

Fungicide activity and performance in wheat

Information Sheet 26
Winter 2013/14



Choosing fungicides

Fungicides should be matched to the primary disease risk, which depends mainly on variety, sowing date, location and local weather. Mixtures and alternations of fungicides with different modes of action, from different fungicide groups, are often most effective and reduce the likelihood that fungicide resistance

will develop in target pathogens. Resistance poses a significant threat to the on-going performance of fungicides and resistance management must be taken into account when planning fungicide programmes.

Fungicides are tested by HGCA in specific performance trials and in

other research projects targeting specific diseases. Performance ratings are indicative and are dependent on dose rate and timing.

Control level

★★★★★ Highest

★ Lowest

blank = insufficient data

Chemical group	Active ingredient	Activity rating					
		Eyespot	Mildew	Septoria tritici	Yellow rust	Brown rust	Ear blight ¹
Amidoxine	cyflufenamid	-	★★★★	-	-	-	-
Anilinopyrimidine	cyprodinil	★★★★	★★	-	-	-	-
Azole + SDHI ²	epoxiconazole + boscalid	★★★★	★★	★★★★	★★★★	★★★★★	-
	epoxiconazole + isopyrazam	★★	★★	★★★★	★★★★★	★★★★★	-
	fluxapyroxad + epoxiconazole	★★★★	★★	★★★★★	★★★★★	★★★★★	★★
	prothioconazole + bixafen	★★★★	★★★★	★★★★★	★★★★	★★★★★	★★★★
Benzophenone	metrafenone	★★★	★★★★	★	-	-	-
Chloronitrile	chlorothalonil ³	-	★	★★★	★	★	-
Dithiocarbamate	mancozeb	-	★	★★	★	★	-
Imidazole	prochloraz (poraz)	★★★	★	★★★	★	★	-
MBC	carbendazim	★	★	★	★	★	★★
	thiophanate-methyl	-	-	-	-	-	★★
Morpholine	fenpropidin	-	★★★	★	★★	★★	-
	fenpropimorph	-	★★	★	★★	★★★	-
Phthalimides	folpet	-	-	★★	-	★	-
Quinolene	quinoxifen	-	★★	-	-	-	-
Quinazolinone	proquinazid	-	★★★★	-	-	-	-
SDHIs	penthiopyrad ⁴	-	-	★★★★	★★★★	-	-
	fluxapyroxad ⁴	-	-	★★★★	★★★★	-	-
Spiroketalamine	spiroxamine	-	★★	-	★★	★★	-
Strobilurin (QoI)	azoxystrobin	-	★	★	★★★	★★★	-
	picoxystrobin	★	★	★	★★★★	★★★	-
	pyraclostrobin	★	★	★	★★★★	★★★★	-
	trifloxystrobin	-	★	★	★★	★★	-
Strobilurin mixtures ²	dimoxystrobin + epoxiconazole	-	-	★★★	-	★★★★★	★★★★
	fluoxastrobin + prothioconazole	★★★★	★★	★★★★	★★★★	★★★★★	★★★★
	kresoxim-methyl + epoxiconazole	★★	★	★★★★	★★★★	★★★★	-
	kresoxim-methyl + fenpropimorph	-	★★	★	★★	★★	-
Triazole	cyproconazole	★	★★	★★	★★★★	★★★	-
	difenoconazole	-	★	★★★	★	★★★	-
	epoxiconazole	★★	★★	★★★★	★★★★★	★★★★	★★
	fluquinconazole	-	★★	★★★	★★★	★★★	-
	flutriafol	-	★	★★	★★	★★	-
	metconazole	-	★★	★★★	★★★	★★★	★★★★
	propiconazole	★	★	★★	★★	★★	-
	prothioconazole	★★★★	★★★★	★★★★	★★★★	★★	★★★★
	tebuconazole	-	★★	★★	★★★★	★★★★	★★★★
	tetraconazole	-	★★	★★	★★	★★	-

¹Ear blight caused by *Fusarium culmorum* or *Fusarium graminearum*. Performance against *Microdochium* species may differ.

²Different products may contain different loadings and formulations which may impact on control level. See 'Active ingredients for wheat disease control' tables for products tested in the HGCA Fungicide Performance trials.

³Chlorothalonil ratings are a 4 in protectant situations, but only a 1 in eradicant situations.

⁴Significant resistance risk. Always use SDHI fungicides in mixture with at least one fungicide from an alternative mode of action group which has efficacy against the target pathogen(s).

Seed treatment options

Active ingredient	Product		Seed-borne diseases				Other diseases							Pests	
			Bunt	Seedling blights	Loose smut	Ergot	Bunt soil-borne	Blue mould	Take-all	Yellow rust	Septoria tritici	Brown rust	Aphids/ BYDV	Wire-worm	Wheat bulb fly
carboxin, thiram	Anchor	Ch	✓	✓		●		●							
clothianidin**	Deter	By											✓	✓	
clothianidin** prothioconazole	Redigo Deter	By	✓	✓	✓	●	✓	●					✓	✓	
cypermethrin	Signal	Ch												●	✓
difenconazole, fludioxonil	Celest Extra	Sy	✓	✓		●	✓	●							
fludioxonil	Beret Gold	Sy	✓	✓		●	✓	●							
fludioxonil, flutriafol	Beret Multi	Sy	✓	✓	✓	●	✓	●							
fludioxonil, tefluthrin	Austral Plus	Sy	✓	✓		●	✓	●						✓	✓
fluquinconazole	Galmano	By	✓			●	●		✓	✓	✓	●			
fluquinconazole	Jockey Solo	Bs	✓			●	●		✓	✓	✓	✓			
fluquinconazole, prochloraz	Jockey	Bs	✓	✓		●	●		✓	✓	✓	✓			
fluquinconazole, prochloraz	Epona	Bs	✓	✓		●	✓			✓	✓	✓			
fuberidazole, triadimenol	Tripod	MA	✓	✓	✓	✓	✓	✓		✓	✓	✓			
ipconazole	Rancona 15ME	Ch	✓	✓	●	●	✓	●							
ipconazole, imazalil	Rancona iMIX	Ch	✓	✓	●	●	✓	●							
prothioconazole	Redigo	By	✓	✓	✓	●	✓	●							
prochloraz, triticonazole	Kinto	Bs	✓	✓	✓	●	✓								
silthiofam	Latitude	Mo							✓						

Bs=BASF By=Bayer CropScience Ch=Chemtura MA=Makhteshim-Agan Mo=Monsanto Sy=Syngenta

✓ label recommendation ● some known activity, but no label recommendation

**Cereals sown between January and June cannot be treated with clothianidin or imidacloprid (neonicotinoids) but treatment is permitted at other times (between July and December).

Wheat disease management guide

This Information Sheet is an annually updated supplement to the Wheat disease management guide. The guide includes information on symptoms and risk factors for the main wheat diseases.

See www.hgca.com/publications

Information Sheet 26 Winter 2013/14

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Fungicide dose-response curves

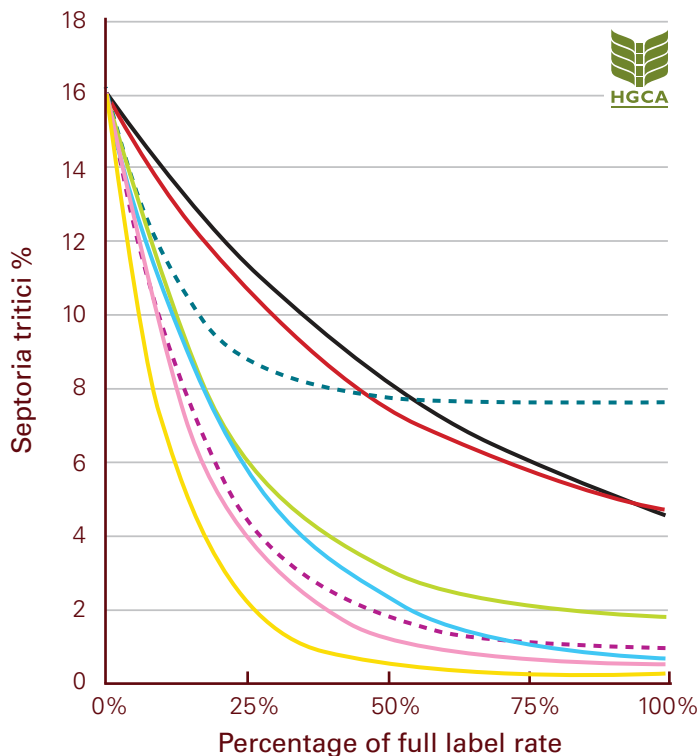
Fungicides are rigorously tested in HGCA-funded trials. Each year, a single spray is applied at a range of doses on varieties that are very susceptible to each major disease

and at sites where disease pressure is high. Disease levels are observed a few weeks later.

Performance of individual active ingredients can be assessed by

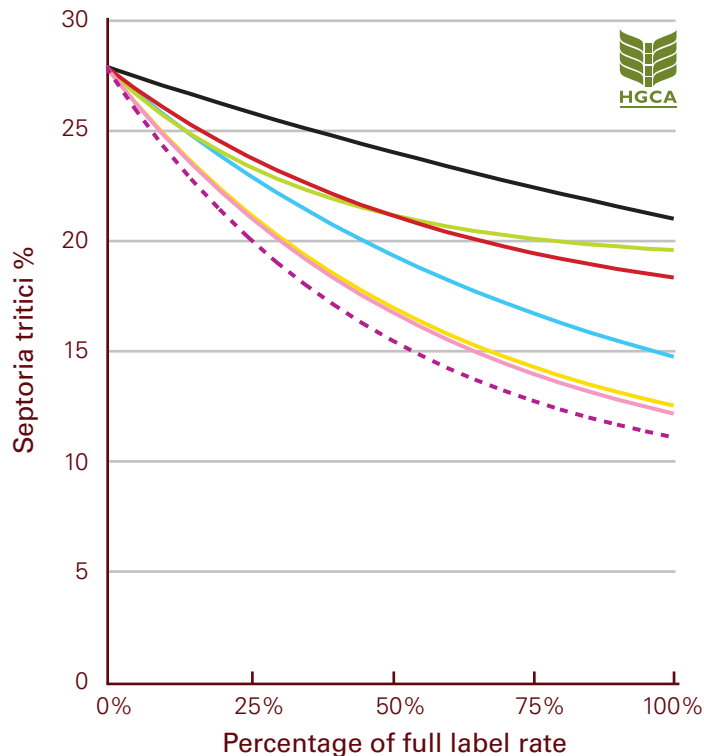
comparing dose-response curves. These show average performance measured across a range of sites, seasons and leaf layers.

Septoria tritici – Protection



2011–2013 data

Septoria tritici – Eradication



2011–2013 data

- Adexar
- Aviator Xpro
- Ignite
- Imtrex
- Phoenix
- Proline
- Seguris
- Vertisan + Ignite

Protection and eradication

'Protection' curves show the activity of fungicides when they are applied soon after the emergence of a leaf layer before much infection has occurred.

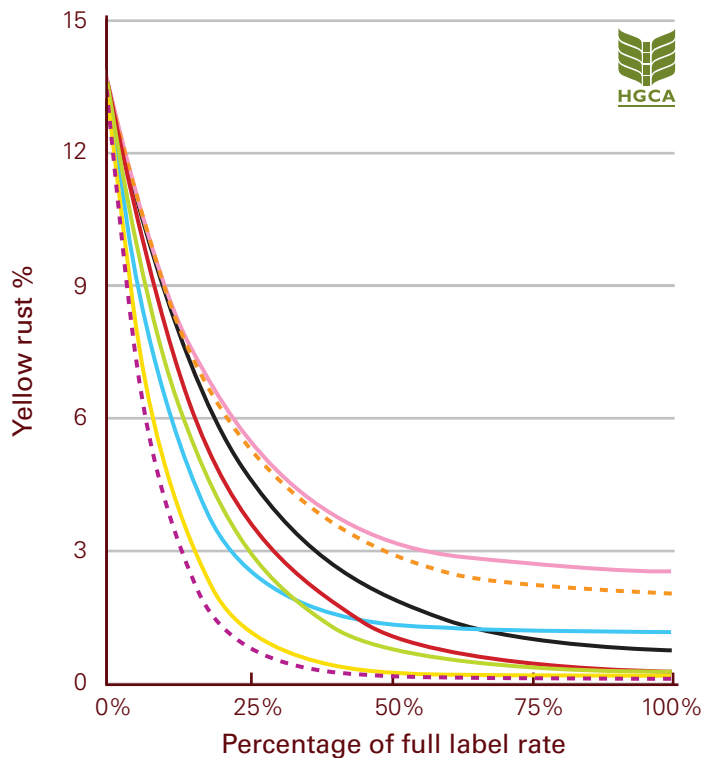
'Eradication' curves indicate fungicidal activity after infection

has occurred but before symptoms become visible.

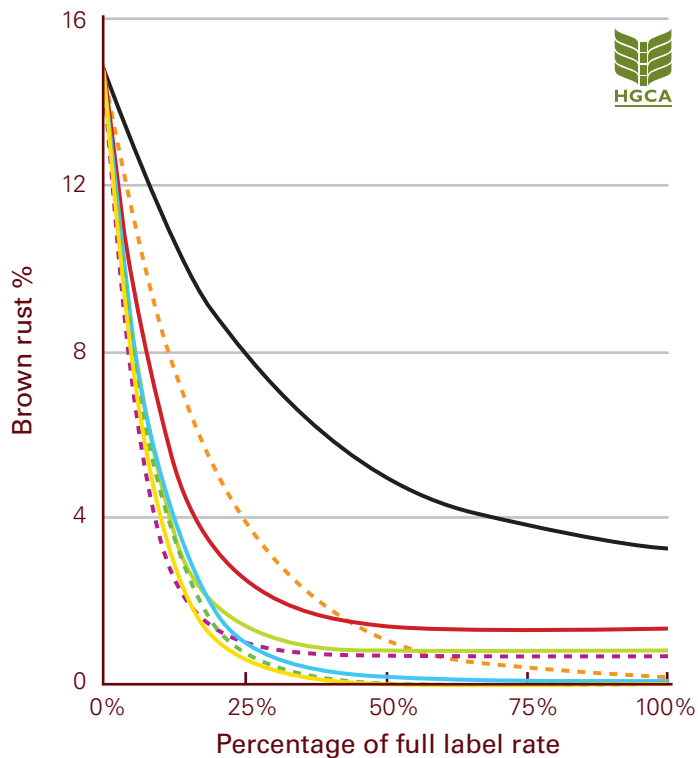
Performance of products on each leaf layer and at each site was classified as protectant or eradicator based on timing of leaf emergence relative to spray application.

Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target pathogen.

Yellow rust – Protection



Brown rust – Protection



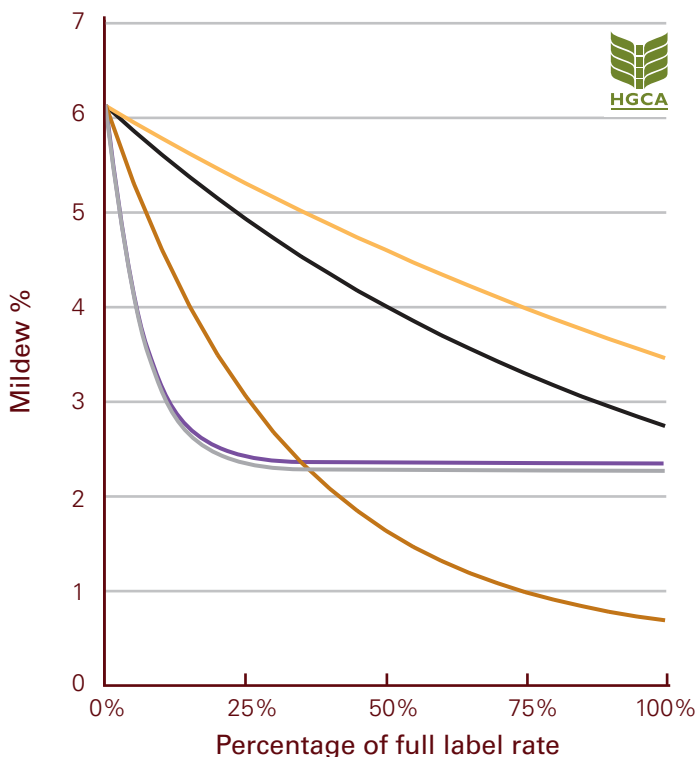
Yellow rust and
Brown rust key

- Adexar
- Aviator Xpro
- Brutus
- - - Comet
- Ignite
- Imtrex
- Proline
- Seguris
- - - Vertisan + Ignite

Mildew key

- Cyflamid
- Flexity
- Proline
- Talius
- Tern

Mildew – Eradication



Fungicide resistance

Fungicide resistance occurs when a pathogen becomes so insensitive to a fungicide that the fungicide's field performance is impaired. Resistance management is vital to maintain control and prolong the effectiveness of fungicides. Use fungicides with different modes of action in mixtures and in alternations and ensure that mixing partners are used at doses that give similar efficacy and persistence. Single azole and SDHI products carry considerable resistance risk and should not be used alone. Never exceed the maximum recommended number of applications and follow any additional label guidance on resistance management. Some mildewicides, for example, carry specific advice on alternating or mixing active ingredients.

2006–2009 data

Protection data not available. Talius and Flexity offer primarily protective activity.

Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target pathogen.

Active ingredients for wheat disease control

Product	Active ingredients																																							
	azoxystrobin	bixafen	boscalid	carbendazim	chlorothalonil	cyflufenamid	cyproconazole	cyprodinil	difenoconazole	dimoxystrobin	epoxiconazole	famoxadone	fenpropidin	fenpropimorph	Folpet	fluoxastrobin	fluquinconazole	flusilazole**	flutriafol	fluxapyroxad	isopyrazam	kresoxim-methyl	mancozeb	metconazole	metrafenone	penthiopyrad	picoxystrobin	prochloraz	propiconazole	proquinazid	prothioconazole	pyraclostrobin	Pyriofenone	quinoxifen	spiroxamine	tebuconazole	thiophanate-methyl	triadimenol	trifloxystrobin	
Acanto Prima							x																			x														
Adexar*										x										x																				
Agate																												x										x		
Alto Elite				x		x																							x										x	
Amistar	x																																							
Amistar Opti	x			x																																				
Anode																													x											
Apres																																			x					
Attenzo																									x															
Aviator 235 Xpro*	x																														x									
Aylora				x																						x														
Boogie Xpro	x																														x						x			
Bravo 500				x																																				
Brutus*										x														x																
Bumper P																												x	x											
Capalo										x			x												x															
Caramba																								x																
Ceando										x															x															
Cello																																x					x	x		
Centaur						x																																		
Cercobin																																								x
Cerix										x											x											x								
Charisma											x								x																					
Cherokee				x		x																								x										
Cogito																													x										x	
Colstar													x				x																							
Comet 200*																																	x							
Consul																				x																				
Contrast				x															x																					
Corbel														x																										
Credo				x																								x												
Cyflamid*						x																																		
Delsene 50 Flo				x																																				
Diamant										x			x																					x						
Eclipse										x			x																											
Ennobe										x																														
Ensign														x								x																		
Enterprise			x							x																														
Epic										x																														
Eros													x																											x
Fandango																	x																							
Firefly 155*																	x																							
Flamenco																		x																						
Flexity*																										x														
Folicur																																								x
Fortress																																								
Frelizon																											x	x												
Furlong							x																						x											
Galileo																													x											
Gemstone											x																													
Guru					x																																			
Harvesan				x																																				
Helix																																								
Ignite*											x																													
Imtrex*																																								
Intellis																																								
Jaunt																																								
Jenton													x				x																							

* Products used in Fungicide Performance trials.

** Flusilazole products are subject to a withdrawal notice and all existing stocks must be used or disposed of by 12 October 2014.

Active ingredients for wheat disease control

Product	Active ingredients																																											
	azoxystrobin	bixafen	boscalid	carbendazim	chlorothalonil	cyflufenamid	cyproconazole	cyprodinil	difenoconazole	dimoxystrobin	epoxiconazole	famoxadone	fenpropidin	fenpropimorph	Folpet	fluoxastrobin	fluquinconazole	flusilazole**	flutriafol	fluxapyroxad	isopyrazam	kresoxim-methyl	mancozeb	metconazole	metrafenone	penthiopyrad	picoxystrobin	prochloraz	propiconazole	proquinazid	prothioconazole	pyraclostrobin	Pyriofenone	quinoxifen	spiroxamine	tebuconazole	thiophanate-methyl	triadimenol	trifloxystrobin					
Justice																													x															
Kestrel																															x													
Kingdom			x								x																																	
Librax																				x				x																				
Lyric																		x																										
Mantra											x			x								x																						
Medley												x						x																										
Menara							x																						x															
Midas					x													x																										
Mobius			x								x																						x									x		
Nebula			x								x																								x									
Opera											x																							x										
Opus*											x																																	
Opus Team											x			x																														
Orka														x																						x								
Osiris-P											x													x																				
Pentangle					x																																					x		
Pexan											x									x																								
Phoenix*															x																													
Plover										x																																		
Pluton																			x																									
Pointer																																												
Poraz																													x															
Prairie					x																									x														
Priori Xtra	x						x																																					
Proline 275*																																												
Property 180SC																																												
Prosaro																																												
Prospa					x															x																								
Punch C				x															x																									
Quell Flo																																												
Radius							x	x																																				
Sage																																										x	x	
Sanction 25																			x																									
Seguris*											x											x																						
Silvacur																																										x	x	
Skyway 285 Xpro		x																																								x		
Sparticus Xpro		x																																								x		
Sphere							x																																				x	
Sunorg Pro																									x																			
Swift SC																																											x	
Swing Gold											x	x																																
Talius*																																												
Tern*																																												
Topsin																																											x	
Torch Extra																																											x	
Tracker			x								x																																	
Treoris*																																												
Unix																																												
Vareon																																											x	
Variano Xpro		x																																										
Vertisan*																																												
Veto F																																											x	x
Vivid																																												
Vortex											x										x																							
Zephyr																																												
Zimbrail					x																																							

* Products used in Fungicide Performance trials.

** Flusilazole products are subject to a withdrawal notice and all existing stocks must be used or disposed of by 12 October 2014.