



NEW  
Veritas® Fungicide  
*Details inside*

# Foliar Fungicide Guide for Cereals



ADAMA

Simply. Grow. Together.



# Foliar Diseases

## The significance of foliar diseases in Cereals

Foliar diseases are responsible for significant production losses throughout Australian cereal growing regions. The value of lost production from leaf diseases in Wheat alone is currently estimated at \$472m per annum, with potential losses of several billion dollars a year if not managed appropriately<sup>1</sup>.

## How do foliar disease outbreaks occur?

There are three factors that must be present for a foliar disease outbreak:

- A viable inoculum source
- A susceptible variety
- Favourable weather conditions.

## Viable inoculum source

The inoculum (fungal spores) that initiates a disease epidemic is called the inoculum source. The primary inoculum source will depend upon the disease and its ability to survive on either a living host (i.e. Rusts) or on dead plant material such as stubble (i.e. Yellow Spot, Septoria, Scald). Volunteers are a host for Rusts and provide a 'Green Bridge' over the summer fallow to initiate new infections in subsequent crops. If volunteers are not properly controlled prior to sowing, there is a greater risk of disease outbreaks in the following crop.

Most cereal diseases are stubble-borne and able to survive over summer on stubble. If a crop is sown into stubble containing the inoculum of diseases such as Yellow Spot or Septoria (i.e. Wheat sown into infected Wheat stubble), there will be a significantly greater chance of infection early in the crop (Figure 1).

## Favourable weather conditions

Pathogens have temperature and leaf wetness requirements for spore germination, infection and sporulation. At a suitable temperature and leaf wetness, spores germinate and infect the plant.

## What can I do to manage foliar diseases?

Growers have a range of options available to manage foliar diseases including:

- Reducing inoculum sources
- Choosing suitable varieties
- Applying seed dressings or in-furrow fungicides on fertiliser
- Applying foliar fungicides.

## Reducing inoculum sources

Inoculum sources can be reduced by:

- Controlling 'Green Bridge' volunteers
- Rotating crops
- Managing stubble

Volunteers should be controlled by mid-March to ensure that spores produced on these plants are not viable by the time of crop emergence. Rotating crops to avoid planting back into infected stubble is also important for diseases such as Yellow Spot (Figure 1) and Septoria in Wheat; and Scald and Net Blotch in Barley.

Stubble management can also have an impact on reducing inoculum of all stubble-borne diseases of Cereals. Burning or cultivating stubble can significantly reduce the level of inoculum prior to sowing and will reduce or delay disease development in the subsequent crop (Figure 2).

### Cropping History Effects on Disease Levels

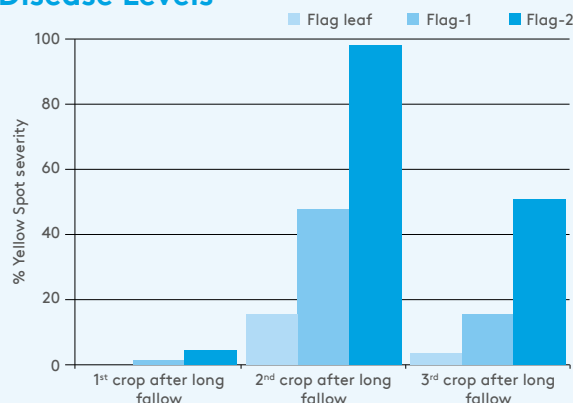


Figure 1. Yellow Spot severity in Wheat with different cropping histories in Southern Queensland<sup>7</sup>

### Stubble Management and Disease Infection

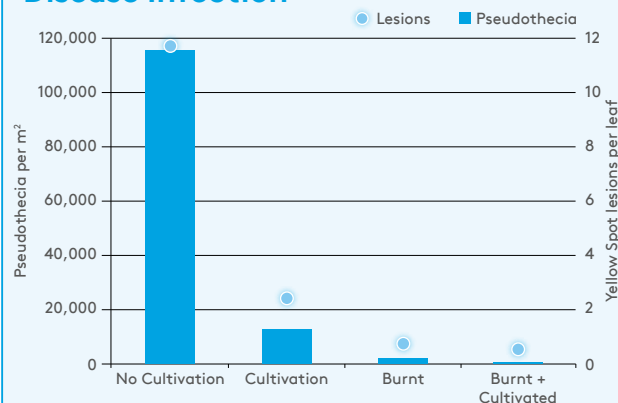


Figure 2. The impact of stubble management strategies on a) Yellow Spot pseudothecia (ascospore bearing structure) survival; and b) Yellow Spot infection levels on primary leaves in the subsequent Wheat crop<sup>2</sup>



## Variety selection

Variety selection can help growers manage the risk of losses from foliar diseases. It can also help tailor fungicide applications according to the yield potential and level of disease risk<sup>3</sup> (Figure 3 & Table 1).

### Genetic Disease Resistance

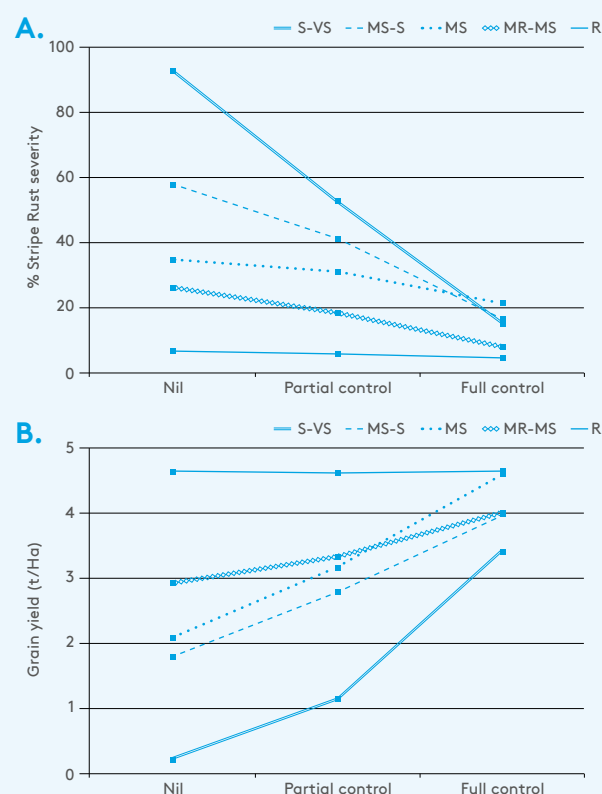


Figure 3. Stripe Rust severity and yield results of interaction between Wheat varieties and fungicide program at Manjimup WA, 2008<sup>3</sup>

Variety Resistance Classification <sup>4</sup>	
Variety Rating	Interpretation of Variety Resistance Rating
<b>R</b>	The disease will not multiply or cause any damage on this variety. This rating is only used where the variety also has seedling resistance.
<b>MR</b>	The disease may be visible and multiply but no significant economic losses will occur. This rating signifies strong adult plant resistance.
<b>MS</b>	The disease may cause damage but this is unlikely to be more than around 15% except in very severe situations.
<b>S</b>	The disease can be severe on this variety and losses of 15-50% can occur.
<b>VS</b>	Where disease is a problem this variety should not be grown. Losses greater than 50% are possible and the variety may create significant problems to other growers.

Table 1. Variety classifications are available from agency websites<sup>5</sup> and are regularly updated.

## Seed dressings and in-furrow fungicide application

Seed dressings or in-furrow fungicides can improve crop establishment and control/suppress a range of foliar diseases (Table 5). Phoenix C® seed dressing will control smuts and bunts, and provide early season control or suppression of Stripe Rust in Wheat, and Scald and Powdery Mildew in Barley (Table 5 on page 11).

**In Wheat**, in-furrow application of Jubilee® Loaded controls foliar diseases such as Stripe Rust and *Septoria tritici* and the root disease Take-all (Table 5). In low-moderate disease scenarios, Jubilee® Loaded can control Stripe Rust from sowing until stem elongation. In high disease pressure scenarios, Jubilee® Loaded provides basal fungicide protection until foliar applications commence at the start of stem elongation.

**In Barley**, Jubilee® Loaded can significantly delay the first foliar fungicide application for both Scald and Powdery Mildew. Jubilee® Loaded is effective when used in a disease management program in conjunction with foliar applications. For both Wheat and Barley, monitoring for disease throughout the season is critical to ensure follow-up foliar sprays are applied when needed.

### Progression of Stripe Rust in 6 Wheat cultivars with different susceptibilities

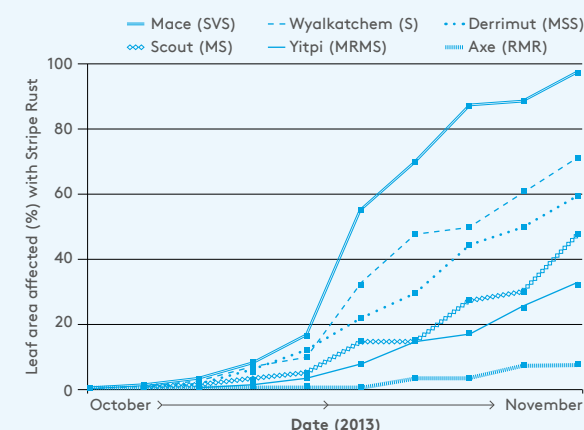


Figure 4. Horsham, 2013 (Data collected by Joshua Fanning, DEPI Horsham). The speed, at which stripe rust can develop in Mace, relative to some other varieties, is shown in Figure 4. In this field example within a period of only 14 days the leaf area affected by Stripe Rust increased from less than 1% (7 Oct) to 55% (21 Oct).



# Applying Foliar Fungicides

## What is the objective of applying a foliar fungicide?

The main goal of foliar fungicide applications is to increase profitability <sup>6</sup>. Fungicides do not generally increase yield, but they protect the yield potential of a given crop by maintaining the green leaf area (including leaves, stems and grain head). Foliar diseases reduce the green leaf area of the plant and its ability to produce energy (via photosynthesis), particularly during key growth stages such as grain fill.

## Getting the best result from fungicide applications

There are a number of key considerations when applying fungicides, including:

- Timing of application
- Product selection
- Rate of application.

## Timing of application

Timing of application of foliar fungicides is the most important consideration for effective disease control.

Key points to consider with fungicide timing are:

- Application at critical growth stages - protect plant tissues that contribute to yield
- Multiple applications may be required as fungicides cannot protect leaves that haven't emerged at the time of spraying <sup>6</sup>
- High disease pressure/susceptible variety = earlier spraying + multiple sprays
- Applying fungicides to prevent the disease from becoming established, not curatively <sup>7</sup>.

## Crop growth stage and spray timing

The most cost-effective timing to apply foliar fungicides is from stem elongation to ear emergence (GS 30-59; *Figure 5*). The final four leaves and grain head/stem contribute the most towards grain yield and quality (*Table 2*). Foliar fungicide applications are designed to protect these plant parts during the grain filling period.

The contribution of plant parts to yield varies with crop type and climatic conditions (*Table 2*). In Wheat the flag leaf is important as it can contribute over 40% of yield. In Barley, flag-2 and flag-1 contribute up to 15% and 40% of yield respectively (*Table 2*). These leaves appear at GS 30-33 and Barley usually requires a spray at this timing and a second application after flag leaf/head emergence.

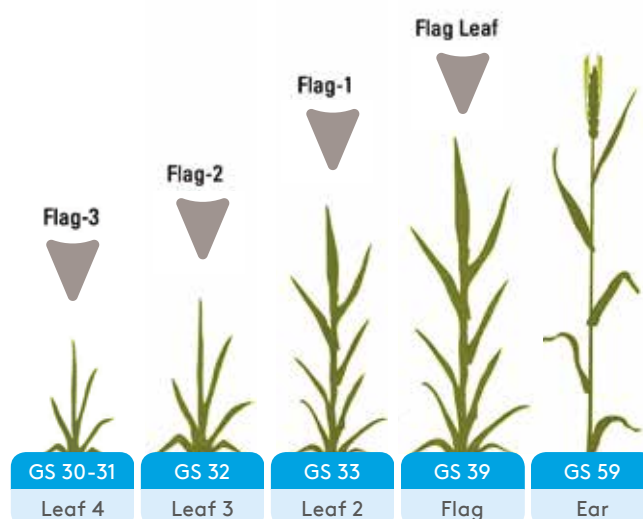


Figure 5. Cereal growth stages and key leaves contributing to yield during grain fill <sup>8</sup>.

Contribution of various plant parts to grain yield in Wheat and Barley <sup>6</sup>

Plant part	Wheat		Barley
	High rainfall zone	Low rainfall zone <sup>^</sup>	
Head/stem/sheath	22%	56-80%	22-38%
Flag leaf	43%	9-29%	5-9%
Flag-1	23%	0-23%	20-40%
Flag-2	7%	-	10-15%
Flag-3	3%	-	6%

Table 2. <sup>^</sup>Source – Vic DPI 2005

# Spray Programs

The decision about when to spray for diseases depends on:

- Disease pressure – depends on variety and weather events
- Visual symptoms – monitor the crop for infection levels
- Seed dressing/in-furrow application
- Crop growth stage – apply fungicides to protect plant parts that contribute most to yield
- Yield potential – in low disease + low yielding crops, fewer sprays are needed. In moderate to heavy disease + higher yielding crops, multiple fungicide inputs are often required.

## Spray programs for Wheat

**Single application** – a single application can control disease where disease pressure is low prior to flag leaf emergence (Table 3 on page 5).

In this situation, the most important timing for applying a fungicide is at flag leaf emergence (GS 37-39).

Trials have shown that a single application prior to flag leaf emergence may not protect the flag leaf or adequately control disease (Figure 6).

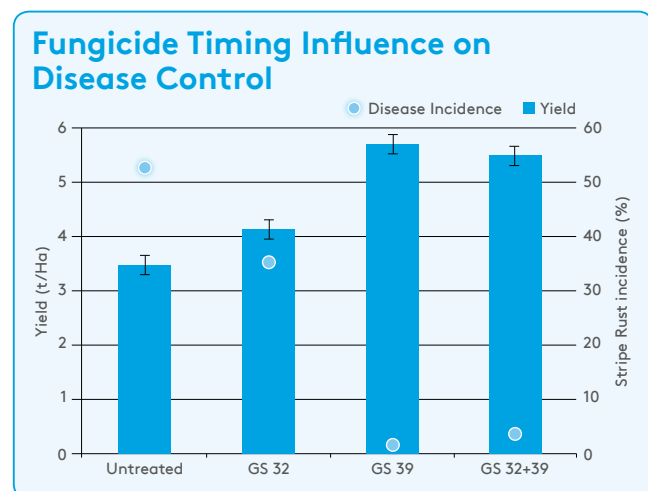


Figure 6. Comparison of fungicide timing from the start of stem elongation (GS 32) to flag leaf emergence (GS39) on Stripe Rust, Harden, NSW<sup>6</sup> (Bars denote yield LSD=0.2)

**Multiple applications** – application of two or more sprays is usually undertaken in susceptible varieties, particularly in higher yielding scenarios when weather conditions are conducive to outbreaks earlier in the crop (Figure 7 and Table 3). Seed/in-furrow treatments can protect crops from certain diseases from sowing to the start of stem elongation. Applications before stem elongation are not usually necessary but if required, use cheaper products such as Bumper® 625 and Orius® (Table 6 on page 11).

## Multiple spray strategies can be employed to protect key plant parts:

- |                             |  |
|-----------------------------|--|
| Apply GS 32 & GS 39:        | 1 <sup>st</sup> spray protects flag-2;<br>2 <sup>nd</sup> spray protects flag, flag-1  |
| Apply GS 33 & GS 59:        | 1 <sup>st</sup> spray protects flag-2 + flag-1;<br>2 <sup>nd</sup> spray protects grain head + flag leaf                                       |
| Apply GS 32, GS 39 & GS 59: | 1 <sup>st</sup> spray protects flag-2;<br>2 <sup>nd</sup> spray protects flag + flag-1,<br>3 <sup>rd</sup> spray protects grain head/peduncle. |

## Fungicide Timing Influence on Disease Control

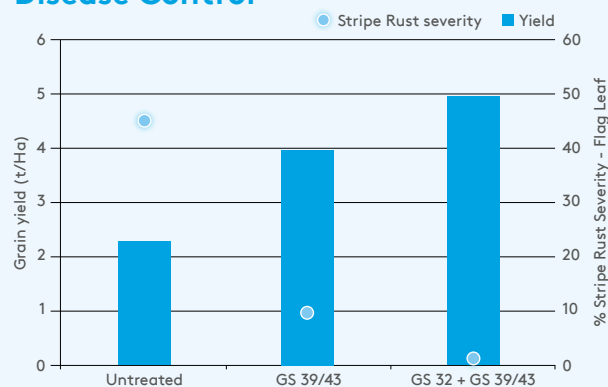


Figure 7. Comparison of fungicide timing at GS 39/43 or GS 32 + GS 39/43 on yield and Stripe Rust severity where disease onset occurs from GS 32, NSW 2004<sup>6</sup>



# Fungicide Programs

Wheat				
Expected Scenario	Sowing to late tillering	GS 32-33	GS 37-39	GS 59
High yield				
Low disease	-	Monitor/Spray	Monitor/Spray <sup>3</sup>	Monitor <sup>2</sup>
Mod disease	SD/IF <sup>1</sup>	Monitor/Spray	Spray <sup>4</sup>	Monitor/Spray
High disease	SD/IF + Monitor <sup>5</sup>	Spray	Spray	Monitor/Spray
Medium yield				
Low disease	-	Monitor/Spray	Monitor/Spray	Monitor
Mod disease	SD/IF	Monitor/Spray	Spray	Monitor
High disease	SD/IF + Monitor	Monitor/Spray	Spray	Monitor/Spray
Low yield				
Low disease	-	Monitor	Monitor/Spray	Monitor
Mod disease	-	Monitor/Spray	Monitor/Spray	Monitor
High disease	SD/IF + Monitor	Monitor/Spray	Monitor/Spray	Monitor

Table 3.

- 1 SD/IF - apply appropriate seed dressing or in-furrow treatment as part of a base fungicide program
- 2 Monitor - no spray is anticipated unless conditions become highly conducive i.e. prolonged wet conditions, head infections
- 3 Monitor/spray - check for disease and spray if fresh infection is present and conditions are conducive to disease
- 4 Spray - apply fungicide at this growth stage as part of a base fungicide program
- 5 SD/IF + Monitor - seed dressings/in-furrow treatments can provide control of Stripe Rust, Leaf Rust and Septoria tritici up to late tillering and stem elongation. Monitor crops during this period to ensure the effectiveness of these treatments and if required apply an early foliar spray.

Barley				
Expected Scenario	Sowing to late tillering	GS 25-31	GS 33	GS 39-59
High yield				
Low disease	SD/IF <sup>1</sup>	Monitor <sup>2</sup>	Spray <sup>3</sup>	Monitor
Mod disease	SD/IF	Spray GS 30-31	-	Monitor/Spray <sup>4</sup>
High disease	SD/IF + Monitor <sup>5</sup>	Spray GS 30-31	-	Spray
Medium yield				
Low disease	SD/IF	-	Spray	Monitor
Mod disease	SD/IF	Spray GS 30-31	-	Monitor/Spray
High disease	SD/IF + Monitor	Spray GS 30-31	-	Monitor/Spray
Low yield				
Low disease	SD/IF	-	Monitor/Spray	Monitor
Mod disease	SD/IF	Monitor/Spray	-	Monitor/Spray
High disease	SD/IF	Spray GS 30-31	-	Monitor/Spray

Table 4.

- 1 SD/IF - apply appropriate seed dressing or in-furrow treatment as part of a base fungicide program
- 2 Monitor - check crop regularly; no spray planned at this timing, but may be required in certain situations i.e. rainfall, fresh pustules/lesions
- 3 Spray - apply fungicide at this growth stage if targeting a single spray program
- 4 Monitor/spray - check for disease and spray if infection is present and conditions are conducive to disease
- 5 SD/IF + Monitor - seed dressings/in-furrow treatments can provide control of Scald, NFNB and Powdery Mildew up to late tillering and stem elongation. However, continue to monitor crops during this period to ensure the effectiveness of these treatments and spray with cheaper products if conditions favour disease i.e. rainfall, fresh pustules/lesions.

## Spray programs for Barley

Barley is less suited to a single spray timing as the flag leaf contributes less to yield than it does in Wheat. Flag-3 is the first significant leaf in Barley, whereas flag-2 is the first significant leaf in Wheat (Table 2). Barley is susceptible to a wide range of diseases and most varieties are susceptible to one or more diseases<sup>6</sup>. Applying a seed dressing or in-furrow treatment will delay onset of Scald and Powdery Mildew (Table 5).

**Single application** – if a single spray timing is intended, it should be at flag-1 emergence<sup>6</sup>. Flag-1 contributes more to yield than the other leaves and is a focal point for a single spray program. Apply a product with longer residual and superior protectant activity such as Radial® or Veritas® if Leaf Rust predominates. If Leaf Rust symptoms are present and a highly curative product is needed then the high rate of Soprano®, Radial® or Veritas® will be the best choices. If Net Blotch or Scald predominate, apply Bumper® 625.

**Multiple applications** – a spray program with two or more applications is usually required in Barley<sup>6</sup> (Table 4). Applications before stem elongation are not usually needed, but if required, apply a lower cost per hectare product such as Bumper® 625 (Table 7). The first spray is usually applied at the start of stem elongation when the first node is detectable (GS 30-31). Where required, a second application is made usually at awn peep (GS 49). Apply a product with longer residual activity such as Radial® or Veritas® if Leaf Rust predominates. If Net Blotch or Scald predominate, apply Bumper® 625.

## Product selection

Adama markets a range of fungicides in Cereals that control the majority of key foliar diseases (Tables 6 and 7 on pages 11 and 13). The choice of fungicide to apply will depend on:

- The disease/s present
- Severity of disease pressure
- Crop growth stage
- Yield potential
- Resistance management.

Fungicides differ in their disease spectrum and efficacy. Matching the right product to the pathogen at the right timing provides a greater likelihood of getting a profitable return on investment.

In lower yielding environments such as low rainfall regions, using high rates of the more expensive fungicides is seldom justified. In higher yielding environments under high disease pressure, application of the premium product/s are usually a more profitable option.



These photos were taken at a Septoria trial at Colac, Vic, 2013.

The photos illustrate the robust control that can be achieved on Septoria spp. with Radial®.





# Foliar Fungicide Range

## Radial® Fungicide

### Radial®

Radial® is a new broad spectrum foliar fungicide for use in Wheat and Barley. The unique strobilurin (*Group 11*) + DMI (*Group 3*) combination in Radial® provides both protectant and curative activity of all key diseases in Wheat and Barley. The combination of a strobilurin + DMI ensures extended disease protection.

Infections are targeted from the time of spore germination on the leaf surface through to mycelial development within leaves. Therefore, growers applying Radial® as a preventative treatment prior to spore germination will achieve the maximum benefit from both the strobilurin and DMI components.

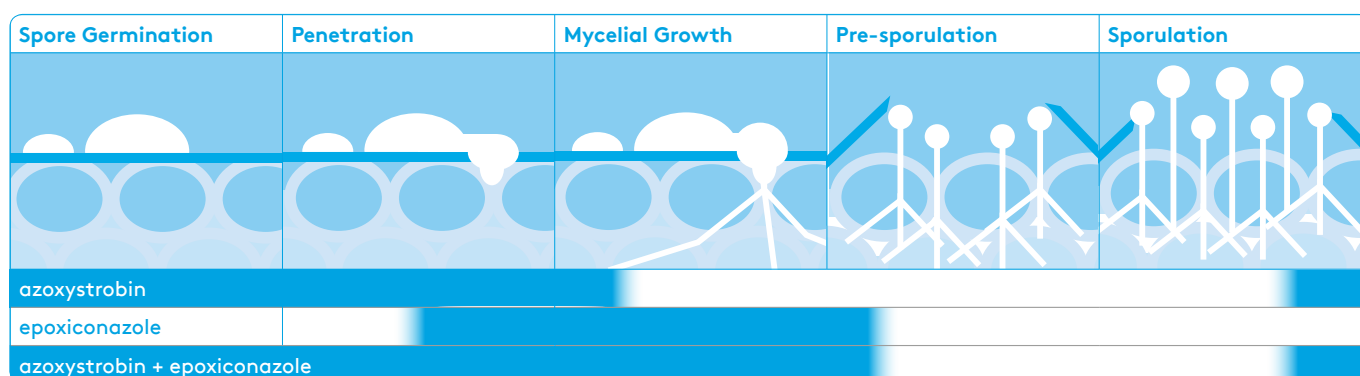


Figure 8. Fungicide impact on Rust developmental stages.

Highly effective

Little or no effect

#### Strobilurin component:

- Inhibits spore germination and host penetration during the early stages of fungal vegetative growth
- Exhibits translaminar and acropetal movement and redistribution in leaves
- Provides extended residual activity on spore germination.

#### DMI (triazole) component:

- Rapidly absorbed into leaves and transported acropetally to provide uniform protection throughout the leaf, active on the vegetative mycelia of the fungi with limited direct activity on spores.

Radial® has been proven in trials to offer excellent disease control and improved yield when compared to other market standards as highlighted in figures 9 & 10.

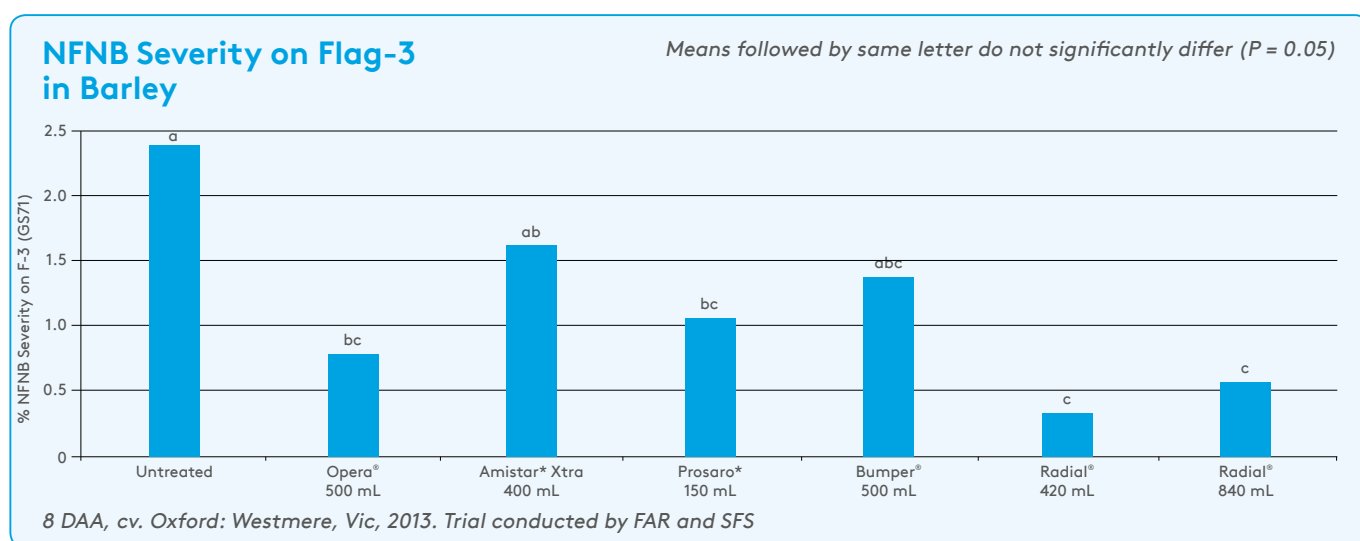
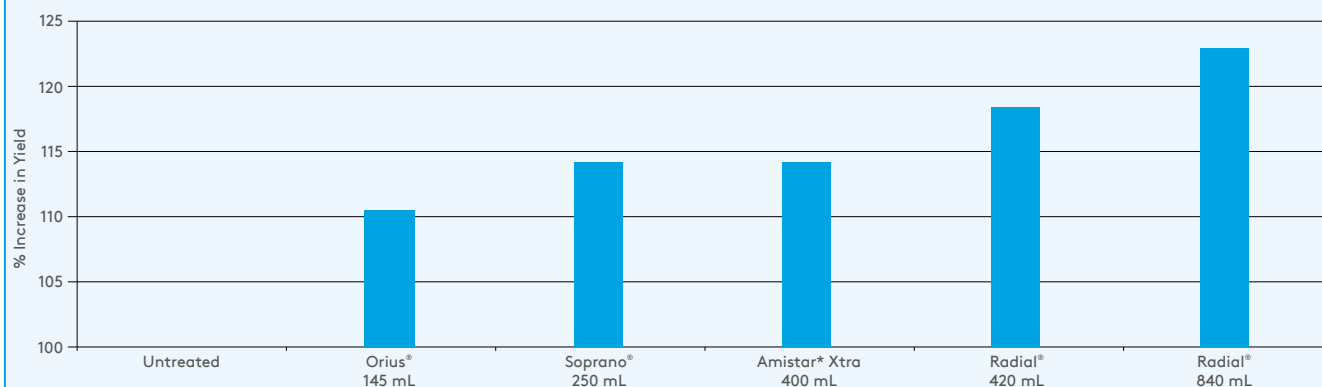


Figure 9.

All fungicide treatments in this SFS and FAR trial at Westmere in Victoria significantly decreased the disease level versus the untreated, except Amistar® Xtra and Bumper® which were not significantly different. Adama have now replaced Bumper® with the new highly concentrated and effective Bumper® 625 formulation. The trend seen in this trial illustrates the strength Radial® has against *Pyrenophora* spp diseases such as NFNBS when compared to some other fungicides.



### Wheat Yield Increase vs. Untreated Ave of 6 Trials, 2011-2013



Average across 6 trials in 2012 and 2013. Stem Rust, Stripe Rust, Powdery Mildew, YLS, YLS/Septoria

Figure 10.

This analysis of the average yield improvement achieved by Radial® in Wheat across a range of diseases and conditions shows that Radial® is an excellent Wheat fungicide and provides yield increases above those seen with alternative fungicides.

### Soprano®

The active ingredient of Soprano®, epoxiconazole, is the benchmark DMI fungicide for rust diseases in Cereals, however it also offers robust control across a range of key cereal diseases. Trial work has demonstrated that Soprano® is highly effective on both Stripe Rust and Leaf Rusts of Wheat and Barley (Figure 11).

A major benefit of Soprano® is that it offers up to four weeks residual control in addition to seven days post-infection activity on Rusts. Soprano® is often used in medium to high yielding crops under moderate to high disease pressure as it will control diseases for longer into the grain fill period than other fungicides such as propiconazole or tebuconazole.

### Soprano® Leaf Rust Control in Barley

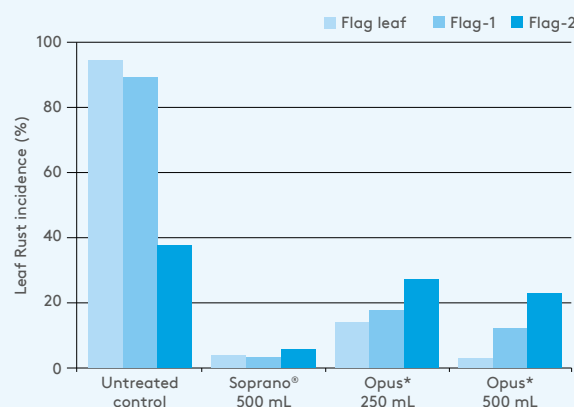


Figure 11. Efficacy of Soprano® on Leaf Rust in Barley



# Foliar Fungicide Range

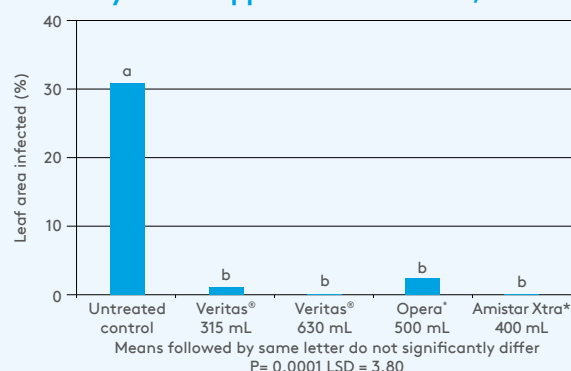
## Veritas®

Veritas® is a unique strobilurin + DMI fungicide that provides excellent disease control and yield improvements in cereal crops. Veritas® contains azoxystrobin 120 g/L + tebuconazole 200 g/L and offers very cost effective, high level disease control. With dual modes of action Veritas® offers broad-spectrum control of all key cereal diseases while also helping with resistance management. A highly compatible SC formulation, Veritas® offers outstanding flexibility and crop safety – extensively tested in Australia on multiple varieties and situations. With a higher triazole rate per hectare than equivalent DMI + Strobilurin fungicides Veritas® has the ability to offer higher levels of control when significant disease pressure is present. Figures 12 and 13 show the excellent level of control Veritas® offers against Leaf Rust in Barley. Veritas® also has the flexibility of being able to be used in multiple cropping situations including cereals, pulses and peanuts.



The photos above taken at a Barley Leaf Rust trial at Balliang, Victoria in 2011 highlight the excellent level of control that can be achieved by Veritas® under significant disease pressure. Photos taken 29 DAA

### A. Leaf Rust in Barley - Severity on Flag leaf 14 days after application Werribee, Vic. 2011



### B. Leaf Rust in Barley, Werribee, Victoria 2011 - Yield

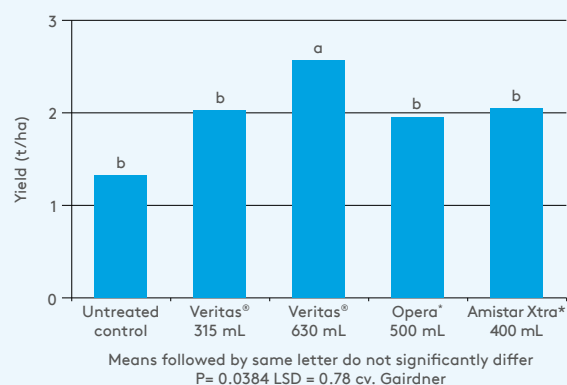


Figure 12. Veritas® offers similar disease control to other Group 11+3 products at 315 mL/Ha but has increased control and grain yield when used at 630 mL/Ha in this trial

## Bumper® 625

Bumper® 625 is a new highly effective and concentrated propiconazole formulation with use rates 2.5 times lower than the previous Bumper®. Bumper® 625 is registered on the broadest range of diseases in Wheat, Barley and Oats (Tables 6 and 7) and is effective on rusts, including Stem Rust, as well as stubble-borne diseases. One of the key strengths of propiconazole is that it provides a high level of control of Yellow Spot in Wheat (Figure 13). In Barley, propiconazole has strengths on diseases such as Net Blotch, Scald and Powdery Mildew.

## Orius®

Orius® (tebuconazole) is a systemic fungicide with post-infection activity and up to three weeks residual control. One of the major benefits of Orius® is that it is registered on a wide range of diseases in Wheat, Barley and Oats. Orius® is registered on problem diseases such as Stripe Rust and Stem Rust and also has some activity on Fusarium Head Blight (not registered for this purpose).

Orius® is one of the most widely used fungicides in low to medium yielding Wheat crops, as it is cost-effective and has greater efficacy and longer residual activity on key diseases such as Stripe Rust when compared with alternatives such as propiconazole.

### Yellow Leaf Spot Control in Wheat

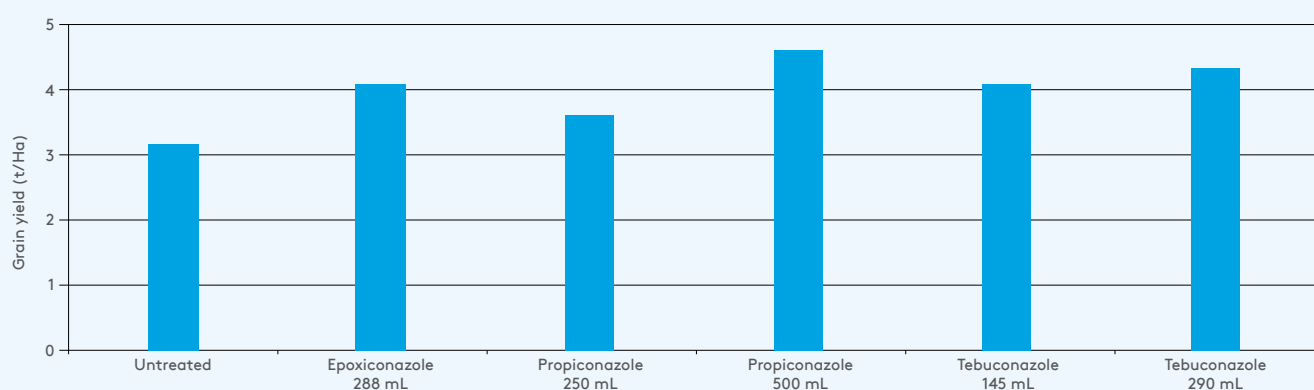


Figure 13. Efficacy of propiconazole and tebuconazole on Yellow Leaf Spot in Wheat can be seen in the final yield results in the above trial, Warwick QLD 1999. Propiconazole in this trial was Bumper® (250 g/L formulation). Rates shown for propiconazole equivalent to 100 mL/Ha and 200 mL/Ha of Bumper® 625 respectively.

## Rate selection

Changing the application rate will alter the efficacy, disease spectrum and residual control (Tables 6 and 7). If several applications are planned, growers may choose to apply split applications of the lower rate. However, in doing so, the spectrum of diseases controlled will be narrower. If higher rates are to be used, growers must ensure they do not exceed the maximum number of sprays permitted for the product for the season i.e. Orius® and Veritas®. This is to ensure that there are not excessive residues in the grain or hay, as well as ensuring that fungicide resistance management is considered.

## Resistance management

In situations where multiple applications of foliar fungicides are required in addition to seed dressing and/or in-furrow application, rotation with another mode of action group is recommended. Soprano®, Orius®, Bumper® 625, Phoenix® and Jubilee® are all Group 3 (DMI) fungicides. By rotating to a product containing an alternate mode of action such as Radial® or Veritas® (Tables 6 and 7), this will help to reduce the selection pressure on the Group 3 fungicides.

CropLife recommends that no more than 3 DMI treatments or formulations including a DMI treatment should be used in any one growing season. For fungicide resistance management Radial® and Veritas® are both a Group 3 and a Group 11 fungicide but CropLife recommend that group 3+11 mixtures like Radial® should be treated like a group 11 only fungicide for resistance management purposes. CropLife also suggest that no more than two group 11 or group 3+11 fungicides be used on any one crop.



# Cereal Fungicide Details

Table 5. Seed dressing and in-furrow fungicides for Wheat, Barley and Oats

Product	Active ingredients	Product type	Registered application rate × Pathogen													Withholding period¹		Equivalent trade name		
			Wheat							Barley				Oats	Wheat, Barley and Oats		Harvest		Grazing	
			Bunt/ Loose smut	Flag smut	Stripe Rust	Leaf Rust	Septoria Tritici	Take-all		Covered/ Loose Smut	Scald	Powdery Mildew	Foliar diseases (SFNB, NFNB, Scald and Leaf Rust)	Covered/ Loose Smut	Pythium Root Rot	Rhizoctonia Root Rot (bare patch)				
Phoenix® C	triadimenol 150 g/L + cypermethrin 4 g/L	Seed dressing	100-150 mL⁹/ 100 kg seed			-	-	-		100-150 mL⁹/ 100 kg seed				100 mL/ 100 kg seed	-	-	-	5 w	Baytan T*	
Jockey*	fluquinconazole 167 g/L	Seed dressing	300 mL or 450 mL/ 100 kg seed						450 mL/ 100 kg seed		300 mL/ 100 kg seed				-	-	-	NR	6 w Hay 12 w Milk	Maxiflo*
Jubilee® Loaded	flutriafol 500 g/L	In-furrow on fertiliser	-	-	100 mL/Ha or 200 mL/Ha	-	200 mL			-	100 or 200 mL/Ha			-	-	-	NR	4 w	Impact Endure*	
Evergol* Prime	penflufen 240 g/L	Seed dressing	40-80 mL/ 100 kg seed		-	-	-	-		40-80 mL/ 100 kg seed	-	-		-	-	40-80 mL/ 100 kg seed	NR	5 w	-	
Vibrance*	difenoconazole 66.2 g/L + metalaxyl-m 16.5 g/L + sedaxane 13.8 g/L	Seed dressing	180 mL/ 100 kg seed		-	-	-	-		180 mL/ 100 kg seed	-	-		Loose Smut only 180 mL/ 100 kg seed	180 mL/ 100 kg seed	360 mL/ 100 kg seed - Suppression	NR	6 w	-	
Systiva*	fluxapyroxad 333 g/L	Seed dressing	150 mL/ 100 kg seed	-	-	-	-	-		150 mL/100 kg seed#					-	150 mL/ 100 kg seed#	NR	4 w	-	

<sup>1</sup> Maximum use rate in QLD for Phoenix C is 100 mL/100 kg seed. w – weeks NR – Not required when used as directed # Suppression of Rhizoctonia in Wheat and Barley only

Table 6. Wheat fungicide guide

Product	Active ingredients	Registered application rate per hectare × Pathogen								Residual control	Rainfast interval	Aerial registration	Withholding period		Equivalent trade name
		Stripe Rust	Stem Rust	Leaf Rust	Powdery Mildew	Septoria Tritici	Septoria Nodorum	Yellow Spot					Harvest	Grazing	
Orius® 430 SC	tebuconazole 430 g/L	145 mL or 290 mL			-	290 mL	145 mL or 290 mL			Up to 4 weeks	2 hours	Yes	35 days	14 days	Folicur*
Bumper® 625	propiconazole 625 g/L	100 mL or 200 mL	200 mL	60 mL to 200 mL		100 mL or 200 mL	60 mL to 200 mL	100 mL to 200 mL		Approx. 3-4 weeks	1 hour		28 days	7 days	Tilt*
Prosaro*	prothioconazole 210 g/L + tebuconazole 210 g/L	150 mL to 300 mL				-	150 mL to 300 mL			At least 3 weeks	Not stated		35 days	14 days	-
Soprano® 125 SC	epoxiconazole 125 g/L	250 mL to 500 mL	-	500 mL	250 mL	-	500 mL	-		Up to 6 weeks	2 hours		42 days	42 days	Opus* 125
Amistar* Xtra	azoxystrobin 200 g/L + cyproconazole 80 g/L	400 mL to 800 mL	-	400 mL to 800 mL		-	-	400 mL to 800 mL		Up to 6 weeks	When spray is dry		42 days	21 days	-
Opera*	pyraclostrobin 85 g/L+ epoxiconazole 62.5 g/L	500 mL		500 mL to 1000 mL	500 mL	-	500 mL	-		At least 4 weeks	Not stated		NR	21 days	-
Veritas®	tebuconazole 200 g/L + azoxystrobin 120 g/L	315 mL to 630 mL#								Up to 6 weeks	2 hours		42 days	21 days	-
Radial®	epoxiconazole 75 g/L + azoxystrobin 75 g/L	420 mL to 840 mL								Up to 6 weeks	2 hours		42 days	42 days	-
Epidemiology × Pathogen									*Prosaro is registered for Fusarium Head Blight						
Primary survival between crops		V	V	V	S, V	S, V	S, V, Sd	S, V							
Growth stage when infected (Zadoks)		11-90	39	11-90	11-90	11-90	11-90	11-90							
Optimal spore germination range		10-15°C	18°C	15-25°C	15-25°C	16-25°C	20-25°C	19-23°C							
Optimal disease development range		12-15°C	18-30°C	10-20°C	15-22°C	15-22°C	20-25°C	21°C							
Latent period – optimal conditions		10-14 days	7-10 days	7-10 days	7-10 days	14-28 days	12-16 days	6-7 days							
Potential yield loss – susceptible variety		>80%	Up to 100%	40%	10%	50%	50%	50%							

\*Prosaro is registered for Fusarium Head Blight

V – volunteers S – stubble Sd – seed-borne

# Cereal Fungicide Details

Table 7. Barley and Oats fungicide guide

Product	Active ingredients	Registered application rate per hectare × Pathogen									Residual control	Rainfast interval	Aerial registration	Withholding period		Equivalent trade name
		Barley					Oats							Harvest	Grazing	
		Powdery Mildew	Scald	Spot Form Net Blotch	Net Form Net Blotch	Leaf Rust	Stem Rust	Leaf/ Crown Rust	Septoria							
Orius® 430 SC	tebuconazole 430 g/L	145 mL or 290 mL	145 mL	-	-	-	145 mL or 290 mL		-		Up to 4 weeks	2 hours	Yes	35 days	14 days	Folicur*
Bumper® 625	propiconazole 625 g/L	60 mL to 200 mL	200 mL	200 mL	-	-	200 mL	100 mL to 200 mL			Approx. 3-4 weeks	1 hour		28 days	7 days	Tilt*
Prosaro*	prothioconazole 210 g/L + tebuconazole 210 g/L	150 mL to 300 mL					300 mL		150 mL to 300 mL		At least 3 weeks	Not stated		35 days	14 days	-
Soprano® 125 SC	epoxiconazole 125 g/L	-	250 mL	-	250 mL to 500 mL		-	-	-		Up to 6 weeks	2 hours		42 days	42 days	Opus* 125
Amistar* Xtra	azoxystrobin 200 g/L + cyproconazole 80 g/L	400 mL to 800 mL	-	200 mL to 800 mL			-	-	-		Up to 6 weeks	When spray is dry		42 days	21 days	-
Opera*	pyraclostrobin 85 g/L+ epoxiconazole 62.5 g/L	500 mL to 1000 mL	500 mL	500 mL to 1000 mL		500 mL	-	-	500 mL		At least 4 weeks	Not stated		NR	21 days	-
Veritas®	tebuconazole 200 g/L + azoxystrobin 120 g/L	315 mL to 630 mL	315 mL	315 mL to 630 mL#			-	-	-		Up to 6 weeks	2 hours		42 days	21 days	-
Radial®	epoxiconazole 75 g/L + azoxystrobin 75 g/L	420 mL to 840 mL					-	-	-		Up to 6 weeks	2 hours		42 days	42 days	-
Epidemiology × Pathogen										<div>^ – Suppression Only</div> <div>#Veritas® registered for suppression only of Net Form Net Blotch and Spot Form Net Blotch.</div> <div><div>Acknowledgements:</div><div>1. Murray, G.M., and Brennan, J.P. (2009). Estimating disease losses to the Australian Wheat industry. Australasian Plant Pathology</div><div>Other Sources</div><div>Victorian Department of Primary Industries - <a href="http://new.dpi.vic.gov.au/">http://new.dpi.vic.gov.au/</a></div></div>						
Primary survival between crops		S, V	S, V	S, V	S,V	V	V	V	S, V							
Growth stage when infected (Zadocks Scale)		11-90	11-90	11-90	11-90	20-90	39	11-90	11-90							
Optimal spore germination range		15-20°C	15-25°C	10-25°C	10-25°C	20°C	15-30°C	15-25°C	16-25°C							
Optimal disease development range		15-22°C	15-25°C	15-25°C	15-25°C	25°C	20°C	20-25°C	20-28°C							
Latent period – optimal conditions		4-7 days	14-20°C	14-20	14-20	7-15 days	7-10 days	7-10 days	21-28 days							
Potential yield loss – susceptible variety		Up to 25%	45%	>30%	>30%	60%	Up to 100%	40%	Up to 50%							

V – volunteers S – stubble Sd – seed-borne

PLEASE NOTE:

This information is not intended to replace the product labels. Always read the complete product label appearing on the container before opening or using products. Product labels are also available on [www.adama.com](http://www.adama.com)

^ – Suppression Only  
#Veritas® registered for suppression only of Net Form Net Blotch and Spot Form Net Blotch.

**Acknowledgements:**

- Murray, G.M., and Brennan, J.P. (2009). Estimating disease losses to the Australian Wheat industry. Australasian Plant Pathology 38:558-570.
- Rees, R.G., and Platz, G.J. (1979). The occurrence and control of Yellow Spot of Wheat in north-eastern Australia. Australian Journal of Experimental Agriculture and Animal Husbandry, 19:369-372.
- Jayasena, K., Thomas, G., Loughman, R., Tanaka, K., MacLeod, B. (2009) Interaction between Wheat varieties and fungicides to control Stripe Rust for grain yield and quality. 2009 Agribusiness Crop Updates. Department of Agriculture and Food, Western Australia and the Grains Research and Development Corporation.
- Wallwork, H., and Zwer, P. (2011). Cereal Variety Disease Guide 2011. SARDI Factsheet, FS 7/86/11, [www.pir.sa.gov.au/factsheets](http://www.pir.sa.gov.au/factsheets).
- Queensland Government, Primary Industries and Fisheries - <http://www.dpi.qld.gov.au/home.htm>
- Poole, N. (2005). Cereal Growth Stages Guide. Grains Research and Development Corporation.
- Poole, N. (2004). The use of foliar fungicides for disease management in Cereals. In “Cereal Foliar Disease Workshop for Advisers”. Grains Research and Development Corporation.
- Poole, N. (2009). Disease Management and Crop Canopies - What are the interactions? Grains Research and Development Corporation.
- Colson, E.S., Platz, G.J., Usher, T.R. (2003). Fungicidal control of *Pyrenophora tritici-repentis* in Wheat. Australasian Plant Pathology, 32:241-246.

**Other Sources**

Victorian Department of Primary Industries - <http://new.dpi.vic.gov.au/>

New South Wales Department of Primary Industries - <http://www.dpi.nsw.gov.au/>

Grains Research and Development Corporation - <http://www.grdc.com.au/>

Australian Cereal Rust control program - <http://www.rustbust.com.au/>



adama.com



Veritas® and Radial® are available through Adama Innovation Centre retailers.

Visit [adama.com](http://adama.com) for further details.

® Registered trademarks of an Adama Agricultural Solutions Ltd Company.  
\* Registered Trademarks

Please note: This information is not intended to replace the product labels. Always read the complete product label appearing on the container before opening or using products. Product labels also available on [adama.com](http://adama.com)



Radial

Scan here for the latest information and resources for Radial®



Veritas

Scan here for the latest information and resources for Veritas®



Disease Management Hub

Join the **Adama Disease Management Hub** to get the latest information and offers during the season.

For Technical Assistance:  
**1800 327 669**

For more information visit  
**[adama.com](http://adama.com)**

For Customer Enquiries:  
**1800 4 ADAMA**