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Responses of Australian Wheat and Triticale Varieties to the Cereal Rust Diseases

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The annual review of rust responses of Australian wheat and triticale varieties is based on data collected in the 2010 season and in view of the body of information that is being progressively assembled over successive years through the assistance of the NVT website. Any change in the response of varieties to the cereal rusts from previous ratings is a reflection of pathotype variations and seasonal variation in disease intensity and severity.

While the data for stripe rust have been the subject of focussed attention by pathologists and breeders across the majority of the Australian wheat growing regions for many years, leaf rust and stem rust have been more sporadic. However, we have made an effort in 2010 to develop a similar consultative process for all wheat rust diseases, culminating in this report which combines disease responses for current varieties, together with relevant resistance genotypes. In following years we anticipate extending this process to rust responses for barley and oat varieties.

Disease response categories are summarised in Table 1.

The response of Australian wheat varieties to the rust diseases is presented in Table 2. The response to stripe rust is presented in two columns. The first column indicates the expected response for the 'WA' pathotype which is predominant in Western Australia but now largely replaced by more virulent pathotypes in the eastern states. The second column indicates expected responses to the recently detected 'Yr17-27' pathotype, and cultivars carrying *Yr17* and/or *Yr27* will generally be expected to show a contrasting response compared to the 'WA' pathotype. Note that the reaction of Livingston (*Yr17+Yr27*) to this new pathotype is not known at present, and growers are advised to monitor Livingston crops during the growing season and consider the possibility of fungicide protection.

The leaf rust and stem rust responses reflect the expected reactions to the predominant pathotypes of these diseases. Leaf rust pathotypes virulent for *Lr37, Lr24* and *Lr13* and stem rust pathotypes 34-1,2,7+Sr38 and 98-1,2,3,5,6,7 have been used to develop the expected responses in Table 1. Note that the combination of *Lr1*, *Lr13* and *Lr37* (Crusader, EGA Eaglehawk, Livingston, Sunlin, Sunstate, Sunzell) remains effective to current leaf rust pathotypes. Stem rust resistance based on *Sr2* confers low to moderate levels of adult plant resistance under low disease pressure. Varieties with *Sr13* (AGT Scythe, Arrivato, Clearfield STL, Kalka, Tamaroi) are moderately susceptible to resistant, depending upon the presence of additional resistance genes. The combination of *Sr36* with *Sr38* (Sunbri, Sunvale, Young) or with *Sr24* (Lang, Sunco) confer resistance to all known stem rust pathotypes.

The response of current triticale varieties to the three wheat rusts is presented in Table 3. Disease responses can be interpreted in the same way as noted above for wheat varieties. The exception is the response to the 'Tobruk' pathotype for stripe rust. This pathotype is adapted to an adult plant resistance in Tobruk, and is also virulent for the *YrJ* resistance common to most commercial triticales.

Acknowledgements

The national rust disease assessments were conducted through extensive consultation with cereal plant pathologists across Australia (Drs Stephen Neate, Steven Simpfendorfer, Andrew Milgate, Grant Hollaway, Hugh Wallwork, Manisha Shankar). The NVT assistance in collecting and assembling data for discussion was greatly appreciated (Alan Bedggood, Neale Sutton).

Table 1. Response descriptors for the rust diseases of wheat

	Description
R	highly resistant: occasional symptoms of infection including necrotic flecks; no sporulation
R-MR	resistant: symptoms evident and usually with necrosis and chlorosis, limited sporulation, and affected leaf area up to 15%
MR	moderately resistant: evidence of sporulating areas on the leaf surface with some chlorosis and necrosis, and affected leaf area up to 30%
MR-MS	intermediate: restricted sporulating areas with some chlorosis, and affected leaf area up to 50%
MS	moderately susceptible: freely sporulating lesions and affected leaf area up to 70%
MS-S	moderately susceptible to susceptible: freely sporulating lesions with leaf area affected up to 90%
S	susceptible: abundant sporulation across the whole leaf surface; leaf area affected up to 100%; some chlorosis and necrosis evident
S-VS	Susceptible to very susceptible: abundant sporulation across the leaf surface ; leaf area affected up to 100%; limited chlorosis
VS	highly susceptible: abundant sporulation across the whole leaf area with no evidence of chlorosis or necrosis; 100% leaf area affected

Table 2 Disease response and resistance genotype of current Australian wheat varieties to predominant pathotypes of the three wheat rust diseases

	Rust Response					Rust Resistance Genotype		
	Leaf Rust[A]		Stem Rust	Stripe Rust				
	Eastern States	WA		WA pt	Yr17-27 pt	Leaf Rust	Stem Rust	Stripe Rust
AGT Katana	MS	MR	MS-S	MR-MS	MR-MS	*Lr13*	*Sr30*	
AGT Scythe	MS	MS	R-MR	MS-S	MS-S		*Sr13*	
Amarok	R	R	S	R	MR-MS	*Lr14a, Lr37*	*Sr38*	*Yr17*
Annuello	R-MR	R-MR	R-MR	MS-S	MS-S	*Lr24, Lr34*	*Sr24*	*Yr18*
Arrino	MS	MS	S-VS	S	S		*Sr30* [C]	
Arrivato	MR	MR	R	R-MR	R-MR		*Sr8b, Sr9e, Sr13*	
Axe	MR	MR	MS	R-MR	R-MR		*Sr8b*	
Babbler	MS	R	R-MR	MS-S	MS-S	*Lr24, Lr34*	*Sr24*	*Yr18*
Banks	MR	MR	MR	MR-MS	MR-MS	*Lr13*	*Sr30*	
Barham	MR-MS	MR-MS	MS	R	MS-S	*Lr1, Lr20, Lr34, Lr37*	*Sr9b,Sr15, Sr38*	*Yr17, Yr18*
Baxter	R	R	R, MR-MS [C]	MS	MS	*Lr17a, Lr34*	*Sr2, Sr30, Sr36* [C]	*Yr18*
Beaufort	R	R	S	R	R-MR	*Lr13, Lr37*	*Sr38*	*Yr17*
Binnu	MR-MS	MR-MS	S	R	MS	*Lr37*	*Sr38*	*Yr17*
Bolac	MR-MS	MR-MS	MR	R-MR	R-MR		*Sr30*	*Yr4*
Bowerbird	R	R	MS	S	S	*Lr1, Lr13*	*Sr2, Sr30*	
Bowie	MS	MS	S	R	S	*Lr37*	*Sr15, Sr38*	*Yr17*

	Rust Response					Rust Resistance Genotype		
	Leaf Rust[A]		Stem Rust	Stripe Rust				
	Eastern States	WA		WA pt	Yr17-27 pt	Leaf Rust	Stem Rust	Stripe Rust
Braewood	R	R	MR	R	MR-MS	*Lr13, Lr37*	*Sr2, Sr30, Sr36, Sr38*	*Yr17*
Brennan	R	R	MS	R-MR	R-MR	*Lr13*	*Sr2, Sr30*	
Bullaring	MS	R	R-MR	MR-MS	MR-MS [C, D]	*Lr24*	*Sr24*	
Bumper	R	R	MS-S	MS	MS	*Lr1, Lr13*	*Sr30*	
Calingiri	MS	MS	S	S	S		*Sr30*	
Caparoi	MR-MS	MR-MS	R-MR	MR	MR			
Carinya	MR-MS	R	R-MR	R	MR-MS	*Lr24, Lr34, Lr37*	*Sr24, Sr38*	*Yr17, Yr18*
Carnamah	MS-S	MS-S	MR-MS	S	S	*Lr27+Lr31*	*Sr2, Sr30*	
Catalina	R	R	R-MR	MS	MS	*Lr24, Lr34*	*Sr24*	*Yr18*
Chara	MR-MS	MR	MR-MS	MS-S	MS-S	*Lr13, Lr34*	*Sr30*	*Yr18*
Clearfield JNZ	MR-MS	R	R-MR	MS-S	MS-S	*Lr24, Lr34*	*Sr24*	*Yr18*
Clearfield STL	S-VS	S-VS	MR	S	S		*Sr13*	
Cook	MR-MS	MR-MS	R	MR	MR	*Lr3a*	*Sr36*	
Correll	MS-S	MS-S	MR	MR-MS	MR-MS		*Sr30*	
Crusader	R	R	R-MR	R	MR-MS[D]	*Lr1, Lr13, Lr34, Lr37*	*Sr2, Sr30, Sr38*	*Yr17, Yr18*
Cunningham	MR-MS	R	R-MR	MS	MS	*Lr24, Lr34*	*Sr24*	*Yr18*
Currawong	R-MR	R-MR	R-MR	MR-MS	MR-MS	*Lr34*	*Sr26*	*Yr18*
Dakota	MR-MS	MR-MS	MR	MR-MS [D]	MR-MS [D]	*Lr34*		*Yr18*
Datatine	MR-MS	R	R-MR	MS-S	MS-S	*Lr24*	*Sr24*	
Derrimut	R	R	MR	R	MS-S	*Lr13, Lr37*	*Sr2, Sr30, Sr38*	*Yr17*
Diamondbird	R	R	MR-MS	MS	MS	*Lr1, Lr13*	*Sr2*	
Drysdale	MS	MS	MR	MS	MS		*Sr2, Sr30*	
EGA Bellaroi	MR-MS	MR-MS	MR	MR	MR			
EGA Bonnie Rock	R-MR	R-MR	MS	VS	VS	*Lr13*	*Sr30*	
EGA Bounty	R	R	MR	MR	MR	*Lr1, Lr13*	*Sr2, Sr30*	
EGA Burke	R	R	MR	MS	MS	*Lr1, Lr13*	*Sr2, Sr30*	
EGA Eagle Rock	MS	R	MR	MS	MS	*Lr24*	*Sr24*	
EGA Eaglehawk	R	R	R-MR	R	MR-MS	*Lr1, Lr13, Lr37*	*Sr2, Sr30, Sr38*	*Yr17*
EGA Gregory	R-MR	R-MR	MR	MR [C, D]	MR [C, D]	*Lr13, Lr23, Lr34*	*Sr30*	*Yr33, Yr18*
EGA Hume	R	R	MR	MR-MS	MR-MS	*Lr13, Lr23, Lr34*	*Sr30*	*Yr18*
EGA Jitarning	MR-MS	R	R-MR	MS	MS	*Lr24*	*Sr24*	
EGA Kidman	R	R	MR	MR-MS [D]	MR-MS [D]	*Lr13, Lr23, Lr34*	*Sr2, Sr30*	*Yr18*
EGA Stampede	R	R	R-MR	MR	MR	*Lr13, Lr34*	*Sr2, Sr30*	*Yr18*
EGA Wedgetail	MS	MS	MR-MS	MR-MS [D]	MR-MS [D]	*Lr34*	*Sr30*	*Yr18*
EGA Wentworth	MR	MR	R-MR	MS	MS	*Lr24, Lr34*	*Sr2, Sr24*	*Yr18*
EGA Wills	R	R	R-MR	MR-MS [D]	MR-MS [D]	*Lr13, Lr24, Lr34*	*Sr2, Sr24*	*Yr18*
EGA Wylie	R	R	R	MS	MS	*Lr17a, Lr34*	*Sr2, Sr30, Sr36*	*Yr18*
EGA2248	MR-MS	MR-MS	MR-MS	MS-S	MS-S			
Ellison	R	R	MR	R	MS	*Lr3a, Lr13, Lr37*	*Sr2, Sr30, Sr38*	*Yr17*
Endure	R-MR	R-MR	MR	R-MR	S	*Lr1, Lr3a, Lr37*	*Sr38*	*Yr17*
Espada	R	R	R-MR	R	MR-MS	*Lr24, Lr37*	*Sr24, Sr38*	*Yr17*
Fang	R	R	MR-MS	R	MS-S	*Lr37*	*Sr38*	*Yr17*
Fortune	MR	MR	MS	MS	MS	*Lr17a*	*Sr30*	
Frame	MS-S	MS-S	MR-MS	MS	MS		*Sr30*	
Gascoigne	MR	MR	MR	R-MR	R-MR	*Lr37*	*Sr38*	*Yr17*
GBA Hunter	MS [C]	MS [C]	R-MR	R-MR	MR-MS [D]	*Lr26*	*Sr31*	*Yr9, Yr27*
GBA Ruby	MR-MS	MR-MS	MS	R-MR	MS-S		*Sr30*	*Yr27*
GBA Sapphire	MR-MS	R	R-MR	MS	MS	*Lr24*	*Sr24*	
Giles	R	R	R-MR	MS	MS	*Lr13, Lr24, Lr34*	*Sr24*	*Yr18*
Gladius	MS	MS	MR	R	MR-MS [D]	*Lr37*	*Sr38*	*Yr17*
Guardian	MR-MS	R	R-MR	MS	MS	*Lr24*	*Sr24*	
H45	R	R	MS	VS	VS	*Lr13*	*Sr30*	
H46	R	R	MR-MS	R-MR	VS	*Lr13, Lr37*	*Sr30, Sr38*	*Yr17*
Hartog	R	R	MR	MS	MS	*Lr1, Lr13*	*Sr2, Sr30*	
Hornet	R	R	MS-S	R	MS	*Lr13, Lr37*	*Sr38*	*Yr17*
Hyperno	R-MR	R-MR	R	MR	MR			
Jandaroi	MR	MR	R	MR [D]	MR [D]			
Janz	MR-MS	R	R-MR	MS	MS	*Lr24, Lr34*	*Sr24*	*Yr18*

	Rust Response					Rust Resistance Genotype		
	Leaf Rust[A]		Stem Rust	Stripe Rust				
	Eastern States	WA		WA pt	Yr17-27 pt	Leaf Rust	Stem Rust	Stripe Rust
Kalka	R-MR	R-MR	R-MR	MR	MR		*Sr13*	
Kellalac	S	S	S	MR-MS	MR-MS		*Sr30*	
Kennedy	MR-MS	MR-MS	MR	MS	MS		*Sr2, Sr30*	
King Rock	R	R	MS	R-MR	S	*Lr13, Lr37*	*Sr30, Sr38*	*Yr17*
Krichauff	S	R	MR-MS	S-VS	S-VS	*Lr24*	*Sr24*	
Kukri	MS [C]	MR	MS	MR-MS	MR-MS	*Lr1, Lr13*	*Sr2, Sr30*	
Lang	MR-MS	R	R	MS	MS	*Lr24, Lr34*	*Sr24, Sr36*	*Yr18*
Leichhardt	R	R	MR	MS	MS	*Lr1, Lr13*	*Sr2, Sr30*	
Lincoln	R	R	MR	R-MR	R-MR		*Sr30*	*Yr4*
Livingston	R	R	MR-MS	R	-	*Lr1, Lr13, Lr37*	*Sr2, Sr38*	*Yr17, Yr27*
Mace	R	R	MR	R	S-VS	*Lr13, Lr23, Lr37*	*Sr2, Sr38*	*Yr17*
Mackellar	S [C]	MR	MR-MS	R-MR	R-MR	*Lr13, Lr17b*	*Sr2, Sr30*	
Magenta	MS	R	R-MR	MS	MS	*Lr24*	*Sr24*	
Marombi	MS-S	MS-S	MS	R	MS	*Lr1, Lr37*	*Sr38*	*Yr17*
Merinda	R	R	R-MR	R-MR	MR-MS	*Lr13, Lr24, Lr34*	*Sr2, Sr24*	*Yr18, Yr27*
Mitre	MR-MS	R	R-MR	MS-S	MS-S	*Lr24, Lr34*	*Sr24*	*Yr18*
Naparoo	R	R	R-MR	R	R	*Lr13, Lr24*	*Sr24*	
Orion	R	R	MR	R-MR	MS	*Lr20, Lr37*	*Sr15, Sr38*	*Yr17*
Pardalote	MS	R	R-MR	MS-S	MS-S	*Lr24*	*Sr24*	
Peake	R	R	MR	MR-MS [D]	MR-MS [D]	*Lr13, Lr37, Lr34*	*Sr2, Sr30, Sr38*	*Yr17, Yr18*
Petrel	MR-MS	MR-MS	R-MR	MR-MS [D]	MR-MS [D]		*Sr26*	
Petrie	MR	MR	R-MR	MS	MS	*Lr13, Lr24, Lr34*	*Sr24*	*Yr18*
Preston	R	R	S-VS	R-MR	R-MR			
Pugsley	MS-S	MS-S	S	R	S	*Lr37*	*Sr38*	*Yr17*
QAL 1064	R	R	R-MR	R-MR	MS-S	*Lr26, Lr37*	*Sr31, Sr38*	*Yr9, Yr17*
QAL Bis	R	R	R-MR	R	MS-S	*Lr24, Lr37*	*Sr24, Sr38*	*Yr17*
QAL2000	R	R	R-MR	R	VS	*Lr24, Lr37*	*Sr24, Sr38*	*Yr17*
Rees	R	R	R-MR	MS-S	MS-S	*Lr1, Lr13*	*Sr2, Sr30*	
Rosella	MR	MR	MR-MS	MR-MS	MR-MS	*Lr34*	*Sr30*	*Yr18*
Rudd	R	R	S	R	R	*Lr13, Lr37*	*Sr38*	*Yr17*
Saintly	MR-MS	MR-MS	R-MR	MR	MR			
Scout	R	R	MR	R-MR	MS	*Lr37*	*Sr38*	*Yr17*
Sentinel	R	R	R-MR	R-MR	R-MR	*Lr26*	*Sr2, Sr31*	
Spitfire	MS	MS	MR	MR	MR		*Sr2, Sr30*	
SQP Revenue	R	R	R	R	R			
Strzelecki	R	R	MR-MS	MR	MR	*Lr13, Lr23, Lr34*	*Sr30*	*Yr18, Yr33*
Sunbri	MR	MR	R	R	MR	*Lr34, Lr37*	*Sr36, Sr38*	*Yr17, Yr18*
Sunbrook	R	R	MR-MS	MR-MS	MR-MS	*Lr1, Lr13*	*Sr2, Sr30*	
Sunco	MR	MR	R	MR-MS	MR-MS	*Lr24, Lr34*	*Sr24, Sr36*	*Yr18*
Sunlin	MR-MS	MR	MR	MR	MR	*Lr1, Lr13, Lr37*	*Sr26, Sr38*	*Yr17*
Sunsoft 98	MR-MS	R	R-MR	MS-S	MS-S	*Lr24, Lr34*	*Sr24*	*Yr18*
Sunstate	R	R	MR	R	MS	*Lr1, Lr13, Lr37*	*Sr2, Sr30, Sr38*	*Yr17*
Sunvale	R-MR	R-MR	R	R	MR [D]	*Lr34, Lr37*	*Sr36, Sr38*	*Yr17, Yr18*
Sunvex	R	R	R	R	MR	*Lr24, Lr37*	*Sr24, Sr38*	*Yr17*
Sunzell	R	R	MR	R-MR	MR-MS [D]	*Lr1, Lr13, Lr37*	*Sr2, Sr30, Sr38*	*Yr17*
Tamaroi	MR	MR	R-MR	MR	MR		*Sr13*	
Tammarin Rock	MR	MR	MS-S	MS-S	MS-S		*Sr30*	
Tennant	MS-S	R	R-MR	R-MR	R-MR	*Lr26*	*Sr31*	*Yr9*
Ventura	R	R	R-MR	R	MS	*Lr13, Lr37*	*Sr2, S38*	*Yr17*
Waagan	MR-MS	MR-MS	MS	R-MR	S		*Sr30*	*Yr27*
Westonia	MS	MS	S-VS	VS	VS			
Whistler	MR-MS	MR-MS	MR	MS-S	MS-S	*Lr34*	*Sr26*	*Yr18*
Wollaroi	R-MR	R-MR	R-MR	MR	MR			
Wyalkatchem	R	R	S [B]	S [B]	S	*Lr13, Lr23*	*Sr2, Sr8a, Sr15*	*Yr29* [C]
Wylah	MR-MS	MR-MS	MR	MS	MS	*Lr34*	*Sr26*	*Yr18*
Yallaroi	R-MR	R-MR	R-MR	MR	MR			
Yandanooka	R	R	MR	S	S		*Sr30*	
Yenda	R	R	R	R	S	*Lr37*	*Sr38*	*Yr17*

	Rust Response					Rust Resistance Genotype		
	Leaf Rust[A]		Stem Rust	Stripe Rust				
	Eastern States	WA		WA pt	Yr17-27 pt	Leaf Rust	Stem Rust	Stripe Rust
Yitpi	MS	MS	S	MR-MS	MR-MS		*Sr30*	
Young	R	R	MR-MS, R[C]	R-MR	MS	*Lr37*	*Sr30, Sr36[C], Sr38*	*Yr17*
Zebu	R	R	R-MR	R-MR	R-MR	*Lr26*	*Sr31*	*Yr9*
Zippy	R-MR	R-MR	MS	MS-S [D]	MS-S [D]			
Zulu	R	R	R	MR	MR		*Sr9e*	

[A] leaf rust responses are against pathotypes virulent for *Lr13*, *Lr24* and *Lr37* in eastern states. WA responses reflect pathotypes avirulent for *Lr24* and/or *Lr13*
[B] Wyalkatchem in WA: MR-MS to stem rust pathotypes avirulent for *Sr15*; MS to stripe rust
[C] indicates a mixed (heterogeneous) response to the disease or for the presence of a resistance gene
[D] these varieties may show high levels of stripe rust if disease onset is early and may benefit from fungicide protection
- response unknown

Table 2 Disease responses for current Australian triticale varieties to predominant pathotypes of the three wheat rust diseases

	Rust Response		
	Leaf rust	Stem rust	Stripe Rust Tobruk pt
Abacus	R	R	S
Berkshire	R	R	MS
Bogong	R-MR	MS	MS [A]
Breakwell	R	R	S
Canobolas	MR-MS	MR-MS	MS-S [A]
Chopper	R	R	MR-MS (MS-S)[B]
Crackerjack	-	R	MS
Credit	R	R-MR	S-VS [A]
Endeavour	R	R-MR	R-MR
Hawkeye	R	R-MR	MR, MS [A]
Jaywick	R	R-MR	MR, MS [A]
Kosciuszko	R	R	S-VS
Rufus	R,MR	R-MR	MR-MS
Speedee	R	R-MR	S-VS
Tahara	R	R-MR	MS
Tickit	R-MR	R-MR	MS [A]
Tobruk	R	R	MS-S
Treat	R,MR	R-MR	MS-S [A]
Tuckerbox	R	R-MR	MR-MS
Yowie	R	R-MR	MR-MS
Yukuri	R	R-MR	R-MR

[A] indicates a mixed (heterogeneous) response to the disease
[B] data from at least one site was distinctly different
- response unknown

GENERAL ENQUIRIES

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RUSTED PLANT SAMPLES
can be mailed in paper envelopes;
do not use plastic wrapping or plastic lined packages.
Direct samples to:

Australian Cereal Rust Survey
Plant Breeding Institute
Private Bag 4011, Narellan NSW 2567

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