MARCH 2013

IRRIGATED WHEAT FACT SHEET

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NORTHERN REGION

DISEASE MANAGEMENT IN IRRIGATED WHEAT

Good disease management has an important role in maximising yield and quality in irrigated wheat crops.

KEY POINTS:

- Irrigating wheat increases green leaf retention in the crop canopy, potentially increasing disease pressure where cultivars are susceptible.
- Fungicide application is unlikely to be profitable on varieties with resistance ratings of moderately resistant (MR) or resistant (R) unless disease pressure is high due to neighbouring susceptible (S) crops.
- Disease ratings are an excellent guide but each crop needs to be managed according to disease levels in the paddock.
- Use fungicides to keep the top three leaves of the crop plants (flag, flag-1 and flag-2) free from disease to maximise green leaf area during grain-fill.
- The timing and number of fungicide sprays will depend on disease pressure and onset, but in general, fungicides need to be applied between first node to booting (GS31 to GS45) to protect the top three leaves of the crop canopy.

Fungicide strategy

Aim to apply a fungicide at flag leaf emergence (GS39) to protect the three top leaves.

Where disease onset is early or the crop is a susceptible cultivar sown with no seed dressing or in-furrow fungicide, an earlier spray at GS31 to GS32 will be needed.

Where stem rust (Puccinnia graminis) *is the principal target, consider an additional fungicide application at ear emergence.*

In wheat or durum where there is a high risk of Fusarium *head blight, an application at early flowering may be beneficial.*

The shorter seasons of the northern region mean a fungicide application at ear emergence to support the flag-leaf spray is unlikely to be necessary in most seasons.

Irrigating wheat increases the need for disease control in disease-susceptible cultivars because:

- increasing moisture availability extends the period for which leaves remain green, thus increasing the opportunity for disease development;
- irrigation increases yield potential, which requires application of nitrogen to achieve that potential; and
- more moisture and nitrogen increases canopy density and humidity, creating conditions conducive to disease development.

Options

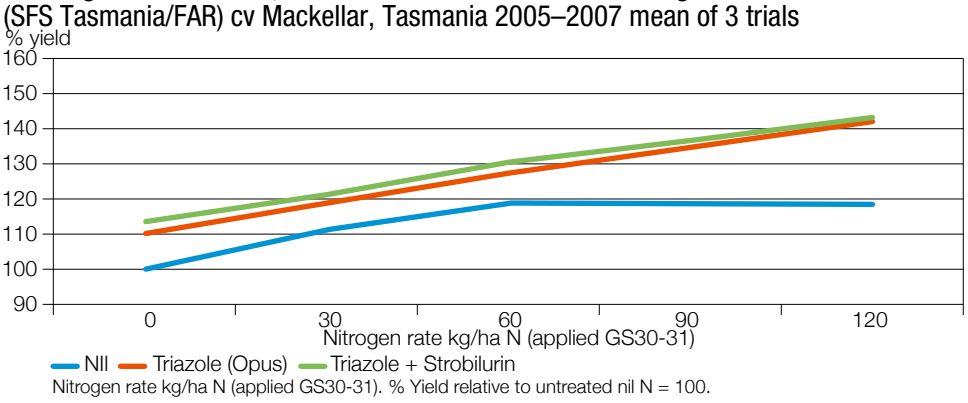
Fungicide application is not the only control method to be considered in managing wheat diseases.

Cultural options need to be considered before fungicides are used. In some

instances a good combination of cultural controls can eliminate the need for fungicide use. Growers can minimise the potential for a disease epidemic by:

- destroying cereal volunteers that host rust over summer;
- burning cereal residues harbouring stubble-borne disease such as yellow spot; and
- selecting cultivars with high levels of resistance to minimise the impact of a given level of inoculum.

As nitrogen rate increases, so does the need for rust control in irrigated wheat.
(SFS Tasmania/FAR) cv Mackellar, Tasmania 2005–2007 mean of 3 trials



Nitrogen rate kg/ha N (applied GS30-31). % Yield relative to untreated nil N = 100.

Resistance effect

The wet 2010 season produced ideal conditions for many of the principal foliar diseases.

Under these high-moisture, disease-conducive conditions yield responses to fungicides applied to national variety trials (NVT) in New South Wales correlated very strongly to the disease resistance ratings of the cultivars in the trials.

There was marginal economic benefit from applying fungicide to cultivars rated moderately resistant (MR) or resistant (R) when the principal disease was stripe rust (*Puccinia striiformis*). However, economic responses were obtained in cultivars with ratings of moderately resistant to moderately susceptible (MR to MS) and more susceptible categories.

While disease ratings are an important guide, growers need to respond to what is happening in the paddock since changes to rust pathotypes in particular can lead to previously resistant cultivars becoming susceptible.

Even without such a change, a moderately resistant cultivar may be infected if it is placed under pressure by spores from surrounding paddocks of susceptible cultivars.

Spray timing

It is important to apply fungicides at the right time.

Fungicides are insurance inputs and need to be applied before the crop canopy, particularly the top three leaves (flag, flag-1 and flag-2), become heavily infected with disease.

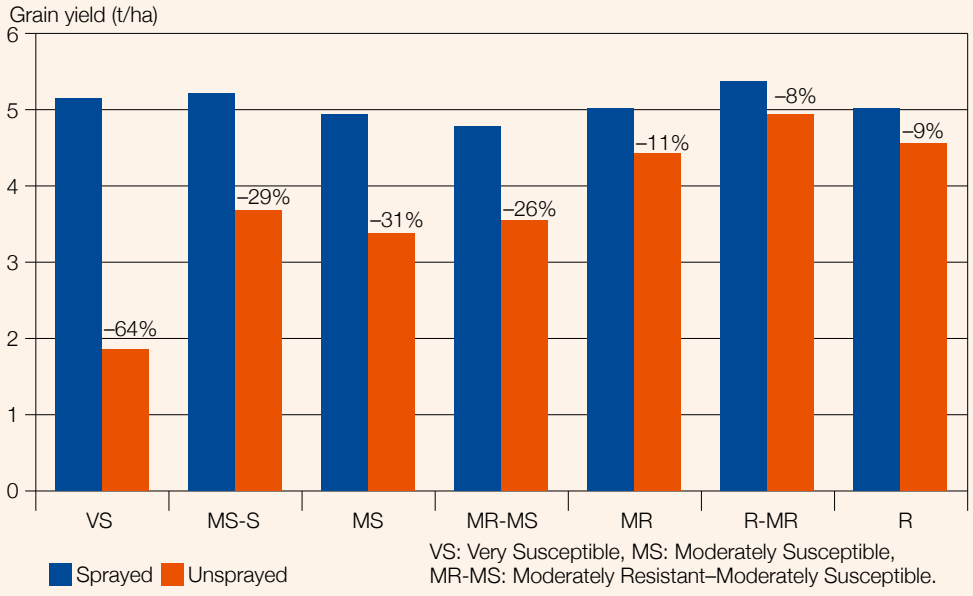
Foliar-applied triazole chemicals (the most commonly-used fungicides in cereals) move in only one direction in the crop, travelling in the xylem towards the leaf tip. They work better as protectants than they do as

Resistance ratings change when new disease pathotypes emerge

Always manage stripe rust on the basis of what is observed in the paddock, and be aware that high inoculum pressure from neighbouring susceptible cultivars will lead to greater infection pressure.

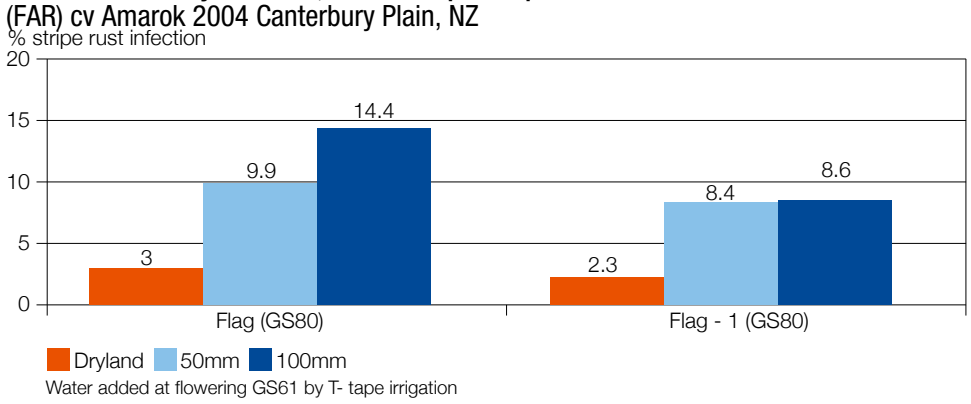
In 2010 a new stripe-rust pathotype (Yr17–27) was identified for the first time. Where this pathotype is present, cultivars such as Livingston$^{\phi}$, Mira and EGA Ruby will not be resistant to stripe rust.

Influence of stripe rust resistance rating on fungicide response.
NSW I & I NVT Cultivar Trials 2010



VS: Very Susceptible, MS: Moderately Susceptible,
MR-MS: Moderately Resistant–Moderately Susceptible.

As water availability increases, so does stripe rust pressure.
(FAR) cv Amarok 2004 Canterbury Plain, NZ



Head emergence fungicide

Head emergence fungicide is optional and is most profitable when stem rust or Fusarium head blight is the target disease. A spray at head emergence applies fungicide to the head before infection occurs and tops up the protection in the top two leaves given by earlier applications.

A spray at head emergence can be more important in irrigated wheat in longer-season southern environments because of the increased duration of grain-fill in cooler conditions.

curative or eradicant inputs.

To best protect the top three leaves, which are the main yield-contributing leaves, a fungicide needs to be applied between first node (GS31) and booting (GS45); the period in which these leaves emerge from the main stem. Sprays applied in this period should provide good protection against foliar diseases such as stripe rust (*Puccinia striiformis*) and yellow leaf spot or tan spot (*Pyrenophora tritici-repentis*).

Staying green

Fungicides are best applied during stem elongation, but their principal benefit is seen during grain fill (GS71 onwards), when the crop benefits from the greater area of green leaf available as a result of effective disease control.

Fungicide-treated crops stay greener for longer, which increases leaf area duration (LAD) and leads to improved yields. Irrigation increases the risk of disease in susceptible cultivars but offers greater opportunities of profitable return from fungicide application since irrigated crops stay greener for longer than their rain-fed equivalents.

Timing strategy

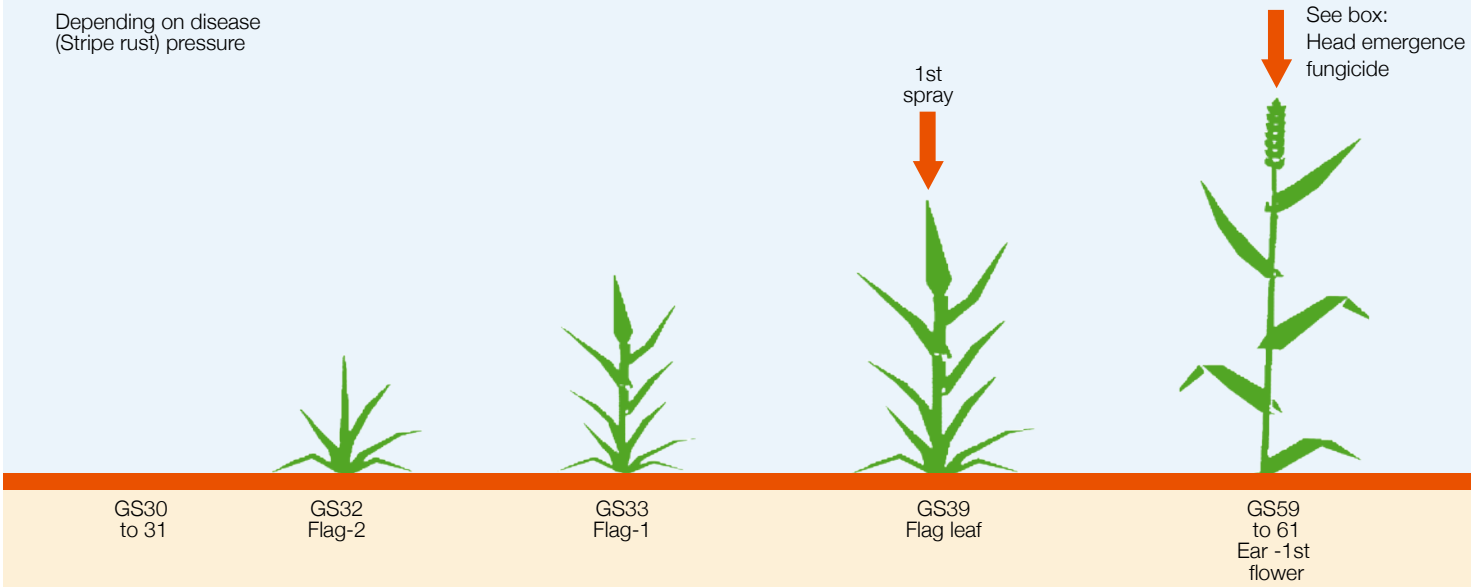
The key timing for a single fungicide application in irrigated wheat crops is flag leaf emergence on the main stem (GS39), since at this growth stage the top three leaves on the main stem are fully emerged.

However, if stripe rust or yellow leaf spot infections occur earlier, say at the start of stem elongation (GS30 to GS31), delaying a fungicide until flag leaf emergence will result in the loss of green leaf in the two leaves below the flag (flag-1 and flag-2).

If there is early disease onset, two fungicide sprays will be needed; one prior to flag leaf at first to second node (between GS31 to GS32) and a second at flag leaf (GS39).

A single early spray applied at GS32

Fungicide timings for later onset of disease at flag leaf GS39 in irrigated wheat.



will not control disease in the two upper leaves, since it does not protect leaves that emerge after the chemical is applied.

This is a critical issue in an irrigated crop where irrigation maintains ideal conditions for disease over an extended period.

Up-front impact

Use of 'up front' fungicides such as Jockey® (fluquinconazole) or Impact® (flutriafol) can influence the need for and timing of foliar fungicides.

With stripe rust, using the full rate of one of the 'up front' products will often protect the crop until the flag leaf emerges, though there may be little active ingredient remaining in the top two leaves at that stage.

Where an up-front fungicide has been used, aim to apply a foliar fungicide at flag leaf emergence (GS39). In dryland crops a full-rate application of an up-front product might be all that is needed, since drier, more hostile conditions during grain fill naturally reduce green leaf retention and stripe rust pressure.

However, in irrigated wheat crops, up-front measures need to be followed up by a foliar fungicide in order to fully protect the top two leaves of the canopy during grain fill.

These measures do not control all foliar diseases.

Cultivar response

Note: In varieties with adult plant resistance (APR), greater resistance to stripe rust can be exhibited at later growth stages.

Selecting cultivars with better disease resistance has two effects on the progress of a disease in a crop:

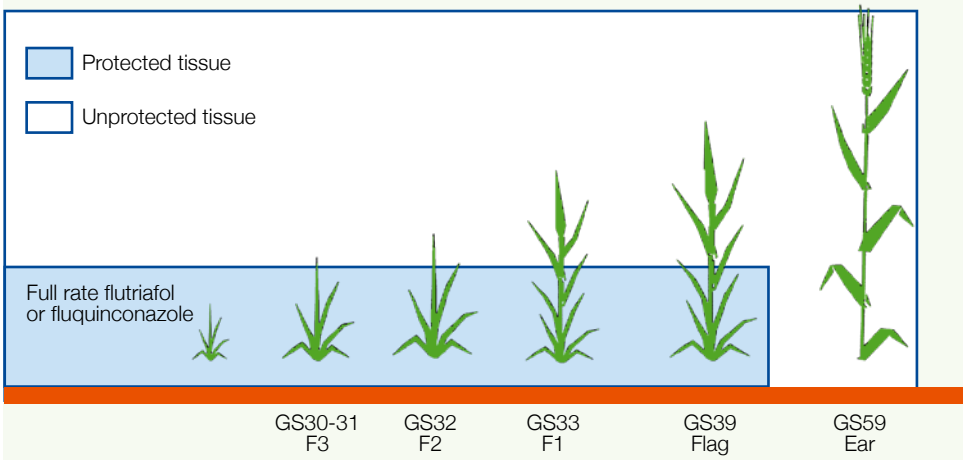
Greater disease susceptibility

Earlier onset of disease
More rapid development

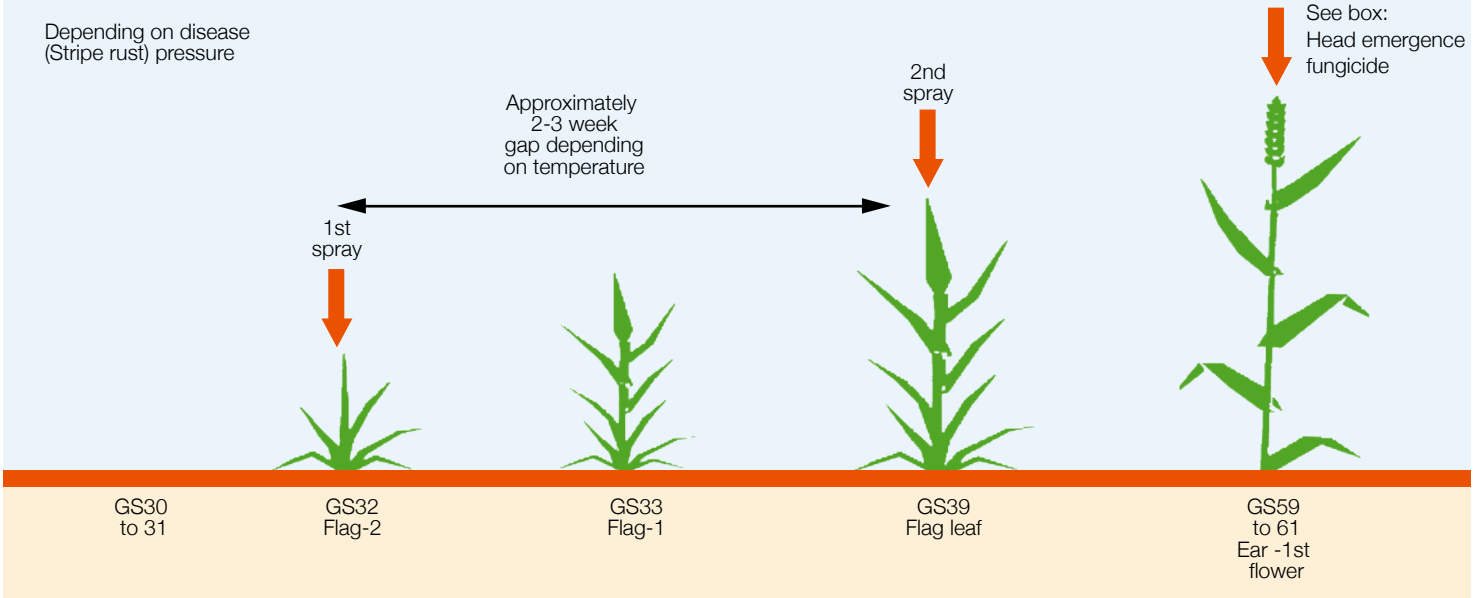
Greater disease resistance

Later onset of disease
Less rapid development

Protection provided by an up-front seed treatment (fluquinconazole – Jockey®) or in-furrow fungicide (flutriafol – Impact®)

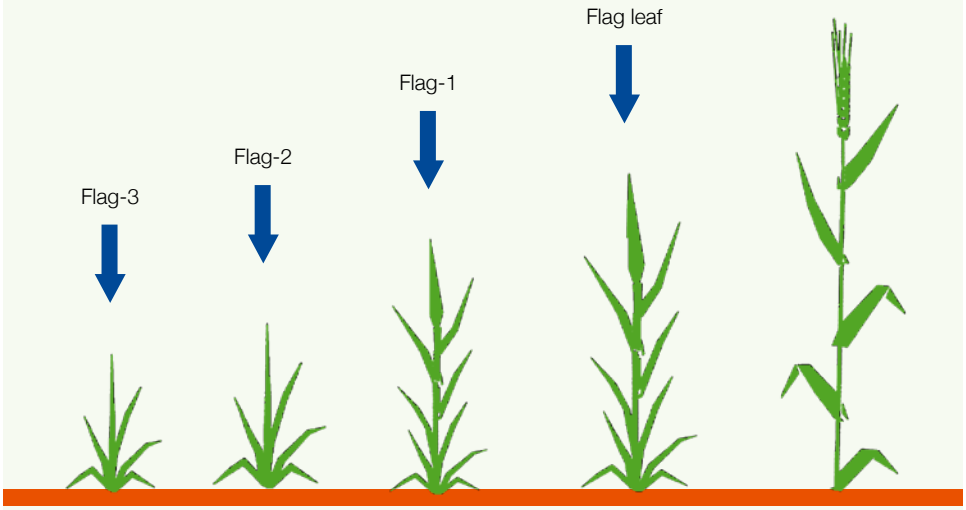


Fungicide timings for early onset of disease at GS30 to 31 in irrigated wheat.



It's all about keeping the crop greener for longer with the soil water available!

These growth stages mark the emergence of the important leaves on the main stem (approximate relationship between nodes and top 4 leaf emergence).



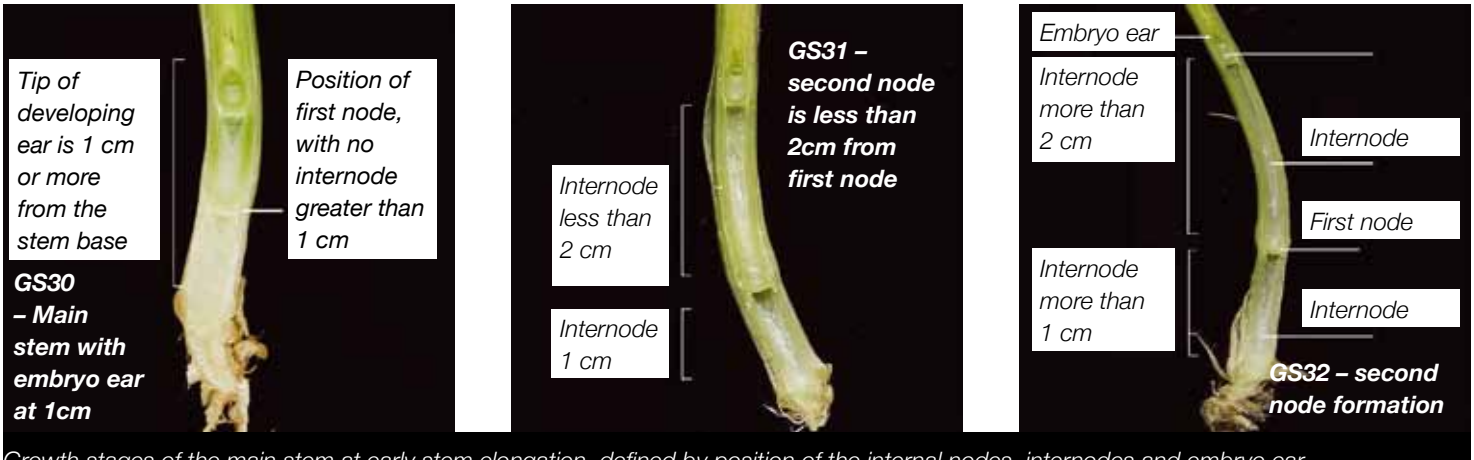
Products such as Jockey® and Impact® are very effective on cereal rusts and powdery mildew and give some control of take-all (*Gaeumannomyces graminis var. tritici*), but are not effective on yellow leaf spot (*Pyrenophora tritici repentis*).

Emergence timing

Nodal growth stages of the main stem give an approximate guide to leaf emergence and are an easy way to identify fungicide timing by growth stage.

Where crops are subject to early attack by a disease such as stripe rust, an ideal timing for the first fungicide would be between the first and second node (GS31 to GS32) stages, since this timing coincides with emergence of the first of the top three leaves (flag-2).

To obtain a clear picture of the growth stage of the crop, select the main stem from five to 10 plants (usually the longest stem or stem with the highest leaf ligule) and split them with a knife to reveal the position of the embryo head and the length of the internodes underneath.



Growth stages of the main stem at early stem elongation, defined by position of the internal nodes, internodes and embryo ear.

Conclusion

Irrigating disease-susceptible wheat increases yield potential and disease risk, so the potential profitability of fungicide application in irrigated wheat is higher than in dryland crops.

To maximise the return from fungicide application, growers should aim to protect the top three leaves, which emerge from first node to booting (GS31 to GS45), by applying foliar fungicides within this timing window.

Whether one or two sprays is needed will depend on the time of disease onset, but flag leaf emergence is the key target.

Cultural control methods for influencing the disease triangle

Cultivar (host)
Minimise the disease risk by selecting a resistant cultivar?

Weather conditions

Are conditions favourable for build up of the disease?

Moisture or free water for spore germination.

Temperature – speed of disease development.

How long is the latent (hidden) period for the disease? This will be affected by temperature.

Pathogen inoculum

With cereal rusts, was there a local green bridge of cereal volunteers building up disease inoculum?

Were those volunteers susceptible to rust?

For stubble-borne diseases such as yellow spot, how old is the stubble?

Was it a susceptible cultivar?

Make a disease triangle for your key wheat cultivars and the paddocks they are being grown in. What diseases is the cultivar susceptible to?

Are you growing in a paddock surrounded by high inoculum pressure?

Is this first wheat or second wheat the break crop?

USEFUL RESOURCES

Disentangling the effects of PAR and R:FR on lodging-associated characters of wheat (Triticum aestivum)
Sparkes, DL and King, M (2008), Annals of Applied Biology, 152, pp. 1-9.

Effects of shade on root characters associated with lodging in wheat (Triticum aestivum)
Sparkes DL, Berry P and King M (2008), Annals of Applied Biology, 152, pp. 389-395.

Increasing yield of irrigated wheat in Queensland and northern NSW
Peake AS and Angus JF (2009), GRDC Northern Region Grains Research Updates, Goondiwindi, 3-4 March 2009
www.grdc.com.au/GRDCUpdatePaper-Peake2009

Agronomy for high yielding cereal environments: varieties, agronomic strategies and case studies
Peake AS, Rebetzke G, Chapman S, Dreccer F, McIntyre L and Hundt A (2012), GRDC Northern Region Grains Research Updates, Goondiwindi, 6-7 March, 2012
www.grdc.com.au/Research-and-Development/

NSW winter crop variety sowing guide 2012
Ground Cover Direct
www.grdc.com.au/Resources/Bookshop

Disease and canopy management: what are the interactions?
Ground Cover Direct
www.grdc.com.au/GRDC-Guide-Disease-Management-Crop-Canopies

MORE INFORMATION

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