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Managing Barley Leaf Diseases

By Kith Jayasena, Ciara Beard, Geoff Thomas and Robert Loughman, Plant Pathologists, Department of Agriculture and Food, Western Australia

This Farmnote outlines disease management options supported by the latest research findings for leaf diseases in barley grown in Western Australia. Intensive cropping and current no-till farming practices have lead to an increase in foliar and root fungal diseases. Foliar diseases such as scald, net blotches (net-type and spot-type), powdery mildew and leaf rust can reduce yield and grain quality. The degree of crop loss depends on variety resistance, abundance of the pathogen and disease conducive weather conditions. In addition, barley yellow dwarf virus (BYDV) is a threat in aphid prone areas.

It is important to remember that abiotic factors such as nutrient deficiencies or adverse weather conditions can also cause abnormalities in barley leaves. Some barley genotypes exhibit varying degrees of physiological spotting on leaves which can also be confused with disease symptoms.

An important starting point in disease management is correct identification as diseases differ in their best management strategies. For specific disease symptoms and effects, refer to Farmnote 65/2001 'Leaf diseases of barley'. Further assistance with disease identification can be obtained from AGWEST Plant Laboratories (9368 3721 or www.agric.wa.gov.au/agency/Agwest/plantlabs).

Integrating disease management

For effective disease management, it is important to use a combination of practices that focus on the factors affecting disease (Table 1). Over-reliance on any one factor to control common foliar diseases, such as fungicide alone, will not be as effective or sustainable as an integrated management approach.

Variety choice and implications for disease management

Grain quality and agronomic adaptation often determine the choice of variety. Knowing the responses of your variety to disease (for example, resistance or susceptibility) will help to determine the need for other disease management approaches. Resistance profiles of barley varieties grown in Western Australia vary across the spectrum of diseases. Current malting varieties are generally more susceptible than feed varieties. See the annual *Barley Variety Guide for Western Australia* or 'The Barley Site: a guide to barley production in Western Australia' for information on the response of current varieties to foliar disease (www.agric.wa.gov.au).

Table 1. Effectiveness of management and cultural practices on barley leaf disease control

Diseases	Cultivar resistance	Crop rotation	Stubble destruction	Disease-free seed	Chemical#	
					Seed	Foliar
Scald	1 to 3	1	1	2	2	1
Spot-type net blotch	1 to 3	2	1	3	3	2
Net-type net blotch	1 to 3	2	1	2	2§	2
Powdery mildew	1 to 3	3	3	3	2	1
Barley leaf rust	1 to 3	3	3	3	2*	1
Barley yellow dwarf virus	1 to 2	3	3	3	2	2

Key: 1 = very effective, 2 = moderately effective, 3 = not effective

 # fungicide use is indicated except for barley yellow dwarf virus for which insecticide use is indicated.

§ Dividend® (seed dressing) is registered to control seed-borne net-type net blotch. No seed or in-furrow fungicides are currently registered for the more common stubble-borne net blotch.

** no fungicide registered at the time of publication*

Fungicide disease management

Fungicide seed dressings or fungicides applied in-furrow with fertiliser can be useful in disease protection or suppression of early seedling infection. The choice of fungicide should be determined by the target diseases and information in the current 'Cereal seed dressing and in-furrow fungicides' Farmnote.

The aim of foliar fungicide application in the crop is to delay disease development and to maintain green leaf area which reduces disease impact on yield and grain quality. In barley, the most important contributors to yield are leaf 2 (flag-1), leaf 3 (flag-2), the ear and upper stem, while the flag leaf is relatively unimportant. Protecting leaf 2 and leaf 3 is the highest priority in effective disease control.

The cost effectiveness of foliar fungicide applications depends on disease severity, susceptibility of the variety, yield potential of the crop, grain quality outlook and the environment where the crop is growing.

Reliance on fungicide is much greater in medium to high rainfall areas than in low rainfall regions due to higher disease pressure and longer growing seasons during which the disease epidemic may increase. For instance, in the medium rainfall region a single application of fungicide may be required at late stem elongation to flag leaf emergence stage (Z33 - 39). In a long season, high rainfall area two fungicide sprays are often required: one at early stem elongation and a follow-up spray at or just prior to flag leaf emergence.

When susceptible varieties are grown in conditions favourable for disease development, such as disease prone areas or high rainfall seasons, fungicide can be cost effective in reducing the disease impact where yield potential is over 2.0 t/ha.

Under high disease pressure, using higher fungicide rates will give longer residual protection.

Rotation and stubble management

Diseases such as scald, spot-type net blotch and net-type net blotch are stubble-borne. Paddock selection is important to minimise stubble-borne diseases. Crop rotation with a non-host crop in the previous year will minimise initial inoculum levels for the current season's crop. To further reduce disease pressure, avoid sowing the current season's crop in paddocks adjoining those with barley stubble from the previous season. Cultural practices such as incorporating the residue into the soil or removing it completely (for example, by burning) will reduce the abundance of the pathogen and the disease pressure. Stubble may be reduced by baling and grazing; however, these methods only result in a small reduction in the disease pressure. Stubble reduction must be balanced against the increased risk of soil erosion by wind or water.

Green bridge management

Three major diseases, barley leaf rust, powdery mildew and barley yellow dwarf virus (BYDV), persist on living hosts. Barley leaf rust survives on barley volunteers, powdery mildew on barley volunteers and stubble, and BYDV on cereal regrowth and perennial grasses. A green bridge of self-sown barley leading into the cropping season provides host material for these diseases and the aphid vector of BYDV and increases the risk of their early onset. Removing this green bridge as early as practicable before seeding will greatly reduce the risk of early crop infection.

Seed health

The foliar diseases scald and net–type net blotch and the head diseases loose smut and covered smut can be seed-borne. Sowing infected seed can introduce disease into a new crop. Therefore clean seed should be used wherever possible. Fungicide seed dressings can reduce the risk associated with sowing infected seed, particularly for smuts and bunts. See the current 'Cereal seed dressing and in-furrow fungicides' Farmnote for further information.

Management of specific diseases

Scald (*Rhynchosporium secalis*)

Scald is a stubble- and seed-borne disease which is favoured by high rainfall environments. Generally, this disease is most damaging in the high rainfall, southern regions but severe epidemics have been observed in medium rainfall areas under favourable conditions.

Control

- Sowing resistant varieties whenever possible is the most effective management strategy. For medium to low rainfall areas, avoid very susceptible (VS) varieties. For high rainfall areas, only sow moderately resistant (MR) and resistant (R) varieties.
- Rotating crops (for example, a break of one year) between barley crops in a paddock will significantly reduce the potential for serious disease.
- Sow clean seed harvested from an uninfected crop.
- A seed dressing or in-furrow fungicide should be used in medium to high rainfall areas or if the seed is from an infected crop.
- Applying a fungicide spray is necessary in medium to high rainfall regions where disease threatens crops that have high yield and quality expectations. Apply fungicide before head emergence if hot spots within the crop are frequently observed during stem elongation or active infections are present on middle canopy leaves.

Spot-type net blotch (*Drechslera teres* f. *maculata*)

Spot-type net blotch occurs state-wide but is most damaging in south coastal and neighbouring medium to high rainfall regions where it can have severe yield and quality effects. This disease is stubble-borne so is more severe where barley is grown year after year in the same paddock. In high disease situations in the southern high rainfall region, more than 35 per cent yield loss has been observed. In addition, current research indicates that every 10 per cent increase in leaf area lost to this disease on the top three leaves accounts for 0.4 t/ha yield loss. Outbreaks can also occur in central and northern agricultural areas.

Control

- Avoid sowing susceptible (S) and very susceptible (VS) varieties, particularly in high production situations.
- A one-year break between barley crops in a paddock will markedly reduce the potential for serious disease. If highly effective stubble retention systems are in use, a two-year break may be required.
- Applying a fungicide spray is necessary in medium to high rainfall regions where disease threatens crops with high yield and quality expectations. The choice of a single-spray or two-spray strategy depends on the environment in which the crop is growing.
  - In high rainfall environments it may be necessary to apply two sprays, such as at early stem elongation stage with a follow-up spray three to four weeks later.
  - In medium rainfall regions, consider one well timed spray between late stem elongation and early flag leaf emergence (Z33 - 39) to protect leaf 2 (flag-1). Under high disease pressure, best results may be obtained by using the maximum recommended rates.

Net-type net blotch (*Drechslera teres* f. *teres*)

Net-type net blotch disease occurs throughout the barley growing areas of Western Australia including the medium and low rainfall areas. This disease can be both stubble- and seed-borne. Infection and spread of this disease is favoured by wet conditions and it is most evident following periods of rainfall. It will cause the greatest yield loss in paddocks that are re-sown to barley without a break-crop.

Control

Effective control practices for this disease are the same as those described above for spot-type net blotch, along with the additional strategy below.

If seed-borne net-type net blotch is suspected, seed can be sent to Agwest Plant Laboratories for diagnosis prior to seeding. If seed is infected, treating it with a fungicide registered for suppression of seed-borne net-type net blotch can reduce seed to seedling transmission. However, this method of spread is not considered important in the overall level of infection by this disease in barley crops in Western Australia. See the current 'Cereal seed dressing and in-furrow fungicides' Farmnote for further information.

Activity of pre-sowing treatments against stubble-borne net-type net blotch has not been demonstrated. There are currently no seed or in-furrow treatments registered for this disease.

Powdery mildew (*Blumeria graminis* f.sp. *hordei*)

Powdery mildew occurs throughout the agricultural areas but is more common in southern regions where high humidity favours disease development. Severe infections can occur in winter months during the early stages of the crop growth, thus affecting yield potential through tiller abortion (up to 25 per cent yield loss has been attributed to this cause). New leaves that emerge later in the season are generally less severely infected as conditions become less favourable to the disease. This may not be the case in high production situations (such as high rainfall or humid coastal areas) where high seed rates or heavy application of nitrogen fertiliser have been used. Severe infection at later stages (after Z39) can cause 5 to 13 per cent yield loss. A powdery mildew infected crop will appear yellow from a distance, similar to a crop suffering from water logging or nutrient deficiency. Therefore, close examination of the crop is needed.

Control

- Using resistant varieties will minimise the impact of powdery mildew. Current malting varieties are either susceptible (S) or moderately susceptible (MS) but some feed varieties grown in Western Australia have resistance to powdery mildew.
- A seed dressing fungicide applied as a standard treatment for susceptible varieties is usually sufficient to minimise the yield loss caused by powdery mildew in medium to high rainfall areas. The duration of early protection depends on the amount (grams per tonne of grain) of active ingredient applied to grain. Higher rates will increase the duration of protection. In-furrow application with fertiliser allows the use of higher rates of fungicide than direct seed application. In medium rainfall regions, use seed dressing fungicides to give adequate protection up to early stem elongation stage. In high rainfall regions or if sowing very early, use in-furrow fungicides (for example, flutriafol or triadimefon products) or a fluquinconazole based seed dressing to give longer control.
- In situations where varieties susceptible to powdery mildew are sown without seed dressings, it is important to spray the crop if there are early signs of mildew, especially during the tillering stage. Application of foliar fungicides is most economical in high risk areas or in regions with high yield or quality expectations. The first foliar fungicide spray may coincide with post-emergent herbicide application at tillering. A second spray may be warranted before head emergence, three to four weeks after the first spray, if active infections are visible on leaves which have emerged subsequent to the first fungicide spray.
- Barley growing on potassium deficient soil (K <50 ppm) is more susceptible to powdery mildew. Consider applying potassium fertiliser, preferably muriate of potash 20 to 50 kg/ha (or sulfate of potash 44 to 97 kg/ha), four weeks after seedling emergence in order to reduce the powdery mildew and increase yield. Muriate of potash has been found to be significantly better than sulfate of potash in aiding powdery mildew control (see Note 216 'Potassium deficient barley is more susceptible to powdery mildew disease').

Barley leaf rust (*Puccinia hordei*)

Once very rare in Western Australia, barley leaf rust has developed into a recurring threat since the occurrence of pathotypes in 1997 that infect Franklin and Gairdner. It is an aggressive and difficult foliar disease to control. So far its impact has been limited to very early sown crops in the southern high rainfall zones and only when these are near volunteer barley (green bridge) harbouring this rust over summer. Barley leaf rust frequently causes yield and quality losses. In seven field experiments from 2002 to 2006, application of fungicide to infected plants resulted in yield improvement ranging from 3 to 145 per cent (mean yield improvement of about 33 per cent) depending on the time of disease onset, fungicide product, rate and time of application. The yield benefits were accompanied by large reductions in screenings and improved grain colour.

Control

- Sowing resistant varieties is the most economical way to control the disease. Current malting varieties are susceptible (S or MS) but there are some resistant (R) feed varieties;
- Minimise green bridge by grazing or applying herbicide to remove volunteer barley which emerged following summer or autumn rains.
- Many of the seed dressing or in-furrow fungicides registered for control of other barley diseases have been shown to be effective in preventing early leaf rust infection under experimental conditions, but they are not currently registered for this use.
- Apply fungicide spray if disease threatens well grown crops. Where an early outbreak of leaf rust in barley occurs, the initial spray should be applied at the onset of the disease and followed by a second application three to four weeks later. Early foliar fungicide sprays are more effective than seed dressing or in-furrow fungicide application for control of early infections of barley leaf rust.

Barley yellow dwarf virus (BYDV)

Barley yellow dwarf virus (BYDV) causes stunting of barley plants and subsequent loss of yield and quality. BYDV can be damaging in the high and very high rainfall areas of the south-west or, more rarely, in nearby medium rainfall areas. BYDV is spread from infected grasses and volunteer cereals to barley by cereal aphids. The greatest risk of significant yield and quality effects is from early infection during the first eight to 10 weeks of crop growth. Risk of early aphid arrival largely depends on the amount of summer and autumn rainfall and the availability of green vegetation before the growing season.

Control

- Sow varieties that are less susceptible to BYDV. Variety resistance is an effective management option in high risk locations.
- Applying a seed dressing containing imidacloprid (for example, Hombre®, Zorro®), or spraying the crop with registered insecticides in the first 3-7 weeks of crop growth, can substantially reduce BYDV infection. Growers need to assess BYDV risk each season for their location and time of sowing to determine the most appropriate insecticide application strategy. Further information and current regional forecasts of BYDV risk are available on the DAFWA website at <www.agric.wa.gov.au/bydv>.

Other leaf diseases

Ring spot (*Pyrenophora semeniperda*), **Halo spot** (*Selenophoma doncis*) and **Wirrega blotch** (*Pyrenophora wirreganensis*) do not normally require specific control measures.

Wheat streak mosaic virus (WSMV)

Barley is a host for wheat streak mosaic virus (WSMV) but this disease is not currently considered to be yield or quality limiting in barley.

Further reading

Farmnote No. 65/2001 ‘Leaf diseases of barley’.

Note 205 ‘Cereal seed dressing and in-furrow fungicides 2006-2007’.

Farmnote 19/1993 ‘Barley yellow dwarf virus in cereals’.

Note 216 ‘Potassium deficient barley is more susceptible to powdery mildew disease’.

Note 257 ‘Barley Variety Guide for WA 2007’.

Note: Mention of trade names does not imply endorsement or preference of any company’s product by Department of Agriculture and Food, Western Australia. Any omission of a trade name is unintentional. Recommendations are current at the time of printing.

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