

Fungicide activity and performance in wheat

Information Sheet 48
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AHDB
CEREALS & OILSEEDS

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 AHDB Cereals & Oilseeds 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

5 = Highest

1 = Lowest

- = insufficient data but may have some activity: check label

Fungicide activity against major diseases

Chemical group	Active ingredient	Activity rating					
		Eyespot	Mildew	Septoria tritici	Yellow rust	Brown rust	Ear blight ¹
Amidoxine	cyflufenamid	-	4	-	-	-	-
Anilinopyrimidine	cyprodinil	4	2	-	-	-	-
Benzophenone	metrafenone	3	4	1	-	-	-
Chloronitrile	chlorothalonil ³	-	1	4	-	-	-
Dithiocarbamate	mancozeb ³	-	1	3	1	1	-
Imidazole	prochloraz (poraz)	3	1	1	1	1	-
MBC	carbendazim	1	1	1	1	1	2
	thiophanate-methyl	-	-	-	-	-	2
Morpholine	fenpropidin	-	3	1	2	2	-
	fenpropimorph	-	2	1	2	3	-
Phthalimides	folpet ³	-	-	2	1	1	-
Quinazolinone	proquinazid	-	4	-	-	-	-
Quinolene	quinoxifen	-	2	-	-	-	-
SDHIs	penthioapyrad ⁴	-	-	4	3	3	-
	fluxapyroxad ⁴	-	-	4	3	3	-
SDHIs + other ²	boscalid + epoxiconazole	4	2	3	4	4	-
	isopyrazam + epoxiconazole	2	2	4	5	5	-
	fluxapyroxad + epoxiconazole	4	2	5	5	5	2
	bixafen + prothioconazole	4	3	5	4	5	3
	penthioapyrad + chlorothalonil	-	-	4	3	3	-
Spiroketalamine	spiroxamine	-	2	-	2	2	-
Strobilurin (QoI)	azoxystrobin	-	1	1	3	4	-
	picoxystrobin	1	1	1	4	3	-
	pyraclostrobin	1	1	1	4	5	-
	trifloxystrobin	-	1	1	2	2	-
Strobilurin mixtures ²	dimoxystrobin + epoxiconazole	-	-	2	4	4	3
	fluoxastrobin + prothioconazole	4	2	3	4	5	3
Triazole ³	cyproconazole	1	2	1	4	3	-
	difenoconazole	-	1	2	1	3	-
	epoxiconazole	2	2	3	5	4	2
	fluquinconazole	-	2	2	3	3	-
	flutriafol	-	1	1	2	2	-
	metconazole	-	2	2	3	3	3
	propiconazole	1	1	1	2	2	-
	prothioconazole	4	3	3	4	2	3
	tebuconazole	-	2	1	4	4	3

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

² Different products may contain different loadings and formulations which may impact on the level of control. See 'Active ingredients for wheat disease control' tables for products tested in the AHDB Cereals & Oilseeds fungicide performance trials.

³ Key products may have significant differences between performance in protectant and eradication situations. This score is for the protectant situation.

⁴ Significant 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 – <i>Tilletia tritici</i>	Microdochium seedling blight – <i>Microdochium species</i>	Fusarium seedling blights – <i>Fusarium graminearum</i> <i>F. culmorum</i>	Septoria seedling blight – <i>Phaeosphaeria nodorum</i>	Loose smut – <i>Ustilago nuda</i> f. sp. <i>tritici</i>	Bunt soil-borne – <i>Tilletia caries</i>	Take-all – <i>Gaeumannomyces graminis</i> (var <i>tritici</i>)	Yellow rust	Septoria tritici	Brown rust	Aphids (BYDV vectors)	Wireworm	Slugs	Wheat bulb fly
carboxin, thiram	Anchor	Ar	✓	✓		✓										
clothianidin, prothioconazole	Redigo Deter	By	✓	✓	✓		✓	✓					✓	✓	✓	
cypermethrin	Signal 300 ES	Ar												✓		✓
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	Epona	Bs	✓		✓			✓		✓	✓	✓				
fluquinconazole, prochloraz	Jockey	Bs	✓		✓			✓	✓	✓	✓	✓				
ipconazole	Rancona 15ME	Ar	✓	✓	✓			✓								
ipconazole, imazalil	Rancona iMIX	Ar	✓	✓	✓			✓								
prochloraz, triticonazole	Kinto	Bs	✓	✓		✓	✓	✓								
prothioconazole	Redigo	By	✓	✓	✓		✓	✓								
prothioconazole, tebuconazole	Redigo Pro	By	✓	✓	✓		✓	✓								
silthiofam	Latitude	Mo							✓							

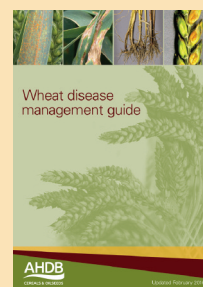
Ar = Arysta, Bs = BASF,
By = Bayer CropScience,
Mo = Monsanto, Sy = Syngenta

✓ label recommendation, control may only be partial, please refer to product label

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 cereals.ahdb.org.uk/publications



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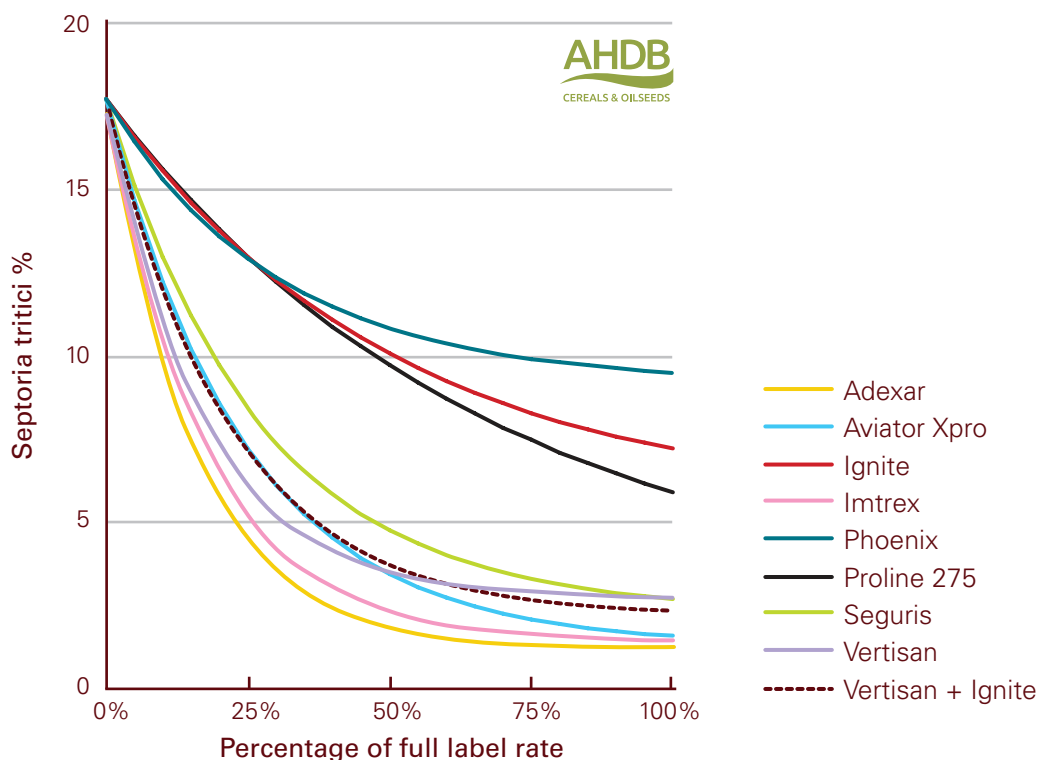
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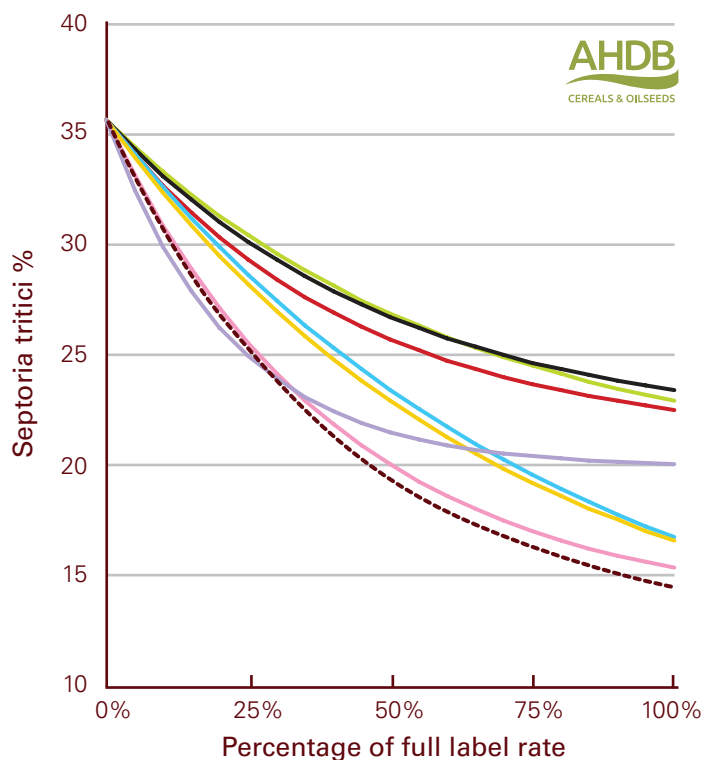
Fungicide dose-response curves

Fungicides are rigorously tested in AHDB Cereals & Oilseeds-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.

Septoria tritici – Protection



Septoria tritici – Eradication



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.

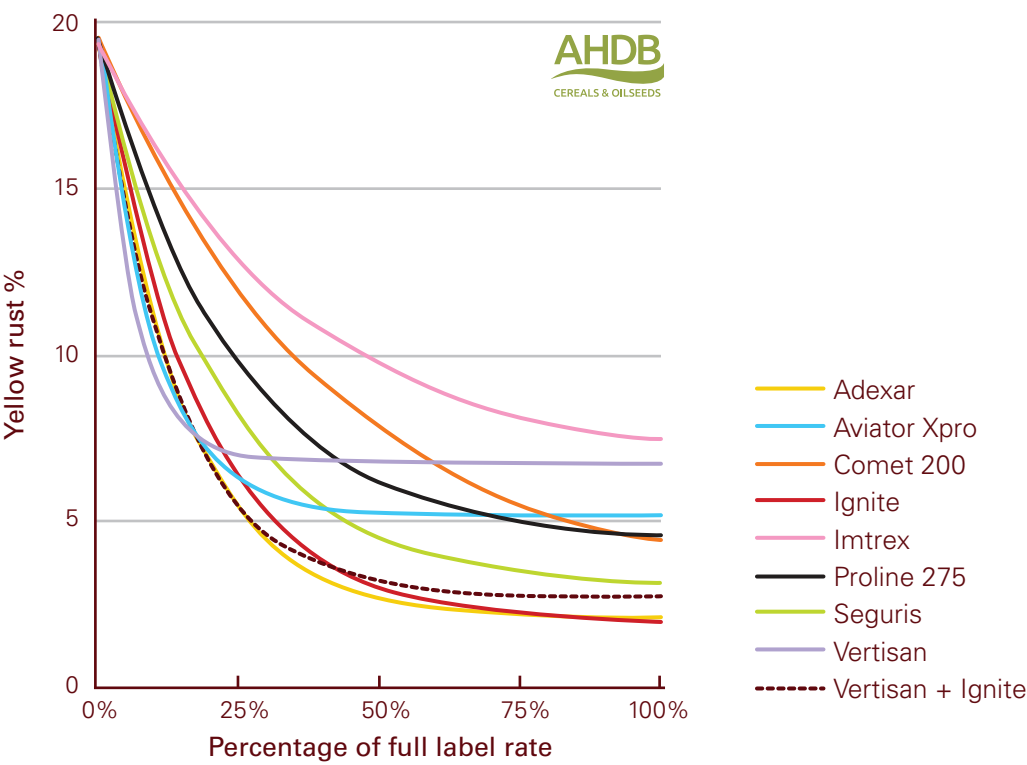
Performance of products on each leaf layer and at each site was classified as protectant or eradican based on timing of leaf emergence relative to spray application.



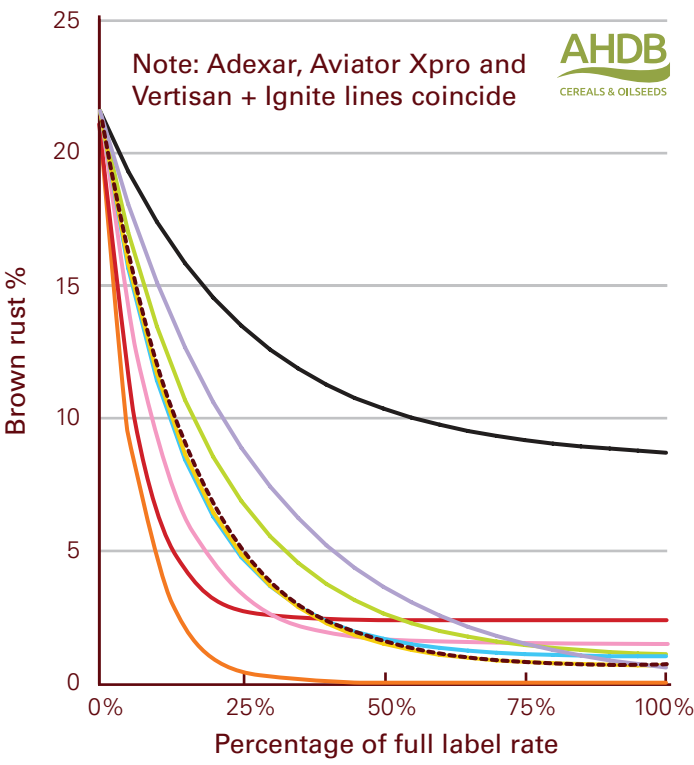
Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action that has comparable efficacy against the target pathogen(s).

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.

Yellow rust – Protection



Brown rust – Protection



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 mildewcides, for example, carry specific advice on alternating or mixing active ingredients.



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

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	flutriafol	fluxapyroxad	isopyrazam	kresoxim-methyl	laminarin	mancozeb	metconazole	metrafenone	penthiopyrad	picoxystrobin	prochloraz	propiconazole	proquinazid	prothioconazole	pyraclostrobin	pyriofenone	quinoxifen	spiroxamine	tebuconazole	thiophanate-methyl	triadimenol	trifloxystrobin			
Adexar*										X									X																							
Agate																												X									X					
Alto Elite					X		X																																X			
Amistar	X																																									
Amistar Opti	X				X																																					
Amistar Pro	X													X																												
Apres																																				X						
Arizona															X																											
Artemis												X																X										X				
Asana										X			X							X																						
Aviator 235 Xpro*		X																			X												X									
Aylora					X																					X																
Balear 720					X																																					
Boogie Xpro		X																															X			X						
Bowman										X																																
Bravo 500					X																																					
Brutus*										X														X																		
Bumper 250EC																													X													
Capalo										X			X												X																	
Caramba																								X																		
Ceando										X															X																	
Cello																																	X				X	X				
Centaur							X																																			
Cerix										X									X															X								
Cherokee					X		X																							X												
Chord			X							X																					X											
Cielex							X																			X																
Cirkon																												X	X													
Cloister										X															X																	
Comet 200*																																		X								
Consul																	X																									
Corbel														X																												
Cortex										X																																
Crafter					X																																			X		
Credo					X																						X															
Cyflamid*						X																																				
Deacon																																							X			
Eclipse										X			X																													
Ennobe										X																			X													
Enterprise			X							X																																
Envoy										X																									X							
Epic										X																																
Fielder					X																											X										
Firefly 155*																X																		X								
Flanker																											X															
Flexity*																									X																	
Flyer																																		X								
Folicur																																							X			
Fortress																																			X							
Frelizon																										X	X															
Furlong							X																					X														
Galileo																											X															
Gemstone										X																								X								
Guru					X																		X																			
Helix																																X				X						
Ignite*										X																																
Imtrex*																			X																							
Intellis																										X																
Jaunt																																										

* Products used in AHDB Cereals & Oilseeds fungicide performance trials.

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	flutriafol	fluxapyroxad	isopyrazam	kresoxim-methyl	laminarin	mancozeb	metconazole	metrafenone	penthiopyrad	picoxystrobin	prochloraz	propiconazole	proquinazid	prothioconazole	pyraclostrobin	pyrifenone	quinoxifen	spiroxamine	tebuconazole	thiophanate-methyl	triadimenol	trifloxystrobin				
Justice																													X														
Juventus																								X																			
Kestrel																															X								X				
Keystone											X									X													X										
Kingdom			X								X																																
Librax																			X					X																			
Manitoba											X				X																												
Mantra											X		X							X																							
Menara							X																						X														
Metal																								X																			
Metal 60																								X																			
Mirage 40EC																											X																
Mobius																												X														X	
Monkey																											X													X			
Nebula			X								X																							X									
Opera											X																							X									
Opus*											X																																
Opus Team											X		X																														
Oranis																											X																
Orius 20EW																																									X		
Orius P																												X													X		
Pentangle				X																																					X		
Pexan											X								X																								
Phoenix*														X																													
Plover									X																																		
Pointer																		X																									
Poraz																												X															
Priaxor EC																			X															X									
Priori Xtra	X						X																																				
Proline 275*																																		X									
Property 180SC																																			X								
Prosaro																																		X									
Prospa				X														X																									
Quell Flo																							X																				
Seguris*											X									X																							
Skyway 285 Xpro		X																															X							X			
Sparticus Xpro		X																															X							X			
Sunorg Pro																								X																			
Supreme				X																																							
Swift SC																																										X	
Swing Gold										X	X																																
Talium*																																	X										
Tarus																																									X		
Tazer	X																																										
Timpani				X																																				X			
Topsin																																								X			
Torch Extra																																										X	
Tracker			X								X																																
Treoris				X																							X																
Vacciplant																						X																					
Vareon																												X	X										X				
Variano Xpro		X															X																X										
Vegas						X																																					

* Products used in AHDB Cereals & Oilseeds fungicide performance trials.