0											
020615	CROC_1/AE.SUARROSA (224)//OPATA	SW	MX	CR GH FLD, PT GH	1	1*	1*		1*																														
030949	SUNR25 (GALA 2-49/(CN#133/SUNSTATE*4))/SU	SW	AUS	CR GH FLD	2	1*			1*	2	2																												
010627	ALTAY 2000	WW	TK	CR GH FLD	1		1*		1*	2	2	2	1*	1*	1		3	1	3	2	2		4	2	1														
000064	BILINMIYEN96.7	WW	TCI	CCN GH, CR GH FLD	1*				1*	2	2	3	1*			2		2	1	1	3	3		3	2	1.4	2												
990857	BURBOT-6	WW	OR-CIT	CR GH FLD	1*	2	1*		1*	1*	1	1*	1*				3	1*	1*	1	3		?	2	1.4	1													
000374	ES84.24/GRK	WW	TCI	CR GH FLD	3	1	1*						1	3	1																								
980872	F130L1.12/ATTILA	WW	MX-TCI	CCN GH, CR GH FLD	2	1*			1*	1*	1**	2	1	2			3	4	2	2	2	4		4	3	1.5	0												

- Anything with 1 is as good as MR resistant check, while 1* is better.
- To promote a MR line for CR at least 2 years GH and 2 years reliable field data is needed.
- Should be able to identify the best lines based on this – eg Croc (SW) and Burbot-6 (WW)
- Please see my comments regarding limitations and strength of GH vs Fld techniques

Mapping populations – linked with AWCMMP GA – joint collaboration with ICWIP (Nicol/Ogbonnaya)

- 233 DH individuals of an advanced synthetic derivative from CIMMYT Mexico CROC_1/AE.SQUARROSA (224)//OPATA (CID 72726; SID 531; SH: CMBW91Y00935S-80Y-11KBY-1KBY-010M-1Y-2M-0Y-0SY) x Janz which has resistance to both RLN-Pt and CR. #
- Furthermore several other valuable disease traits could be explored (FHS, CR, YS, BP, SEPT).
- This population has been partially mapped for RLN – Pt resistance two resistance loci located on chromosomes 1B and 3B (Toktay et al., 2006 Genome. 49: 1-5).
- This population belongs to CIMMYT and GRDC and can be utilised without restriction for this project.
- Planned to be phenotyped for CR and RLN-Pt this year in Turkey and Syria.

Other new mapping populations are planned for SBP as part of this project

Concluding remarks

- ◆ Thanks to all collaborators for interest in nurseries and for the most part good email correspondence
- ◆ Next set of germplasm will be sent Dec 2009, for distribution in 2011.
- ◆ Distribution of new SBP materials will be in early 2010 – suggestion to collect valuable data from materials to share.
- ◆ Emphasis on germplasm returned to Australia
 - ▶ SBW>WBW>SDW
 - ▶ Which SBP traits especially
 - ▶ Other trait info of interest?

Visitors welcome to Turkey and any feedback please contact me
j.nicol@cgiar.org