Designing fungicide programmes for 2015: Fungicide performance in wheat, barley and oilseed rape

Stuart Knight
Director of Crops & Agronomy NIAB
Fungicide performance in wheat 2014

Winter and spring rainfall 2013/14
### Wheat trials: summary 2014

<table>
<thead>
<tr>
<th>Target Disease</th>
<th>Site (Variety)</th>
<th>Organisation</th>
<th>Disease data</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septoria tritici (T1 and T2 trials)</td>
<td>Fife, Scotland (Consort)</td>
<td>SRUC</td>
<td>Septoria tritici</td>
<td>Yield Spec Weight</td>
</tr>
<tr>
<td>Septoria tritici (T1 and T2 trials)</td>
<td>Sutton Scoatney, Hants (KWS Sterling)</td>
<td>NIAB</td>
<td>Septoria tritici</td>
<td>Yield Spec Weight</td>
</tr>
<tr>
<td>Septoria tritici (Leaf 2, timing trial)</td>
<td>Rosemaund, Hereford (Consort)</td>
<td>ADAS</td>
<td>Septoria tritici</td>
<td>Yield Spec Weight</td>
</tr>
<tr>
<td>Septoria tritici (Leaf 2 trial)</td>
<td>Carlow, Ireland</td>
<td>TEAGASC</td>
<td>Septoria tritici</td>
<td>Yield Spec Weight</td>
</tr>
<tr>
<td>Yellow rust (T1 trial)</td>
<td>Kings Lynn, Norfolk (Oakley)</td>
<td>ADAS</td>
<td>Yellow rust</td>
<td>Yield Spec Weight</td>
</tr>
<tr>
<td>Brown rust (T2 trial, inoculated in April)</td>
<td>Cambridge (Warrior)</td>
<td>NIAB</td>
<td>Brown rust</td>
<td>No significant differences</td>
</tr>
<tr>
<td>Powdery mildew</td>
<td>Fife, Scotland (Claire)</td>
<td>SRUC</td>
<td>No mildew (Septoria tritici)</td>
<td>Yield Spec Weight</td>
</tr>
</tbody>
</table>

### Wheat: septoria trial treatments

<table>
<thead>
<tr>
<th>Product</th>
<th>Active(s)</th>
<th>Full Dose (l/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Azoles and multisites</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ignite / Opus Max</td>
<td>epoxiconazole</td>
<td>1.5</td>
</tr>
<tr>
<td>Proline* 275 / 250</td>
<td>prothioconazole</td>
<td>0.72 / 0.8</td>
</tr>
<tr>
<td>Phoenix*</td>
<td>folpet</td>
<td>1.5</td>
</tr>
<tr>
<td>Bravo</td>
<td>chlorothalonil</td>
<td>1.0 l/ha (half dose) only</td>
</tr>
<tr>
<td><em>Solo SDHI’s</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrex</td>
<td>fluxapyroxad</td>
<td>2.0</td>
</tr>
<tr>
<td>Vertisan</td>
<td>pentiopryrad</td>
<td>1.5</td>
</tr>
<tr>
<td><em>SDHI / Azole mixtures</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aviator 235 / 225 Xpro</td>
<td>bixafen + prothioconazole</td>
<td>1.25</td>
</tr>
<tr>
<td>Adexar</td>
<td>epoxiconazole + fluxapyroxad</td>
<td>2.0</td>
</tr>
<tr>
<td>Vertisan + Ignite*</td>
<td>pentiopryrad + epoxiconazole</td>
<td>1.5 + 1.5</td>
</tr>
</tbody>
</table>

(* products included at 5 of the 6 trial sites, means balanced by REML)
Septoria: protectant (6 trial mean 2014)

Septoria: protectant (over year 2012/13/14)
Septoria: eradicant (4 trial mean 2014)

Yield summary: all 2014 septoria trials (7)
Trend in azole protectant activity over time

Variance accounted for = 62.0%
Variance accounted for = 43.2%

Trend in azole eradicant activity over time

Variance accounted for = 54.5%
Variance accounted for = 62.4%
Wheat: yellow and brown rust trial treatments

<table>
<thead>
<tr>
<th>Products tested</th>
<th>Active(s)</th>
<th>Full Dose (l/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ignite</td>
<td>epoxiconazole</td>
<td>1.5</td>
</tr>
<tr>
<td>Comet 200</td>
<td>pyraclostrobin</td>
<td>1.25</td>
</tr>
<tr>
<td>Phoenix</td>
<td>folpet</td>
<td>1.5</td>
</tr>
<tr>
<td>Imtrex</td>
<td>fluxapyroxad</td>
<td>2.0</td>
</tr>
<tr>
<td>Vertisan</td>
<td>penthio pyrad</td>
<td>1.5</td>
</tr>
<tr>
<td>Aviator 235 Xpro</td>
<td>bixafen + prothioconazole</td>
<td>1.25</td>
</tr>
<tr>
<td>Adexar</td>
<td>epoxiconazole + fluxapyroxad</td>
<td>2.0</td>
</tr>
<tr>
<td>Seguris</td>
<td>epoxiconazole + isopyrazam</td>
<td>1.0</td>
</tr>
<tr>
<td>Vertisan + Ignite</td>
<td>penthio pyrad + epoxiconazole</td>
<td>1.5 + 1.5</td>
</tr>
</tbody>
</table>

Brown rust (Cambridge 2014)
Yellow rust (Kings Lynn 2014)

Yellow rust (over year 2012/13/14)
Conclusions: septoria

- High disease pressure in 2014 giving good protectant and eradicant data, and yield responses
- Differences between Proline and Ignite seen only in protectant activity. Considered unlikely to represent shift in relative efficacy
- Solo SDHIs Vertisan and Imtrex highly active on Septoria tritici
- But ALWAYS use SDHIs in mix with effective partner(s)
- SDHI/azole mixtures Adexar, Aviator & Vertisan + Ignite closely matched for septoria control, and superior to solo SDHIs
- Multisites Bravo and Phoenix remain valuable as protectants

Conclusions: rusts

- Vertisan and Imtrex showed activity on both rusts, but more effective on brown rust
- Phoenix had no effect on brown rust but low level of activity on yellow rust (neither disease is currently on the label)
- Comet remains highly effective against brown rust, and Ignite most effective against yellow rust
- SDHI/azole mixtures more robust than solo SDHIs across yield and overall disease
### Designing effective programmes (wheat)

<table>
<thead>
<tr>
<th>Timings</th>
<th>For Septoria</th>
<th>For Yellow Rust</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0 - GS30-31</td>
<td>(Multisite)</td>
<td>(Azole or Strobilurin)</td>
</tr>
<tr>
<td>T1 – GS32 / Leaf 3 emerged</td>
<td>Azole + Multisite (+ SDHI)</td>
<td>(+ Strobilurin)</td>
</tr>
<tr>
<td>T1.5 - GS37 / Leaf 2 emerged</td>
<td>(Multisite)</td>
<td>(Azole or Strobilurin)</td>
</tr>
<tr>
<td>T2 - GS39 / Flag Leaf emerged</td>
<td>Azole + SDHI (+ Multisite)</td>
<td>(+ Strobilurin)</td>
</tr>
<tr>
<td>T3 - GS63-65 – Early / Mid Flowering</td>
<td>Azole (+ Strobilurin) for rusts and ear diseases,</td>
<td></td>
</tr>
</tbody>
</table>

### Fungicide performance in barley 2014

[ADAS](https://www.adas.co.uk)  [NIAB TAG](https://www.niabtag.co.uk)  [SRUC](https://www.sruc.ac.uk)
### Barley: trials summary 2014

<table>
<thead>
<tr>
<th>Target Disease</th>
<th>Site (Variety)</th>
<th>Organisation</th>
<th>Disease data</th>
<th>Other data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhynchosporium (Winter Barley)</td>
<td>Lanark (Saffron)</td>
<td>SRUC</td>
<td>Rhynchosporium (Mildew)</td>
<td>Yield</td>
</tr>
<tr>
<td>Rhynchosporium (Winter Barley)</td>
<td>Cardigan (Cassia)</td>
<td>ADAS</td>
<td>Rhynchosporium</td>
<td>Yield</td>
</tr>
<tr>
<td>Rhynchosporium (Winter Barley)</td>
<td>Carlow (Saffron)</td>
<td>TEAGASC</td>
<td>Rhynchosporium</td>
<td>Yield</td>
</tr>
<tr>
<td>Net Blotch (Winter Barley)</td>
<td>High Mowthorpe (Cassata)</td>
<td>ADAS</td>
<td>Net blotch (Brown rust)</td>
<td>Yield, Spec Weight</td>
</tr>
<tr>
<td>Net Blotch (Winter Barley)</td>
<td>Morley, Norfolk (Cassata)</td>
<td>NIAB</td>
<td>Net blotch (Brown rust)</td>
<td>Yield Brackling</td>
</tr>
<tr>
<td>Brown rust (Winter Barley)</td>
<td>Caythorpe, Lincs (Escadre)</td>
<td>NIAB</td>
<td>Brown rust</td>
<td>Yield, Spec Wt, Brackling</td>
</tr>
<tr>
<td>Powdery mildew (Winter Barley)</td>
<td>Bush Midlothian (Cassata)</td>
<td>SRUC</td>
<td>Mildew (L4)</td>
<td>Yield</td>
</tr>
<tr>
<td>Ramularia (Spring Barley)</td>
<td>Bush Midlothian (Prestige)</td>
<td>SRUC</td>
<td>No ramularia (B rust, Rhyncho)</td>
<td>Yield</td>
</tr>
</tbody>
</table>

### Barley: trial treatments

<table>
<thead>
<tr>
<th>Product</th>
<th>Active(s)</th>
<th>Full Dose (l/ha)</th>
<th>Rhyncho Trials</th>
<th>Net Blotch Trials</th>
<th>Brown Rust Trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td>+ + +</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proline 275/250</td>
<td>prothiocazenole</td>
<td>0.72/0.80</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Comet 200</td>
<td>pyraclostrobin</td>
<td>1.25</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Phoenix</td>
<td>folpet</td>
<td>1.5</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imtrex</td>
<td>fluxapyroxad</td>
<td>2.0</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Zulu</td>
<td>isopyrazam</td>
<td>1.0</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Vertisan</td>
<td>penthiopyrad</td>
<td>1.5</td>
<td>+*</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Siltra Xpro</td>
<td>bixafen + prothiocazenole</td>
<td>1.0</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Adexar</td>
<td>epoxiconazole + fluxapyroxad</td>
<td>2.0</td>
<td>+</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Vertisan + Proline 275</td>
<td>penthiopyrad + prothiocazenole</td>
<td>1.5 + 0.72</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

* TEAGASC trial only
Rhynchosporium: protectant (over-year 2012/13/14)

Rhynchosporium: eradicant (over-year 2012/13/14)
Net blotch: eradicant (over-year 2012/14)

Brown rust (Lincs 2014)
Barley: mildew trial treatments

<table>
<thead>
<tr>
<th>Product</th>
<th>Active(s)</th>
<th>Full Dose (l/ha)</th>
<th>Mildew Trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Proline 275</td>
<td>prothioconazole</td>
<td>0.72</td>
<td>+</td>
</tr>
<tr>
<td>Cyflamid</td>
<td>cyflufenamid</td>
<td>0.5</td>
<td>+</td>
</tr>
<tr>
<td>Flexity</td>
<td>metrafenone</td>
<td>0.5</td>
<td>+</td>
</tr>
<tr>
<td>Talius</td>
<td>proquinazid</td>
<td>0.25</td>
<td>+</td>
</tr>
<tr>
<td>Torch</td>
<td>spiroxamine</td>
<td>1.5</td>
<td>+</td>
</tr>
<tr>
<td>Vertisan</td>
<td>pentiopyrad</td>
<td>1.5</td>
<td>+</td>
</tr>
<tr>
<td>Zulu</td>
<td>isopyrazam</td>
<td>1.0</td>
<td>+</td>
</tr>
<tr>
<td>Siltra Xpro</td>
<td>bixafen + prothioconazole</td>
<td>1.0</td>
<td>+</td>
</tr>
</tbody>
</table>

Mildew: Leaf 4 (Scotland 2014)
Designing effective programmes (barley)

- More differentiation between SDHI actives:
  - Imtrex performed well, especially on rhyncho and net blotch
  - Zulu effective on net blotch and brown rust but less active on rhyncho
  - Vertisan less active on net blotch than Imtrex

- Proline still a consistently good, broad-spectrum azole

- Siltra Xpro highly effective, similar activity from Adexar

- Comet less effective on net blotch, still good against brown rust

- Phoenix has limited activity on rhynchosporium.

- Avoid over-reliance on SDHI + azole: other mixtures are available
## Oilseed rape: trials summary

<table>
<thead>
<tr>
<th>Target Disease</th>
<th>Site (Variety)</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phoma (2-spray*)</td>
<td>Boxworth, Cambs (2013-14 cv. Catana)</td>
<td>ADAS</td>
</tr>
<tr>
<td></td>
<td>Terrington, Norfolk (2013-14 cv. Catana)</td>
<td>ADAS</td>
</tr>
<tr>
<td>Light Leaf Spot (2-spray**)</td>
<td>Malton, North Yorks (2013-14 cv. PR46W21)</td>
<td>ADAS</td>
</tr>
<tr>
<td></td>
<td>Edinburgh (2013-14 cv. Castille)</td>
<td>SRUC</td>
</tr>
<tr>
<td>Sclerotinia Stem Rot (single spray)</td>
<td>Herefordshire (2013-14 low disease)</td>
<td>ADAS</td>
</tr>
<tr>
<td></td>
<td>Kent / Berkshire (2013-14 low disease)</td>
<td>ADAS</td>
</tr>
</tbody>
</table>

*10-20% plants affected followed by 4-10 weeks when similar level of re-infection evident

** Autumn (November) followed by pre or early stem extension (February / March)

## Phoma and light leaf spot treatments

<table>
<thead>
<tr>
<th>Product</th>
<th>Active(s)</th>
<th>Full Dose (l/ha)</th>
<th>Phoma</th>
<th>Light Leaf Spot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Proline 275</td>
<td>prothioconazole</td>
<td>0.63</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Prosaro</td>
<td>prothioconazole + tebuconazole</td>
<td>1.00</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Orius 20EW</td>
<td>tebuconazole</td>
<td>1.25</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Orius P</td>
<td>prochloraz + tebuconazole</td>
<td>1.50</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Sunorg Pro</td>
<td>metconazole</td>
<td>0.80</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Refinzar***</td>
<td>penthiopyrad + picoxystrobin</td>
<td>1.0</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

*** Refinzar tested as a 2-spray programme in common with other phoma treatments BUT the label restricts use to one application per season (at full dose)
Phoma leaf spot and stem canker

Phoma: Canker Index
(Boxworth, Cambs 2014: curative situation)

Pale bars not significantly different from untreated

LSD between products/rates 13.8 (canker)
Effective Programmes for Phoma

• Good control can be achieved with two sprays at half rate

• Early epidemics most damaging to yield (0.5 t/ha yield at risk). Late epidemics damaging if plants small in late autumn / winter

• All triazoles offer protection when applied prior to infection. Product choice influenced by requirement for curative activity

• SDHI + strobilurin co-form (Refinzar) now available, but label restriction of one application per season at full rate (1.0 l/ha)

Light leaf spot

![Light leaf spot image]
Historic trends in light leaf spot incidence

Light leaf spot: severity at T2 + 6 weeks (North Yorks 2014)
Light leaf spot: severity and yield (North Yorks 2014)

<table>
<thead>
<tr>
<th>Product</th>
<th>Yield (t/ha)</th>
<th>LLS Severity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated Prosaro</td>
<td>3.5</td>
<td>8</td>
</tr>
<tr>
<td>Proline</td>
<td>3.6</td>
<td>6</td>
</tr>
<tr>
<td>Orius 20EW</td>
<td>3.7</td>
<td>4</td>
</tr>
<tr>
<td>Orius P</td>
<td>3.8</td>
<td>2</td>
</tr>
<tr>
<td>Half rate</td>
<td>4.0</td>
<td>1</td>
</tr>
<tr>
<td>Full rate</td>
<td>4.1</td>
<td>0</td>
</tr>
<tr>
<td>Untreated yield</td>
<td>4.2</td>
<td>0</td>
</tr>
</tbody>
</table>

LSD between products/rates 2.7% (LLS severity), 0.38 t/ha (yield)

Pale points not significantly different from untreated

Effective programmes for light leaf spot

- Assess farm risk:
  - Previous OSR crops: did they have stem/pod symptoms pre-harvest (crop debris)?
  - Varietal resistance: all but one variety (SY Harnas) on E/W list have RL ratings below 7
- Monitor in autumn / winter and apply fungicide when LLS found
  - At stem extension 15% plants affected equates to 5% yield loss
- Some differences between products. Increasing number of applications more effective than increasing dose to improve control.
### Sclerotinia: treatments

<table>
<thead>
<tr>
<th>Product</th>
<th>Active(s)</th>
<th>Full Dose (l/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amistar</td>
<td>azoxystrobin</td>
<td>1.0</td>
</tr>
<tr>
<td>Compass</td>
<td>iprodione + thiophanate-methyl</td>
<td>3.0</td>
</tr>
<tr>
<td>Filan</td>
<td>boscalid</td>
<td>0.5 kg/ha</td>
</tr>
<tr>
<td>Folicur</td>
<td>tebuconazole</td>
<td>1.0</td>
</tr>
<tr>
<td>Galileo</td>
<td>picoxystrobin</td>
<td>1.0</td>
</tr>
<tr>
<td>Pictor</td>
<td>boscalid + dimoxystrobin</td>
<td>0.5</td>
</tr>
<tr>
<td>Priori Xtra</td>
<td>azoxystrobin + cyproconazole</td>
<td>1.0</td>
</tr>
<tr>
<td>Proline 275</td>
<td>prothioconazole</td>
<td>0.63</td>
</tr>
<tr>
<td>Prosaro</td>
<td>prothioconazole + tebuconazole</td>
<td>1.0</td>
</tr>
<tr>
<td>Propulse</td>
<td>fluopyram + prothioconazole</td>
<td>1.0</td>
</tr>
<tr>
<td>Tectura</td>
<td>boscalid + metconazole</td>
<td>1.0</td>
</tr>
<tr>
<td>Topsin</td>
<td>thiophanate-methyl</td>
<td>0.71</td>
</tr>
</tbody>
</table>
High sclerotinia pressure: only late infection controlled (Herefordshire 2012)

Sclerotinia (Kent and Herefordshire 2006–08)
Effective Programmes for Sclerotinia

- Evaluate risk:
  - previous monitoring, cropping history, weather / microclimate
- Spray timing is critical:
  - Only protectant, with activity for 3 weeks
- Where risk is high, consider using:
  - Higher application rates
  - more than one application
- Pictor new to the market in 2015

Fungicide Performance 2015: What’s New?

- New partner:
- Oilseed rape, wheat and barley now form a single project
- Wheat: inoculated brown rust trial and inoculated fusarium trial
- Barley: no brown rust trial
- Oilseed rape: additional light leaf spot trial (south-west location)
What variety disease ratings mean for your control programme

Amanda Bennett
AHDB-HGCA

Outline

1. How are HGCA Recommended List disease ratings calculated?

2. How can disease ratings be used as part of an integrated approach?

3. New HGCA on-line tools
How are disease ratings calculated?
– Untreated trials

1. Disease Observation Plots (1 replicate, unyielded)

2. Untreated trials (3 replicates, yielded)

3. Inoculated trials (2-4 replicates, unyielded)
   • Spore suspension spray
   • Spreader rows and transplants
   • Affected stubble

How are disease ratings calculated?
– Field observations

Yellow rust 5%
How are disease ratings calculated?
– Field observations

Septoria disease progression
Hampshire 2014

More than 1 valid disease assessment may be accepted per trial

Susceptible variety (Septoria tritici rating of 4)

Susceptible variety (Septoria tritici rating of 4)

How are disease ratings calculated?
– Field data validation and analysis

Validation:
• Does the data show differences between varieties?
• Are disease levels too low or too high?
• What is the best assessment date(s)?
• Are the results what we expect?

Analysis:
• For each disease, 3-5 years of data is used and log transformed
• Data from previous seasons is revalidated
• High value placed on inoculated data
• Predicted means calculated for each variety
How are disease ratings calculated?
– Calculations

Mean disease severity (log+1)

Septoria tritici

High/low disease fixed points
Calculated ratings for individual varieties

WW S. tritici disease rating

How are disease ratings calculated?
– Calculations

4 5 6 7
Using disease ratings
– A disease rating is an indicator of risk

Yellow rust development, Banbury, 2013

Using disease ratings
– To guide spray priorities

Economic benefit of treating for Septoria tritici:

- 5 pairs of RL treated and untreated trials
- Septoria the only disease present in the untreated trials
- Based on an average wheat price of £178/t and treatment programme cost of £81/ha

Error bars show standard error of the mean.
Using disease ratings – What if chemistry is lost?

Yield penalty to some resistances

**BUT** if chemistry is lost these resistances become very important

Comparison between yields of 5 pairs of RL treated and untreated trials where septoria the only disease present

Error bars show standard error of the mean

Using disease ratings – Race changes

The effect of the ‘Warrior’ yellow rust race, first detected in 2011, on wheat yields

Error bars show standard error of the mean
How can you help?

UKCPVS monitors changes in cereal rust and mildew populations across the UK

Provides information on race changes to the industry at the earliest possible opportunity

Results underpin the RL disease ratings

The survey relies on samples sent in by growers, agronomists, plant breeders and trial operators

New Tools
– HGCA disease monitoring

Weekly disease monitoring (April – July)

www.hgca.com/monitoring
HGCA Variety selection tool

2015/16 RL disease ratings

Now available on-line
www.hgca.com/varieties

The 2015/16 RL booklet will be available from mid February
Summary

There are bigger differences in levels of disease between low disease ratings than between higher ratings.

The ratings give an indication of disease risk.

Use ratings to guide spray prioritisation.

There is a yield penalty associated with Septoria tritici resistance.

If chemistry is lost, varietal resistance will become of increased importance.

Monitoring activities are essential to identify new races.

Rotation, rotation, rotation: the increasing economic rationale

Session facilitated by your HGCA Regional Manager
Jack Watts, Lead Analyst (Cereals and Oilseeds)
Anna Lockwood, Analyst (Cereals and Oilseeds)
Overview

• Brief market summary

• The economic rationale for rethinking rotations
  • CAP reform
  • Power shift in the rotation
  • OSR economics (risk versus reward)
  • The cash and yield cost of a specific pest, disease or weed

• Appreciating local markets when making rotational decisions

• Take-home messages

Grain market – UK ex-farm prices

Two largely bearish seasons as the world has built feed grain stocks.

But we are only one weather event away from volatility as we head into the 2015 ‘weather market’.

This season, prices are capped by supply (esp. UK), but supported by geopolitics – Russia.

Source: AHDB/HGCA
**Oilseed market – Erith delivered OSR**

Big soyabean crops in North and South America have quenched concerns over supply in recent seasons.

But demand growth remains and so does weather.

For the UK, a strong Pound versus Euro is impacting OSR the most.

Crude oil concerning?  
*Source: AHDB/HGCA*

---

**Forecast gross margin returns relative to first feed wheat**

This graph looks at generic forecast gross margin returns ahead of planting.

Due to lower prices, OSR has lost some of its economic appeal.

Spring bean success requires yield (good agronomy), quality (good agronomy) and protection of the premium (use of contracts).

*Source: Agro Business Consultants*
**Impact of black grass**
-- any yield loss likely to undermine the viability of second wheat

At current grain prices, second feed wheat looks uncompetitive against spring barley if yield loss is expected.

At higher grain prices, some yield loss could be tolerable from a relative gross margin perspective.

Does the use of more spring cropping create more exposure to the spring weather risk?

Source: Agro Business Consultants, AHDB/HGCA

---

**Is barley falling out of favour with the world’s arable farmers?**
-- opportunity for UK exports?

Unlike wheat and maize, which continue to set new global production records, barley is at best stagnant.

The crop has become uncompetitive for key producers, such as Canada. The likely cause – stronger yield growth in maize, soyabean and OSR.

This could well be creating a barley niche for the UK.

Source: USDA
Appreciating local markets when making rotational decisions

Take-home messages

- The economic rationale of rotations is changing
  - But are we becoming increasingly exposed to a dry / late spring risk?
- Focus on the profitability of the whole rotation rather than individual crops
- The indirect economic benefits of rotational options need to be better understood – What are the following worth on your farm?
  - Residual nitrogen from pulses
  - Improved soil due to cover crops
  - Wider cultivating and harvesting windows
- Increasingly, formulaic rotations need to be replaced by more responsive rotations which can flex in response to agronomic and economic challenges – probably at an individual field level
- Assess the local market to ensure there is sufficient demand for the crops you grow
Pest thresholds and sprays: Getting the timing right

Caroline Nicholls, HGCA
Steve Ellis, ADAS

Why should you only spray when absolutely necessary?

Economics

Lack of new actives

Environment

Resistance

Integrated pest management

Prevention

Cultural/Sanitation

Physical/Mechanical

Biological

Chemical
Too many pests to monitor!

- Online monitoring tools
- Incidence surveys
- Trapping
- e-Newsletters

What is a threshold?
Risk assessment and thresholds

A review of invertebrate pest thresholds (HGCA RR73)

- Thresholds valuable in defining need to treat
- Lack of confidence in current thresholds?
- Improved knowledge of crop physiology
- Use crop tolerance to assess pest risk

Pollen beetle
Percentage larval parasitism of pollen beetle in EU (2003–2005)

Level of parasitism ranging between
- 4 - 26% in EE
- 18 - 46% in DE and PL
- 26 - 80% in SE and the UK (up to 97% in the UK)

Data collected by B Ulber DE, A Luik PL, Z Klukowski PL, C Nilsson SE, IH Williams UK

Pollen beetle predictor forecast tool

www.hgca.com/pests

Tried and tested through HGCA-funded research
Adopted by Bayer

- Start of migration
- % migration
- New migration
Pollen beetle numbers 1988–2006

Source: Fera survey data

Area of oilseed rape treated against pollen beetle
Changes in the pyrethroid susceptibility of pollen beetle populations 2007–2013

Pollen beetle: the story so far

- Natural enemies
- Spray thresholds rarely exceeded
- Around 20% OSR area sprayed against pollen beetles (2012 PUS)
- Insecticide resistance
- Thresholds out of date?
- OSR is inherently tolerant of pest attack
- Could the thresholds be re-evaluated in relation to crop tolerance?
Threshold components

- Number of beetles
- Excess flowers
- Flowers eaten per beetle

Pollen beetles introduced at green bud
A single beetle can destroy nine buds (On average)

\[ y = 9.5766e^{-0.0397x} \]
\[ R^2 = 0.9823 \]

Excess flower number is dependent on variety in winter rape

<table>
<thead>
<tr>
<th>Variety</th>
<th>Excess flowers/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008/09</td>
</tr>
<tr>
<td>Castille (OP)</td>
<td>3747</td>
</tr>
<tr>
<td>Excalibur (Hybrid)</td>
<td>7019</td>
</tr>
<tr>
<td>PR54D03 (Semi dwarf hybrid)</td>
<td>7107</td>
</tr>
<tr>
<td>Mean</td>
<td>5958</td>
</tr>
</tbody>
</table>
Pod number for maximum yield

Excess flower number is inversely related to plant number
WOSR: Threshold calculation

- Assuming crop with 40 plants/m²
- Excess flower number would be on average ~ 200/plant
- Single beetle can destroy about 9 buds
- Need about 22 beetles/plant to destroy all excess flowers

Pollen beetle threshold varies with plant number

![Graph showing pollen beetle threshold per plant for Winter OSR and Spring OSR, with thresholds decreasing as plant number increases.]
### Pollen beetle control thresholds

Plants in lower plant populations produce more branches and, therefore, more flowers.

<table>
<thead>
<tr>
<th>Plant Density</th>
<th>Control Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30 plants/m²</td>
<td>Threshold is 25 pollen beetles per plant</td>
</tr>
<tr>
<td>30–50 plants/m²</td>
<td>Threshold is 18 pollen beetles per plant</td>
</tr>
<tr>
<td>50–70 plants/m²</td>
<td>Threshold is 11 pollen beetles per plant</td>
</tr>
<tr>
<td>More than 70 plants/m²</td>
<td>Threshold is 7 pollen beetles per plant</td>
</tr>
</tbody>
</table>

Plants/m² can be estimated by counting the number of plants within a square foot and multiplying by 11.

### Cabbage stem flea beetle (CSFB)

![Cabbage stem flea beetle images]

Past Paper - HGCA Agronomy 2015
Oxfordshire
CSFB resistance to pyrethroids

Knock-down resistance (KDR) AND enhanced metabolism

<table>
<thead>
<tr>
<th></th>
<th>No. of samples</th>
<th>No. beetles</th>
<th>Resistant beetles (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hertfordshire</td>
<td>1</td>
<td>31</td>
<td>55</td>
</tr>
<tr>
<td>Essex</td>
<td>1</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Cambridgeshire</td>
<td>4</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>Suffolk</td>
<td>2</td>
<td>57</td>
<td>54</td>
</tr>
<tr>
<td>Norfolk</td>
<td>2</td>
<td>45</td>
<td>27</td>
</tr>
<tr>
<td>Yorkshire</td>
<td>2</td>
<td>49</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>289</td>
<td></td>
</tr>
</tbody>
</table>

CSFB control thresholds

**Adult beetles**
- >25% leaf area eaten at the cotyledon–2 true leaf growth stage
- >50% the leaf area eaten at the 3–4 true leaf stage
- The crop is growing more slowly than it is being destroyed

**Larvae**
- >35 beetles/water trap in total over the monitoring period (emergence – end Oct)
- >2 larvae/plant or 50% petioles damaged
Tolerance of OSR to loss of leaf area

Creating cabbage stem flea beetle adult damage

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Both cotyledons</th>
<th>Leaf 1</th>
<th>Leaf 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>Slight</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>3</td>
<td>Moderate</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>4</td>
<td>Severe</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>5</td>
<td>Moderate</td>
<td>Slight</td>
<td>N/A</td>
</tr>
<tr>
<td>6</td>
<td>Moderate</td>
<td>Moderate</td>
<td>N/A</td>
</tr>
<tr>
<td>7</td>
<td>Moderate</td>
<td>Severe</td>
<td>N/A</td>
</tr>
<tr>
<td>8</td>
<td>Moderate</td>
<td>Slight</td>
<td>Slight</td>
</tr>
<tr>
<td>9</td>
<td>Moderate</td>
<td>Slight</td>
<td>Moderate</td>
</tr>
<tr>
<td>10</td>
<td>Moderate</td>
<td>Slight</td>
<td>Severe</td>
</tr>
<tr>
<td>11</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Slight</td>
</tr>
<tr>
<td>12</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>13</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Severe</td>
</tr>
<tr>
<td>14</td>
<td>Moderate</td>
<td>Severe</td>
<td>Slight</td>
</tr>
<tr>
<td>15</td>
<td>Moderate</td>
<td>Severe</td>
<td>Moderate</td>
</tr>
<tr>
<td>16</td>
<td>Moderate</td>
<td>Severe</td>
<td>Severe</td>
</tr>
</tbody>
</table>
Tolerance of OSR to loss of leaf area

Green leaf area (Bars = LSD P<0.05)

How will thresholds evolve?

- User friendly
- Inexpensive to use
- Based on sound science
- Take account of crop tolerance
- Combine pests in feeding groups
Aphids

Aphid migration

Past Paper - HGCA Agronomy 2015
Oxfordshire
Aphid migration data

Aphid migration data

Numbers of peach–potato aphid found in suction-traps are above average in eastern England. If aphids can be found easily in crops it is worth considering control…
Resistance status (Peach–potato aphid)

HGCA e-Newsletters
Useful for monitoring why?
- Remind you to monitor
- Remind you of thresholds
- Remind you of legislation
- Warn you of outbreaks
- Warn you of new issues
Pest-specific information

www.hgca.com/pests

Information on just about every cereal and oilseed pest
Attention to agronomic detail: 
Herbicide-resistant weeds

Stephen Moss, Senior Research Scientist
Rothamsted Research

Herbicide-resistant weeds in the UK

The most important herbicide-resistant weed in western Europe
Black-grass Alopecurus myosuroides
Rye-grass Lolium multiflorum
Wild-oats Avena spp.
Chickweed Stellaria media
Poppy Papaver rhoeas
Mayweed Tripleurospermum inodorum
Herbicides alone are not enough

No new herbicide modes of action
Non-chemical control of black-grass in winter wheat

<table>
<thead>
<tr>
<th>Method</th>
<th>Number of experiments</th>
<th>% reduction achieved</th>
<th>Mean</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ploughing</td>
<td>25</td>
<td>69%</td>
<td>-</td>
<td>- 82% to 95%</td>
</tr>
<tr>
<td>Delayed autumn drilling</td>
<td>19</td>
<td>31%</td>
<td>-</td>
<td>- 71% to 97%</td>
</tr>
<tr>
<td>Higher seed rates</td>
<td>16</td>
<td>26%</td>
<td>-</td>
<td>+ 7% to 63%</td>
</tr>
<tr>
<td>Competitive cultivars</td>
<td>5</td>
<td>22%</td>
<td>-</td>
<td>+ 8% to 45%</td>
</tr>
<tr>
<td>Spring cropping</td>
<td>5</td>
<td>88%</td>
<td>-</td>
<td>+78 to 96%</td>
</tr>
<tr>
<td>Fallowing/grass leys</td>
<td>-</td>
<td></td>
<td>70-80%/year</td>
<td>(of seedbank)</td>
</tr>
</tbody>
</table>

Based on review, by Lutman, Moss, Cook & Welham, Weed Research, 2013

1. Crop rotation – what are the issues?
More balanced rotations are needed:

1. To help control grass-weeds

2. To reduce the impact of pests and diseases on crops such as oilseed rape, which are often grown too frequently

3. To improve soil organic matter and fertility, partly by inclusion of cover crops

2. Rotational ploughing

Are the potential benefits of rotational ploughing not being achieved due to the lack of proper ploughing?
Ploughing

Ploughing reduced black-grass populations by 69% relative to shallow tillage.

BUT control varied from -82% to 95% between experiments:
• Better results where seed buried greatly exceeded amount brought up (e.g. after long run of minimum tillage).
• Poorer results where very little seed buried but much more brought up (e.g. where many seeds ploughed down previous year).

Good inversion vital to bury all freshly shed seeds over 5 cm deep.

Rotational ploughing (once every 3–6 years) can be very effective – but only if good inversion is achieved.

3. Delayed autumn drilling

How late are you willing to delay autumn drilling and do the benefits outweigh the risks?
Results from 5 HGCA drilling date trials

<table>
<thead>
<tr>
<th></th>
<th>Delaying drilling by 3 wks from mid September:</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black-grass plants/m²</td>
<td>33% less</td>
<td>-41 to 78%</td>
</tr>
<tr>
<td>Black-grass heads/plant</td>
<td>49% less</td>
<td>-15 to 84%</td>
</tr>
<tr>
<td>Additional control from pre-em herbicides</td>
<td>25% more (from 47% at DD1)</td>
<td>5 to 45%</td>
</tr>
<tr>
<td>Black-grass impact on crop yield</td>
<td>Black-grass plants 55% less competitive (late Sept v late Oct)</td>
<td>7 – 75%</td>
</tr>
</tbody>
</table>

Note that most of the benefits come from delaying drilling from mid-September to the first half of...

Delayed autumn drilling has 4 benefits

1. It will **usually** result in less black-grass in the crop as more can be destroyed before drilling
2. There will **typically** be fewer black-grass heads per plant and consequently less seed return
3. It will **generally** result in better control from the herbicide programme as conditions for residual herbicides will usually be better
4. Black-grass emerging in later drilled crops will **normally** be less competitive

Winter wheat trials conducted by Rothamsted and NIAB TAG, 2010–2015
### Delayed drilling is the only solution

If so, how long do you delay from mid-September?

<table>
<thead>
<tr>
<th>Delay for:</th>
<th>To:</th>
<th>Crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 weeks</td>
<td>Early October</td>
<td>Wheat</td>
</tr>
<tr>
<td>6 weeks</td>
<td>Late October</td>
<td>Wheat</td>
</tr>
<tr>
<td>6 months</td>
<td>March</td>
<td>Spring crop</td>
</tr>
<tr>
<td>7 - 8 months</td>
<td>April/May</td>
<td>Linseed, maize</td>
</tr>
<tr>
<td>12 months</td>
<td>1 year fallow/grass ley</td>
<td>Wheat</td>
</tr>
<tr>
<td>18 months</td>
<td>1½ yr fallow + spring crop</td>
<td>Spring crop</td>
</tr>
<tr>
<td>24 months</td>
<td>2 year fallow/grass ley</td>
<td>Wheat</td>
</tr>
<tr>
<td>36 months</td>
<td>3 year fallow/grass ley</td>
<td>Wheat</td>
</tr>
</tbody>
</table>

The greater the black-grass population and the bigger the resistance problem, the more urgent is the need for the ‘unacceptable’ to become ‘acceptable’.

### 4. Spring cropping

Are you convinced of the value of spring cropping for grass-weed control and is it viable financially?
Effect of spring cropping at reducing black-grass populations

Spring cropping can reduce black-grass populations by 88% but........

1. Spring drilling is difficult on heavy land
2. Actual infestation level may still be considerable
3. Other crops may be less competitive than cereals
4. Impact of different spring drilling dates not known
5. Herbicide options are limited in many spring crops
6. Financial returns may be poorer
7. May impact on drilling dates for following crops
5. Is fallowing or growing grass leys a strategy you would consider?

- Fallowing?
- Grass leys?

Effects of fallowing/leys on black-grass

A one-year fallow/grass ley is not enough
6. Hand rogueing black-grass: how realistic is it?

Remove black-grass by hand if possible – before mid June when seed shedding starts

Spraying off patches with glyphosate in early June

Why not repeat (if necessary) for 2 – 3 years?
How easy is it to use GPS for repeated annual spraying of small patches?
7. Do shallow stubble cultivations increase black-grass germination?

Post-harvest stubble cultivations

Black-grass on uncultivated stubble
17 September 2013

How much would shallow cultivations help?
Are shallow post-harvest cultivations a waste of time for black-grass?

Cultivating straight after harvest resulted in only 16% less black-grass in the following wheat crop, compared with cultivating just prior to drilling*

Stale seedbeds do help:
- volunteer cereal germination
- sterile brome germination
- incorporation of straw and chaff
- remove surface compaction
- may improve quality of final seedbed which might favour subsequent pre-emergence herbicide activity

“Experiments do not support the belief that shallow stubble cultivations are a means of stimulating black-grass germination, although they may be useful for other purposes” Moss 1978.

* based on 22 comparisons over 11 field experiments in LINK project

8. Should more farmers conduct experiments to get a better idea of what is the best weed control strategy on their own farm?

Deliberately unsprayed patches can be very useful in quantifying herbicide efficacy

£120/ha spent on herbicides
90% control
Unsprayed area
32 x 3 m
(but 8 x 3 m fine)
Ideally have at least two in representative areas of field

Unsprayed area

9. Influencing farmers – what sources of information have the biggest impact on your decision-making?

Ultimately, it’s the individual farmer who must recognise the need for more non-chemical control and decide what measures to adopt.
Understanding the relationship between advice and behaviour

- Communication
  - Face to face meetings
  - Web
  - Email/Text
  - Mailshots
  - Phone
  - Group presentations/talks
  - Demonstrations
  - Farming press
  - Leaflets
  - Adverts

- Willingness to change
  - Confidence of success
  - Social responsibility
  - Farming philosophy
  - Personal ideology
  - Financial incentives
  - Avoid penalties
  - Time/effort/'hassle'

- Ability to change
  - Legal/regulatory constraints
  - Farm characteristics
  - Resources
    - e.g. Labour/machinery
  - Farm tenure
  - Finance
  - Knowledge/Skills
  - Time

Success!

Questions?

1. Crop rotation – benefits v financial/management implications?
2. Ploughing – too much poor quality ploughing?
3. Delayed autumn drilling – benefits v risks?
4. Spring cropping – how much does it help? Which crop to grow?
5. Fallowing/grass leys/AD – how realistic?
6. Annual hand rogueing/patch spraying of same areas – practicality?
7. Stubble cultivations for weed control – what do they achieve?
8. On-farm experiments – how much would they help?
9. Knowledge transfer – how best to influence farmers?
Event close