HGCA/SRUC Agronomy 2015

Agronomic solutions for local challenges
Disease and fungicides: lessons from 2014, improvements for 2015
Fiona Burnett, Team Lead Crop Protection and Neil Havis, Senior pathologist
SRUC

What are our key crop protection issues?

- Very variable yield potential in crops between seasons
- Very variable disease pressure between seasons
- Very variable performance from different fungicides
- Different growth patterns each year
- Scottish weather at key growth stages
- Product availability
- Concerns over product losses through resistance
- Concerns over product losses through legislation
Wide swings in responses to fungicide programmes – winter wheat

- Early drilling
- Warm autumn with disease present early
- Very few winter frosts
- Early growth of crops and diseases in spring
- Warm / wet conditions over critical timings
- Spray timings sometimes awry
- Difficulties in sourcing key products
- Good potential in crops
- Large responses to fungicides
- 2014/2015 similar with early disease
Winter – warm and wet

Et voila...
2014 – disease burden high
Wheat results 2014

Advisory Activity A314 – Crop health monitoring
Disease levels in commercial crops

![Graph showing disease levels in crops]

- Septoria 2011
- Septoria 2012
- Septoria 2013
- Septoria 2014
- Yellow rust 2011
- Yellow rust 2012
- Yellow rust 2013
- Yellow rust 2014
- Head disease 2011
- Head disease 2012
- Head disease 2013
- Head disease 2014

Source AAC data

Growth stages – varies widely between seasons – crops stayed early this year

![Graph showing growth stages in crops]

- GS 2011
- GS 2012
- GS 2013
- 2014

Source AAC Winter wheat
Poor control sometimes explained by difficulties with timing spray applications

- T0s popular but early
- T1 early
- Gap long
- T2
- T3 often close to flag spray
- T4s?

**Benefit of T0 sprays**

- Success difficult to judge without a control case
- Benefit clear in trials – GS33–37 post T1 without T0 (top) and with T0 (bottom)
Fungicide Performance in wheat 2014

Septoria: protectant (6 trial mean 2014)
Septoria: protectant (over year 2012/13/14)

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

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

Half dose

Variance accounted for = 62.0%

Full dose

Variance accounted for = 43.2%

% control Septoria tritici


Trend in azole eradicant activity over time

Half dose

Variance accounted for = 54.5%

Full dose

Variance accounted for = 62.4%

% control Septoria tritici


Proline
Opus / Ignite
Yellow rust (Kings Lynn 2014)

Yellow rust (over year 2012/13/14)
Brown rust (Cambridge 2014)

FP 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
- Make full use of multisites as protectants
FP 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

Programmes – were they worth it?
Winter wheat T1 and T2 treatments 1887 – Gilchriston Viscount – high disease pressure

More typical programmes but control often just over 50%, best ~ 75%

Winter wheat T1 and T2 treatments 1887 – Gilchriston Viscount

Yield t/ha
Winter wheat T1 and T2 treatments
1887 – Gilchriston Viscount – margin over fungicide cost (MOFC) at £135/tonne

ICM – over reliance of fungicides
Winter wheat varieties generally susceptible to Septoria

HGCA Recommended List® Winter wheat 2014/15

YIELD, AGRONOMY AND DISEASE RESISTANCE

2014/2015 HGCA Recommended List
Eyespot and take-all were the final disease stings of 2014

Wheat – key messages for 2015

- High risk of disease carry over, exacerbated by early drilling and warm autumn
- Plan programmes early around best available chemistry
- Optimise timings
- Early clean up sprays (T0s) allow more preventative programmes
- Watch for eyespot risk – carry over from 2014 likely
- T1 sprays should be carefully planned, reactive to the season, but more robust than in the past
- Potential to modify T2 to adjust to season – no way back if you miss the boat earlier
- Keep head sprays to the highest risk timing (early to mid flowering)
- Consider higher rates in preference to additional sprays
Barley fungicide trials 2014

Disease pressure extreme
Fungicide Performance in Barley 2014

Rhynchosporium: protectant
Lanark 2014

![Graph showing the effect of different fungicides on Rhynchosporium]

- Siltra Xpro
- Adexar
- Vertisan + Proline275
- Imtrex
- Phoenix
- Zulu
Rhynchosporium: protectant (over-year 2012/13/14)

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

Brackling: 2014
Mildew: Leaf 4 (Midlothian 2014)

Winter barley T1 and T2 treatments
Stanley Saffron

Winter barley T1 and T2 treatments
Stanley Saffron
Winter barley T1 and T2 treatments Stanley Saffron

Yield t/ha

MOFC £

Winter barley T1 and T2 treatments Stanley Saffron – margin over fungicide cost (MOFC) at £127/tonne
Spring barley T1 and T2 treatments
Boghall Concerto

% Surface area affected

Yield

Spring barley  T1 and T2 treatments
Boghall Concerto
Spring barley T1 and T2 treatments
Boghall Concerto – margin over fungicide
cost (MOFC) at £127/tonne

Yield response in barley fungicides
2014
### Ramularia risk forecast (Spring barley)

#### WP 6.4 Lanark S Barley (Overture)

<table>
<thead>
<tr>
<th>Date</th>
<th>Site</th>
<th>Risk Forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-Jun</td>
<td>Aberdeen</td>
<td>High</td>
</tr>
<tr>
<td>02-Jun</td>
<td>Auchincruive</td>
<td>High</td>
</tr>
<tr>
<td>03-Jun</td>
<td>Lanark</td>
<td>High</td>
</tr>
<tr>
<td>04-Jun</td>
<td>Markle</td>
<td>High</td>
</tr>
<tr>
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<td>High</td>
</tr>
<tr>
<td>06-Jun</td>
<td>Edinburgh</td>
<td>High</td>
</tr>
<tr>
<td>07-Jun</td>
<td>Markle</td>
<td>High</td>
</tr>
<tr>
<td>08-Jun</td>
<td>Gilmerton</td>
<td>High</td>
</tr>
<tr>
<td>09-Jun</td>
<td>Lanark</td>
<td>High</td>
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</table>

#### S Barley RLS risk 2014

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<td>Markle</td>
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**Risk Levels**
- **High**
- **Medium**
- **Low**
- **Very Low**
Barley – Key messages for 2015

• Net blotch, mildew and rhynchosporium present in crops
• Plan early for core products
• Early treatments (T0s) likely to be needed on winter crop
• Judge T1 actives and rates on diseases present
• Plan for ramularia treatments and react to risk warnings

Oilseed rape fungicides

• Optimum timing
• Product choice
Light leaf spot (LLS) risk high
As forecast by the Rothamsted light leaf spot forecast
(lead by Weather INnovations, funded by HGCA and Bayer)
www.rothamsted.ac.uk/light-leaf-spot-forecast

…and present in trials at the start of December

HGCA fungicide performance
LLS 2014 trial (Midlothian)
Oilseed rape – Key messages for 2015

- Light leaf spot pressure high
- Proline and Prosaro still standards
- Variable sensitivity to azoles in light leaf spot population
- Refinzer (SDHI / strobilurin mix) would offer a break from azole chemistry, if light leaf spot added to label
- Try to use non-azole chemistry as a sclerotinia spray to give more diversity to the programme

Key messages for 2015

- Plan programmes early
- Plan for main timings
- Aim to be preventative
- Increase dose rather than add timings
- Adapt later sprays to the situation
- Take fungicide stewardship seriously
Variety choices: New Recommended Lists and getting the most from disease ratings

Steve Hoad, Crop Science Team Leader
SRUC

Introduction

• Overview of new and established varieties
• Understanding the difference between disease ratings
• How to make best use of disease ratings in varietal selection
Choice of variety and market requirements

Before choosing a variety, consider the following factors and decide which will influence your decision:

- Sale for brewing, distilling or milling (check with your buyer)
- Earliness or need to spread the harvest period
- Ear loss and sprouting risks
- Disease risk
- Straw strength and length (barley straw can be of considerable value)
- Specific weight

Protecting crop yield and quality

- The most economic way of avoiding yield loss and poor quality due to disease is to grow disease-resistant varieties
- Disease ratings are calculated from assessments of disease in naturally infected trials and in inoculated tests
- Ratings are UK ratings on a 1-9 scale, where 9 indicates relatively good resistance and 1 relatively poor resistance
Reducing disease risk

- A rating is an indicator of disease risk. It describes the likely severity of infection when conditions favour disease development and compatible races of the disease are present.

- Where conditions are less favourable to a particular disease, or compatible races are absent, a susceptible variety may not show disease symptoms.

- A variety may be less resistant than expected due to the emergence of a new race of disease which overcomes its resistance.

- Variety resistance can sometimes break down within season. If this occurs, the rating may change from 9 (excellent) to 4 or lower (susceptible).

Varieties with ratings of…

[Graph showing the development of yellow rust over time for different varieties.]

Yellow rust development, Banbury, 2013
Variety review for 2015

- Spring barley
- Winter barley
- Winter wheat
- Spring wheat
- Spring oats
- Winter oats

Malting spring barley – Market leaders

<table>
<thead>
<tr>
<th>Status</th>
<th>Variety</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Concerto</td>
<td>Market leader. Yield becoming outclassed</td>
</tr>
<tr>
<td>O</td>
<td>Optic</td>
<td>In its 20th year. Nearly 10% market in 2014</td>
</tr>
<tr>
<td>R</td>
<td>Belgravia</td>
<td>The main GD variety, but declining</td>
</tr>
<tr>
<td>R</td>
<td>Moonshine</td>
<td>Niche market</td>
</tr>
<tr>
<td>R</td>
<td>Odyssey</td>
<td>Increasing interest, compare with Concerto</td>
</tr>
<tr>
<td>R</td>
<td>Propino</td>
<td>Good variety; brewing and feed use</td>
</tr>
<tr>
<td>P2</td>
<td>Sanette</td>
<td>Very high yielding brewing variety</td>
</tr>
<tr>
<td>P2</td>
<td>KWS Irina</td>
<td>Very high yielding brewing variety</td>
</tr>
</tbody>
</table>
### Malting spring barley – Key changes

<table>
<thead>
<tr>
<th>Status</th>
<th>Variety</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olympus</td>
<td>P1</td>
<td>Potential for D and GD</td>
</tr>
<tr>
<td>Sienna</td>
<td>Defer</td>
<td></td>
</tr>
<tr>
<td>Deveron</td>
<td>Defer</td>
<td></td>
</tr>
<tr>
<td>Vault</td>
<td>Defer</td>
<td>All have some potential for malt distilling</td>
</tr>
<tr>
<td>Octavia</td>
<td>Defer</td>
<td></td>
</tr>
<tr>
<td>RGT Planet</td>
<td>Defer</td>
<td>Very high yielding brewing variety</td>
</tr>
</tbody>
</table>

Overture | Off | No market interest
Glassel  | Off |
Shaloo   | Off |

### Feed spring barley – Key changes

<table>
<thead>
<tr>
<th>Status</th>
<th>Variety</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waggon</td>
<td>R</td>
<td>Early, well-adapted variety</td>
</tr>
<tr>
<td>Westminster</td>
<td>Off</td>
<td>Low yielding, some niche use</td>
</tr>
<tr>
<td>Shada</td>
<td>Off</td>
<td>Doesn’t offer anything new</td>
</tr>
<tr>
<td>Scholar</td>
<td>P1</td>
<td>New and very high yield</td>
</tr>
</tbody>
</table>
## Malting winter barley

<table>
<thead>
<tr>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassata</td>
</tr>
<tr>
<td>Pearl</td>
</tr>
<tr>
<td>SY Venture</td>
</tr>
<tr>
<td>Talisman</td>
</tr>
</tbody>
</table>

Both used in 2014

Small interest in 2014

Wait and see

## Two-row feed winter barley

<table>
<thead>
<tr>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retriever</td>
</tr>
<tr>
<td>KWS Cassia</td>
</tr>
<tr>
<td>KWS Glacier</td>
</tr>
<tr>
<td>KWS Tower</td>
</tr>
<tr>
<td>Cavalier</td>
</tr>
<tr>
<td>KWS Infinity</td>
</tr>
</tbody>
</table>

Yield still okay, but newer varieties are better

Modest yield, very good sp wt.

Good yield and sp wt. Weak for mildew

Good yield, acceptable sp wt.

Good North region yield, v good sp wt.

Good yield, acceptable sp wt. Weak for mildew
### Six-row feed winter barley

<table>
<thead>
<tr>
<th>Variety</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (hybrid)</td>
<td>R</td>
<td>Remains highest yielding WB</td>
</tr>
<tr>
<td>Escadre</td>
<td>O</td>
<td>Outclassed for yield. Very good sp wt.</td>
</tr>
<tr>
<td>KWS Meridian</td>
<td>R</td>
<td>Good yield, modest sp wt.</td>
</tr>
<tr>
<td>Daxor</td>
<td>P1</td>
<td>New. Good yield, modest sp wt.</td>
</tr>
</tbody>
</table>

### Winter wheat – Distilling

<table>
<thead>
<tr>
<th>Variety</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscount</td>
<td>R</td>
<td>Good. Benchmark.</td>
</tr>
<tr>
<td>Horatio</td>
<td>R</td>
<td>Medium.</td>
</tr>
<tr>
<td>Beluga</td>
<td>O</td>
<td>Reduced interest</td>
</tr>
<tr>
<td>Alchemy</td>
<td>O</td>
<td>Medium. Less interest. Low yield</td>
</tr>
<tr>
<td>Leeds</td>
<td>R</td>
<td>Medium. High yield. Growing interest. Weak for mildew</td>
</tr>
<tr>
<td>Myriad</td>
<td>R</td>
<td>Medium. Growing interest.</td>
</tr>
<tr>
<td>Twister</td>
<td>P2</td>
<td>Medium. High yield. Weak for mildew</td>
</tr>
</tbody>
</table>
**Winter wheat – Biscuit and Distilling**

<table>
<thead>
<tr>
<th>Status</th>
<th>Variety</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Invicta</td>
<td>Medium for distilling. Late maturing</td>
</tr>
<tr>
<td>P2</td>
<td>Icon</td>
<td>Good for distilling</td>
</tr>
<tr>
<td>P2</td>
<td>Zulu</td>
<td>Medium for distilling</td>
</tr>
<tr>
<td>P1</td>
<td>RGT Conversion</td>
<td>Good for distilling</td>
</tr>
<tr>
<td>Off</td>
<td>Tuxedo</td>
<td>Medium for distilling. No market pull</td>
</tr>
<tr>
<td>No</td>
<td>Britannia</td>
<td>Poor for distilling. Biscuit only</td>
</tr>
</tbody>
</table>

**Winter wheat – Milling and Feed**

<table>
<thead>
<tr>
<th>Status</th>
<th>Variety</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Gallant</td>
<td>No market pull</td>
</tr>
<tr>
<td>Off</td>
<td>Solstice</td>
<td>No market pull</td>
</tr>
<tr>
<td>O</td>
<td>Cordiale</td>
<td>Limited use</td>
</tr>
<tr>
<td>P2</td>
<td>Skyfall</td>
<td>The best of the new milling varieties</td>
</tr>
<tr>
<td>Defer</td>
<td>KWS Lili</td>
<td>New nabim Group 1</td>
</tr>
<tr>
<td>Defer</td>
<td>KWS Trinity</td>
<td>New nabim Group 2</td>
</tr>
<tr>
<td>R</td>
<td>Grafton</td>
<td>Modest yield, but robust, early and stiff</td>
</tr>
<tr>
<td>P1</td>
<td>Reflection</td>
<td>New. Very high yield. Relatively early</td>
</tr>
</tbody>
</table>
## Spring wheat

<table>
<thead>
<tr>
<th>Name</th>
<th>Status</th>
<th>Status Notes</th>
</tr>
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<tbody>
<tr>
<td>Paragon</td>
<td>Off</td>
<td>Outclassed on yield</td>
</tr>
<tr>
<td>Ashby</td>
<td>Off</td>
<td>Limited interest</td>
</tr>
<tr>
<td>Tybalt</td>
<td>R</td>
<td>nabim Group 2. Good yield</td>
</tr>
<tr>
<td>Mulika</td>
<td>R</td>
<td>nabim Group 1. Good protein level</td>
</tr>
<tr>
<td>KWS Kilburn</td>
<td>Defer</td>
<td>Feed variety. Yield looks good</td>
</tr>
</tbody>
</table>

## Spring oats

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<thead>
<tr>
<th>Name</th>
<th>Status</th>
<th>Status Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firth</td>
<td>R</td>
<td>Remains the market leader</td>
</tr>
<tr>
<td>Husky</td>
<td>Off</td>
<td>No market interest</td>
</tr>
<tr>
<td>Atego</td>
<td>O</td>
<td>Poorer milling quality</td>
</tr>
<tr>
<td>Canyon</td>
<td>R</td>
<td>Moderate milling quality</td>
</tr>
<tr>
<td>Conway</td>
<td>P2</td>
<td>Moderate milling quality</td>
</tr>
<tr>
<td>Aspen</td>
<td>P1</td>
<td>New. Very high yield. Quality looks good</td>
</tr>
<tr>
<td>Montrose</td>
<td>P1</td>
<td>New. High yield, stiff straw</td>
</tr>
</tbody>
</table>
**Winter oats**

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<thead>
<tr>
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<th>Status</th>
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<tbody>
<tr>
<td>Gerald</td>
<td>R</td>
<td>Remains market leader</td>
</tr>
<tr>
<td>Dalguise</td>
<td>R</td>
<td>Market interest. Good sp wt.</td>
</tr>
<tr>
<td>Mascani</td>
<td>O</td>
<td>Underperforms in Scotland</td>
</tr>
<tr>
<td>Balado</td>
<td>S</td>
<td>Dwarf variety</td>
</tr>
<tr>
<td>Rhapsody</td>
<td>P2</td>
<td>High yield, but low sp wt and kernel content</td>
</tr>
</tbody>
</table>

**Action points**

- Compare 1 or 2 new varieties against your current choices
  - Assess tillering and speed of development to GS31
  - Check grain nitrogen and grain maturity
  - Assess ear number and seed set
  - Judge grain maturity
- Use disease ratings to put varieties into risk categories
- Note how varietal yield differences compare with those on the Recommended Lists
Managing herbicide resistant weeds
Lessons from England’s experience with black-grass
Dr Paul Gosling, Research Manager
AHDB-HGCA

• Black-grass in England – what happened?
• The black-grass threat to Scotland
• Problem weeds in Scotland
• What can England’s experience with black-grass tell us about managing herbicide resistance?
Black-grass apocalypse?

Seismic shift in habits required to beat blackgrass

“But we have to get on top of it – growing wheat and oilseed rape won’t be sustainable if we don’t,”

Black-grass messes with the mind

Farmers frustrated by insidious black grass (Guardian online)

Lincolnshire farmers fear they are facing their worst harvest in 20 years due to an outbreak of the black grass weed (BBC online)

Beat blackgrass by turning to barley

Cambridgeshire, 2014
Black-grass (*Alopecurus myosuroides*), *Slender Foxtail*

Yield loss

16 trials on W. wheat in England

Average and ranges

Agroecology

- Emergence pattern - 80% Sept/Oct (?)
- Depth of emergence - < 5 cm from soil surface
- Seed longevity in soil - 75% decline/year
- High seed production - 100 seeds per head
- Population dynamics - > 95% control needed

Why has it become such a problem in England?

- Decline in spring cropping
  (barley, peas, s. beet, potatoes have all declined since mid 1980s)
- Decline in ploughing
  (wheat area ploughed declined from 90% in 1990s to 60% by 2012)
- A trend towards earlier drilling
  (5% of English wheat sown in September in 1970, 50% by 2012)
- W. wheat/W. rape rotations dominate
  (fits nicely with black-grass preferences)
- Herbicide resistance
Herbicide resistance in England

Types of herbicide resistance

The incidence of three types of resistance (RR or RRR rated) in black-grass from 122 samples (BASF, 2013)
### Status of herbicide resistance

<table>
<thead>
<tr>
<th>Herbicide group</th>
<th>Resistance status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-sowing:</strong></td>
<td></td>
</tr>
<tr>
<td>Glyphosate</td>
<td>No known resistance</td>
</tr>
<tr>
<td><strong>Pre-emergence:</strong></td>
<td></td>
</tr>
<tr>
<td>Oxyacetamides (flufenacet)</td>
<td>Limited resistance, slow developing</td>
</tr>
<tr>
<td>Dinitroalines (pendimethalin)</td>
<td>Limited resistance, slow developing</td>
</tr>
<tr>
<td>Thiocarbamates (prosulfocarb)</td>
<td>Limited resistance, slow developing</td>
</tr>
<tr>
<td><strong>Post-emergence:</strong></td>
<td></td>
</tr>
<tr>
<td>ALS inhibitors (mesosulfuron)</td>
<td>Widespread</td>
</tr>
<tr>
<td>ACCase inhibitors (clodinafop)</td>
<td>Widespread</td>
</tr>
<tr>
<td>Benzamides (propyzamide)</td>
<td>No known resistance</td>
</tr>
<tr>
<td>Carbamates (carbetamide)</td>
<td>No known resistance</td>
</tr>
</tbody>
</table>

### The black-grass threat to Scotland

Bridge of Earn, Perthshire, Brian Forbes
It’s here already

• Prefers heavier soils but not waterlogged soils (England)
• Favoured by warmer winters
• Local, rare populations responding to increased winter cropping and reduced tillage?
• New populations coming in from England & S. Scotland (possibly resistant)

New Atlas of the British and Irish Flora

How does black-grass spread?

SRUC HGCA
**Scotland – what is different?**

- **Spring cropping** is the most effective cultural control (90% average in trials in England) ✓
- **Mixed farming**, grass leys can ‘cure’ black-grass (70-80% of seed buried below 5 cm dies each year) ✓
- **Ploughing**
  (Gives effective control if used in the correct way) ✓
- **Soil moisture**, improves activity of pre-em herbicides
  (But spray days for applying them are fewer) ?
- **Cool damp summers**/cool autumns increase dormancy
  (Reduce total emergence and emergence period) ?
- **Delayed drilling** in Scotland
  (Is it realistic, mid-October, will it work?) ?

---

**Will black-grass be a serious problem in Scotland?**

Probably not

But don’t be complacent, it could become a problem locally
Problem weeds in Scotland

Species showing increased occurrence

- **Fumitory** - s. barley and winter cereals. Complex species mix makes control challenging
- **Field pansy** - s. barley, limited herbicide options
- **Speedwells** - no resistance found globally
- **Annual Meadow Grass** - s. & w. barley. Little yield penalty but holds moisture at the base of the crop thus reducing combining hours/day, increases moisture content of the grain
- **Bromes** - moving from headlands into field: plough, Liberator, Crystal and Avadex give control
Herbicide resistance in Scotland
ALS resistant Chickweed

- First found in 2000
- Rare in England
- Mainly found where spring cropping dominates
- Overreliance on ALS-inhibitors drives selection

Really?

Resistance
Impact on control of chickweed

- Proline 197 gene mutation more common than Tryptophan 574 mutation, both found in Scotland
- Resistance to Mecoprop-P has been found in England

Under threat WFD
Herbicide resistance in Scotland
ALS resistant Scentless Mayweed

- Now confirmed in Angus
- Still rare – 5 cases in UK
- Confirmed in Germany
- Type of mutation?

What can England’s experience with black-grass tell us about managing herbicide resistance?
Lessons from black-grass
1) General factors causing problems

• Simplified autumn only (or spring only) rotations
  • Selects ‘best’ weeds
• Reliance solely on herbicides for weed control
  • Resistant individuals escape
• Repeated use of herbicides which have the same MOA
  • ALS and ACCase especially vulnerable to resistance
• Increased reliance on pre-em herbicides
  • Conditions become very important – loss of control
• Earlier weed growth stage targets
  • Fewer spray opportunities – loss of control
• High seed production rates/high populations
  • Ability to go from a small to a large problem very quickly

Lessons from black-grass
2) Don’t let resistance gain a foothold

• Early detection is important, look out for
  • A gradual decline in control by a herbicide
  • A sudden loss of control
  • Healthy plants beside dead plants of the same species
  • Poor weed control leading to discrete patches
• Using ALS herbicides to control grasses is selecting for resistance in BLW
• Investigate herbicide failures – why didn’t it work?
Lessons from black-grass in England
3) Be pro-active, don’t become a victim

- Take a long-term view of weed control – future weed problems on your farm are in your hands
- Consider the cost of weeds across the rotation – ‘standard’ gross output figures are for zero weeds!
- Deal with a low level of resistance now rather than a high level later – it’s cheaper and easier
- Control in OSR isn’t always good, you just can’t see it!
- Resistance doesn’t go away – things won’t be better next year, no new MOA

We are probably going to loose key herbicides to EU legislation
carbetamide, propyzamide, chlorotoluron 2,4-D, mecoprop, glyphosate…….

- Resistance doesn’t go away – things won’t be better next year, no new MOA
Action points

• Diversify rotations
• Use a mixture of herbicides and cultural controls
• Watch out for resistant weeds

Integrating pest management: thresholds, timings and a whole farm approach

Andy Evans, Applied Practice Team Leader
SRUC

andy.evans@sruc.ac.uk  0131 535 4093
What is Integrated Pest Management (IPM)?

IPM is the careful consideration of all available plant protection methods and subsequent integration of appropriate measures that discourage the development of populations of harmful organisms and keep the use of plant protection products and other forms of intervention to levels that are economically and ecologically justified and reduce or minimise risks to human health and the environment.

Sustainable Use Directive (SUD)

What are the key components of the IPM ‘Toolbox’?

- Crop rotation
- Cultivation techniques
- Resistant/tolerant cultivars and standard/certified seed/planting material
- Protection and enhancement of important beneficial organisms
- Pest monitoring/forecasting and application of control based on monitoring data (thresholds)
- Use of biological, physical and other non-chemical methods
- Targeted application of pesticides
- Anti-resistance strategies
What are ‘thresholds’ within an IPM context?

- Thresholds are defined as the pest density at which some control should be exerted to prevent a pest population from increasing further and causing economic loss.

Thresholds allow some leeway regarding timing of management.
Some examples of pest thresholds

Cereals

• Summer aphids
  • Before GS61: half of tillers infested
  • GS61 to two weeks before end of grain filling: two-thirds of tillers infested

• Leatherjackets in spring barley
  • 50 leatherjackets per m²
  • 5 leatherjackets per metre of row

• Slugs per trap, prior to cultivation
  • Winter cereals: 4
  • Spring cereals: 1

Winter oilseed rape

• Cabbage seed weevil
  • Weevils per plant during flowering:
    • Northern UK: 0.5
    • Elsewhere: 1

• Cabbage stem flea beetle
  • >25% leaf area eaten at the cotyledon–2 leaf stage
  • >50% leaf area eaten at the 3–4 leaf stage

• Slugs per trap, prior to cultivation
  • In cereal crops: 4
  • In cereal stubble: 1
New publication available at www.hgca.com/pests
Has details of pest thresholds and IPM guidelines for pests of arable and horticultural crops

Issues with using thresholds (1)

- **Requires regular pest monitoring**
  - Use crop intelligence to guide timing of monitoring: eg AHDB Aphid News, SRUC Crop Protection Report, Bayer CropScience Pollen beetle forecast tool

- **Direct and indirect monitoring**
  - **Direct** is counting the actual number of pests or damage on the crop
  - **Indirect** is using a trap, such as slug refuge traps and pheromone traps
Issues with using thresholds (2)

- Correct identification of the pest
  - Use crop guides, keys and phone apps
- Relate to key growth stage and/or plant count
  - eg Orange wheat blossom midge and pollen beetle
- Assess pests throughout the crop (not just on the crop edge)
  - eg pollen beetle and aphids
- Use pre-planting pest thresholds
  - eg wheat bulb fly egg count and slugs in traps
- Weather
  - Warm weather makes pests easier to see on the crop
- Presence of natural enemies

Natural enemies help keep pest populations below thresholds

- Only when conditions favour the pest ahead of its natural enemy do problems arise
- To encourage natural control, it is important to encourage the natural enemies to prevent pest numbers reaching threshold levels
- Encourage natural enemies of pests by providing a diverse landscape (hedgerows, flowers), minimise insecticide inputs

The ‘SAFE’ approach
The ‘SAFE’ approach

What are we wanting to encourage?

<table>
<thead>
<tr>
<th>Cereal pests</th>
<th>Number of important parasitic species (abundant)</th>
<th>Diweed rape pests</th>
<th>Number of important parasitic species (abundant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereal aphids</td>
<td>8</td>
<td>Cabbage aphid</td>
<td>3</td>
</tr>
<tr>
<td>Orange wheat</td>
<td>4 (31)</td>
<td>Bash-potato aphid</td>
<td>2</td>
</tr>
<tr>
<td>Yellow wheat</td>
<td>3</td>
<td>Brassica pod midge</td>
<td>&gt;20 (2)</td>
</tr>
<tr>
<td>blossom midge</td>
<td></td>
<td>Cabbage root fly</td>
<td>2</td>
</tr>
<tr>
<td>Frit fly</td>
<td>91 (2)</td>
<td>Cabbage stem</td>
<td>6 (1)</td>
</tr>
<tr>
<td>Grass fly</td>
<td>2</td>
<td>Flea beetle</td>
<td></td>
</tr>
<tr>
<td>Yellow cereal</td>
<td>0</td>
<td>Cabbage fle beetle</td>
<td>4</td>
</tr>
<tr>
<td>Wheat bulb</td>
<td>2</td>
<td>Rapa winter</td>
<td>4 (2)</td>
</tr>
<tr>
<td>Cereal leaf</td>
<td>3</td>
<td>Stem weevil</td>
<td>&gt;20 (3)</td>
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<tr>
<td>Cereal ground</td>
<td></td>
<td>Cabbage stem</td>
<td>6 (1)</td>
</tr>
<tr>
<td>beetles</td>
<td>unknown</td>
<td>Rapa stem</td>
<td>3 (1)</td>
</tr>
<tr>
<td>Wireworm</td>
<td>unknown</td>
<td>Pollen beetle</td>
<td>9 (3)</td>
</tr>
<tr>
<td>Cereal stem</td>
<td>2</td>
<td>Tump sawfly</td>
<td>2</td>
</tr>
<tr>
<td>Sawfly</td>
<td></td>
<td>Slugs</td>
<td>10–20</td>
</tr>
<tr>
<td>Leathirjackets</td>
<td>2</td>
<td>Slugs</td>
<td>10–20</td>
</tr>
</tbody>
</table>
Using thresholds in practice
Pollen beetle

Monitoring
Estimate plant population per m² by counting the number of plants within a square foot and multiplying by 11. This is easiest at the 5-6 leaf stage. Ideally, make a number of estimates of plant population and calculate the average. Use the plant population to determine the threshold.

Count adults on the plant during the green bud stage. Once the crop is in flower, it is no longer at risk.

Thresholds
The threshold scheme is based on the maximum number of buds each beetle can destroy and the number of excess flowers produced by different crops. Plant population is important, as low plant populations tend to produce more branches and more flowers.

- If there are fewer than 30 plants/m², the threshold is 25 pollen beetles per plant
- If there are 30–50 plants/m², the threshold is 18 pollen beetles per plant
- If there are 50–70 plants/m², the threshold is 11 pollen beetles per plant
- If there are more than 70 plants/m², the threshold is 7 pollen beetles per plant

Consider using a non-pyrethroid insecticide due to resistance issues.

Flexibility with thresholds

*Increase monitoring frequency when at this point – natural control and/or weather may intervene and knock pest numbers down avoiding need for treatment.
Thresholds

Review of pest problems in 2014

Further pressure on slug control options as methiocarb is withdrawn

3 February 2014

EU member states have voted to withdraw approval for all methiocarb slug pellets because of the risk the active ingredient poses to birds, mammals and non-target arthropods.

WEDNESDAY 19 MARCH 2014

Bill for lack of slug control products put at £100m

WORK by AHDB’s crop divisions has estimated that a lack of slug control products could cost UK crop production £100 million annually.

High slug pressures look to challenge autumn establishment

8 August 2014

Caution urged with metaldehyde

6 November 2014
### Lessons to learn for 2015

- **Loss of dimethoate in cereals for wheat bulb fly**
  - Egg hatch treatment with chlorpyrifos the only option

- **Fallout from the loss of the neonicotinoids in oilseed rape**
  - How crops fare in 2015 will provide the whole story – TuYv impact?

- **Metaldehyde residues in water and loss of methiocarb**

- **Leatherjacket risk to spring barley**
  - SRUC survey ongoing

- **Pyrethroid resistance awareness**
  - Pollen beetle
  - Grain aphid
  - Cabbage stem flea beetle
  - Peach-potato aphid
Action points

• Identify what can be done on farm to increase natural enemies of pests – ‘SAFE’
  • Shelter – Alternative Prey – Flower Rich – Environment

• Familiarise yourself with the thresholds for major pests on crops
  • AHDB pest encyclopaedia

• Utilise tools available in the IPM toolbox
  • Forecasting, monitoring, thresholds, non-chemical controls etc.

Grain market and CAP update
January 2015

Julian Bell, Senior Business Consultant
SAC Consulting, SRUC

Julian.Bell@sac.co.uk 07795 302 264
World grain markets – another massive US maize crop sets the price floor

Source: HGCA

2014: second year of near record harvests – world; crop+2mt, demand+26mt, stocks+27mt

Source: USDA
World demand growth slows – feed leads

Source: USDA/SAC Consulting

Rapeseed loses its premium over soya – on weaker veg oil prices while meal is stable

Source: HGCA
Rape loses as world demands protein, not oil – oil content; rape 44%, soyabean 19%,

Source: HGCA

2015 world harvest: with 25mt rise in demand;
(A) Another record crop needed to hold stocks steady
(B) A 2% fall in area, record yields = 37mt fall in stocks
(C) Static area, 0.1t/ha fall in yields = 54mt fall in stocks

Source: USDA
Large UK wheat surplus in 2014 – selling into milling rather than feed market key to price

<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>2,186</td>
<td>1,959</td>
</tr>
<tr>
<td>Production</td>
<td>15,257</td>
<td>13,261</td>
<td>11,921</td>
<td>16,621</td>
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<tr>
<td>Imports</td>
<td>908</td>
<td>2,944</td>
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<tr>
<td>Available</td>
<td>17,702</td>
<td>17,700</td>
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</tr>
<tr>
<td>Human Use</td>
<td>6,816</td>
<td>7,572</td>
<td>7,423</td>
<td>7,810</td>
</tr>
<tr>
<td>- of which</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- flour milling</td>
<td>4,989</td>
<td>5,040</td>
<td>5,087</td>
<td>5,087</td>
</tr>
<tr>
<td>- starch/ethanol</td>
<td>1,227</td>
<td>1,752</td>
<td>1,625</td>
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<tr>
<td>- distilling &amp; malt</td>
<td>630</td>
<td>740</td>
<td>710</td>
<td>740</td>
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<tr>
<td>Animal Feed</td>
<td>6,475</td>
<td>6,835</td>
<td>6,148</td>
<td>6,721</td>
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<tr>
<td>Seed etc</td>
<td>371</td>
<td>370</td>
<td>355</td>
<td>373</td>
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<tr>
<td>Domestic Use</td>
<td>13,692</td>
<td>14,777</td>
<td>13,926</td>
<td>14,904</td>
</tr>
<tr>
<td>Exports</td>
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<td>737</td>
<td>431</td>
<td>3,476</td>
</tr>
<tr>
<td>End Stocks</td>
<td>1,485</td>
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<td>1,959</td>
<td>1,500</td>
</tr>
<tr>
<td>Net Trade</td>
<td>1,607</td>
<td>2,207</td>
<td>1,778</td>
<td>2,176</td>
</tr>
</tbody>
</table>

Source: DEFRA/HGCA/SAC Consulting

UK wheat exports – competitive for low grade milling but not feed – £10/t more than maize

Source: DEFRA/HGCA/SAC Consulting
UK 2015 – lower wheat area, average yields could see wheat crop fall 2.4mt, barley ~ stable

<table>
<thead>
<tr>
<th>Area (ha)</th>
<th>Yield (t/ha)</th>
<th>Prod'n (t)</th>
<th>Change (t)</th>
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</thead>
<tbody>
<tr>
<td><strong>WHEAT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>1929000</td>
<td>8.62</td>
<td>16,627,980</td>
</tr>
<tr>
<td>2015</td>
<td>1832000</td>
<td>7.79</td>
<td>14,271,280</td>
</tr>
<tr>
<td><strong>W. BARLEY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>427000</td>
<td>7.25</td>
<td>3,095,750</td>
</tr>
<tr>
<td>2015</td>
<td>476000</td>
<td>6.45</td>
<td>3,070,200</td>
</tr>
<tr>
<td><strong>S. BARLEY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>653000</td>
<td>6.02</td>
<td>3,931,060</td>
</tr>
<tr>
<td>2015</td>
<td>713000</td>
<td>5.45</td>
<td>3,885,850</td>
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</tbody>
</table>

Source: HGCA, SAC Consulting

UK wheat to return to net deficit in 2015 – on lower wheat area, average yields?

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<thead>
<tr>
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<th>2011/12</th>
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<td>5,087</td>
<td>5,067</td>
<td>5,007</td>
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<tr>
<td>- starch/ethanol</td>
<td>1,227</td>
<td>1,351</td>
<td>1,626</td>
<td>1,943</td>
<td>2,067</td>
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<tr>
<td>- distilling &amp; malt</td>
<td>650</td>
<td>780</td>
<td>710</td>
<td>780</td>
<td>760</td>
</tr>
<tr>
<td>Animal feed</td>
<td>6,475</td>
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<td>715</td>
</tr>
</tbody>
</table>

Source: AHDB, DEFRA and SRUC - SAC Consulting

Source: DEFRA/HGCA/SAC Consulting
Whisky production and grain use; 10 yrs growth to 2013 - malting barley + 500kt (+87%), grain +275kt (+54%)

Source: Sutherlands 2013, SAC Consulting. Note* - wheat and maize, excludes grain used in "white" spirit production

Scottish spring barley in 2015 – to fall 10-15k ha on three crop rule?

Source: Scottish Govt./SAC Consulting
Scottish spring malting barley – meeting specification

![Graph showing nitrogen content and screenings percentage through a 2.25mm screen over years.]  
Source: HGCA average Scottish barley samples, SAC Consulting

Malting barley purchases/capacity in Scotland – premiums supported as malting use rises

<table>
<thead>
<tr>
<th>Year</th>
<th>Scottish malting barley purchases/capacity ('000's t)</th>
<th>Scottish Sp. Barley Crop ('000's t)</th>
<th>Est. Malting varieties (%)</th>
<th>Est. Malting varieties ('000's t)</th>
<th>Scottish malting purchases/capacity as % of malting varieties</th>
<th>Malting premium over feed £/t</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>739</td>
<td>1,587</td>
<td>85%</td>
<td>1,349</td>
<td>55%</td>
<td>10</td>
</tr>
<tr>
<td>2010</td>
<td>693</td>
<td>1,328</td>
<td>76%</td>
<td>1,009</td>
<td>69%</td>
<td>13</td>
</tr>
<tr>
<td>2011</td>
<td>872</td>
<td>1,533</td>
<td>79%</td>
<td>1,211</td>
<td><strong>72%</strong></td>
<td><strong>54</strong></td>
</tr>
<tr>
<td>2012</td>
<td>930</td>
<td>1,447</td>
<td>74%</td>
<td>1,071</td>
<td><strong>87%</strong></td>
<td><strong>31</strong></td>
</tr>
<tr>
<td>2013</td>
<td>930</td>
<td>1,714</td>
<td>79%</td>
<td>1,354</td>
<td>69%</td>
<td>19</td>
</tr>
<tr>
<td>2014</td>
<td>930</td>
<td>1,745</td>
<td>72%</td>
<td>1,256</td>
<td>74%</td>
<td>26</td>
</tr>
<tr>
<td>2015 (f)</td>
<td>930</td>
<td>1,510</td>
<td>76%</td>
<td>1,148</td>
<td><strong>81%</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

*NB – 2015 example estimate - 265k ha at 5.7t/ha*

Source: MAGB/Scottish Govt./SAC Consulting
**Distilling malting premiums over feed barley** – 10yr av. £28.70, ~£25/t at harvest, harvest 2015 values around £40/t

![Graph showing malting premiums over feed barley (2005-2015)](source: HGCA/SAC Consulting)

**Distilling wheat use in Scotland** – increasingly reliant on imports when crop poor

<table>
<thead>
<tr>
<th>Year</th>
<th>Distilling* use of wheat in Scotland (t)</th>
<th>Scottish Wheat crop (t)</th>
<th>Distilling use as % of crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>495</td>
<td>747</td>
<td>66%</td>
</tr>
<tr>
<td>2010</td>
<td>499</td>
<td>918</td>
<td>54%</td>
</tr>
<tr>
<td>2011</td>
<td>630</td>
<td>957</td>
<td>66%</td>
</tr>
<tr>
<td>2012</td>
<td>786</td>
<td>673</td>
<td>117%</td>
</tr>
<tr>
<td>2013</td>
<td>805</td>
<td>653</td>
<td>123%</td>
</tr>
<tr>
<td>2014</td>
<td>818</td>
<td>954</td>
<td>86%</td>
</tr>
<tr>
<td>2015</td>
<td>818</td>
<td>861</td>
<td>95%</td>
</tr>
</tbody>
</table>

- Distilling – use for whisky and “white” spirit production
- No figures available for maize use in distilling

Source: DEFRA, SAC Consulting
CAP Direct Payments
- Scottish cereal farm payments to fall 20-25%
- ~ £5 to £10/t of grain produced

Source: FAS, SAC Consulting

Redistribution impacts – cereals

Net Change - 2011 vs 2019 (€m) - Main Sectors

Source: SRUC, HGCA

**BY REGION**

<table>
<thead>
<tr>
<th>Region</th>
<th>Highland</th>
<th>NE Scotland</th>
<th>Tayside</th>
<th>Fife</th>
<th>Lothian</th>
<th>Scottish Borders</th>
<th>Scotland TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring barley area (ha)</td>
<td>22,605</td>
<td>104,651</td>
<td>50,780</td>
<td>16,757</td>
<td>13,857</td>
<td>16,544</td>
<td>258,617</td>
</tr>
<tr>
<td>Crop Diversification - fail (ha)</td>
<td>5,421</td>
<td>26,974</td>
<td>3,452</td>
<td>2,379</td>
<td>2,468</td>
<td>3,388</td>
<td>51,948</td>
</tr>
<tr>
<td>Crop Diversification - fail (%)</td>
<td>24%</td>
<td>26%</td>
<td>7%</td>
<td>14%</td>
<td>18%</td>
<td>20%</td>
<td>20%</td>
</tr>
</tbody>
</table>

* SRUC analysis of June Census holdings data (2011)

Three Crops rule possible UK impact* – 60k ha rise in spring barley in 2015?

**Early Bird Survey estimates of UK harvest 2015 crop areas**

<table>
<thead>
<tr>
<th>Crops</th>
<th>Defra June Survey 2014</th>
<th>EBS Forecast Harvest 2015</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Wheat</td>
<td>1,929</td>
<td>1,832</td>
<td>-5%</td>
</tr>
<tr>
<td>Winter Barley</td>
<td>427</td>
<td>476</td>
<td>12%</td>
</tr>
<tr>
<td>Spring Barley</td>
<td>603</td>
<td>713</td>
<td>9%</td>
</tr>
<tr>
<td>Oats</td>
<td>136</td>
<td>118</td>
<td>-13%</td>
</tr>
<tr>
<td>Other Cereals</td>
<td>26</td>
<td>38</td>
<td>48%</td>
</tr>
<tr>
<td>OSR</td>
<td>674</td>
<td>649</td>
<td>-4%</td>
</tr>
<tr>
<td>Other Oilseeds</td>
<td>17</td>
<td>15</td>
<td>-10%</td>
</tr>
<tr>
<td>Pulses</td>
<td>138</td>
<td>171</td>
<td>24%</td>
</tr>
<tr>
<td>Peas</td>
<td>160</td>
<td>189</td>
<td>18%</td>
</tr>
<tr>
<td>Other Crops on Arable Land*</td>
<td>397</td>
<td>404</td>
<td>2%</td>
</tr>
</tbody>
</table>

* S: Beet, potatoes, maize, vegetables, roots, other stock feed

Source: Defra / The Andersons Centre

* HGCA “Early bird” survey
CAP reform impacts on cereal producers
– start planning now

Financial impact on direct payments – potential reduction in area payment – £50-60/ha or £20-24/ac, £5-10 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, three crop 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 production costs and yields
– top 25% of producers have 30% lower costs

<table>
<thead>
<tr>
<th>2012 Farm Accounts Scheme</th>
<th>Winter Wheat</th>
<th>Spring Barley</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Top 25%</td>
</tr>
<tr>
<td>Yield (t/ha)</td>
<td>6.5</td>
<td>7.8</td>
</tr>
<tr>
<td>Price (£/t)</td>
<td>191</td>
<td>204</td>
</tr>
<tr>
<td>Grain output (£/ha)</td>
<td>1249</td>
<td>1583</td>
</tr>
<tr>
<td>Straw (£/ha)</td>
<td>107</td>
<td>159</td>
</tr>
<tr>
<td>OUTPUT (£/ha)</td>
<td>1356</td>
<td>1742</td>
</tr>
<tr>
<td>Variable costs (£/ha)</td>
<td>572</td>
<td>568</td>
</tr>
<tr>
<td>Gross margin (£/ha)</td>
<td>784</td>
<td>1174</td>
</tr>
<tr>
<td>FIXED COSTS (£/ha)</td>
<td>804</td>
<td>645</td>
</tr>
<tr>
<td>TOTAL COSTS (£/ha)</td>
<td>1269</td>
<td>1054</td>
</tr>
<tr>
<td>(less straw sales)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total costs (£/t grain)</td>
<td>194</td>
<td>136</td>
</tr>
<tr>
<td>Margin (£/t)</td>
<td>-3</td>
<td>68</td>
</tr>
</tbody>
</table>

Source: SAC Consulting
Long-term action needed to raise yields and competitiveness – last 20 yrs UK wheat stuck at 8t/ha; US maize up 2.5t to 10.5t/ha

Source: USDA, HGCA

Spot vs forward selling?
- spread risk, forward prices up £25/t since lows

<table>
<thead>
<tr>
<th>Harvest Year</th>
<th>Wheat Yield (t/ha)</th>
<th>Harvest Price (£/t)</th>
<th>Harvest Output (£/ha)</th>
<th>VC (£/ha)</th>
<th>GM (£/ha)</th>
</tr>
</thead>
<tbody>
<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>7.5</td>
<td>168.60</td>
<td>1,265</td>
<td>490</td>
<td>775</td>
</tr>
<tr>
<td>2014</td>
<td>8.8</td>
<td>130.00</td>
<td>1,138</td>
<td>494</td>
<td>644</td>
</tr>
<tr>
<td>2015 SEP’14</td>
<td>8.1</td>
<td>120.00</td>
<td>972</td>
<td>443</td>
<td>529</td>
</tr>
<tr>
<td>2015 DEC’14</td>
<td>8.1</td>
<td>145.00</td>
<td>1,175</td>
<td>443</td>
<td>732</td>
</tr>
</tbody>
</table>

S. Barley - malting

<table>
<thead>
<tr>
<th>Harvest Year</th>
<th>Wheat Yield (t/ha)</th>
<th>Harvest Price (£/t)</th>
<th>Harvest Output (£/ha)</th>
<th>VC (£/ha)</th>
<th>GM (£/ha)</th>
</tr>
</thead>
<tbody>
<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>5.8</td>
<td>145.40</td>
<td>840</td>
<td>335</td>
<td>505</td>
</tr>
<tr>
<td>2014</td>
<td>6.4</td>
<td>133.50</td>
<td>849</td>
<td>340</td>
<td>509</td>
</tr>
<tr>
<td>2015 SEP’14</td>
<td>5.6</td>
<td>140.00</td>
<td>784</td>
<td>300</td>
<td>484</td>
</tr>
<tr>
<td>2015 DEC’14</td>
<td>5.6</td>
<td>165.00</td>
<td>924</td>
<td>300</td>
<td>624</td>
</tr>
</tbody>
</table>

- Start locking some forward prices in now?
- SOURCE: SAC Consulting, Crop Gross Margin estimates (excluding straw sales), assumes ’14 forward sales
Grain market and CAP outlook  
– 2014 harvest and beyond

1) 2014 – second year of near record world harvest leaves market oversupplied for now – maize and feed grains most burdensome, wheat market more positive

2) 2015 – another record world grain crop will be needed to keep pace with global demand growth trends – some early problems with US, Russian wheat,

3) 2015 shifts in UK and Scottish crop areas – UK to return to net deficit, spring barley down in Scotland, up in England?

4) CAP reform – £5-£10/t cut in direct support, how to make it up – yield, price? Three crop rule and EFA could reduce spring barley area

5) Margins, costs and risk strategy – if you know your costs, you can identify selling opportunities

Grain market and CAP outlook  
– take away messages

1) Know your cost of production as it will:

- give you a firm price trigger to aid selling decisions

- help you understand how farmers around the world might react to forward prices – if you are feeling hard done by, so are they! And crop area is likely to fall. If forward margins looking better – sell some!

- help you re-structure and adapt your business to cope with CAP reform
The main aim of a green crop is for ploughing-in to increase the organic matter content of a soil. Particularly useful for light sandy soils, but also helps soil structure in heavy clay soils.

When established to prevent nutrient loss, they are known as a catch crops. Such crops may also redistribute nutrients from soil depth (nutrient mining). Some may also fix nitrogen.

There is considerable cross-over between the two groups and they both provide soil cover.
What are we looking for in a green crop?

- Quick establishment to fit between main crops
- Rapid ground cover
- High biomass production
- Winter tolerant, if autumn sown

Green crops: other potential benefits

- Weed control
- Pest and disease control (ie green crops can act as break crops)
- Food source for insects
Green crops: examples

To increase soil organic matter using green leafy crops:
Common examples:-

- Forage rye
- Mustard
- Forage rape

Green crops: examples

- Phacelia
- Common vetch
What are we looking for in catch crop?

Primary role is to capture nutrients that could be lost from soil

Main attributes

• Quick establishment

• Deep, dense extensive root system

• If legume crop used, it will enhance soil nitrogen levels

Catch crops: other potential benefits

• Weed control

• Disease and pest control

• Food source for insects
**Catch crops: examples**

Chicory

Harvested barley, undersown with grass

**Cover crops and soil conservation**

The importance of soil and its conservation is now being taken very seriously

UN General Assembly: 2015 is International Year of Soils
Soil erosion

• Surface runoff, but also downward percolation, can remove soil particles

• It is evident that a dense crop or grass cover will assist in preventing soil erosion, as opposed to fallow soil.

• Vegetative cover will reduce surface flow rate

• Root mass will stabilise soil particles

Green crops and soil organic matter

Benefit to soil organic matter content

A crop producing 10 tonnes dry matter per hectare (eg forage rye) ploughed in to a depth of 6 inches (15 cm) will add approximately 0.5 % organic matter

A typical arable soil contains 5% organic matter

So the effect would be to immediately increase soil organic matter content by up to a tenth
Green crops and soil organic matter

Increasing organic matter assists

- Moisture retention
- Earthworm activity
- Retention and holds nutrients
- Aids soil structure

Green crops and soil structure

- **Granular**: Reminiscent of cookie crumbs and is usually less than 0.5 cm in diameter. Commonly found in surface horizons where roots have been growing.

- **Blocky**: Irregular blocks that are usually 1.5 - 5.0 cm in diameter. Commonly found in lower horizons.

- **Prismatic**: Vertical columns of soil that might be a number of cm long. Usually found in lower horizons.

- **Columnar**: Vertical columns of soil that have a salt "cap" at the top. Found in soils of arid climates.

- **Platy**: Thin, flat plates of soil that lie horizontally. Usually found in compacted soil.

- **Single Grained**: Soil is broken into individual particles that do not stick together. Always accompanies a lower consistency. Commonly found in sandy soils.
Green crops and soil structure

• Crop type may have a specific effect:

• Trial established (Wageningen University) Spring 2004

<table>
<thead>
<tr>
<th>December 2005</th>
<th>Root biomass g/m² 0-10 cm</th>
<th>Earthworm Number/m² (0 to 20cm depth)</th>
<th>Earthworm Burrows/m² (10 cm depth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass only</td>
<td>218</td>
<td>326</td>
<td>67</td>
</tr>
<tr>
<td>Grass/clover</td>
<td>193</td>
<td>359</td>
<td>138</td>
</tr>
<tr>
<td>Clover only</td>
<td>73</td>
<td>480</td>
<td>225</td>
</tr>
</tbody>
</table>

Catch crops and nitrogen capture

• Soils typically contain:

• 4,000 to 5,000 kg nitrogen/ha (3,200 to 4,000 units N per acre) – primarily in soil organic matter

• In a fallow soil potentially 1 to 2% of this could be lost – ie around 40 to 100 kg/ha per annum of nitrogen by mineralisation
Catch crops and nutrient mining

• Deep rooting crops, such as lucerne, will draw up nutrients, such as potash and magnesium, to the leaf. This is then returned to the soil surface.

Catch crops and N fixation

• Lucerne, vetches and red clover can fix nitrogen in the soil. Potentially 100 kg N/ha can be accumulated in the soil.

• It is actually more productive to sow along with grass in order that the fixed nitrogen can be utilised.

• Indeed, a fallow period after a N-fixing catch crop could allow the accumulated nitrogen to be lost by mineralisation.
Choosing the appropriate green crop

• Likely to be determined by CAP Greening requirements

### EFA green crops

<table>
<thead>
<tr>
<th>Crop</th>
<th>Green crop</th>
<th>Catch crop</th>
<th>Nitrogen fixing</th>
<th>Weed suppress</th>
<th>Pollinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rye</td>
<td>****</td>
<td>***</td>
<td>*****</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phacelia</td>
<td>****</td>
<td>***</td>
<td>***</td>
<td>****</td>
<td>**</td>
</tr>
<tr>
<td>Barley</td>
<td>****</td>
<td>***</td>
<td>***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oats</td>
<td>****</td>
<td>**</td>
<td>***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mustard</td>
<td>*****</td>
<td>**</td>
<td>****</td>
<td>***</td>
<td>**</td>
</tr>
<tr>
<td>Lucerne</td>
<td>****</td>
<td>*****</td>
<td>****</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Vetch</td>
<td>***</td>
<td>**</td>
<td>****</td>
<td>**</td>
<td>****</td>
</tr>
<tr>
<td>Undersown grass</td>
<td>(****)</td>
<td>****</td>
<td>*****</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Other considerations

Other specific issues may be considered:

Avoid 'green bridge' for disease. For instance:

<table>
<thead>
<tr>
<th>Main crop</th>
<th>AVOID as green crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>Rye</td>
</tr>
<tr>
<td>OSR</td>
<td>Mustard / radish</td>
</tr>
<tr>
<td>Peas</td>
<td>Vetch</td>
</tr>
</tbody>
</table>

Mustard as a green crop has been shown to suppress nematode activity in soils (releases isothiocyanates)

Research

• Much of the perceived benefits from cover crops are anecdotal or theoretical

• There is a limited amount of long-term research on green crops
Research

HGCA Project Report 414 (R.B Overthrow& P.C. Brookes)

• Winter wheat with mustard as green crop?

• Two sites for 4 years

• Yield increases not evident until year 4 and only on the site with heavier soil → +1.47 tonnes/ha increase in yield

• Concluded that an increase of 0.5 tonnes/ha per annum was needed to finance the green crop establishment

Research

HGCA Report No 513 (T.F. Doring, J.A. Baddeley, R.Brown et al)

Legume based mixtures for cropping systems

• Used an autumn-sown legume mixture cover crop prior to sowing spring sown wheat or OSR; maintained at 3 N rates

• Produced an average yield response of 9%, relating to an average improvement of £77/ha
Action points

- CAP Greening will have a major influence on whether or not cover crops are established more widely.

However, cover crops can provide multiple benefits to the soil and environment:

- Reducing soil erosion
- Promoting good soil structure
- Increasing net soil fertility, particularly with legumes
- Food sources for insects