Ramularia leaf spot in barley

Symptoms and importance
Strong sunlight, prolonged leaf wetness, agrochemical scorch and nutritional stress can all trigger physiological leaf spots associated with infections of the fungus *Ramularia collo-cygni* in barley.

Symptoms comprise small brown rectangular lesions with yellow margins within leaf veins. 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.

Ramularia leaf spot poses the greatest threat to spring malting barley crops. While most common in northern Britain, it can occur UK-wide as well as in Ireland, France, Germany, Scandinavia and other northern European countries. Though less common, ramularia on winter barley (feed and malting) can act as a source of inoculum for the spring crop.

Physiological leaf spots can be easily mistaken for net blotch. Diagnostics can help determine the real cause. Ramularia also impairs quality and can increase screenings by up to 4%.

Other leaf spots caused by oxidative stress tend to be superficial browning on upper leaf surfaces, while the undersides are unaffected. Physiological leaf spots cause less yield loss, but trigger the production of ramularia leaf spots.

Variatel resistance
Spring barley varieties show different levels of resistance (Table 1), but no variety is fully resistant. Potential yield losses range from 0.9t/ha in Optic, down to 0.1t/ha in Decanter. The average yield loss in high disease risk sites is 0.4t/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.

Winter barley varieties are also susceptible, but economic loss is rare since the disease develops late in the season.

**Table 1. SAC resistance ratings to ramularia leaf spot in spring barley**

<table>
<thead>
<tr>
<th>Variety</th>
<th>Resistance rating</th>
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<th>Resistance rating</th>
<th>Variety</th>
<th>Resistance rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocktail</td>
<td>4</td>
<td>NFC-Tipple</td>
<td>6</td>
<td>Waggon</td>
<td>7</td>
</tr>
<tr>
<td>Doyen</td>
<td>4</td>
<td>Oxbridge</td>
<td>6</td>
<td>Rebecca</td>
<td>7</td>
</tr>
<tr>
<td>Troon</td>
<td>5</td>
<td>Wicket</td>
<td>6</td>
<td>Static</td>
<td>7</td>
</tr>
<tr>
<td>Cellar</td>
<td>5</td>
<td>Spire</td>
<td>6</td>
<td>Riviera</td>
<td>7</td>
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<tr>
<td>Optic</td>
<td>5</td>
<td>Quench</td>
<td>7</td>
<td>Appalossa</td>
<td>8</td>
</tr>
<tr>
<td>Chalice</td>
<td>5</td>
<td>Publican</td>
<td>7</td>
<td>Decanter</td>
<td>8</td>
</tr>
<tr>
<td>Kirsty</td>
<td>5</td>
<td>Westminster</td>
<td>7</td>
<td>Power</td>
<td>8</td>
</tr>
</tbody>
</table>

Rating based on 1-9 scale (not given on HGCA Recommended List). High number indicates higher resistance to ramularia.

Life cycle
Infected seed is the main source of ramularia in spring barley. Infection can also result from spores on grasses and winter barley.

The ramularia fungus will spread from infected seed and grow 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.
At flowering, food reserves produced in upper leaves are diverted to the grain. This triggers production of a toxin, which scorches and eventually kills leaves in the presence of light. Symptoms are most common on the most exposed upper leaves.

Typical ramularia leaf spot lesions can now form. Wind spreads spores from lesions to infect other plants, particularly when leaves are wet.

**Forecasting**

A forecast is being developed based on variety, weather (rainfall and leaf wetness) and presence of spores, and including region. The forecast will help growers assess the risk of crop loss as the disease spreads.

Susceptible varieties are at risk if leaves remain wet for several days before GS49. Prolonged sunshine following wet spells will increase severity.

**Control**

Current data indicates that ramularia is not controlled by seed treatments or fungicides applied at tillering.

Trials were carried out in Perthshire to determine effects of various fungicides and combinations on disease and yield. Figure 1 shows the effects on percent disease and distinguishes spots caused by ramularia and stress effects (physiological spots).

Prevention with fungicides can be effective (Table 2) but correct timing is critical. Fungicides should be applied before symptoms are likely to develop, preferably at the boot to awns peeping stage (GS45-49). For information on fungicide doses see www.sac.ac.uk/crops and open the ‘Fungicide Dose Curves’ window.

Sprays were applied at GS49 to spring barley variety Optic in Perthshire in 2005. Triazoles used were epoxiconazole and prothioconazole; strobilurins were azoxystrobin and fluoxastrobin. A standard GS25 fungicide spray was applied to all, except the ‘Nil,’ treatment.

**Overview**

An increased incidence of leaf spotting in barley in recent years has reduced yields for some farmers, especially of malting crops in northern Britain. HGCA-funded projects have shown how a fungus, ramularia, and stress conditions interact to cause spotting. A current project is investigating disease prediction and control.

**Highlights**

Variety choice is important to minimise disease risk. Control measures – usually a triazole: chlorothalonil mixture spray at GS45-49 - need to be applied before symptoms appear.

**Further information**

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TN568: Barley Disease Control  
(available on SAC and HGCA websites)

**Fungicide options at GS45-49 for ramularia leaf spot control**

<table>
<thead>
<tr>
<th>Partner 1</th>
<th>Partner 2</th>
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<tbody>
<tr>
<td>prothioconazole</td>
<td>chlorothalonil</td>
</tr>
<tr>
<td>fluoxastrobin + prothioconazole*</td>
<td>chlorothalonil</td>
</tr>
<tr>
<td>boscalid + epoxiconazole*</td>
<td>chlorothalonil</td>
</tr>
<tr>
<td>prothioconazole</td>
<td>azoxystrobin + chlorothalonil*</td>
</tr>
<tr>
<td>epoxiconazole</td>
<td>azoxystrobin + chlorothalonil*</td>
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</tbody>
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* Formulated mixtures

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