Fungicide performance update for wheat, barley and oilseed rape 2019
Note:

The graphs in these slides show dose-response curves up to 100% label dose.

The graphs at the AHDB Agronomists’ Conference (3 December 2019) showed dose-response curves up to 200% label dose.

Fungicides are tested at double rate to improve the ‘fit’ of the dose-response curves.
Choosing fungicides

- Match fungicides to the primary disease risk, which depends mainly on variety, sowing date, location and local weather.

- Mixtures and alternations of fungicides with different modes of action, from different fungicide groups, are often most effective and reduce the likelihood that fungicide resistance will develop in pathogens.

- Resistance poses a significant threat to the performance of fungicides. It is essential to take resistance management into account when planning fungicide programmes.

- For further information, visit the Fungicide Resistance Action Group’s (FRAG) web page: [ahdb.org.uk/frag](http://ahdb.org.uk/frag)
Protection and curative

• ‘Protectant’ curves show the activity of fungicides when they are applied soon after the emergence of a leaf layer, before much infection has occurred

• ‘Curative’ curves indicate fungicidal activity after infection has occurred but before symptoms become visible

• Performance of products on each leaf layer and at each site was classified as protectant or curative based on timing of leaf emergence relative to spray application

• Performance of individual active ingredients can be assessed by comparing dose-response graphs. These show average performance measured across a range of sites, seasons and leaf layers
Trial methods

In order to provide a good test of the fungicides:

• Trials are located in areas that are at high risk from the target disease in most years

• Trials are carried out on varieties that are very susceptible to the target disease and not too susceptible to other diseases

• If necessary, over-sprays that are not active against the target disease are used to reduce the effect of other diseases on the trial

• Fusarium trial inoculated with fusarium species and mist-irrigated before and after inoculation to establish infection
Fungicide performance 2019 update for wheat
### Septoria tritici efficacy data 2019

<table>
<thead>
<tr>
<th>Site (Organisation)</th>
<th>Protectant</th>
<th>Curative</th>
<th>Mixed</th>
<th>Growth stage of application</th>
<th>Variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herefordshire (ADAS)</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>GS37</td>
<td>KWS Kielder</td>
</tr>
<tr>
<td>Hampshire (NIAB)</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>GS32</td>
<td>Dickens</td>
</tr>
<tr>
<td>East Lothian (SRUC)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>GS39</td>
<td>Viscount</td>
</tr>
<tr>
<td>Carlow, Ireland (Teagasc)</td>
<td>✓</td>
<td></td>
<td></td>
<td>GS37</td>
<td>KWS Lumos</td>
</tr>
<tr>
<td>Cardigan (ADAS)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>GS39</td>
<td>KWS Santiago</td>
</tr>
<tr>
<td>Shropshire (NIAB)</td>
<td></td>
<td></td>
<td>✓</td>
<td>GS39</td>
<td>Dickens</td>
</tr>
</tbody>
</table>
Revystar XE

New fungicide product for 2020

• Contains a new triazole (Revysol) and an SDHI (Xemium)
  • 100 g/L mefentrifluconazole + 47.5 g/L fluxapyroxad

• Maximum individual dose 1.5 L/ha

• Maximum of two applications

• To be applied before GS69

• Approved for wheat, barley, oats, rye, triticale, spelt and durum wheat
<table>
<thead>
<tr>
<th>Product</th>
<th>Active(s)</th>
<th>Septoria</th>
<th>Brown rust</th>
<th>Yellow rust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bravo</td>
<td>chlorothalonil</td>
<td>✓*</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Proline</td>
<td>prothioconazole</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Bassoon</td>
<td>epoxiconazole</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Imtrex</td>
<td>fluxapyroxad</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Comet</td>
<td>pyraclostrobin</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Amistar</td>
<td>azoxystrobin</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Ascra Xpro</td>
<td>bixafen + fluopyram + prothioconazole</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Librax</td>
<td>fluxapyroxad + metconazole</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Elatus Era</td>
<td>solatenol + prothioconazole</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Revystar XE</td>
<td>mefentrifluconazole + fluxapyroxad</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

*Bravo at 50% dose only
Septoria tritici protectant 2019 (5 trials)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Septoria tritici mixed protectant and curative 2019 (4 trials)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Septoria tritici trial yields 2019 (7 trials)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Rothamsted early season monitoring
2019 SDHIs (n=49)

Strains less sensitive to SDHIs (e.g. T79N and N86S) now widely present in populations

H152R overwintered at this site
SDHI decline and stabilisation?
fluxapyroxad

Data extracted from AHDB Fungicide Performance trials
Rothamsted early season monitoring 2019
Azoles

Epoxiconazole

Prothio-desthio

Cumulative frequency (%)

EC$_{50}$ (µg ml$^{-1}$)

5 ppm

0.001 0.01 0.1 1 10 100

0 10 20 30 40 50 60 70 80 90 100

2003
2008
2013
2014
2015
2016
2017
2018
2019

0.5 ppm

0.001 0.01 0.1 1 10 100

0 10 20 30 40 50 60 70 80 90 100

2003
2008
2013
2014
2015
2016
2017
2018
2019
Azole efficacy on septoria tritici (2001–19)
Protectant activity at full rate
Septoria tritici protectant 2017–19 (15 trials)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Septoria tritici curative 2017–19 (6 trials)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Septoria tritici trial yields 2017–19 (20 trials)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Yellow rust 2019
Reflection (near Kings Lynn)

Yellow rust – widespread in 2019

RL ratings changes
   Zyatt 8 to 7
   Bennington 6 to 5
   Viscount 7 to 6

Late sowings can be higher risk
Yellow rust 2019 (1 trial)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Yellow rust trial yields 2019 (1 trial)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Yellow rust yield 2017–19 (3 trials)

Priaxor = fluxapyroxad + pyraclostrobin

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Brown rust 2019
Crusoe (Cambridge)

Slow to develop in 2019 following cool spring weather

RL ratings changes

- Firefly 8 to 6
- Viscount 9 to 8
- Skyscraper 5 to 6
- Spotlight 6 to 7

Fungicide performance trial (Cambridge)

- Crusoe
- GS 39 application
Brown rust 2019 (1 trial)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Brown rust yield 2019 (1 trial)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Brown rust 2017–19 (3 trials)

Caramba 90 = metconazole

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Brown rust yields 2017–19 (3 trials)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Fusarium trial (inoculated)
Zyatt (near Mansfield, Nottinghamshire)

2018–19 (2 trials)

2019 (1 trial)

Soleil = tebuconazole + bromuconazole, Unizeb Gold = Mancozeb
Mycotoxin control 2019

Maximum legal limit of DON in wheat for human consumption = 1250ppb
Wheat powdery mildew 2019 (2 trials)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Wheat summary 2019

Septoria tritici
  • Revystar XE very effective with a yield response up to full dose
  • Ascra ahead of Elatus Era in 2019
  • Solo SDHI Imtrex ~60% protectant control, prothioconazole ~ 45%

Rusts
  • Elatus Era highest yield on yellow rust, matched by Revystar XE on brown rust

Fusarium
  • Soleil and Proline effective, Soleil better DON reduction in 2019
  • Unizeb Gold adding activity on visual head blight symptoms

Mildew
  • All SDHI/azoles tested showed good levels of control
Fungicide performance 2019 update for barley
<table>
<thead>
<tr>
<th>Site (Organisation)</th>
<th>Target disease</th>
<th>Variety</th>
<th>Rhyncho</th>
<th>Net Blotch</th>
<th>Ramularia</th>
<th>Mildew</th>
<th>Tan spot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lanark (SRUC)</td>
<td>Rhyncho</td>
<td>KWS Tower</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Cardigan (ADAS)</td>
<td>Rhyncho</td>
<td>KWS Cassia</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Carlow, Ireland (Teagasc)</td>
<td>Rhyncho</td>
<td>KWS Cassia</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Morley, Norfolk (NIAB)</td>
<td>Net blotch</td>
<td>Flagon</td>
<td></td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midlothian (SRUC)</td>
<td>Ramularia</td>
<td>Laureate (SB)</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Carlow, Ireland (Teagasc)</td>
<td>Ramularia</td>
<td>Pixel (WB)</td>
<td></td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Rhynchosporium 2017–19 (8 trials)
(protectant activity)

Priaxor = fluxapyroxad + pyraclostrobin

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Winter barley tan spot 2019 (1 trial)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Net blotch 2017–19 (4 trials)
(protectant activity)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Net blotch yields 2017–19 (5 trials)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease.
Ramularia 2019 (2 sites)

![Graph showing the percentage of Ramularia against the percentage of full label dose for different products. The graph includes lines for Bravo, Proline, and Revystar XE.](image-url)
Barley summary 2019

- Rhynchosporium and net blotch – fluxapyroxad- or prothioconazole-based products lead (higher doses required for net blotch control)
- Mildew – prothioconazole-based products and Cyflamid most effective
- Tan spot – very good efficacy Proline and Siltra at low rates (Imtrex useful activity)
- Ramularia:
  - Revystar XE promising.
  - Resistance appears patchy – some activity from prothioconazole
  - Loss of CTL in 2020 will impact
Fungicide performance 2019 update for oilseed rape
Two new products, with existing actives, for OSR

**Aviator Xpro**
- 75g/l bixafen + 160g/l prothioconazole
- Maximum individual dose 1.0 l/ha
- Maximum of two applications per crop
- Can be applied up to 56 days before harvest
- Approved for control of:
  - Light leaf spot
  - Phoma stem canker
  - Sclerotinia control

**Angle**
- 125g/l azoxystrobin + 125g/l difenoconazole
- Maximum individual dose 1.0 l/ha
- Maximum of two applications per crop
- Can be applied up to and including end of flowering
- Approved for:
  - Phoma stem canker reduction
  - Sclerotinia control (moderate control)
Phoma stem canker 2018–19 (4 trials)

Four trials at Rosemaund, Herefordshire and Terrington, Norfolk.
Light leaf spot control 2019
(March assessments)

Note: Labels for Filan and Angle do not include control of light leaf spot
Light leaf spot yields 2019 (2 trials)

![Graph showing the relationship between percentage of full label dose and yield (t/ha) for different cultivars. The x-axis represents the percentage of full label dose (0% to 100%), and the y-axis represents yield (t/ha) ranging from 3.0 to 4.0.]

- **Proline**
- **Filan**
- **Angle**
Light leaf spot: disease and yield 2015–16 (5 trials)

Trials based in Yorkshire and Midlothian
Sclerotinia stem rot 2015–17 (4 trials)

Trials in Ceredigion and Herefordshire, single applications

Percentage of full label dose

Sclerotinia index (0 to 100)

Yield (t/ha)

Proline
Amistar
Filan
Aviator Xpro
Angle
Pictor
OSR summary 2019

Phoma stem canker
- Azoles, SDHIs and strobilurins all have efficacy
- Two applications providing effective control

Light leaf spot
- Early sown crops more at risk
- Significant yield benefits (~0.4t/ha) from control in 2019

Sclerotinia stem rot
- Products containing prothioconazole or boscalid lead
- Azoxystrobin also effective
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