SPOT FORM NET BLOTCH FACT SHEET

GRDC
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Spot form net blotch in barley: a comprehensive guide to economic management

PHOTO: AGRICULTURE VICTORIA

SFNB-affected barley plants.

KEY POINTS

- Spot form net blotch (SFNB) is the most common foliar disease of barley in Australia across all rainfall zones
- It is favoured by close rotation of susceptible barley varieties and crop residue retention practices
- SFNB frequently causes yield loss where grain yield potential exceeds 2.5 tonnes per hectare
- Significant losses are possible in all varieties given conducive conditions, with potential losses greatest in varieties rated susceptible to very susceptible (SVS) or very susceptible (VS)
- When susceptible varieties are grown in situations where disease is present, fungicides are likely to provide economic return where grain yield potential exceeds 3t/ha
- The most effective fungicide application strategies include treatment at two stages – either seed/fertiliser treatment and foliar at Z39, or foliar at both Z31 and Z39

Summary

Spot form net blotch (SFNB) is the most common foliar disease of barley in Australia. It can be economically important in favourable seasons. Management relies on a combination of crop rotation, variety selection and strategic fungicide applications.

Economic impact and risk

SFNB is a stubble-borne foliar disease found wherever barley is grown across Australia. It is favoured by crop residue retention practices and the widespread cultivation of susceptible barley varieties.

It is caused by the fungus *Pyrenophora teres* f. *maculata*, and is closely related, but distinct from net form of net blotch (NFNB, caused by *P. teres* f. *teres*).

SFNB can cause significant production losses through reduced grain yield and quality. The extent of losses caused is related to seasonal conditions (that is, it is more severe in wetter seasons) and the susceptibility of the variety grown.

Crops are generally considered at risk of yield loss when SFNB is easily found on all plants and the infection affects more than 10 per cent of the leaf area. Rainfall during late winter and spring favours SFNB infection and will increase potential losses.

When SFNB is present in varieties rated susceptible to very susceptible (SVS), it consistently causes grain yield and quality loss in situations where in-crop rainfall is sufficient for

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SYMPTOMS AND LIFECYCLE

FIGURE 2 Typical symptoms of spot form net blotch.

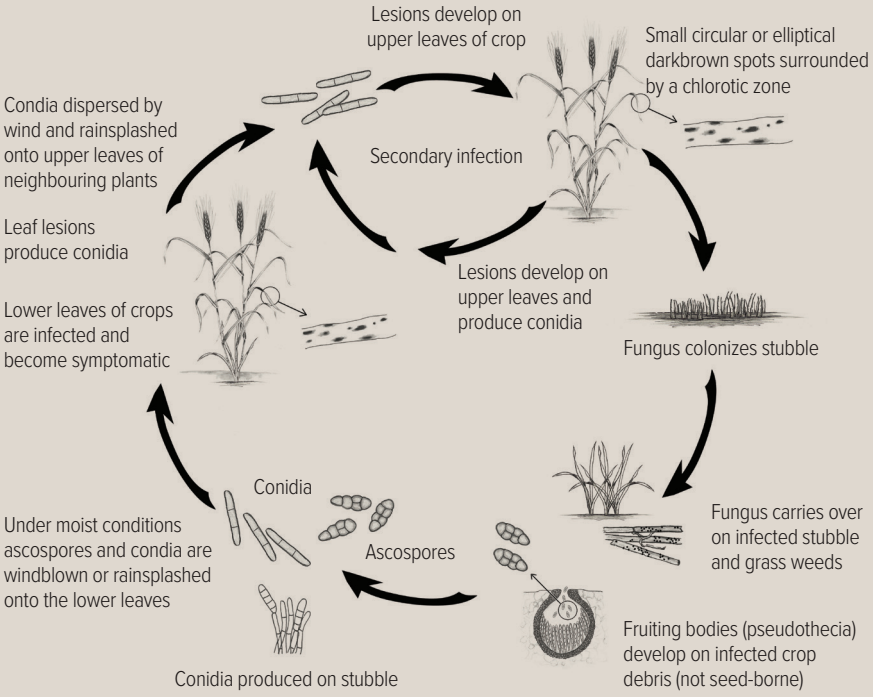
PHOTO: AGRICULTURE VICTORIA

Spot form net blotch (SFNB) appears as dark brown necrotic spots surrounded by a chlorotic zone (Figure 2). Spots vary in size depending on the variety's level of susceptibility.

SFNB is distinguished by spots that do not elongate. In contrast, with net form of net blotch (NFNB), the pinpoint brown lesions develop into dark streaks along and across the leaf blades, creating a distinctive net-like pattern.

SFNB is carried over from one season to the next on stubble residue. SFNB inoculum can survive on infected barley stubble as long as the stubble is present on the soil surface (Figure 3). Typically, a two-year break from barley is sufficient to reduce inoculum to a safe level.

FIGURE 3 Disease cycle of spot form net blotch of barley.



SOURCE: AGRICULTURE VICTORIA (ILLUSTRATION BY KYLIE FOWLER)

Barley crops that are sown into barley stubble are at the highest risk of severe infection.

Primary infection is from spores that the stubble releases during cool and sustained moist conditions. These are mainly spread to neighbouring plants by wind but can also be spread by rain-splash.

Spores can travel by wind from stubble or volunteer plants to infect neighboring barley crops; however, the level of infection is generally lower as spores are widely dispersed.

Secondary infection is from conidia produced from lesions on the leaves, which infect the upper leaves under moist conditions.

Repeated cycles of infection occur throughout the growing season when cool (8 to 25°C) and wet (95 to 100 per cent humidity) conditions occur for prolonged periods (10+ hours).

Secondary hosts such as barley grass provide minimal infection, while soil and seed are not sources of infection.

crops to yield 2.5 tonnes per hectare or more. Yield loss in crops during seasons with in-crop rainfall sufficient to grow a crop with a 7t/ha yield potential can be up to 25 per cent.

Fungicides can provide economic disease management in seasons conducive for disease development in susceptible varieties.

The extent of loss caused by SFNB is related to the frequency and total growing season rainfall received, regardless of the rainfall zone where the crop is situated. For instance, varieties rated SVS have suffered yield losses of up to 20 per cent in the low rainfall zone in seasons with a high frequency of rainfall events.

Grain plumpness (retention and screenings), weight and protein are all affected by SFNB, which can result in grain being downgraded at receival.

Management strategies

SFNB can be effectively managed using an integrated disease management (IDM) approach to reduce the impact of the disease on yield and quality. This approach comprises:

- variety selection;
- paddock selection; and
- fungicide strategies.

In addition to reducing the impacts of disease on production, these strategies will also help protect the longevity of plant resistance genes and fungicides.

Variety selection

Growers should avoid using varieties rated SVS and very susceptible (VS) in high-risk situations, such as paddocks with barley residue from the previous two seasons. These varieties and paddocks will have the greatest risk of loss and will require fungicide applications in many cases.

Varieties rated susceptible (S) or better have sufficient resistance to reduce the risk of economic loss for crops in seasons with sufficient in-crop rain to grow a potential yield of up to 2.5t/ha in most cases (Table 1).

Varieties rated moderately susceptible (MS) or better have sufficient resistance to protect crops from yield loss during seasons where yield potential is up to 4t/ha.

Refer to the current disease guide for your area to select varieties, as ratings can change in response to changes in pathogen virulence.

Paddock selection

Since SFNB inoculum survives from one crop to the next on stubble, it is important to avoid growing barley in paddocks where barley stubble is still present. Usually this means avoiding any paddocks where barley has been grown in the previous two years, or longer in low-rainfall environments where stubble breakdown is slower.

Stubble destruction methods, such as burning or burial, can reduce the amount of inoculum, but do not consistently reduce the risk of infection. The negative effects of burning in terms of water loss and erosion should also be considered.

Fungicides

Fungicides can suppress SFNB and reduce losses when applied using best management practice.

In general, an economic response to fungicides is likely where more than 10 per cent of leaf area is infected by SFNB in susceptible varieties and there is sufficient in-crop rainfall to achieve at least 3t/ha in grain yield (Figure 1). Economic benefit will be greater in seasons with greater yield potential.

Fungicides are less likely to be economic during seasons where in-crop rainfall limits yield potential to less than 3t/ha. There is a 50 per cent probability of returns during seasons when grain yield potential is 2 to 3t/ha and returns are very unlikely when grain yield potential is less than 2t/ha.

Fungicide timing

Strategies that consist of two well-timed fungicide applications are effective in reducing economic loss in all environments. These strategies are:

- seed or fertiliser-applied fungicide combined with one foliar fungicide at flag leaf emergence (Z39); or
- foliar fungicide applied at both stem elongation (Z31) and Z39.

The seed-applied fungicide Systiva® (fluxapyroxad) provides suppression for a prolonged period during the emergence, tillering and stem elongation stages of crop development. The fertiliser-applied fungicide Uniform® (azoxystrobin + metalaxyl-M) provides suppression during the emergence and tillering stages and can be used in place of seed-applied Systiva®.

Foliar fungicide application at mid-tillering (Z25) has been shown to be as effective as Z31 in shorter season environments and seasons.

The efficacy of seed and fertiliser-applied fungicides is influenced by seasonal conditions at sowing and emergence. They work best when there is a wet start to the season as this facilitates chemical uptake by the plant. Poor performance from seed and fertiliser fungicide has been observed with dry seasonal conditions during crop establishment.

Data from 30 GRDC field trials across Australia was used to analyse the economic benefit of fungicide application for varieties rated SVS. Using a barley grain price of $220 per tonne, the economic return on a fungicide strategy based on two applications was between $33 and $127 per hectare with a grain yield of 3 to 7t/ha (Figure 1).

Economic benefits will be higher in higher-yielding situations and when grain prices exceed $220/t.

A single foliar application is less reliable and is not sufficient to prevent a reduction in grain yield. In general, single foliar fungicide application strategies provided 50 to 60 per cent of the benefit of two applications.

Consider the presence of other barley fungal foliar diseases such as scald and NFNB, as these can cause similar losses and can be effectively managed with the same well-timed fungicide strategies.

Growers should use yield prediction tools, such as Yield Prophet®, to help make informed decisions on yield potential and match fungicide application strategies accordingly.

Fungicide resistance

The pathogen population of *P. teres* f. *maculata* is genetically diverse and has the potential to develop resistance to fungicides.

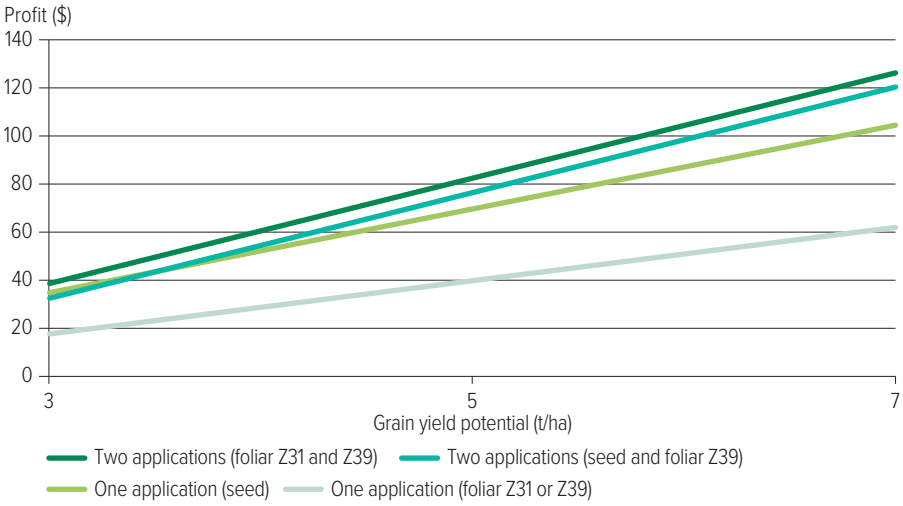
To reduce the risk of resistance, growers should minimise the use of fungicides by avoiding applications in

TABLE 1 Grain yield losses from spot form net blotch can be reduced by planting resistant barley varieties. Data based on variety rating and yield potential.

Variety disease rating	Average loss (%) per yield potential				Potential loss (%) per yield potential			
	2t/ha	3t/ha	5t/ha	7t/ha	2t/ha	3t/ha	5t/ha	7t/ha
MR	0	0	0	0	0	0	14	15
MS	0	0	8	10	0	0	22	17
S	0	0	8	11	0	7	22	20
SVS	0	5	13	20	0	28	30	35

SOURCE: AGRICULTURE VICTORIA ANALYSIS OF 30 NATIONAL GRDC TRIALS

FIGURE 1 When barley yield potential is 3t/ha or more, the most cost-effective fungicide strategy for spot form net blotch relies on two applications of fungicide – either a seed application (Systiva®) plus a single foliar application at Z39 or two foliar applications at Z31 and Z39. A single seed application is more profitable than a single foliar application. Based on a variety rated susceptible to very susceptible (SVS) and a barley price of $220/t.



SOURCE: SOURCE: AGRICULTURE VICTORIA ANALYSIS OF 30 NATIONAL GRDC TRIALS

low-yielding crops. Only spray when necessary and rotate or mix different fungicide groups (Groups 3, 7 and 11) where possible to reduce selection pressure on the pathogen population.

SFNB populations with resistance or reduced sensitivity to Group 3 DMI (triazoles) fungicides, including tebuconazole and propiconazole, have already been found in Australia.

Resistance to Group 7 SDHI fungicides in SFNB has been found overseas and in NFNB in Australia, demonstrating that the SDHI seed dressing Systiva® (fluxapyroxad) needs to be used with caution to protect its efficacy here in Australia.

USEFUL RESOURCES

Net blotches of barley
www.agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/plant-diseases/grains-pulses-and-cereals/net-blotches-of-barley

Diagnosing spot type net blotch
www.agric.wa.gov.au/mycrop/diagnosing-spot-type-net-blotch

Net blotches of barley
www.croppro.com.au/crop_disease_manual/ch02s18.php

Cereal fungicides Fact Sheet
www.grdc.com.au/Resources/Factsheets/2013/05/Cereal-fungicides

Foliar applications of fungicides and insecticides Fact Sheet
www.grdc.com.au/GRDC-FS-FoliarApplications

Cereal disease guides for each state
www.communities.grdc.com.au/field-crop-diseases/cereal-disease-guides
www.nvtonline.com.au/interactive-tools/apps

FREQUENTLY ASKED QUESTIONS

Are fungicide applications outside Z31 and Z39 effective?

Fungicide application outside of stem elongation and flag leaf emergence stages are less economic than during these stages. However, in shorter season environments or when infection pressure is high at early growth stages, moving the first foliar fungicide application as early as mid-tillering (Z25) can provide economic suppression. While early sprays are the most effective, foliar fungicide application as late as ear emergence (Z55) can be economic in longer, wetter seasons.

Do these fungicide strategies work for other diseases?

Most barley fungal foliar diseases can be effectively managed with a similar well-timed fungicide strategy. Economic responses are likely from suppression of scald (caused by *Rhynchosporium commune*), NFNB and leaf rust (caused by *Puccinia hordei*) during seasons where yield potential is greater than 3t/ha.

MORE INFORMATION

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