Grain market update
January 2014

Julian Bell - Senior Business Consultant, SAC Consulting, SRUC
Julian.Bell@sac.co.uk / 07795 302 264

Grain market outlook
– 2013 harvest and beyond

1) 2013 – bumper harvest means stocks rebuilt for first time in 4 years BUT stocks remain historically low

2) 2014 – it will take another good harvest to bring prices down much further – market will remain on edge til then

3) UK will return as a major wheat exporter in 2014 – Scotland’s wheat crop could rise 50% - lower prices and Scottish premium but demand will also grow

4) Malting barley prices for 2014 stronger on lower spring area

5) Look ahead to identify opportunities – forward margins for 2014 looking better at present, IF you sell some forward

6) CAP reform – lower area payments increase focus on the market
World feed grain price floor drops £80 in one year – on massive US maize crop

Source: HGCA

2013 world harvest up 179mt; grain demand up 116mt & stocks up 40mt

Source: USDA
World demand growth sharply higher – feed leads

Source: USDA/SAC Consulting

2013 world oilseeds harvest up 6%, stocks up 20% - China key to supporting demand

Source: HGCA
2014 world harvest; another good harvest needed to rebuild stocks further

![Graph showing grain production and use million tonnes from 2009 to 2014.](Source: USDA)

UK wheat deficit widens in 2013 – but large crop and return to exports in 2014

<table>
<thead>
<tr>
<th>UK wheat '000 t</th>
<th>2011/12</th>
<th>2012/13</th>
<th>2013/14</th>
<th>2014/15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Stocks</td>
<td>1,537</td>
<td>1,495</td>
<td>2,166</td>
<td>1,450</td>
</tr>
<tr>
<td>Production</td>
<td>15,257</td>
<td>13,251</td>
<td>11,921</td>
<td>16,800</td>
</tr>
<tr>
<td>Imports</td>
<td>900</td>
<td>2,544</td>
<td>1,615</td>
<td>1,000</td>
</tr>
<tr>
<td>Available</td>
<td>17,702</td>
<td>17,700</td>
<td>15,722</td>
<td>19,250</td>
</tr>
<tr>
<td>Human Use</td>
<td>6,846</td>
<td>7,572</td>
<td>7,865</td>
<td>7,857</td>
</tr>
<tr>
<td>- of which</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- for milling</td>
<td>4,689</td>
<td>5,040</td>
<td>5,287</td>
<td>5,087</td>
</tr>
<tr>
<td>- starch/ethanol</td>
<td>1,227</td>
<td>1,752</td>
<td>2,088</td>
<td>2,099</td>
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<tr>
<td>- distilling &amp; malt</td>
<td>680</td>
<td>780</td>
<td>770</td>
<td>780</td>
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<tr>
<td>Animal Feed</td>
<td>6,475</td>
<td>6,835</td>
<td>5,903</td>
<td>6,750</td>
</tr>
<tr>
<td>Seed etc</td>
<td>371</td>
<td>370</td>
<td>356</td>
<td>380</td>
</tr>
<tr>
<td>Domestic Use</td>
<td>13,692</td>
<td>14,777</td>
<td>14,064</td>
<td>14,997</td>
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<tr>
<td>Exports</td>
<td>2,518</td>
<td>737</td>
<td>209</td>
<td>2,403</td>
</tr>
<tr>
<td>End Stocks</td>
<td>1,490</td>
<td>2,186</td>
<td>1,456</td>
<td>1,480</td>
</tr>
</tbody>
</table>

Source: DEFRA/HGCA/SAC Consulting
UK wheat has been overpriced vs French maize – large increase in UK maize imports, loss of distilling demand to maize

<table>
<thead>
<tr>
<th>Year</th>
<th>Net UK surplus/ deficit [000’s t]</th>
<th>UK wheat - vs French wheat</th>
<th>French maize</th>
<th>UK av.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009/10</td>
<td>1186</td>
<td>-11.82</td>
<td>-17.06</td>
<td>5.3</td>
</tr>
<tr>
<td>2010/11</td>
<td>1654</td>
<td>-16.88</td>
<td>-7.68</td>
<td>7.3</td>
</tr>
<tr>
<td>2011/12</td>
<td>1607</td>
<td>-7.14</td>
<td>-11.31</td>
<td>5.2</td>
</tr>
<tr>
<td>2012/13</td>
<td>-2207</td>
<td>-3.96</td>
<td>4.36</td>
<td>14.3</td>
</tr>
<tr>
<td>2013/14</td>
<td>-1407</td>
<td>-5.64</td>
<td>7.79</td>
<td>16.7</td>
</tr>
<tr>
<td>2014/15</td>
<td>1803</td>
<td>-6.00</td>
<td>3.00</td>
<td></td>
</tr>
</tbody>
</table>

Average 2009 - 2011: -12 -12
Difference: -0 -15

Source: SRUC

UK new crop wheat at £155/t is £5-15/t overvalued vs French wheat and maize - given the expected size of the net surplus

Source: HGCA
### Big swing in UK wheat and spring barley output next year – wheat + 40-50%, spr barley -10-40%

<table>
<thead>
<tr>
<th>Crop</th>
<th>2013 ('000's t)</th>
<th>2014 ('000's t)</th>
<th>Change ('000's t)</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat - UK</td>
<td>11,921</td>
<td>16,800</td>
<td>4879</td>
<td>41%</td>
</tr>
<tr>
<td>Wheat - Scotland</td>
<td>643</td>
<td>953</td>
<td>310</td>
<td>48%</td>
</tr>
<tr>
<td>Spring barley - UK</td>
<td>5,110</td>
<td>3,215</td>
<td>-1895</td>
<td>-37%</td>
</tr>
<tr>
<td>Spring barley - Scotland</td>
<td>1,714</td>
<td>1,537</td>
<td>-177</td>
<td>-10%</td>
</tr>
</tbody>
</table>

Source: SRUC

### Scottish spring barley in 2014? - to fall on higher wheat area

**Spring barley area**

<table>
<thead>
<tr>
<th>Year</th>
<th>Area ('000's ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>300</td>
</tr>
<tr>
<td>1989</td>
<td>290</td>
</tr>
<tr>
<td>1991</td>
<td>280</td>
</tr>
<tr>
<td>1993</td>
<td>270</td>
</tr>
<tr>
<td>1995</td>
<td>260</td>
</tr>
<tr>
<td>1997</td>
<td>250</td>
</tr>
<tr>
<td>1999</td>
<td>240</td>
</tr>
<tr>
<td>2001</td>
<td>230</td>
</tr>
<tr>
<td>2003</td>
<td>220</td>
</tr>
<tr>
<td>2005</td>
<td>210</td>
</tr>
<tr>
<td>2007</td>
<td>200</td>
</tr>
<tr>
<td>2009</td>
<td>190</td>
</tr>
<tr>
<td>2011</td>
<td>180</td>
</tr>
<tr>
<td>2013</td>
<td>170</td>
</tr>
</tbody>
</table>

**2014?**

Source: Scottish Govt./SAC Consulting
Malting barley purchases in Scotland – could be over 60% of 2014 crop – boost to premiums?

<table>
<thead>
<tr>
<th>Year</th>
<th>MAGB Scottish Sp. barley purchases ('000's t)</th>
<th>Scottish Sp. barley crop ('000's t)</th>
<th>MAGB purchases as % of crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>739</td>
<td>1,587</td>
<td>46%</td>
</tr>
<tr>
<td>2010</td>
<td>693</td>
<td>1,328</td>
<td>52%</td>
</tr>
<tr>
<td>2011</td>
<td>872</td>
<td>1,475</td>
<td>58%</td>
</tr>
<tr>
<td>2012</td>
<td>930</td>
<td>1,408</td>
<td>66%</td>
</tr>
<tr>
<td>2013</td>
<td>930</td>
<td>1,714</td>
<td>54%</td>
</tr>
<tr>
<td>2014?</td>
<td>930</td>
<td>1,537</td>
<td>60%</td>
</tr>
</tbody>
</table>

NB – 2014 example estimate - 275k ha at 5.6t/ha
Source: MAGB/Scottish Govt./ SAC Consulting

Malting barley prices and premiums – premiums over feed barley fell to ~£15/t at harvest, down from £40/t+

Source: HGCA/SAC Consulting
Spot vs forward selling?
- better prices for malting barley, better yields for wheat boost potential 2014 crop margins
- IF you start locking some forward prices in now

<table>
<thead>
<tr>
<th>Harvest Year</th>
<th>Yield (t/ha)</th>
<th>Price (£/t)</th>
<th>Output (£/ha)</th>
<th>VC (£/ha)</th>
<th>GM (£/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>8.3</td>
<td>160.90</td>
<td>1,335</td>
<td>427</td>
<td>908</td>
</tr>
<tr>
<td>2012</td>
<td>6.7</td>
<td>194.80</td>
<td>1,305</td>
<td>513</td>
<td>792</td>
</tr>
<tr>
<td>2013</td>
<td>7.2</td>
<td>168.60</td>
<td>1,221</td>
<td>490</td>
<td>731</td>
</tr>
<tr>
<td>2014</td>
<td>8.2</td>
<td>160.00</td>
<td>1,312</td>
<td>494</td>
<td>818</td>
</tr>
<tr>
<td>S. Barley - malting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>5.8</td>
<td>203.20</td>
<td>1,185</td>
<td>270</td>
<td>915</td>
</tr>
<tr>
<td>2012</td>
<td>5.0</td>
<td>209.90</td>
<td>1,050</td>
<td>316</td>
<td>734</td>
</tr>
<tr>
<td>2013</td>
<td>5.6</td>
<td>145.40</td>
<td>815</td>
<td>335</td>
<td>480</td>
</tr>
<tr>
<td>2014</td>
<td>5.6</td>
<td>180.00</td>
<td>1,008</td>
<td>340</td>
<td>668</td>
</tr>
</tbody>
</table>

SOURCE: SAC Consulting. Crop Gross Margin estimates (excluding straw sales)

CAP reform impacts on cereal producers
- start planning now

**Financial impact on direct payments** – potential reduction in area payment – per ha, per farm and per tonne of grain

**How to make this up?** – yield, price, long term contracts with distillers etc more important

**Other effects** – livestock demand for feed grain/straw

**Greening measures** - Ecological Focus Areas, 3 crops rule significant effect on spring barley plantings in North of Scotland forcing farmers to diversify – impact on distillers and prices

**Overall message** – identify impacts on your business now and plan ahead how you are going to compensate.
Grain market outlook
– 2013 harvest and beyond

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2) 2014 – it will take another good harvest to bring prices down much further – market will remain on edge til then

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4) Malting barley prices for 2014 stronger on lower spring area –

5) Look ahead to identify opportunities – forward margins for 2014 looking better at present, IF you sell some forward

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Thank you
Crop update: quality issues

Dr Simon Oxley
Senior Research & Knowledge Transfer Manager

Dr Ellie Marshall
Research & Knowledge Transfer Manager

HGCA Recommended Lists

‘Does the variety have a balance of features that are sufficiently better than existing varieties and such that it could potentially provide a more economic return in the market?’

• How do RL results compare with commercial information?
• How do varieties perform in different geographic or climatic regions?
HGCA Recommended List Quality Criteria

**Yield** above highest yielding variety or average of top yielding varieties in nabim group

**Agronomic criteria**

**Quality** characteristics identified by nabim (wheat)

<table>
<thead>
<tr>
<th>End use</th>
<th>nabim Group 1</th>
<th>nabim Group 2</th>
<th>nabim Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Weight</td>
<td>75kg/hl</td>
<td>75kg/hl</td>
<td>75kg/hl</td>
<td>74kg/hl</td>
</tr>
<tr>
<td>Hagberg Falling Number</td>
<td>230s</td>
<td>230s</td>
<td>180s</td>
<td>150s</td>
</tr>
</tbody>
</table>

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Wheat Market Requirements

<table>
<thead>
<tr>
<th>End use</th>
<th>nabim Group 1</th>
<th>nabim Group 2</th>
<th>nabim Group 3</th>
<th>Group 4</th>
<th>uks</th>
<th>ukp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Weight</td>
<td>76</td>
<td>76</td>
<td>74</td>
<td>72</td>
<td>75</td>
<td>76</td>
</tr>
<tr>
<td>Hagberg Falling</td>
<td>250</td>
<td>250</td>
<td>220</td>
<td>150</td>
<td>220</td>
<td>250</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>13</td>
<td>12.5</td>
<td>11.5</td>
<td>10.5-11.5</td>
<td>11-13</td>
<td></td>
</tr>
<tr>
<td># RL Varieties</td>
<td>4</td>
<td>5</td>
<td>11</td>
<td>20</td>
<td>11</td>
<td>8</td>
</tr>
</tbody>
</table>

2014-2015
Barley Market Requirements

### Winter Barley
- Two-row malting: 7
- Two-row feed: 10
- Six-row feed: 4

### Spring Barley
- Malting: 15
- Feed: 11

### Soft Group 4 RL wheat varieties

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>UK treated yield</td>
<td>106</td>
<td>105</td>
<td>105</td>
<td>103</td>
<td>98</td>
</tr>
<tr>
<td>North region yield</td>
<td>[106]</td>
<td>[109]</td>
<td>108</td>
<td>105</td>
<td>98</td>
</tr>
<tr>
<td>Lodging – (+) PGR</td>
<td>5 (7)</td>
<td>7 (8)</td>
<td>7 (7)</td>
<td>6 (6)</td>
<td>7 (7)</td>
</tr>
<tr>
<td>Mildew</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Yellow rust</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Brown rust</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Septoria tritici</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Orange wheat blossom midge</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>-</td>
</tr>
</tbody>
</table>
Spring Barley feed RL varieties

<table>
<thead>
<tr>
<th></th>
<th>Shada</th>
<th>Waggon</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK Treated yield</td>
<td>110</td>
<td>102</td>
</tr>
<tr>
<td>North Treated yield</td>
<td>110</td>
<td>103</td>
</tr>
<tr>
<td>Lodging [8]</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Mildew</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Brown Rust</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Rhynchosporium</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Ramularia [8]</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

RL Wheat trials mirror wheat area
UK Barley Yields – Feed Varieties (RL)

![Barley Yield Chart](chart1.png)

UK Barley RL Specific Weight – Malting Varieties

![Specific Weight Chart](chart2.png)
Season Effects – Grain filling months (wheat)

Rainfall

Sunshine

Wheat Variety Ripening

Is the quest for yield leading to later varieties with lower specific weights?
UK Barley RL Grain Nitrogen – Malting Varieties

Grain Nitrogen (%)

2008 2009 2010 2011 2012

Winter Barley  Spring Barley

Soil type

What impact does soil have on variety performance?
Wheat 2013 RL Yield

Yield (t/ha)

D-clay  D-silt  L-sand  Medium  Shallow

Wheat 2013 RL Yield – Compared to 5 year average

Yield difference (t/ha)

D-clay  D-silt  L-sand  Medium  Shallow
Wheat 5 year RL Yield

Yield (t/ha)

24th September - 7th October
8th October - 21st October
22nd October - 4th November
5th November - 18th November

Specific weight (kg/hl)

24th September - 7th October
8th - 21st October
22nd October - 4th November
5th - 18th November
1.30
1.35
1.40
1.45
1.50
1.55
1.60
1.65
1.70
1.75
1.30
10th February - 23rd February
24th February - 8th March
9th March - 22nd March
23rd March - 5th April
6th April - 28th April
Spring Barley 5 year RL Grain Nitrogen

Barley (Malting) RL Quality in Rotation
Met office regional climates

Weather impacts within a region

Trial weather information can help understand differences between trials in a region.
Can RL trials be categorised by seasonal weather?

Are there sufficient trials in each region to achieve this?

Wheat – 2013 RL Yields

<table>
<thead>
<tr>
<th>Region</th>
<th>5 year average (2009-2013)</th>
<th>2013 difference from 5 year average</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW</td>
<td>9.2 t/ha</td>
<td>-2.5</td>
</tr>
<tr>
<td>SE</td>
<td>9.6 t/ha</td>
<td>-2.0</td>
</tr>
<tr>
<td>E</td>
<td>10.3 t/ha</td>
<td>-1.5</td>
</tr>
<tr>
<td>M</td>
<td>9.7 t/ha</td>
<td>-1.0</td>
</tr>
<tr>
<td>N</td>
<td>9.2 t/ha</td>
<td>-0.5</td>
</tr>
<tr>
<td>Scot</td>
<td>11.3 t/ha</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*Map showing seasonal weather data and yield differences.*
Wheat – 2013 RL Specific Weight

5 year average (2009-2013)

2013 difference from 5 year average

Specific weight difference (kg/hl)

Spring Barley Regional Quality (Malting)
**Sensitivity & Stability**

- **Sensitivity** – degree to which a variety responds to a “good” or “poor” environment (relative to other varieties)
  - Sensitive varieties tend to perform better relative to other varieties in environments where the average yield of varieties is high

- **Stability** – degree to which a variety’s performance varies across trials
  - Stable varieties tend to not to change their performance much relative to other varieties in different trials

- HGCA research will evaluate methods which may be used to provide a measure of stability
Conclusions

- RL quality reflects seasonal commercial situation
- Require access accurate commercial yields for comparison with RL
- Higher yielding wheat varieties tend to be later with lower specific weight
- Increase sunshine during ripening improves specific weight in commercial and RL trials
- Sow date can affect both yield and quality characteristics
- Identifying weather regions as opposed to geographical regions may assist to identify stable varieties

Thank you
Crop update: variety choice from grower, breeder and industry perspectives

Steve Hoad, Crop Science Team Leader
SRUC

Outline

• Review of changes to the Scottish List
• Industry requirements
• Grower perspective
• Challenges for plant breeders
• Barley grain skinning projects
Scottish barley crop

<table>
<thead>
<tr>
<th></th>
<th>Spring barley</th>
<th>Winter barley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (ha)</td>
<td>265,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Yield (t/ha)</td>
<td>5.51</td>
<td>7.30</td>
</tr>
<tr>
<td>Production (t)</td>
<td>1,460,000</td>
<td>360,000</td>
</tr>
</tbody>
</table>

- Malts for the production of Scotch whisky (malt distilling)
  - Accounts for 84% of malting barley purchases
  - Uses low grain nitrogen barley

- High enzyme (high diastatic power) malts for grain whisky (grain distilling)
  - Accounts for 16% of malting barley purchases
  - Uses high grain nitrogen barley

Spring barley varieties are needed for two types of distilling
Spring barley grain quality requirements

- Non producers of glycosidic nitrile (for distilling uses)
- Grain nitrogen percent (%) to suit end use
- High spirit yield (for distilling uses)
- Ease of processing
  - Ease of Beta-glucan removal (brewing)
- High malt extract (brewing)
- Good enzyme levels – includes alpha amylase (DU) and diastatic power (DP)

Spring barley, 2014

Market leaders make up 92% of Scottish malting intake

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>R Concerto</td>
<td>&gt; 55% of intake</td>
</tr>
<tr>
<td>R Optic</td>
<td>Still has a place</td>
</tr>
<tr>
<td>R Belgravia</td>
<td>Dual purpose</td>
</tr>
<tr>
<td>R Propino</td>
<td>Biggest brewing variety – take market advice</td>
</tr>
<tr>
<td>R Waggon</td>
<td>Good all-round performer</td>
</tr>
</tbody>
</table>
### Spring barley, 2014

#### Varieties making progress

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>R Moonshine</td>
<td>Alternative option, niche market, early maturing</td>
</tr>
<tr>
<td>R Odyssey</td>
<td>Increase in seed area</td>
</tr>
<tr>
<td>P3 Overture</td>
<td>Future less certain, malting tests ongoing</td>
</tr>
<tr>
<td>P2 Glassel</td>
<td>Alternative option, malting tests ongoing</td>
</tr>
<tr>
<td>P1 KWS Irina</td>
<td>New brewing variety</td>
</tr>
<tr>
<td>P1 Shaloo</td>
<td>New brewing variety</td>
</tr>
<tr>
<td>P1 Shada</td>
<td>New feed variety</td>
</tr>
</tbody>
</table>

**Other changes in spring barley**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off Chronicle</td>
<td>Removed from IBD Approved List</td>
</tr>
<tr>
<td>O Westminster</td>
<td>Retains some interest as a tall feeder, but becoming outclassed for yield</td>
</tr>
</tbody>
</table>
**IBD approved malting barley list for distilling varieties harvest 2014**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>IBD Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>R Concerto</td>
<td>Full</td>
</tr>
<tr>
<td>R Optic</td>
<td>Full</td>
</tr>
<tr>
<td>R Belgravia</td>
<td>Full (includes Grain Distilling)</td>
</tr>
<tr>
<td>R Odyssey</td>
<td>Full</td>
</tr>
<tr>
<td>R Moonshine</td>
<td>Full</td>
</tr>
<tr>
<td>P3 Overture</td>
<td>Provisional Stage 2</td>
</tr>
<tr>
<td>P2 Glassel</td>
<td>Provisional Stage 1</td>
</tr>
</tbody>
</table>

**Varieties with no grain quality defects**

- Good grain size
  - plumpness
  - low screenings
- Good husk adhesion
  - low skinning
  - even malting
  - low malt breakage

From: Maree Brennan & Steve Hoad (SRUC)
Grain skinning projects

- Crop improvement project funded by BBSRC and a grower/maltster project funded by HGCA
- Developing a new scoring protocol

Skinning weakness was evident in 2012

- Wide range of skinning (4% to 67%) recorded in field trial
- Many Recommended List varieties (*) performed poorly

*Skinned*
Grain skinning projects. Findings so far

- Most current varieties had some weakness in 2012, a year of poor grain filling and prolonged harvesting period
- Crops were much less susceptible in 2013, though weaker varieties skinned under SRUC under lab tests
- Skinning can be induced by repeated (prolonged) wet-dry spells
- Dispelled the myth that brewing varieties were less susceptible to skinning
- Variety and environmental influences on a glue-like material are being investigated

from: Maree Brennan & Steve Hoad (SRUC)

Two-row barley for autumn 2014

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Malting and feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Pearl</td>
<td>More than 65% of Scottish winter malting intake</td>
</tr>
<tr>
<td>S Cassata</td>
<td>25% of Scottish intake</td>
</tr>
<tr>
<td>Defer Archer</td>
<td>Possible, but needs more testing</td>
</tr>
<tr>
<td>Defer Talisman</td>
<td>Hopeful, but testing ongoing</td>
</tr>
<tr>
<td>R Retriever</td>
<td>High yield, but low specific weight</td>
</tr>
<tr>
<td>R KWS Cassia</td>
<td>Good yield, excellent specific weight</td>
</tr>
<tr>
<td>P2 KWS Glacier</td>
<td>High yield, excellent specific weight</td>
</tr>
<tr>
<td>P1 Cavalier</td>
<td>High yield, excellent specific weight</td>
</tr>
<tr>
<td>P1 KWS Tower</td>
<td>High yield, average specific weight</td>
</tr>
</tbody>
</table>
**Six-row barley for autumn 2014**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>R  Volume</td>
<td>High yield, with good spec weight for 6-row</td>
</tr>
<tr>
<td>R  Escadre</td>
<td>Modest yield, but excellent spec weight</td>
</tr>
<tr>
<td>R  KWS Meridian</td>
<td>High yield, but low spec weight</td>
</tr>
<tr>
<td>Off Sequel</td>
<td>Outclassed for yield, good spec weight</td>
</tr>
</tbody>
</table>

**Scottish wheat crop**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (ha)</td>
<td>110,000</td>
</tr>
<tr>
<td>Yield (t/ha)</td>
<td>8.10</td>
</tr>
<tr>
<td>Production (t)</td>
<td>900,000</td>
</tr>
</tbody>
</table>
Grain distilling

- Approximately 550,000 t of wheat used per year
- Equates to 60% of Scottish wheat production or approximately half of all wheat used in Scotland
- Grain distilling = 60% of annual spirit production (Malt distilling = 40%)
- Grain distilling uses unmalted cereal (85-90%) plus barley malt (10-15%)
- Uses about 16% of all malted barley production

Distilling wheat grain quality requirements

- Soft endosperm texture
- Grain with high starch content and low nitrogen (protein)
- ‘Good’ or ‘medium’ rating for alcohol yield per tonne
- Grain should have low residue viscosity during processing
- Hard endosperm wheat or soft wheat carrying the 1b/1r rye gene translocation tend to be poor for distilling
Other variety characteristics

- nabim Group 3 (biscuit, cake and other flours)
- nabim Soft Group 4 not hard Group 4
- Preferred varieties should have:
  - Stiff straw
  - Early maturity (ripening date spreads moving north)
  - Low sprouting risk
  - Disease resistance e.g. Septoria tritici and Eyespot
- Several varieties with a ‘good’ rating for distilling are not grown because of agronomic weaknesses

---

Soft wheat for autumn 2014

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>SWRI rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2 Leeds</td>
<td>Good</td>
</tr>
<tr>
<td>P2 Myriad</td>
<td>Medium</td>
</tr>
<tr>
<td>R Viscount</td>
<td>Good</td>
</tr>
<tr>
<td>R Horatio</td>
<td>Medium</td>
</tr>
<tr>
<td>R Beluga</td>
<td>Good</td>
</tr>
<tr>
<td>O Alchemy</td>
<td>Medium</td>
</tr>
<tr>
<td>P1 Twister</td>
<td>Medium</td>
</tr>
<tr>
<td>O Tuxedo</td>
<td>Medium</td>
</tr>
<tr>
<td>R Invicta</td>
<td>Medium</td>
</tr>
<tr>
<td>P1 Icon</td>
<td>Good</td>
</tr>
<tr>
<td>P1 Zulu</td>
<td>Medium</td>
</tr>
</tbody>
</table>
### Hard wheat for autumn 2014

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Variety</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Gallant</td>
<td>Widely accepted</td>
</tr>
<tr>
<td>S</td>
<td>Solstice</td>
<td>Widely accepted</td>
</tr>
<tr>
<td>S</td>
<td>Cordiale</td>
<td>A preferred variety</td>
</tr>
<tr>
<td>Defer</td>
<td>Chilton</td>
<td>High yielding Group 2</td>
</tr>
<tr>
<td>Defer</td>
<td>Cubanita</td>
<td>New Group 2</td>
</tr>
<tr>
<td>Defer</td>
<td>Skyfall</td>
<td>New Group 1</td>
</tr>
<tr>
<td>R</td>
<td>Grafton</td>
<td>Feed; early maturing, stiff straw</td>
</tr>
</tbody>
</table>

### Other changes for wheat

#### Varieties removed from Scottish List

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Variety</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Einstein</td>
<td>Limited interest, not re-sown in trials</td>
</tr>
<tr>
<td>Off</td>
<td>Robigus</td>
<td>No data, no longer on HGCA RL</td>
</tr>
<tr>
<td>Off</td>
<td>Istabraq</td>
<td>No data, no longer on HGCA RL. Missed opportunity?</td>
</tr>
</tbody>
</table>
# Spring wheat for 2014

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Milling</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>Paragon</td>
</tr>
<tr>
<td>R</td>
<td>Ashby</td>
</tr>
<tr>
<td>R</td>
<td>Tybalt</td>
</tr>
<tr>
<td>R</td>
<td>Mulika</td>
</tr>
<tr>
<td>Defer</td>
<td>KWS Kilburn</td>
</tr>
</tbody>
</table>

All are rated as good with Mulika being a preferred variety

**High yield, high protein**

---

# Spring oats for 2014

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Firth Preferred</td>
</tr>
<tr>
<td>R</td>
<td>Husky Very good; early maturing</td>
</tr>
<tr>
<td>R</td>
<td>Atego Not much used</td>
</tr>
<tr>
<td>R</td>
<td>Canyon Good variety</td>
</tr>
<tr>
<td>Defer</td>
<td>Conway Good kernel content and spec weight</td>
</tr>
</tbody>
</table>
### Winter oats for autumn 2014

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>R Gerald</td>
<td>A preferred variety</td>
</tr>
<tr>
<td>R Dalguise</td>
<td>A preferred variety</td>
</tr>
<tr>
<td>R Mascani</td>
<td>Big in UK, but some under-performance</td>
</tr>
<tr>
<td>R Balado</td>
<td>Declining interest</td>
</tr>
<tr>
<td>Defer Rhapsody</td>
<td>Low specific and kernel content</td>
</tr>
</tbody>
</table>

### Summary for variety choice in 2014

<table>
<thead>
<tr>
<th>Cereal</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring barley</td>
<td>Check niche and emerging markets to support Concerto dominance</td>
</tr>
<tr>
<td>Winter barley</td>
<td>Check out new two-rows, nothing exciting in six rows</td>
</tr>
<tr>
<td>Winter wheat</td>
<td>Good choice of soft varieties, spread risk by increasing variety choice</td>
</tr>
<tr>
<td>Spring wheat</td>
<td>No major changes. More options possible in next 2-3 years</td>
</tr>
<tr>
<td>Spring oats</td>
<td></td>
</tr>
<tr>
<td>Winter oats</td>
<td></td>
</tr>
</tbody>
</table>
Thank you
Managing disease risk over contrasting seasons

Fiona Burnett, Crop Protection Team Lead
SRUC

Introduction – extremes of seasons

- 2011 low disease pressure
- 2012 high disease, poor crop potential
- 2013 low disease, mixed crop potential
- What strategies work best and should be used in 2014?
Growth stages – varied widely over last three seasons

March temperatures – deviation from average 2012 and 2013
Disease levels in commercial wheat crops

Summary 2012/2013 crop season

- Poor establishment of winter crops
- Record levels of spring crops
- Very low disease levels
- Hot July helped to fill heads but led to early ripening of some crops
- Humidity and heat caused ear moulds
- Yields OK but variable
- Early drilling of new 2014 crop
- Advanced crops and early disease

How do fungicides perform over several seasons?

- Winter and spring barley – long-term data trends in yield responses
- Best products and timings
- Winter wheat – data from contrasting seasons
- Winter oilseed rape – products, timings and doses
Barley

- Yield responses to treatments
- Best products and timings

Fungicide Performance in Barley 2013

ADAS  NIAB TAG  SRUC RESEARCH
Rhynchosporium over years (2011-2013) protection (n=4)

Use Imtex, Zulu and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.

Rhynchosporium over years (2011-2013) eradication (n=4)

Use Imtex, Zulu and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Barley mildew 2013 (n=2)

Use Zulu and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.

Net blotch over years (2010-2013) protection (n=4)

Use Imtex, Zulu and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Conclusions

- Siltra Xpro and Adexar showed good broad spectrum activity in 2013, consistent with previous years.
- Proline still a highly effective azole on barley diseases
- Comet (strobilurin) remains effective against net blotch
- Phoenix has some activity on Rhynchosporium
- SDHIs mixes all performing well and quite closely matched
Three-year data on yield response
winter barley

Three-year data on yield response
spring barley
Winter barley – without (1) and with (2) fungicides

Data from SRUC fungicide slot trials – only one year in 18 with no yield response (2003)

Spring barley – without (1) and with (2) fungicides

Data from SRUC fungicide slot trials – 18 out of 19 years +ve yield response
Yield response to fungicides – including 2013

- Range for winter barley has been 0 t/ha to 1.8 t/ha
- Mean response for winter barley 1.4 t/ha
- Only 2 years out of 19 with nil response for winter barley
- Range for spring barley -0.1 to 1.3 t/ha
- Mean response 1.1 t/ha
- Only 2 years in 20 with nil / negative response

Yield response to fungicides in barley

- T0
- Stem extension
- Booting GS45-49
Barley – 2013/2014 season

- Well established winter crop
- Mildew, net blotch and traces of rhynchosporium active before frosts
- Autumn mildewicides
- Increased use of T0s?

- Spring crop?
- Some disease transfer from winter crop?

Wheat
Fungicide Performance in Wheat 2013

Septoria Protectant 2013 (n=8)

The Imexa and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen
Septoria Protectant 2012-13 (n=12)

Use Imex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.

Septoria eradicant data 2012 – 2013 (n=5)

Use Imex and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.
Rusts 2013

Last season...

Yellow rust
- Yellow rust epidemics delayed by cold March in 2013.
- Still a major issue in Oakley, other susceptible varieties include: Solstice, Gallant, KWS Kielder and Viscount

Brown rust
- No new data from FP trials in 2013 (cold spring).
- Over 50% of RL varieties rated 5 or less for brown rust.
- Winter conditions will determine risk for 2014

Terrington 2012 / 13
Yellow rust (n=2)

Use Imexi and Vertisam only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen
Andover 2012
Brown rust

Use Intox and Vertisan only in mixture with at least one fungicide with an alternative mode of action and that has efficacy against the target pathogen.

Opus and Proline **Eradicant / curative activity**
(same year span)

Half label rate

Full label rate

R² = 0.6289

R² = 0.586

R² = 0.7131

R² = 0.6545
Viscount – SDHI or no SDHI? Perth site SRUC trial

Grafton – Perth site SRUC trial
Key Messages

Septoria tritici
In protectant situations, half rates of the best azoles provided less than 50% control, all SDHI + azole mixes gave 91-99% control.
• Solo SDHI’s very active – but azoles and multisite partners are important to broaden activity and reduce resistance risk.
• Phoenix adds some useful protectant activity.
• CTL very effective in a protectant situation.
• Yields responses in 2013 trials were low (<0.5/ha)

Yellow rust
SDHI’s and strobilurins useful but less active than azoles.

Stewardship of SDHI fungicides

• Maximum of 2 SDHI fungicide-containing sprays. (statutory requirement)

• Always use SDHI fungicides in mixture with at least one fungicide from an alternative mode of action group which has efficacy against the target pathogen(s).

• Tank mixing 2 SDHI fungicides is not an anti-resistance strategy.
Sooty moulds 2013

• Empty or light ears were particularly prone

• Concern after a succession of wet summers

• Despite perceptions, July wasn’t exceptionally dry

Source: AAC monitored commercial crops

Sunshine hours July 2012 and 2013
Rainfall deviation from average 2012 and 2013

Winter wheat additional ear sprays yield study 1748 – Laurencekirk

T3 and T4 applications – no significant benefit to T4
Winter wheat response to fungicides
Mean trial responses by season

Yield response in wheat to fungicides – mean data SRUC trials 2009-2013
Wheat 2013 – 2014 season

- Winter crop well established
- Septoria and mildew present in autumn
- T0s more likely to be used
- Use best products in balanced partnerships

Oilseed rape autumn fungicides

- Fungicide performance
- Optimum timing / dose
HGCA Fungicides – light leaf spot dose response 2013

Aberdeen 2013 – Disease (applied autumn & spring)
Light leaf spot management

Phoma

Low canker severity and yield - 4 trials (2010 to 2012)
Take home messages – oilseed rape

- The most effective products give around 50% control and below half dose the drop off is steep
- Proline, Folicur and Prosaro gave good control in 2013
- Sensitivity to azoles in light leaf spot is variable
- Slippage in varietal ratings
- Use varietal resistance and fungicides together to manage risk
- Disease levels currently low and most autumn sprays were applied as protectants
- Growth regulation may be required from fungicides in spring

Predicting the yield response 2014

Do you …

a) Gamble?

b) Insure – manage the potential downside and maximise the potential upside?
Great returns on fungicide investment….

….or your money back*

*(92% of the time!)

Thank you
Biology and control of key Scottish pathogens, *Ramularia collo-cygni* and light leaf spot

Neil Havis, Plant Pathologist
SRUC
Epidemiology and seed transmission

Life cycle of *Ramularia collo-cygni*

- **GS0** Ramularia seed-borne (under seed coat)
- **GS 10-13** Ramularia detectable by diagnostics but no visual symptoms
- **GS25-30** Ramularia spots on dying leaves
  - Fungicides can reduce later disease epidemic
- **GS25-30** Fungus detected inside leaves 2-4 weeks before symptoms
- **GS45-49** Protect crops with fungicide
- **GS72-85** Ramularia symptoms on leaves, heads and awns
- **Seed treatments**
- **Second spore type on straw**
- **Airborne spores**
Seed borne *Ramularia collo-cygni* levels

Control of Ramularia leaf spot

<table>
<thead>
<tr>
<th>Physical Treatments</th>
<th>Biological Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot water 1 (2 h at 52 °C followed by 72 h at 25 °C)</td>
<td>Cedomon®</td>
</tr>
<tr>
<td>Hot water 2 (21 °C for 1 h, then 10 min at 52 °C)</td>
<td><em>(Pseudomonas chlororaphis)</em></td>
</tr>
<tr>
<td>Dry Heat (60 °C for 3 days)</td>
<td>Subtilex™</td>
</tr>
<tr>
<td>Steam (using Thermoseed™ conditions)</td>
<td><em>(Bacillus subtilis)</em></td>
</tr>
<tr>
<td>Microwaving (25 secs in an 800W oven)</td>
<td></td>
</tr>
</tbody>
</table>

Control of ramularia leaf spot in a changing climate – the ‘CORACLE’ project
Advances in control of *R. collo-cygni*

Control of RLS by seed treatments

Significant reduction in RLS (P<0.05) by seed treatment alone
B= Bush Estate, L = Lanark O= Optic, C = Cocktail, D = Decanter

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Hot water 1</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot water 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Heat</td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steam</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Microwave</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fungicide</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cedomon</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtilex</td>
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<td></td>
</tr>
</tbody>
</table>
Localisation of \textit{R.cc-gfp} in barley seed

Thick layer of hyphae present under the seed coat, outside the aleurone layer of the endosperm

Embryo infection

Embryo 24h after placing in humid environment for germination
Transverse section of the developing stem from seedling

Intercellular growth in leaf primordia (developing leaves)
Developing ‘rolled’ 1\textsuperscript{st} leaf

*Rcc- gfp* seems to be able to colonise the vascular bundles

Movement of Rcc in crop (S Barley – 2009)
Virulence factor – Rubellin

Live-cell imaging of rubellin *in planta*

Fluorescence emission spectrum determined by spectral analysis (lambda scan)
Development of symptoms

Rubellin signal localised to developing necrosis around stomata and in colonised mesophyll tissue

Epidemiology of *R. collo-cygni*

Ramularia collo-cygni DNA 2004-5
### Spore levels during project

Peak Levels of Rcc DNA from spore samplers
(Date and DNA levels)

<table>
<thead>
<tr>
<th>Site\Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bush Estate</td>
<td>10 Aug 8.7 ng</td>
<td>8 Aug 1.4 ng</td>
<td>15 Jul 1.3 ng</td>
<td>17 Mar 8.4 ng</td>
</tr>
<tr>
<td>Lanark</td>
<td>20 July 51 ng</td>
<td>13 Oct 0.13 ng</td>
<td>17 Aug 1.08 ng</td>
<td>6 Mar 83 ng</td>
</tr>
<tr>
<td>Norfolk</td>
<td>23 July 44 ng</td>
<td>25 July 0.05 ng</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Risk Forecast – Bush 2012
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Winter Barley</th>
<th>Spring Barley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous season epidemic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High disease levels and spore release</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Low disease levels and spore release</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Varietal choice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tolerant</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>Susceptible</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Cultivation system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Tillage</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Ploughed</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sowing date</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early (pre spring barley harvest)</td>
<td>+</td>
<td>N/A</td>
</tr>
<tr>
<td>Late (post spring barley harvest)</td>
<td>-</td>
<td>N/A</td>
</tr>
<tr>
<td>Surface wetness at GS 31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prolonged periods of 100% wetness in the crop</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Few periods of crop wetness</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Winter barley epidemics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High disease levels and spore release</td>
<td>N/A</td>
<td>+</td>
</tr>
<tr>
<td>Low disease levels and spore release</td>
<td>N/A</td>
<td>-</td>
</tr>
</tbody>
</table>

**Economic impact of *R collo-cygni***

- Assuming a price of £128/t/ha for feed barley a reduction in AUDPC of 96 will give an economic benefit.
- Assuming a price of £147/t/ha for malting barley a reduction in AUDPC of 74 would be economically viable.
Effect on yield (calculating yield loss)

Coracle: Key Points – Environment

- Ramularia leaf spot (RLS) epidemics have a quantifiable negative effect on the yield of winter and spring barley and the disease has been detected in an increasing number of barley growing countries worldwide

- The fungus is able to move from infected seed into the barley plant without producing symptoms. A majority of seed stocks have Ramularia infection

- Seed treatments can reduce RLS epidemics in susceptible varieties but remain less effective than late season foliar sprays
Coracle: Key Points – Varieties

• There is wide genetic diversity for susceptible to Ramularia in both spring and winter barley

• The mlo gene for mildew resistance tends to increase susceptibility of barley to Ramularia

• Plant breeders can select for improved resistance to Ramularia, even in the presence of mlo, by selecting progeny lines from genetically diverse parents

Coracle: Key Points – Control

• The major spore movement of the pathogen takes place in July and August after prolonged periods of surface wetness in the crop

• RLS epidemics can be predicted based on surface wetness in the crop at stem extension

• The fungus is genetically very diverse and is therefore capable of rapid mutation generation and should be regarded as a high risk pathogen for the development of fungicide resistance
Oilseed rape

Light leaf spot
(*Pyrenopeziza brassicae*)

Levels of disease vary from year to year

Monitoring of sensitivity of isolates to fungicides undertaken

Light leaf spot prediction - Rothamsted

Light leaf spot in spring has been high for the last 6 years

Data source: Defra-funded winter oilseed rape pest and disease survey
Regional Light Leaf Spot risk forecast

2013/14 season - forecast updated 2/10/2013

Be wary as stems had high levels of light leaf spot

Regional forecast for the percentage of crops with >25% affected plants.

<table>
<thead>
<tr>
<th>Site and Year</th>
<th>ED_{50} (ppm) prothioconazole</th>
<th>ED_{50} (ppm) tebuconazole</th>
<th>ED_{50} (ppm) flusilazole</th>
<th>ED_{50} (ppm) prochloraz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aberdeen 2010</td>
<td>1.56 (3)</td>
<td>2.76 (3)</td>
<td>6.67 (9)</td>
<td>2.19 (3)</td>
</tr>
<tr>
<td>High Mowthorpe 2010</td>
<td>7.35 (2)</td>
<td>0.64 (2)</td>
<td>12.1 (5)</td>
<td>1.52 (2)</td>
</tr>
<tr>
<td>Aberdeen 2011</td>
<td>0.51 (12)</td>
<td>0.16 (11)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>High Mowthorpe 2011</td>
<td>0.15 (11)</td>
<td>0.34 (9)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Midlothian 2012</td>
<td>3.95 (5)</td>
<td>5.80 (2)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cambridge 2012</td>
<td>0.33</td>
<td>0.05 (4)</td>
<td>0.037</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.001</td>
<td>0.001</td>
<td>0.037</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
HGCA Fungicides – Light leaf spot dose response 2013

New HGCA-funded project

<table>
<thead>
<tr>
<th>Name/description of output</th>
<th>Indicators</th>
</tr>
</thead>
</table>
| 1. Modelling and new forecasts | 1. Preparation of historic datasets and weather data  
2. Produce model and update with new data from the project  
3. Validate new model  
4. Air sampling  
5. Historic samples  
6. Disease assessments.  
7. Yield responses |
| 1. Spore trapping | 4.1 Prepare new forecasts based on existing models each year with spring update for LLS |
| 1. Variety x fungicide interactions | 5.1 Annual reports  
5.2 Final report |
| 1. Light leaf spot and phoma forecasts |
| 1. Reports |
**Strategies for light leaf spot control – for 2013 (forecast for England)**

- High risk in 2014 forecast – early drilling may increase risk
- Phoma decisions drive inputs but look for LLS after T2
- Apply fungicides at first sign of disease in winter (Jan/Feb) – no threshold
- Control not improved beyond half dose – application timing important and may need an extra spray

---

**Canopy Management for OSR**
### Varietal Resistance

<table>
<thead>
<tr>
<th>Variety</th>
<th>LLS Resistance</th>
<th>Variety</th>
<th>LLS Resistance</th>
<th>Variety</th>
<th>LLS Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incentive</td>
<td>6</td>
<td>Troy</td>
<td>6</td>
<td>Catana</td>
<td>7</td>
</tr>
<tr>
<td>Anastasia</td>
<td>6</td>
<td>Pendulum</td>
<td>6</td>
<td>PR45D05</td>
<td>6</td>
</tr>
<tr>
<td>PT211</td>
<td>6</td>
<td>DK Explorer</td>
<td>6</td>
<td>Cullin</td>
<td>8</td>
</tr>
<tr>
<td>Boheme</td>
<td>7</td>
<td>Artoga</td>
<td>7</td>
<td>Cracker</td>
<td>8</td>
</tr>
<tr>
<td>Compass</td>
<td>6</td>
<td>Temple</td>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Control of WOSR pests in the absence of neonicotinoid seed treatments

Daan Kiezebrink
Applied Potato Pathologist
SRUC
OSR products affected

<table>
<thead>
<tr>
<th>Product</th>
<th>Active Ingredients</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinook Blue</td>
<td>beta-cyfluthrin + imidacloprid</td>
<td>Cabbage stem flea beetle, Other flea beetles</td>
</tr>
<tr>
<td>Bayer CropScience</td>
<td>WOSR, SOSR</td>
<td></td>
</tr>
<tr>
<td>Chinook Colourless</td>
<td>beta-cyfluthrin + imidacloprid</td>
<td>Cabbage stem flea beetle, Other flea beetles</td>
</tr>
<tr>
<td>Bayer CropScience</td>
<td>WOSR, (EAMU: Linseed)</td>
<td></td>
</tr>
<tr>
<td>Conquest</td>
<td>Fludioxonil + metalaxyl-M + thiamethoxam</td>
<td>Flea beetles, Cabbage stem flea beetle, Peach–potato aphid</td>
</tr>
<tr>
<td>AgChem Access</td>
<td>WOSR, SOSR</td>
<td></td>
</tr>
<tr>
<td>Cruiser OSR</td>
<td>Fludioxonil + metalaxyl-M + thiamethoxam</td>
<td>Flea beetles, Cabbage stem flea beetle, Peach–potato aphid</td>
</tr>
<tr>
<td>Syngenta</td>
<td>WOSR, SOSR (EAMU for linseed for disease)</td>
<td></td>
</tr>
<tr>
<td>Modesto</td>
<td>beta-cyfluthrin + clothianidin</td>
<td>Cabbage stem flea beetle, Turnip sawfly, Peach–potato aphid</td>
</tr>
<tr>
<td>Bayer CropScience</td>
<td>WOSR</td>
<td></td>
</tr>
</tbody>
</table>

Aphids in WOSR

- Not usually major problem in autumn but aphicide-resistant peach–potato aphids caused problems in 2001

- Chinook (beta-cyfluthrin + imidacloprid), Modesto (beta-cyfluthrin + clothianidin) and Cruiser OSR (thiamethoxam) gave high level of control and reduction of turnip yellows virus (TuYV)
TuYV

- Reddening, purpling of leaf margins and inter-veinal discoloration
- Not readily recognisable
- Confused with physiological and nutritional deficiencies
- Symptoms usually not expressed before stem extension

Impact of TuYV on 10 OSR varieties

Up to 30% yield loss, average around 15%
TuYV

- Thought that ~ 60% of OSR area infected with TuYV ~ 400,000 ha a year
- If assume infection causes 15% yield loss, ~ 200,000 tonnes lost in yield a year
- Estimated £67m loss per season due to TuYV if left untreated
- Equivalent to ~ 9% of the total value of the crop

Source: Research Review 77, HGCA
TuYV Transmission
Peach–potato aphid – Myzus persicae

Aphid flights into WOSR
TuYV Management

- Seed treatments no longer available
- Sprays
  - Pyrethroids (e.g. Decis - ~ £5/ha)
    > but 95% of aphids have kdr and MACE resistance
- Plenum WG (pymetrozine) – no issues with resistance but ~£18-20/ha

TuYV – Summary

- Main virus vector – *Myzus persicae*
- Higher risk if aphid flights in the late summer/autumn
- Milder autumns – more survival of the aphids and more spread of the virus overwinter
- Up to 72% of winged *M. persicae* carry TuYV (in England at least)
- HGCA trials data show that TuYV can decrease yields by up to 30% (typically 15%)
- Plenum is currently the only effective option due to pyrethroid resistance
Flea Beetles

- May attack germinating winter and spring rape
- Damage is seen as small holes in the cotyledons and first true leaves of the emerging crop
- The beetles are mainly active during dry soil conditions: slugs like it wetter

Flea Beetles

- Neonicotinoid seed treatments gave good protection
- Be prepared to spray with a pyrethroid insecticide (such as Hallmark Zeon, Decis, or Fury) if feeding punctures are present on germinating plants
- Once 2-3 leaves emerged, no need for treatment
- Cost ~ £5/ha
Cabbage Stem Flea Beetle (CSFB)

- Adults cause shot-holing of leaves
- Larvae burrow into stem – winter kill, no stem elongation or lodging in spring
- Around two-thirds of crops affected (~440,000 ha/15,000 tonnes)
- £5m loss a year, if left untreated

Cabbage Stem Flea Beetle (CSFB)

- Treatments for adult CSFB control are the same as for flea beetle: Hallmark Zeon, Decis or Fury
- Thresholds:
  - >25 % of the leaf area damaged at the 1 to 2 true leaf growth stage
  - >50 % of the leaf area damaged at the 3 to 4 true leaf growth stage
Cabbage Stem Flea Beetle (CSFB)

- Monitor for adult beetles using yellow water traps (4) per field from early September to end of October – empty regularly
- If > 35 beetles have been caught, consider applying a pyrethroid spray to control the grubs
- Cost ~ £5/ha per spray
- Pyrethroid resistance present in Germany – being monitored in the UK (HGCA)
- See HGCA Information Sheet 24 for more information

Cabbage Root Fly (CRF)
CRF: a problem in oilseed rape?

- CRF has become the main OSR autumn pest threat in Germany
- Potential for problems in the UK, especially with early sowing of WOSR, 3rd generation CRF and loss of neonicotinoid seed treatments
- 3rd generation damage in Scotland on WOSR in 2013
- CRF increases risk of *Phoma* stem canker and *Verticillium wilt* in WOSR

Cabbage Root Fly (CRF)

- White grubs feed on the roots causing wilting/death of plants
- Flies lay their oval white eggs (about 1mm in size) at the base of the plants in September and the larvae can kill off young seedlings or allow diseases to get into stems
- Pyrethroid sprays at crop emergence will not be effective – currently no effective treatment (after loss of neonics)
Turnip sawfly

- Larvae can skeletonise leaves
- On WOSR, source is 3rd generation coming from nearby veg or migrants carried from the continent by wind currents
- In Germany, threshold is 1-2 per plant
- Neonics gave early season control
- Pyrethroids, as for CSFB, will give control

Summary of cost implications due to loss of neonics

<table>
<thead>
<tr>
<th>Table 1. Summary of crop protection implications of growing OSR resulting from the neonicotinoid restrictions (Clarke et al., 2009; Defra, 2013; AHDB/HGCA Market Intelligence, 2013).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total area of UK crop affected</strong></td>
</tr>
<tr>
<td>Total area of UK crop affected</td>
</tr>
<tr>
<td>Average annual yield loss from affected area</td>
</tr>
<tr>
<td>Total annual yield loss using no insecticide treatments</td>
</tr>
<tr>
<td>Cost to UK industry using no insecticide treatments</td>
</tr>
<tr>
<td>Proportion of total crop value</td>
</tr>
</tbody>
</table>

Source: Research Review 77, HGCA

<table>
<thead>
<tr>
<th>Table 2. Total cost of 1 to 4 applications of clothianidin to 502,632 ha and 21,693 ha (area neonicotinoid treated seed in 2010) for OSR and linseed respectively (Garthwaite et al., 2011; Nix, 2013).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost of additional pyrethroid applications to total crop area affected</strong></td>
</tr>
<tr>
<td><strong>Cost per ha</strong></td>
</tr>
<tr>
<td>1 pyrethroid application</td>
</tr>
<tr>
<td>2 pyrethroid applications</td>
</tr>
<tr>
<td>3 pyrethroid applications</td>
</tr>
<tr>
<td>4 pyrethroid applications</td>
</tr>
</tbody>
</table>

Plenum (£18/ha) £9,047,214
Summary of impacts on WOSR 2014

- Sprays from crop emergence
  - Pyrethroids for flea beetles (1 or 2 sprays)
  - Also require pyrethroid spray for rape winter stem weevil (Oct/Nov)
  - Plenum for aphids and TuYV

- Reliance on crop intelligence for timing and need for treatments
  - e.g. SRUC Crop Report, website, HGCA Aphid News

- Avoid overuse of pyrethroids to reduce risk of resistance arising

Neonicotinoids: key messages
www.hgca.com/neonics
Neonicotinoids – How Will the Ban Impact on Growers?

The European Commission recently restricted the use of neonicotinoid insecticides for two years on certain crops within the EU. The UK cannot opt out of this restriction of use, which is due to be implemented from 1st December 2013.

Now is the opportunity to plan for a future insecticide-free era that helps growers to overcome some challenges in the short term. This will not be without cost, as there are concerns that alternative treatments could be more expensive.

As a result, the new requirements of this year will allow for growers to make a more accurate determination of the cost of these new treatments. There will be efforts to purchase and maintain flowering crops. These treatments will be necessary in light of national data but will not necessarily be fitted.

The avoidance of neonicotinoid treatments was available for certain plants in autumn 2013 to the resolution of pests. This will allow for the restriction of this requirement in spring and summer.

The required results under these conditions are expected to have an impact on the use of neonicotinoid treatments. This could lead to a reduction in the use of these treatments. However, the management of this situation will need to be adapted and future treatments will need to be considered at the earlier stages.
Thank you
Understanding Soil Physical Conditions

Bruce Ball and Joanna Cloy
Senior Soil Scientists, SRUC

Soil physics – air, water, minerals

- Air 25%
- Water 25%
- Mineral Particles 45%
- Organic Matter 5%

- Organisms 10%
- Roots 10%
- Humus 80%
Physical properties – stable or variable

• Stable – texture, stoniness, drainage

• Variable – porosity, soil structure, organic matter content, aggregate stability, compactibility

These can be used as measures of soil quality

Soil variability

• Soil variability is spatial change across the landscape, mostly in soil type (stable properties) and soil depth

• Important to include soil variability in precision farming
Texture

- Texture describes the mixture of different particle sizes in soil (the relative proportions of sand, silt and clay)
- Texture is stable and influences drainage, water storage, workability and liability to erosion and compaction
- Texture is important in defining soil structure
- Texture is measured either as particle size distribution or by hand texturing

Particle size distribution

Simplified texture triangle and groupings (after Defra Cross Compliance Guidance)
Soil texture influences

- Nutrient retention – clay particles retain plant nutrients
- Lime requirement – sandy soils acidify more quickly than clays but need less lime
- Cultivation – light sandy soils are more easily cultivated than heavier clay soils
- Cropping – early crops on light sandy soils

Aggregation

- A grouping of particles joined together or a grouping of aggregates (from pinhead to hand size)
- Joining is by ‘glues’ of clay and organic matter and binding by roots and fungal hyphae
Soil Structure

Structure is the how the particles bind together to form aggregates that allows:

• Roots to anchor the plant
• Water to drain through pores and cracks
• Water retention
• Air to roots for favorable gas exchange
• Biodiversity of microbes
• Mineralisation of nutrients and release to crop roots

Aggregate stability

• Aggregate stability measures the resistance of aggregates (< 1 cm diameter) to break-up by water drops
• Aggregate stability is a measure of the resistance of soil to erosion
Fine sandy, coarse silty and low organic matter soils are vulnerable
Aggregates in Sq2, Sq3 and Sq4

Measuring compaction – bulk density

Dry bulk density = Mass of dry soil/Total volume of soil
Measuring compaction – bulk density

Vg: Volume Gas
Vw: Volume Water
Vs: Volume Soil

Typical range is 0.9 g/cm³ (freshly tilled) to 1.8 g/cm³ (compacted clay subsoil)
Porosity

Total porosity (ε) = Volume of pores/Total volume of soil
Water content (Θ) = Volume of water/Total volume of soil
Water-filled pore space (WFPS) = fraction of pore volume filled with water

Compaction and barley root growth
Drainage effects
N$_2$O emissions and fertiliser N loss

- Impeded drainage increases the water filled pore space and N$_2$O emissions by denitrification

- N$_2$O emissions can vary by 3 orders of magnitude with changes in water table depth

Dobbie and Smith 2006. Soil Use and Management, 22, 22-28

Cone resistance

Measures soil strength (hardness) that depends on compaction, texture, stones and moisture content
Infiltration and runoff

Soil structure under minimum tillage
Structure poorer in 2013 than 2012

Key messages: soil conservation

Texture – sands and silts need more care

Structure – be aware of layering – the nearer a compact or wet layer is to the surface the more influence it has

Erosion – reduce risk with higher organic matter, crop choice and smaller fields

Compaction – avoid or control but porosity can become continuous to allow good rooting

Drainage – porosity important – small pores for water storage and large pores for flow to drains
Thank you
Importance of Soil Biology

Bryan Griffiths, Senior Soil Scientist
SRUC

Outline of my presentation

1. Life in soil – who’s there and how much
2. Relevance for soil quality – indicators and current research
3. On-farm use – local ‘rule of thumb’
4. Quick questionnaire
NAKED AMOEBA

NEMATODES
Collembola

Enchytraeid worms
Earthworms

Below-ground biomass = approx 100 sheep or 5 tonnes ha$^{-1}$

How many 'sheep' below-ground?
Outline of my presentation

1. Life in soil – who’s there and how much
2. Relevance for soil quality – indicators and current research
3. On-farm use – local ‘rule of thumb’
4. Quick questionnaire

Soils deliver many ecosystem services

- Food & biomass production
- Soil ecosystem services
- Storing, filtering & transformation
- Source of raw materials
- Habitat, gene pool
- Physical & cultural environment for mankind

Courtesy of Antonio Bispo, ADEME
Site selection

Atlantic – Grassland
Atlantic – Arable
Continental – Grassland
Continental – Arable
Mediterranean – Arable
Pannonian – Arable

Three replicate plots of
Two treatments

List of potential indicators

<table>
<thead>
<tr>
<th>Ecosystem service</th>
<th>Biodiversity</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insurance</td>
<td>Nematodes</td>
<td>Fungal biomass - ergosterol</td>
</tr>
<tr>
<td>Nutrients, Water Regulation, etc</td>
<td>Nematodes</td>
<td>F:B ratio and structure - PLFA</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Enchytraeids</td>
<td>Bacteria/Archaea/ Fungal TRFLP</td>
</tr>
<tr>
<td>Function</td>
<td>Collembola</td>
<td>Labile C+N</td>
</tr>
<tr>
<td></td>
<td>Microbe</td>
<td>Respiration: MicroResp</td>
</tr>
<tr>
<td></td>
<td>Protozoa (molecular)</td>
<td>Resilience</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bait lamina</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water infiltration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nitrification</td>
</tr>
</tbody>
</table>
Sampling UK grassland site

Absolute values of potentially mineralisable nitrogen (PMN) per site

<table>
<thead>
<tr>
<th>Site</th>
<th>ARABLE</th>
<th>GRASSLAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR</td>
<td>a</td>
<td>c</td>
</tr>
<tr>
<td>SI</td>
<td>b</td>
<td>c</td>
</tr>
<tr>
<td>DE</td>
<td>a</td>
<td>c</td>
</tr>
<tr>
<td>PT</td>
<td>a</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mg N/kg soil
Outline of my presentation

1. Life in soil – who’s there and how much
2. Relevance for soil quality – indicators and current research
3. On-farm use – local ‘rule of thumb’
4. Quick questionairre
Local ‘rule of thumb’

1. How good is my soil
2. Comparison with blood test

Outline of my presentation

1. Life in soil – who’s there and how much
2. Relevance for soil quality – indicators and current research
3. On-farm use – local ‘rule of thumb’
4. Quick questionnaire
Soil biology is clearly an integral part of soil quality, but where should we be aiming our indicators of soil quality?

1. Entirely offsite laboratory analysis, as for SAC SOILCHECK topsoil analysis but to include biological components

2. Entirely onsite analysis, carry-on luggage size kits available for self-determination of biological, physical and chemical indicators

3. Combination of hands-on onsite tests (VESS, earthworms) and selected laboratory tests

Thank you
Management practices and soil resilience – compaction and associated effects

Names: Blair McKenzie, Kenneth Loades & Martyn Silgram
Organisations: James Hutton Institute & ADAS

Reducing risks associated with autumn wheeling of combinable crops
RD-2007-3386
Mar 2009 – Mar 2014
Introduction

- Defra-funded R&D shows tramline wheelings can account for 80% of runoff and diffuse pollution loss to edge of field from w. cereals on moderate slopes
  - focus on effect of autumn spray operation on over-winter losses
- Given pressures to improve water quality, spatially targeted measures which are practical and cost-effective are needed to limit losses from high-risk fields
  - help meet requirements of SPR & maintain GAEC (cross-compliance)
  - minimise soil compaction risk and help retain soil fertility
  - potential future opportunity for ELS points

Drivers of risk of soil compaction

- Soil texture: increased clay
- Soil carbon: less carbon
- Soil drainage and water content at time of traffic
- Axle load of traffic (total weight of machine or animal)
- Ground pressure of traffic (pressure beneath tyre or foot)
- Frequency of passes (trampling, tramlines etc.)
- Speed – creating shear
Stress distribution under a tractor wheel

**Test vehicles**

- **Tractor, ripper, harrow and packer**
  - 9.2 Mg total load / 3.6 Mg wheel load
  - 135 kPa contact pressure

- **Tractor and plough**
  - 8.8 Mg total load / 2.9 Mg wheel load
  - 110 kPa contact pressure

- **Potato harvester**
  - 5.8 Mg total load / 3 Mg wheel load
  - 123 kPa contact pressure
In situ measurements of stress and strain distribution

Displacement measurement at 20 cm
**Project objectives**

- **LINK collaboration** – combined fieldwork and modelling evaluation of practical, cost-effective management options
  - Diverse range of skillsets covering industry, research and policy

- **Primary outputs:**
  - Practical guidance to industry
    - to minimise soil compaction and erosion risk
    - to help farmers maintain GAEC & satisfy requirements of SPR
    - recommendations on ‘what works where’ incl. cost-benefit assessments
  - Catchment-scale impacts of changing management on water quality
  - Policy implications for points awarded under agri-environment schemes

**Field sites**

- **Sites established:**
  - LS (Staffs), 4°
  - CL (Leics), 5°
  - ZCL (Heref), 10°
  - SL (Dundee), 5°

- **Treatments imposed at all sites**
  - 150 bhp tractor with 3000L trailed sprayer
  - 4 treatments of 4 reps

- **Field monitoring:**
  - Nov 09 – Mar 10
  - Nov 10 – Mar 11
  - Nov 11 – Mar 12
  - Nov 12 – Mar 13
Balruddery Farm

- Sites instrumented (monitoring October–March)
- Unbounded hillslope sections (70–270 m long)
- 4 replicates x 4 mitigation treatments evaluated in each site-year
- Moderate (4–7°) slopes monitored using novel flow-proportional samplers
- Event-based surface runoff samples analysed for SS, TP, TN
- Soil physics (wheelslip, soil compaction, surface roughness)
- Yields; capital & variable costs; benefits; practical constraints

Experimental design
## Treatments outline for 2012–13

<table>
<thead>
<tr>
<th>4 sites over 4 years</th>
<th>Typical Configuration Tyres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different treatment combinations</td>
<td>Sown tramline</td>
</tr>
<tr>
<td></td>
<td>Optimum tyre with sown tramline</td>
</tr>
<tr>
<td></td>
<td>Spiked harrow</td>
</tr>
</tbody>
</table>

**Experiment design - 2012/13**

**3m drill bouts**

**Design criteria:**
- Single pass that increases surface roughness
- Negligible impact on trafficability in spring; no yield effect
- Low draft and high speed requirement

**Options 1 & 2 impractical:**
- Focus on spiked harrow

---

## Early equipment trials

**Design criteria:**
- Single pass that increases surface roughness
- Negligible impact on trafficability in spring; no yield effect
- Low draft and high speed requirement

**Options 1 & 2 impractical:**
- Focus on spiked harrow
Treatments

Used MF7480 and Chafer sprayer with 3000 litres
Michelin standard or Xeobib low pressure tyres
No spray boom but equivalent weight of concrete

Spiked harrow on sprayer
Optimum (very flexible) tyres on sprayer

Erosion linked soil structure by soil physics, compaction

Runoff collected
Volume measured
Erosion monitoring and runoff collection

Samples analysed for sediment and nutrient losses

2012-2013 – Key results
Dundee, Balruddery
2011/12 results: Heref (ZCL)

12 events
107 mm rainfall

2012-2013 – Ranked key results
Dundee, Balruddery
Macroporosity

- Usable macropores (UM):
  \[ UM = \text{Macropores Total (dry)} - \text{Macropores at field capacity (-10 kPa)} \]

Shear vane data
**Key messages**

- Correctly-inflated low ground pressure tyres reduce compaction, surface runoff and sediment loss from autumn spray … at NO extra cost.

- Drilling the wheeling area has no consistent effect, as autumn spray operation still causes compaction.

- Novel rotary harrow usually more effective than LGP tyres.

- No effect of treatments on wheelslip, fuel use or crop yield.

---

**Key messages**

- Tramlines are an important management tool but can increase risk of compaction, erosion, nutrient & sediment loss in runoff.

- Localised problem needs targeted solution to manage soils (GAEC 1; SPR).

- Project identifies cost:benefit and ‘what works where and when’.

**Minimise risk**

- identify high risk fields (SPR); increase tramline spacing (≥ 24 m).
- correctly inflated tyres; LGP tyres in autumn; careful timing.

**Adapt practice**

- on high risk fields, consider targeted change in land use / rotation.

**Mitigate losses**

- remove near-surface soil compaction (e.g. rotary harrow unit).
Thank you
Shaping the direction of future arable research (2015–2018)

Amanda Bennett, Research & KT Manager
HGCA

HGCA Mission

To deliver a world-class arable industry through

Independence,
Innovation,
& Investment
What growers highlighted last time...

HGCA research strategy consultation in 2010

Grower response

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<th>Priority for new research</th>
<th>% response</th>
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What advisors highlighted last time...

HGCA research strategy consultation in 2010

Advisor Response

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Investing in Innovation

Launched April 2011

4 strategic objectives
1. Increasing crop yields
2. Optimising inputs
3. Increasing crop value
4. Preparing the industry

Priority matrix (web only)
- 31 specific areas

www.hgca.com/funding

Progress update

Issued 12 new calls for projects

73 new projects commissioned to date

£13.5m levy invested + £16.1m of co-funding (incl. RL)

Projects commissioned in 28 out of 31 research areas
Making the £160m go further
Developing the strategy

New Strategy 2015

And finally…

Please complete the HGCA research questionnaires – and you could also win a British produce hamper!

Also available online at:
www.hgca.com/haveyoursay

Contact HGCA with further suggestions for new research priorities at:
vicky.foster@hgca.ahdb.org.uk
Thank you