Ramularia leaf spot in barley

Symptoms and importance
Ramularia leaf spot, caused by the fungus *Ramularia collo-cygni*, poses the greatest threat to spring barley malting crops, but in recent years it has also caused economic losses in winter barley. Ramularia also impairs quality and can increase screenings by 4%. While most common in northern Britain, it can occur UK-wide and is probably under-reported due to unfamiliarity of the symptoms. The disease is also widespread in Ireland, France, Germany, Poland, Scandinavia, other northern European countries and New Zealand.

Early symptoms comprise small brown pepper spots on the upper leaves. These quickly develop into typical Ramularia leaf spot lesions: small brown rectangular lesions with yellow margins within leaf veins, visible from both sides of the leaf. Lesions occur on green and dead leaves, where brown spots remain visible. Rows of spores can be seen with a hand lens on the undersides of affected leaves later in the season.

Ramularia leaf spot can be easily mistaken for net blotch. Diagnostics can help determine the real cause. Physiological leaf spots caused by oxidative stress tend to be superficial browning on upper leaf surfaces, while the undersides are unaffected. These cause less yield loss, but trigger the production of Ramularia leaf spots.

VARIETAL RESISTANCE

Spring barley varieties show different levels of resistance, but no variety is fully resistant. Potential yield losses range from 0.9 t/ha in the most susceptible varieties to 0.1 t/ha in more resistant varieties. The average yield loss in intermediate varieties on high disease risk sites is 0.4 t/ha. Malting crops are affected more than feed barley. This may be because malting varieties are more susceptible; they are also subjected to greater stress as less nitrogen is applied.

Economic losses have become more common in unprotected susceptible winter barley varieties in recent years.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Resistance to Ramularia leaf spot</th>
<th>Variety</th>
<th>Resistance to Ramularia leaf spot</th>
<th>Variety</th>
<th>Resistance to Ramularia leaf spot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malabar</td>
<td>Good</td>
<td>Vanquish</td>
<td>Good</td>
<td>Flagon</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Pearl</td>
<td>Good</td>
<td>Trick</td>
<td>Good</td>
<td>Purdey</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Saffron</td>
<td>Good</td>
<td>Cassata</td>
<td>Intermediate</td>
<td>Suzuka</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Boost</td>
<td>Good</td>
<td>Winsome</td>
<td>Intermediate</td>
<td>Retriever</td>
<td>Susceptible</td>
</tr>
<tr>
<td>Volume</td>
<td>Good</td>
<td>Sequel</td>
<td>Intermediate</td>
<td>Pelican</td>
<td>Susceptible</td>
</tr>
<tr>
<td>KWS Cassia</td>
<td>Good</td>
<td>Florentine</td>
<td>Intermediate</td>
<td>Blazing</td>
<td>Susceptible</td>
</tr>
<tr>
<td>Element</td>
<td>Good</td>
<td>Hercule</td>
<td>Intermediate</td>
<td>Escadre</td>
<td>Susceptible</td>
</tr>
</tbody>
</table>

Action
Consider the variety and losses due to Ramularia on your farm in recent years when assessing the need for treatment.

If treatment for Ramularia is considered necessary, use a preventative spray before symptoms appear at boot stage – awns peeping (GS45-49).

Control measures – usually a triazole in combination with a Succinate Dehydrogenase Inhibitor (SDHI) fungicide and chlorothalonil – need to be applied at GS45-49 before symptoms appear.

Do not apply tank mixtures to the upper leaves which lead to leaf stress, as this will increase the risk of Ramularia symptoms developing.

Always consider your local conditions and consult a professional agronomist if necessary.
Life cycle

Infected seed and spores on barley and grasses are the main sources of Ramularia in barley. The fungus spreads from infected seed and grows inside barley leaves as they develop, causing no visible symptoms. Dying leaves may show signs of infection throughout the season, but the main damage occurs on the top leaves after flowering. Spores present in trash can also infect plants during wet weather, leading to symptoms late in the season.

At flowering, food reserves produced in the upper leaves are diverted to the grain. This triggers the fungus to produce a toxin (rubellin D) that scorches and eventually kills leaves in the presence of light. Symptoms are most common on the most exposed upper leaves, stems and awns.

Forecasting

A forecast is being developed based on variety, region, weather (rainfall and leaf wetness early in the season), and presence of spores. This will help growers assess the risk of crop loss as the disease spreads. Other factors, including dry weather later in the season can lead to a lower risk. Conversely wet weather and long periods of sunshine will increase the risk. These risk factors can be incorporated into the regional risk.

Control

Current information indicates that Ramularia is not controlled by seed treatments. Research into new chemical and heat seed treatments is ongoing to determine their use as part of integrated control strategies.

Foliar fungicide treatments applied at tillering to control other diseases can influence Ramularia, but only to a limited effect.

The most effective control is currently achieved from a fungicide application at booting (GS45-49). Treatments applied later up to ear fully emerged will also be effective, but treatment is limited by the latest application time. For most fungicides applied to malting barley crops this is before ear emergence. Once symptoms develop on the upper leaves post-flowering, all treatments will be ineffective.

Fungicide mixtures must be used to achieve the best control and also to minimise the risk of fungicide resistance developing. Strobilurin fungicides are no longer effective against this disease, but they may form a component in a mixture to control other barley diseases.

<table>
<thead>
<tr>
<th>Partner 1</th>
<th>Partner 2</th>
<th>Number of components with activity against Ramularia</th>
</tr>
</thead>
<tbody>
<tr>
<td>prothiocazone (Proline 275)</td>
<td>chlorothalonil (Bravo)</td>
<td>2</td>
</tr>
<tr>
<td>fluoxastrobin + prothiocazone* (Fandango)</td>
<td>chlorothalonil (Bravo)</td>
<td>2</td>
</tr>
<tr>
<td>boscalid + epoxiconazole* (Tracker)</td>
<td>chlorothalonil (Bravo)</td>
<td>3</td>
</tr>
<tr>
<td>isopyrazam + epoxiconazole* (Seguris)</td>
<td>chlorothalonil (Bravo)</td>
<td>3</td>
</tr>
<tr>
<td>isopyrazam + cyprodinil* (Bontima)</td>
<td>chlorothalonil (Bravo)</td>
<td>2</td>
</tr>
<tr>
<td>prothiocazone + bixafen* (Siltra Xpro)</td>
<td>chlorothalonil (Bravo)</td>
<td>3</td>
</tr>
<tr>
<td>prothiocazone (Proline 275)</td>
<td>azoxystrobin + chlorothalonil* (Amistar Opti)</td>
<td>2</td>
</tr>
<tr>
<td>epoxiconazole (Ignite)</td>
<td>azoxystrobin + chlorothalonil* (Amistar Opti)</td>
<td>2</td>
</tr>
</tbody>
</table>

*formulated mixtures

Further information

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Barley Disease Management Guide (updated annually)
Cereal growth stages - a guide for crop treatments (HGCA, 2009)
www.hgca.com/diseasecontrol
www.hgca.com/varieties
www.hgca.com/publications
www.sac.ac.uk/crops
HGCA Project Report PR463
HGCA Project Report PR431
HGCA Project Report PR366
HGCA Project Report PR282

Overview

- An increased incidence of leaf spotting in barley in recent years has reduced yields for some farmers.
- Variety choice is important to minimise disease risk.
- HGCA-funded projects have shown how a fungus (Ramularia collo-cygni) and stress conditions interact to cause spotting.
- A current project, partly funded by HGCA, is investigating disease prediction, fungicide resistance and varietal resistance.

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