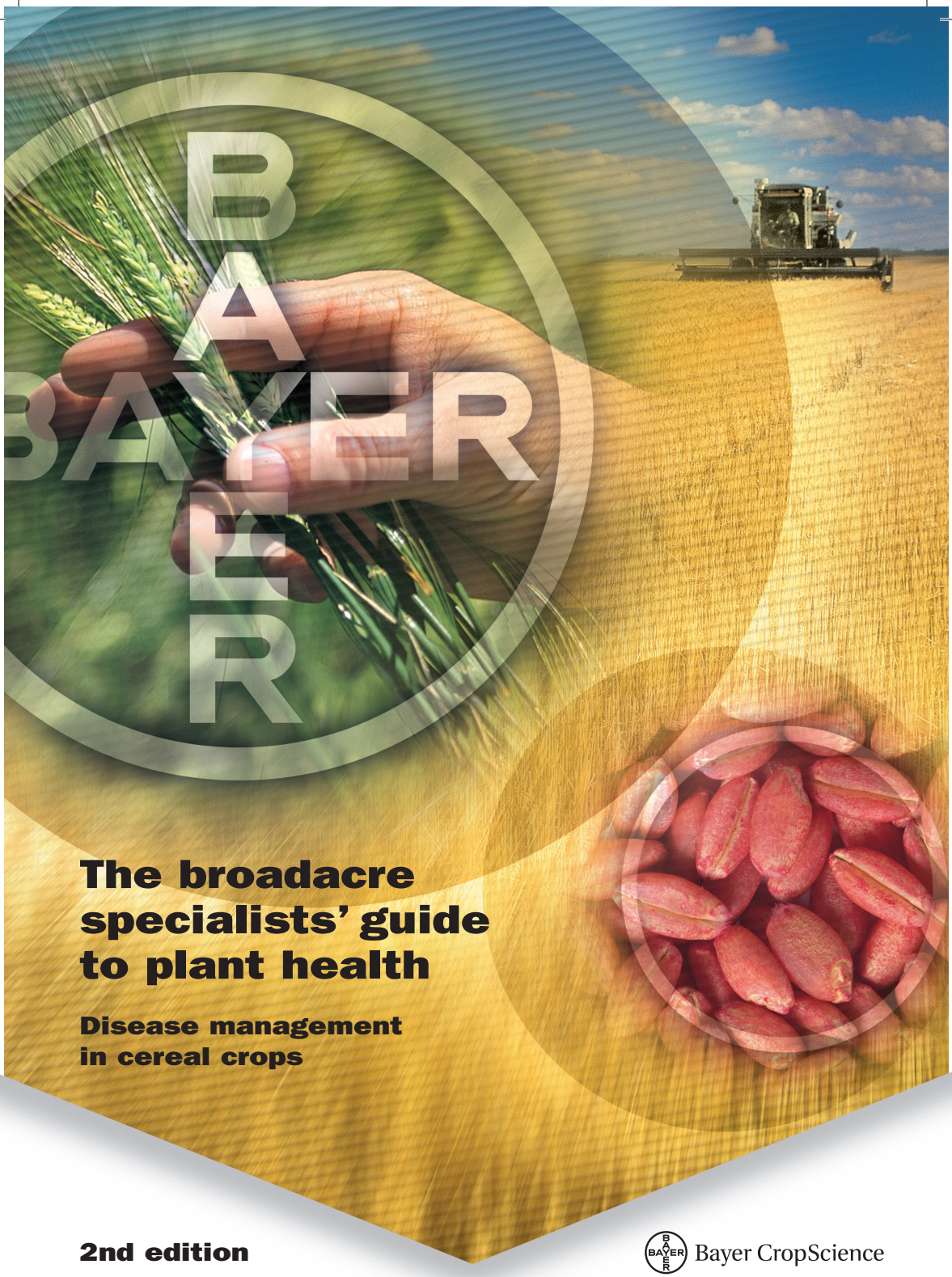


The broadacre specialists' guide to plant health

Disease management in cereal crops

2nd edition

Bayer CropScience

CONTENTS

Introduction

The fungal diseases of cereals described in this guide can reduce crop yield enormously, largely by damaging green leaves and preventing them from producing the sugars and proteins they need for growth.

Understanding your fungicidal management options, and the most cost-effective use of them, is essential to maximise returns. The management of fungal diseases is the new frontier for Australian cereal producers, ensuring better yields from season to season.

This guide can be used in two ways.

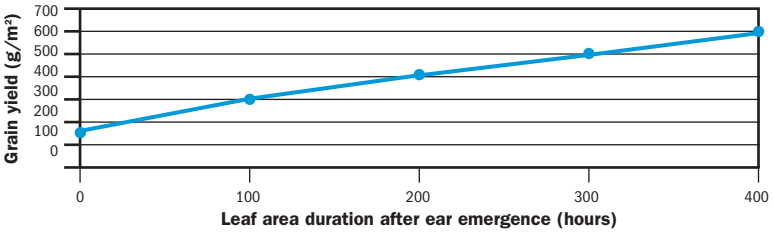
- You can use the tables on pages 6 to 9 to plan strategic protection programs for each of the three main cereal crops that will help prevent the development of a range of diseases.
- If, on the other hand, you know your crop is threatened by a particular disease (because of variety, your previous crop was infected or it's in the district and the conditions are favourable), you can look up that disease in the index on the left and use the disease-specific treatment table in that section.

Photos courtesy of Robert Park, Planting Breeding Institute, Cobbitty. Additional disease information from Hugh Wallwork Cereal Leaf and Stem Diseases SARDI & GRDC 2000.

Fungicidal control and yield

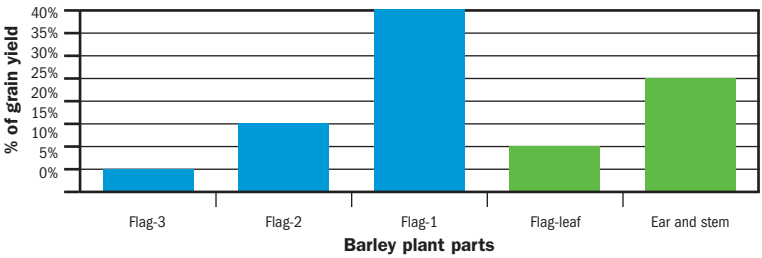
These tables show how great an impact leaf damage can have on grain yield. Timely fungicidal treatment can help maximise crop vigour and green leaf area to protect your potential yield, and additionally reduce inoculum levels to prevent or reduce disease carry-over into future crops.

Relationship between grain yield and green leaf area duration



Evans et al. 1975, in Crop Physiology, Editor L.T. Evans Cambridge University Press. Fig 5.7 p 129.

Contribution to grain filling – barley

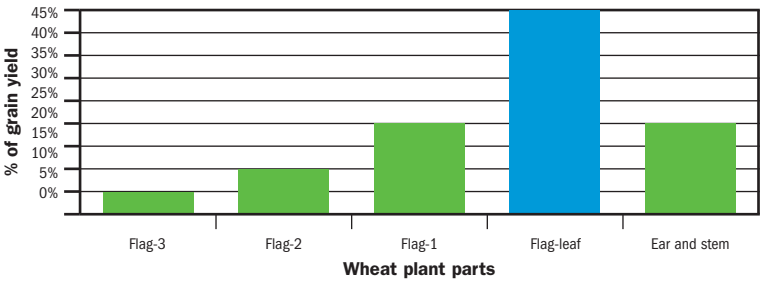


Collectively contribute to 60% of yield.

Flag-3 = 3 leaves below flag leaf

Source: GRDC cereal disease update 2002.

Contribution to grain filling – wheat



Contributes to 45% of yield.

Flag-3 = 3 leaves below flag leaf

Source: GRDC cereal disease update 2002.

Your plant health guide

The crop protection plans in this guide have been designed to give you the best possible chance to optimise your yields.

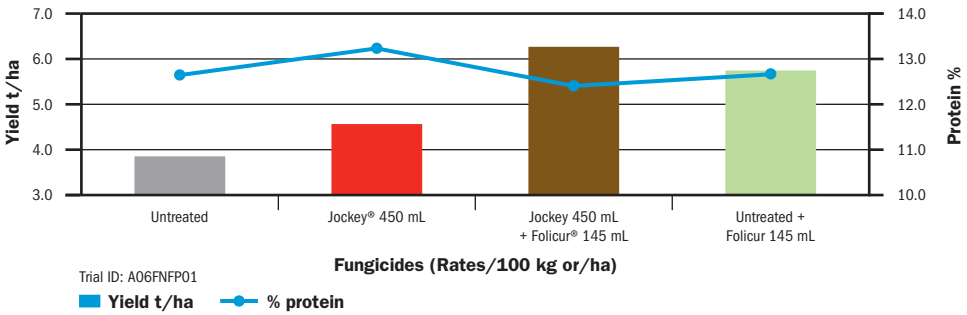
How to make the most of your plant health guide.

The crop protection plans in this guide have been designed to give you the best possible chance to optimise your yields.

You will see that using fungicides at planting and as foliar applications is an effective way to keep disease out of your crops. Timing is also crucial for successful control of disease in your cereal crops. Whilst using either a seed treatment or a foliar fungicide is beneficial in terms of yield and grain quality, using a combination of both clearly gives you the best results.

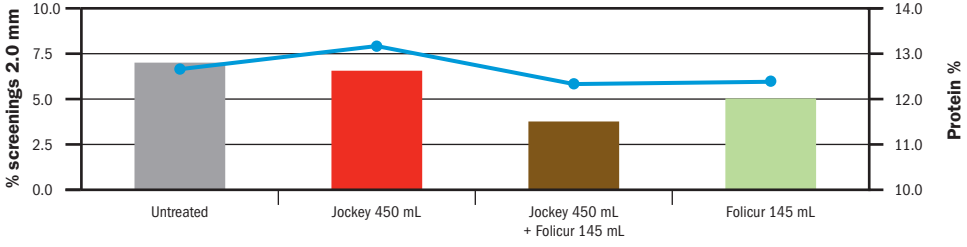
Indeed, research conducted over several seasons has proven that the best approach to plant health is to use a seed treatment followed by a foliar fungicide.

Influence of seed treatment and foliar fungicides on yield (t/ha) and % protein of Mitre wheat

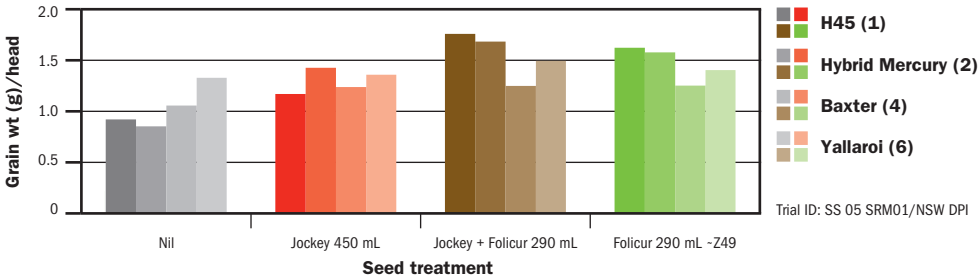


Independent results

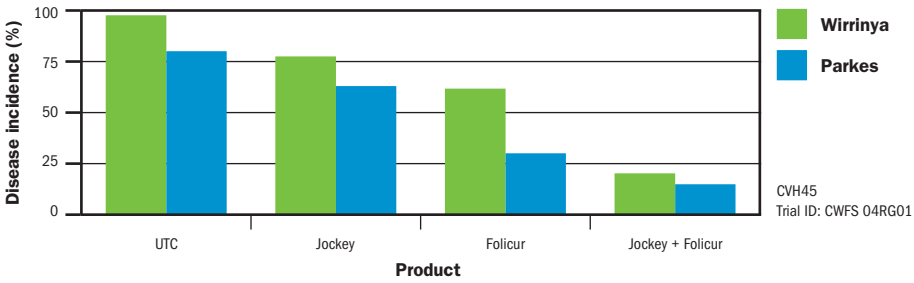
Influence of fungicide treatment on % protein and screening wheat cv Mitre – Yalla Y Poora, Victoria



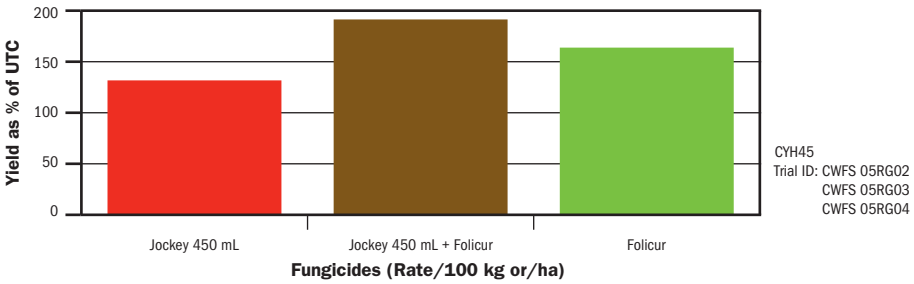
Effect of various seed and foliar treatments on wheat grain yield (g/head) in the presence of stripe rust



Flag leaf stripe rust incidence – wheat



Average yield, moderate stripe rust pressure sites (3 trials) – wheat

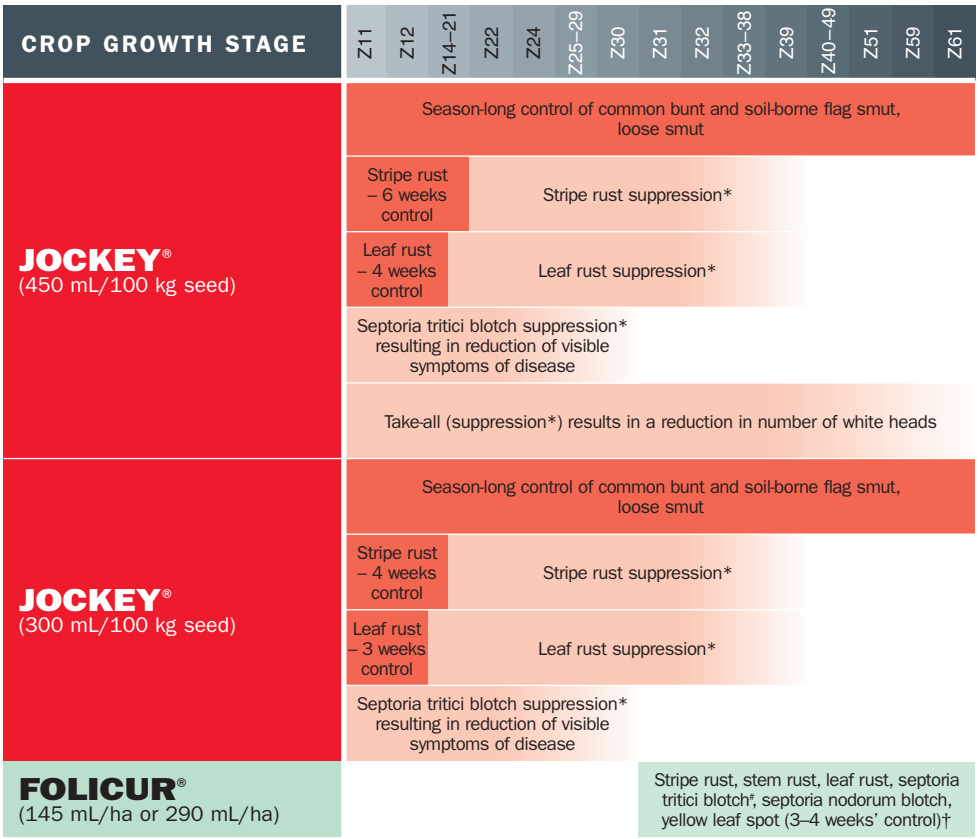


Wheat protection plans

This range of wheat protection plans allows for various levels of investment depending on the likely severity of infection and the projected yield potential of the crop.

Premium wheat protection plan

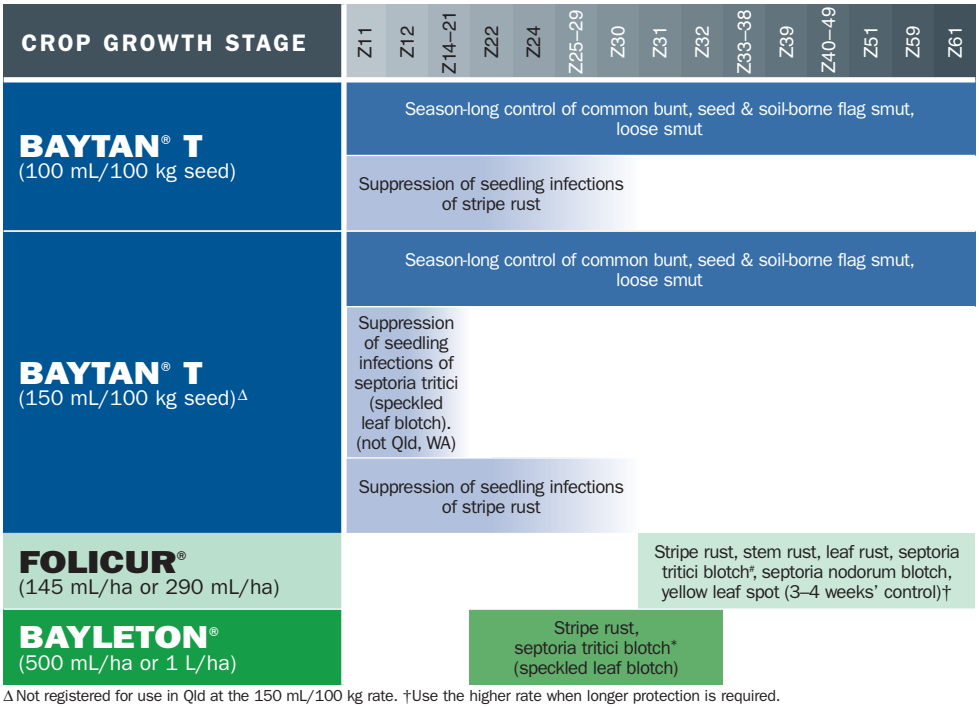
The premium protection plan is suited to areas where productive rainfall can be relied upon and yields are normally high, and/or where there is also a high risk of foliar disease.



*Suppression delays the development of disease once infection occurs as described by the Jockey label. Continue to monitor the crop to determine the need for supplementary control measures against foliar diseases.
†Use the higher rate when longer protection is required.
#290 mL/ha only.

Standard wheat protection plan

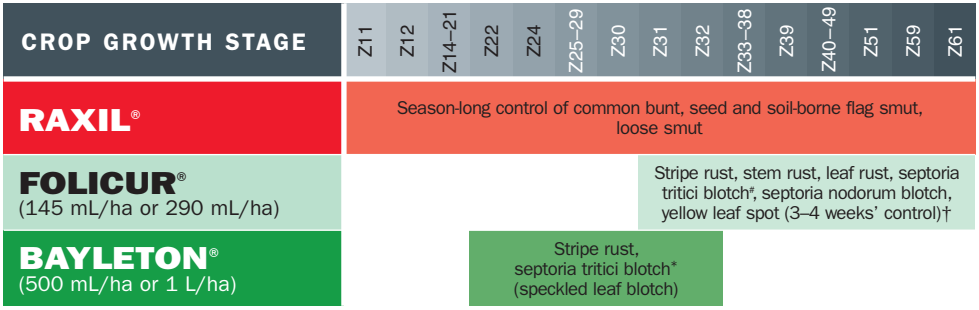
This plan will suit most growing areas, where establishment is usually good but adequate rain during the growing season cannot be relied upon, and/or where the risk of foliar disease is moderate to high.



Δ Not registered for use in Qld at the 150 mL/100 kg rate. †Use the higher rate when longer protection is required.
#290 mL/ha only. *1 L/ha only in MIA and NW Vic.

Economy wheat protection plan

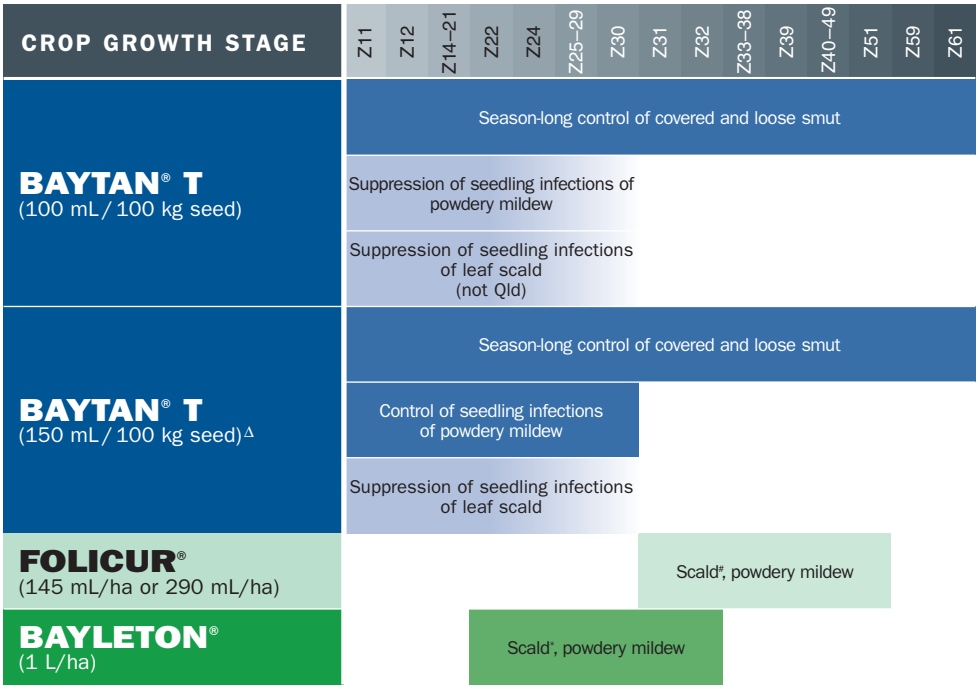
The economy plan is best implemented in cropping areas where yields are traditionally lower because rainfall levels are very likely to be marginal throughout the growing season.



†Use the higher rate when longer protection is required. #290 mL/ha only. *1 L/ha only in MIA and NW Vic.

Barley protection plan

This plan should be implemented in all barley growing areas. The high rate of Baytan may be necessary when successive barley crops increase the potential for disease development.



Δ Not registered for use in Qld at the 150 mL/100 kg rate.
If the spot form of net blotch is an issue, consider a foliar spray of propiconazole.
#145 mL/ha only.
*NSW, Vic, Tas, SA, WA.

Oats protection plan

This plan should be considered in any areas known to have a high risk for disease, or where crops are being grown for the export hay market.

CROP GROWTH STAGE	Z11	Z12	Z14–21	Z22	Z24	Z25–29	Z30	Z31	Z32	Z33–38	Z39	Z40–49	Z51	Z59	Z61
BAYTAN® T (100 mL/100 kg seed)	Season-long control of covered and loose smut														
FOLICUR® (145 mL/ha or 290 mL/ha)												Crown rust, stem rust			

Treatment options

	WHEAT				
DISEASE	JOCKEY®	BAYTAN®	RAXIL®	FOLICUR®	BAYLETON®
Covered smut (or bunt in wheat)	✔	✔Δ	✔		
Loose smut	✔	✔Δ	✔		
Flag smut (seed-borne)	✔	✔Δ	✔		
Flag smut (soil-borne)	✔	✔Δ	✔		
Stripe rust seedling infections (suppression)	S	SΔ†			
Stripe rust seedling infections (control)	✔			✔	✔
Stripe rust	S			✔	✔
Leaf rust seedling infections (suppression)	S				
Leaf rust seedling infections (control)	✔			✔	
Leaf rust	S			✔	
Stem rust				✔	
Crown rust					
Powdery mildew seedling infections (suppression)					
Powdery mildew seedling infections (control)					
Powdery mildew					
Leaf scald seedling infections (suppression)					
Leaf scald					
Septoria tritici blotch seedling infections (suppression)	S	S*†			
Septoria tritici blotch				✔†	✔***†
Septoria nodorum blotch				✔	
Yellow leaf spot				✔	
Take-all (suppression)	S				

*Not registered for use in Qld or WA. **Not registered for use in Qld. ***MIA & North Western Victoria only. ****NSW, Vic, Tas, SA, WA.
S = Suppression ✔ = Control

BARLEY				OATS		
BAYTAN®	RAXIL®	FOLICUR®	BAYLETON®	BAYTAN®	RAXIL®	FOLICUR®
✔Δ	✔			✔	✔	
✔Δ	✔			✔	✔	
						✔
						✔
S^Δ						
✔Δ†		✔	✔			
		✔	✔			
S**						
		✔	✔****			

†Rate dependent; refer to label. ΔNot registered for use in Qld at the 150 mL/100 kg rate.

Take-all

Hay-die
Gaeumannomyces graminis

Take-all (often called hay-die) is a major fungal disease of wheat and barley in the winter rainfall areas of Australia. It is most often seen when a wheat crop follows wheat, barley or a grassy pasture. The fungus penetrates the centre of the roots, effectively 'blocking the plumbing.'

Symptoms:

- Take-all can show up in winter or early spring as stunted, yellowing plants. It is often most obvious however, after hot, dry weather at heading when whiteheads appear in patches.
- The paddock symptoms are harder to see in barley than wheat, despite the disease being present.
- The primary roots should be checked for black lesions. After a damp spring the subcrown internodes, crown roots and tiller bases may also be blackened.

Take-all life-cycle:

SUMMER	The severity of take-all generally increases as soil alkalinity increases (pH rises) and fertility (especially nitrogen and phosphorous) decreases.
AUTUMN	Soil compaction aggravates take-all. Cool weather (12°C – 18°C) is more favourable than warm weather.
WINTER	Take-all predisposes wheat to drought stress, especially in June and July. The disease is more severe when wheat is sown early than when sown near the end of winter or early spring.
SPRING	Wet soil, especially in spring and early summer, is highly favourable to the disease.

Reasons to treat:

Take-all can cause very serious yield losses in wheat. If patches of whiteheads are seen, the loss may be from 20 to 50 per cent of the potential yield. However, losses up to 20 per cent can occur in crops with no whiteheads. Although barley can become heavily infected, yield losses are generally less than in wheat.

Other control measures:

- Ensure each wheat crop is preceded by a take-all disease break. Use oats, grain legumes, legume pastures or an oilseed crop.
- Because grasses host take-all, good control of grasses and self-sown cereals is important.

Fungicide options:

CROP GROWTH STAGE Wheat only	Z11	Z12	Z14–21	Z22	Z24	Z25–29	Z30	Z31	Z32	Z33–38	Z39	Z40–49	Z51	Z59	Z61
JOCKEY® (450 mL/100 kg seed)	Suppression (wheat only)														

Flag smut

Urocystis agropyri

Plants infected with flag smut can be difficult to detect early in the season because the disease causes stunting that keeps them out of sight. In very heavily infected crops, though, large numbers of loose black spores may become obvious as crops are harvested.

Symptoms:

- Long, grey-black raised streaks on leaves, leaf sheaths and occasionally stems.
- The streaks break through the plant tissues to reveal a mass of powdery grey-black spores.
- Affected leaves are often twisted and split lengthways.
- Affected plants may produce numerous tillers, some of which lodge.
- If heads emerge, they produce poor grain.

Flag smut life-cycle:

SUMMER	Wind-borne spores from wheat straw spread the disease after harvest. Smut survives both in soil (potentially for years) and on the surface of seed in summer storage.
AUTUMN	Sowing infected seed, or clean seed into infected soil, carries the disease into the following season's crop.
WINTER	Stunting may make affected plants hard to spot.
SPRING	Heads fail to emerge or produce low quality grain.

Reasons to treat:

- Substantial reduction in yield.
- Likely downgrading and possible rejection of grain.
- Contamination of grain and soil that will cause carry-over into subsequent crops.

Other control measures:

- Replace seed from infected crops with clean seed.
- Sow resistant varieties.

Fungicide options:

	WHEAT	
	Flag smut (seed-borne)	Flag smut (soil-borne)
JOCKEY®	✔	✔
BAYTAN®	✔Δ	✔Δ
RAXIL®	✔	✔

Δ Not registered for use in Qld at the 150 mL/100 kg rate.

Covered smut

Tilletia laevis/Tilletia tritici (wheat) Ustilago segetum var. hordei (barley/oats)

Covered smut or bunt in wheat is spread by spores released from ruptured smut balls at harvest. Those spores contaminate both seed and soil, and are more likely to infect wheat seedlings if the weather is cool and the soil is moist at planting. Infection is greater in barley when conditions at planting are warmer (14-25ºC).

Symptoms:

- Infected plants may grow more slowly than healthy ones, and stay green for longer.
- Smut balls take the place of the grain in the head.
- The smut balls often break during threshing, releasing the spores.
- Strong fishy odour (wheat)

Covered smut or bunt life-cycle:

SUMMER	Both soil and seed are contaminated by spores released at harvest.
AUTUMN	Smut spores carried over on the seed or in the soil infect the emerging seedlings.
WINTER	Mycelium grows inside the plant behind the growing point.
SPRING	Smutted heads with smut balls instead of grain provide the first clear symptoms.

Reasons to treat:

- Smutted grain is not accepted into the bulk handling system.
- Contamination can be hard to eliminate without regular seed treatment.

Other control measures:

- Sow resistant varieties.
- Replace infected seed with new seed from an uncontaminated source.

Fungicide options:

	WHEAT				BARLEY		OATS	
	Covered smut (bunt in wheat)	Loose smut	Flag smut (seed-borne)	Flag smut (soil-borne)	Covered smut	Loose smut	Covered smut	Loose smut
JOCKEY®	✔	✔	✔	✔				
BAYTAN®	✔Δ	✔Δ	✔Δ	✔Δ	✔Δ	✔Δ	✔	✔
RAXIL®	✔	✔	✔	✔	✔	✔	✔	✔

Δ Not registered for use in Qld at the 150 mL/100 kg rate.

Loose smut

Ustilago tritici (wheat/barley)
Ustilago avenae (oats)

Spores are released from the emerging heads of affected plants and can infect florets of other plants. Moist conditions during flowering favour the spread of loose smut.

Symptoms:

- Dark brown powdery spores in place of florets at head emergence.
- Once the spores are released (soon after head emergence), the head is gradually reduced to a bare stalk.

Loose smut life-cycle:

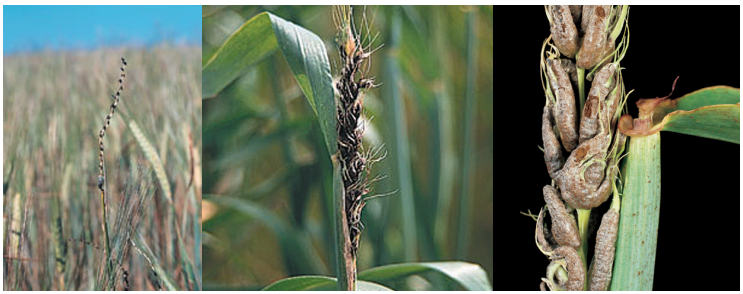
SUMMER	Infected but healthy-looking grain is harvested without detection of the contamination.
AUTUMN	Untreated infected seeds produce diseased plants that will develop spores in place of florets.
WINTER	Wind-borne spores from the smutted heads of infected plants infect the florets of neighbouring plants.
SPRING	Newly infected plants grow normally, but carry the fungus in the developing seed.

Reasons to treat:

- Loss of potential yield.
- Barley affected by loose smut may not be accepted for malting.

Other control measures:

- While the level of resistance to loose smut varies across grain varieties, there is a shortage of detailed information to help you select more resistant varieties.



Fungicide options:

	WHEAT				BARLEY		OATS	
	Covered smut (bunt in wheat)	Loose smut	Flag smut (seed-borne)	Flag smut (soil-borne)	Covered smut	Loose smut	Covered smut	Loose smut
JOCKEY®	✔	✔	✔	✔				
BAYTAN®	✔Δ	✔Δ	✔Δ	✔Δ	✔Δ	✔Δ	✔	✔
RAXIL®	✔	✔	✔	✔	✔	✔	✔	✔

Δ Not registered for use in Qld at the 150 mL/100 kg rate.

Stripe rust

Puccinia striiformis

Even wheat varieties that are resistant to stripe rust at later growth stages may be susceptible as seedlings. Stripe rust cannot survive in soil or plant debris – it requires green host plants (usually wheat or barley grass) to remain a threat from one season to the next.

Symptoms:

LEAF INFECTION:

- Yellow/orange powdery pustules on the leaf surface arranged in stripes parallel to the veins of the leaf.

HEAD INFECTION:

- Discoloured florets with evidence of yellow rust spores.

Stripe rust life-cycle:

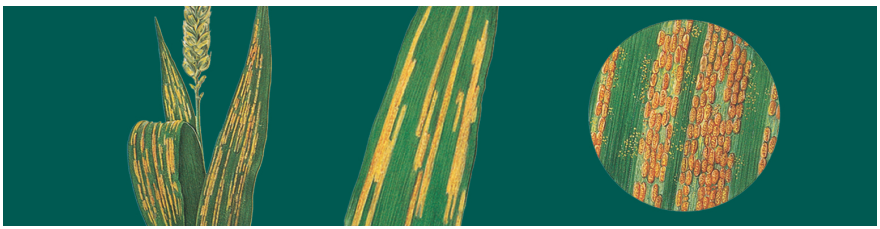
SUMMER	Rust requires host plants like volunteer wheat and barley grass for its survival. It cannot survive in soil or crop residues.
AUTUMN	Spores are blown from host plants to growing wheat crops.
WINTER	Spores germinate on the leaf surface and can rapidly multiply. Germination is favoured by temperatures of 8–15°C and moist conditions.
SPRING	Infection can occur after flowering, as weather warms less infection occurs.

Reasons to treat:

- Leaf infection reduces green leaf area and subsequently the plant's ability to fill grain, potentially reducing yield.
- Head infection will produce shrivelled grain, increased screenings and potentially seed staining.

Other control measures:

- Grow varieties with a favourable resistance rating.
- Graze or remove any volunteer wheat or barley grass that emerges from summer rains.



Fungicide options:

CROP GROWTH STAGE		Z11	Z12	Z14–21	Z22	Z24	Z25–29	Z30	Z31	Z32	Z33–38	Z39	Z40–49	Z51	Z59	Z61
BAYTAN® (100 or 150 mL/100 kg seed)Δ		Suppression only														
JOCKEY®	(450 mL/ 100 kg seed)	Control (6 weeks)					Suppression*									
	(300 mL/100 kg seed)	Control (4 weeks)					Suppression*									
FOLICUR® (145 mL/ha or 290 mL/ha)									Control							
BAYLETON® (500 mL/ha or 1 L/ha)					Control											

Δ Not registered for use in Qld at the 150 mL/100 kg rate.
*Suppression delays the development of disease once infection occurs as described by the Jockey label. Continue to monitor the crop to determine the need for supplementary control measures against foliar diseases.

Leaf rust

Puccinia triticina

Like stripe rust, leaf rust needs green host plants to survive between crops. It is important to plant resistant varieties, to help manage the disease from season to season.

Symptoms:

- Small circular to oval pustules only on the upper surface of the leaves, which produce light-brown spores.
- As the crop matures, the pustules will turn black.

Leaf rust life-cycle:

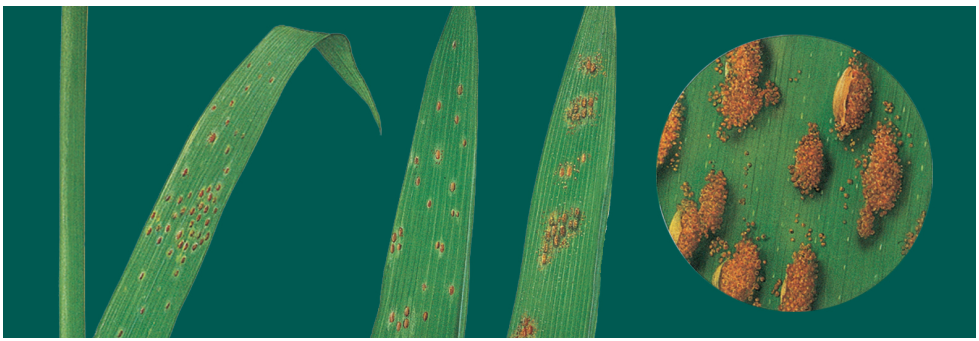
SUMMER	Rust requires host plants like volunteer wheat for its survival. It cannot survive in soil or crop residues.
AUTUMN	Spores are blown from host plants to growing wheat crops.
WINTER	Spores germinate on the leaf surface and can rapidly multiply. Germination is favoured by temperatures of 15–22°C and moist conditions.
SPRING	Fungus established on crops sown early spreads to those sown late.

Reasons to treat:

- Leaf infection reduces green leaf area and subsequently the plant's ability to fill grain, potentially reducing yield.

Other control measures:

- Remove volunteer wheat between crops.
- Avoid early sowing of varieties that are not fully resistant.



Fungicide options:

CROP GROWTH STAGE	Z11	Z12	Z14–21	Z22	Z24	Z25–29	Z30	Z31	Z32	Z33–38	Z39	Z40–49	Z51	Z59	Z61
JOCKEY® (450 mL/100 kg seed)	Control (4 weeks)			Suppression*											
JOCKEY® (300 mL/100 kg seed)	Control (3 weeks)			Suppression*											
FOLICUR® (145 mL/ha or 290 mL/ha)				Control (more than one application may be necessary)#											

At 290 mL/ha only 1 application is permitted per year. At 145 mL/ha up to 2 applications may be made per year.
*Suppression delays the development of disease once infection occurs as described by the Jockey label. Continue to monitor the crop to determine the need for supplementary control measures against foliar diseases.

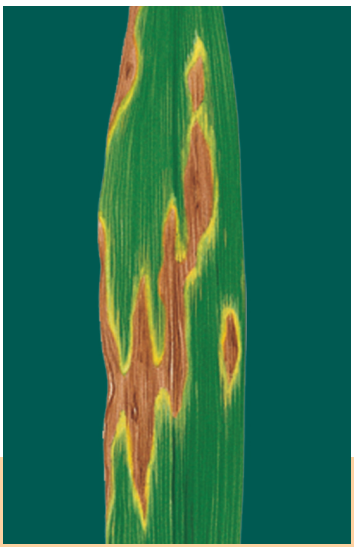
Septoria tritici blotch

Mycosphaerella graminicola

Also known as speckled leaf blotch because of its characteristic appearance, this fungus produces windborne spores after rain early in the season. The resulting 'spore showers' can infect any wheat that has already emerged.

Symptoms:

- The disease will be seen as irregular, elongated blotches, often striped at the leaf edges.
- The lesions bear characteristic black pycnidia and are surrounded by a yellow chlorotic halo.



Septoria tritici blotch life-cycle:

SUMMER	Survives on crop residues.
AUTUMN	Following rain early in the season, the fungus produces spores that are blown around by the wind in spore showers to infect young crops.
WINTER	The spores germinate on the leaves and create a root-like structure that penetrates the leaves. The pycnidia that eventually develop release further spores which infect neighbouring plants.
SPRING	Rain encourages the development of the disease, while 3 or 4 dry weeks will slow it down.

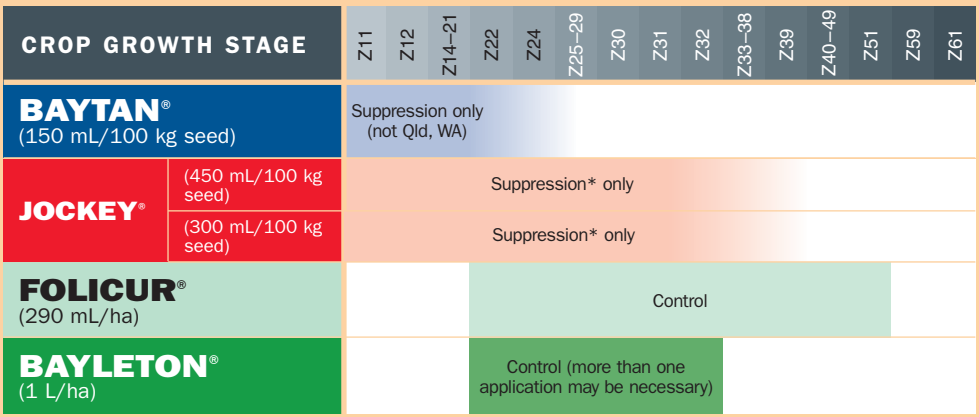
Reasons to treat:

- Leaf infection reduces green leaf area and subsequently the plant's ability to fill grain, potentially reducing yield.
- The damage caused by this fungus can range from nil to almost total loss of a crop.
- Intensity of the disease depends entirely on the time of onset of infection and the weather.
- Some varieties have better resistance than others.

Other control measures:

- Avoid sowing susceptible wheat varieties close to infected stubble.
- Sowing resistant varieties will reduce the inoculum for subsequent years.

Fungicide options:



*Suppression delays the development of disease once infection occurs as described by the Jockey label. Continue to monitor the crop to determine the need for supplementary control measures against foliar diseases.

Septoria nodorum blotch

Stagonospora nodorum

The development and spread of septoria nodorum blotch is favoured by warm, wet weather. Severe damage can occur after heavy and frequent rain.

Symptoms:

- Yellow or tan/brown blotches appear on the leaves.
- Blotches are oval-shaped and become grey as they enlarge and the leaves die.
- Blotches can have dark centres and thin yellow margins.

Septoria nodorum blotch life-cycle:

SUMMER	This fungus survives on infected plant debris – including barley grass and brome grass as well as wheat and barley.
AUTUMN	Airborne spores produced within the plant debris are blown into the developing crops.
WINTER	Further spores are produced in the crop and dispersed by rain splashes.
SPRING	Warm, wet weather encourages the continuing spread of the disease.

Reasons to treat:

- Disease becomes more damaging and noticeable later in the season.
- Reduced green leaf area results in reduced yield.
- Heavy infection can result in blotching over the ear, leading to grain shrivelling and the complete loss of the seed.

Other control measures:

- Do not grow wheat continuously, especially if the stubble is retained.
- Where septoria nodorum has occurred, reduce the crop debris by grazing or tillage to lessen the disease severity in subsequent years.

Fungicide options:

CROP GROWTH STAGE	Z11	Z12	Z14–21	Z22	Z24	Z25–29	Z30	Z31	Z32	Z33–38	Z39	Z40–49	Z51	Z59	Z61
FOLICUR® (145 mL/ha or 290 mL/ha)								Control							

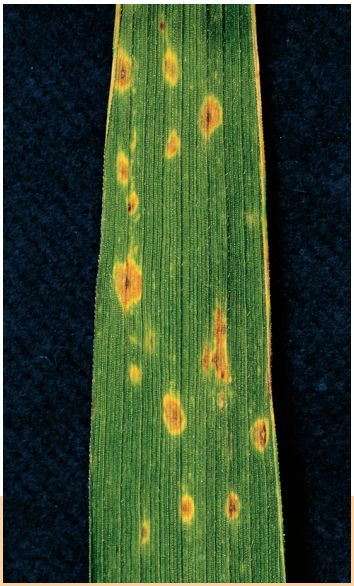
Yellow leaf spot

Pyrenophora tritici-repentis

This disease requires wet weather to become established. Although other cereals are not as badly affected as wheat, their stubble can become infected and provide inoculum for carry-over into a subsequent wheat crop.

Symptoms:

- Tan spots with yellow margins appear on the leaves.
- Spots vary in size and shape and are often elongated.
- These spots often expand and join together.
- Tips of severely affected leaves soon yellow and die.



Yellow leaf spot life-cycle:

SUMMER	Following harvest, the disease survives on crop stubble.
AUTUMN	Small black fruiting bodies (pseudothecia) are produced and survive on the previous season's stubble.
WINTER	Under humid conditions, the spores are forcibly ejected and blown onto emerging new wheat plants.
SPRING	Once the weather becomes drier, the progress of the disease stops.

Reasons to treat:

- Leaf infection reduces green leaf area and subsequently the plant's ability to fill grain, potentially reducing yield.

Other control measures:

- Select varieties with higher levels of resistance.
- Bury, burn or graze wheat stubble before sowing.

Fungicide options:

CROP GROWTH STAGE	Z11	Z12	Z14–21	Z22	Z24	Z25–29	Z30	Z31	Z32	Z33–38	Z39	Z40–49	Z51	Z59	Z61
FOLICUR® (145 mL/ha or 290 mL/ha)								Control							

Powdery mildew

Blumeria graminis* f.sp. *hordei

High humidity encourages the build-up of powdery mildew, but rain can slow epidemics by washing away spores. Wheat is rarely as severely infected as barley.

Symptoms:

- Colonies of fungal spores appear as fluffy white growth on the surface of the leaf.
- The area surrounding the spores turns yellow as the fungus depletes the leaf nutrients.
- Older infections turn grey and may develop small black fruiting bodies called cleistothecia.
- Moderate to severe infection leads to premature yellowing and eventually the death of the entire leaf.

Powdery mildew life-cycle:

SUMMER	The fungus survives on plant residues, where spores are produced.
AUTUMN	The autumn break releases those spores to infect volunteer barley.
WINTER	The infected weeds in turn produce spores that are likely to be the main source of infection in the barley crop.
SPRING	Secondary infection can occur very quickly as white powdery spores are produced within the crop canopy and blown onto neighbouring plants.

Reasons to treat:

- Early infection in the crop, in the crop stage leading up to stem elongation, has the greatest effect on yield, as it can reduce the number of tillers.
- Infection can reduce green leaf area and subsequently the plant's ability to fill grain, potentially reducing yield.

Other control measures:

- Although some barley varieties are more resistant than others, powdery mildew is not usually severe enough to justify selecting them.

Fungicide options:

CROP GROWTH STAGE	Z11	Z12	Z14–21	Z22	Z24	Z25–29	Z30	Z31	Z32	Z33–38	Z39	Z40–49	Z51	Z59	Z61
BAYTAN® (100 mL/100 kg seed)	Suppression only														
BAYTAN® (150 mL/100 kg seed)	Control (not Qld)														
FOLICUR® (145 mL/ha or 290 mL/ha)				Control											
BAYLETON® (1 L/ha)				Control											

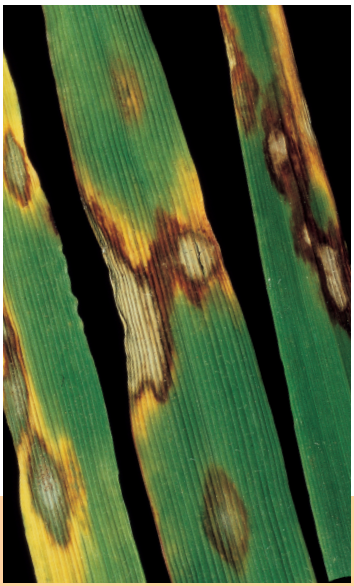
Leaf scald

Rhynchosporium secalis

The pathogen population that causes scald can vary enormously, so barley varieties may have different levels of resistance in different areas – and become susceptible in a particular locality as the pathogen population changes.

Symptoms:

- Lower leaves are usually the first affected by scald.
- The first sign of the disease is a blue/grey/green water-soaked area on the leaf.
- These lesions become bleached, with a distinctive brown margin.
- Lesions are most commonly seen on the leaf blades, but are also seen on the leaf sheath and head when the level of infection is high.



Leaf scald life-cycle:

SUMMER	Scald is carried over from season to season in plant residues and infected seed.
AUTUMN	If it occurs, scald is normally more severe in crops sown early. Moisture is crucial to the spread of the disease, which is not wind-borne.
WINTER	Spores produced within the crop are spread by rain-splash.
SPRING	What originally appears as a blue/grey/green water-soaked area on the leaf becomes a bleached lesion with a distinctive brown margin.

Reasons to treat:

- Scald is potentially very damaging in barley because an infection can kill leaves prematurely, reduce seed weight and subsequently yield.
- A severe early infection can reduce the number of heads and grains per head.
- In highly productive crops, yield losses of up to 45% are possible with associated grain quality reductions.

Other control measures:

- Avoid very early sowing.
- Choose resistant varieties.
- Bury, burn or graze infected stubble before sowing.

Fungicide options:

CROP GROWTH STAGE	Z11	Z12	Z14–21	Z22	Z24	Z25–29	Z30	Z31	Z32	Z33–38	Z39	Z40–49	Z51	Z59	Z61
BAYTAN® (100 mL or 150 mL/100 kg seed)	Suppression only (not Qld)														
FOLICUR® (145 mL/ha)								Control							
BAYLETON® (1 L/ha)				Control											

Stem rust

Puccinia graminis* f.sp. *tritici
Puccinia graminis* f.sp. *avenae

WHEAT OATS

Stem rust is one of the less common fungal diseases, but it can also be one of the most damaging. If conditions are favourable for its spread, stem rust can cause a total loss of your wheat or oat crop.

Symptoms:

- Large oval pustules on stems, leaves and heads.
- Each pustule is filled with ruddy brown powdery spores.
- Stem rust in both wheat and oats can be mistaken for leaf rust. The keys to distinguishing stem rust are that the pustules are larger and less round; the spores are darker; and they are not only on the tops of the leaves.

Fungicide options:

CROP GROWTH STAGE	Z11	Z12	Z14–21	Z22	Z24	Z25–29	Z30	Z31	Z32	Z33–38	Z39	Z40–49	Z51	Z59	Z61
FOLICUR® (145 mL/ha or 290 mL/ha)#								Control							

In extreme cases, repeat application after 3 weeks may be required.
#Only a single application is permitted when using the 290 mL/ha rate.

Crown rust

Puccinia coronata* f.sp. *avenae

Also known as leaf rust, crown rust in oats is a major problem – particularly when conditions are moist and warm just after sowing. It has the potential to halve yield and reduce the palatability of any hay or forage that can be salvaged.

Symptoms:

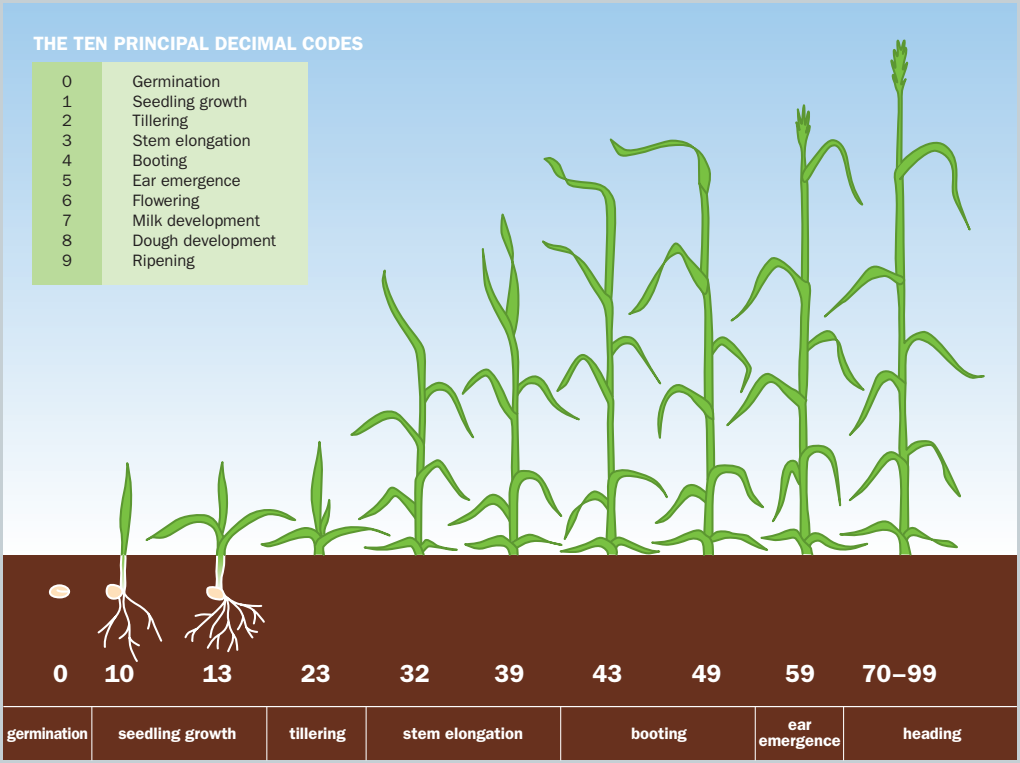
- Small orange pustules appear – initially only on the upper surface of leaves.
- Each pustule produces a mass of readily dispersed orange spores.
- Later in the season, the orange spores are replaced by more widespread black ones.

Fungicide options:

CROP GROWTH STAGE	Z11	Z12	Z14–21	Z22	Z24	Z25–29	Z30	Z31	Z32	Z33–38	Z39	Z40–49	Z51	Z59	Z61
FOLICUR® (145 mL/ha or 290 mL/ha)#								Control							

#Only a single application is permitted when using the 290 mL/ha rate.

THE ZADOKS GROWTH SCALE



Bayer CropScience Pty Ltd ABN 87 000 226 022
391–393 Tooronga Road East Hawthorn, Vic. 3123
Ph (03) 9248 6888 www.bayercropscience.com.au
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