



*from theory
to field*

Keeping barley world class

“Growers are coming back to barley and it's no longer the crop of yesteryear.”

You could argue that barley is the crop with the most potential to lead the UK into the Brave New World of agricultural production. UK and particularly Scottish malting barley is renowned as the best in the world. As importing nations, such as China and Russia, grow wealthier and their consumption of beer increases, their demand can only increase for the premium-quality malting barley supplied by UK growers.

But are we equipped to meet the challenge? “In terms of research provision, barley growers have rarely had as much near-field knowledge, as well as investment in the future, as there is at present,” notes HGCA research and knowledge transfer manager Paul Gosling.

“Barley's turned a corner in terms of demand – growers are coming back to it and it's no longer the crop of yesteryear. But it's always been an important crop in Scotland and currently there are a number of projects that will ensure the industry is prepared for future challenges.”

In the field, the key priority is managing *Rhynchosporium secalis*. “Losses from the disease have been estimated at £2.5m,” he points out. A major four-year project has recently come to an end that has improved understanding of how the disease develops in a plant and the influence of seed-borne infection. “As a result, better information will be produced

on the importance of seed-borne infection and how fungicides should be used to control disease.”

Another key project has established the resistance status of *rhynchosporium* populations to QoI fungicides, such as strobilurins. “Results from the project indicate that at present there is no QoI resistance in UK populations of *rhynchosporium*. But it may develop in the future and this project has formed the basis of independent monitoring that will now be continued on the pathogen.”

Little-known disease

Ramularia is a relatively new and little-known disease. “HGCA is part of a large LINK consortium for a project called CORACLE that aims to develop a greater fundamental understanding of the pathogen. As well as producing practical messages for growers, the project is equipping the industry with essential information for varietal and chemical development.”

Another LINK project is looking at optimum timings for fungicide applications, with a view towards improving yield at harvest. “Finally, the most visible output from HGCA on disease management is always the fungicide performance trials. These trials provide practical information every year on how the different products compare — also providing valuable information on when

The UK produces the best barley in the world, and demand is growing. CPM finds out how grower-funded research aims to keep UK barley crops at the top of their game.

By Tom Allen-Stevens

performance starts to slip. While many projects look at developing future solutions to disease control, the fungicide performance trials provide information that growers and agronomists need on an annual basis.”

So what has this wealth of research uncovered? “We now know a lot more about *rhynchosporium* and *ramularia* for starters,” notes Dr Fiona Burnett from SAC, who has carried out much of the research with her team of colleagues.

“*Rhynchosporium* is the major yield robber. We're very reliant on fungicides to keep it in check, and are lucky we have a broad choice. But we need to know how effective these fungicides are, particularly with the threat of resistance, and how the pathogen develops in the plant.”

The screening work followed the identification in France of a couple of isolates that were resistant to QoI fungicides. Hundreds of samples of rhynchosporium were collected from across the UK and tested for resistance — the occurrence of a crucial gene mutation.

“All UK isolates were susceptible, which is good news, and so strobilurins remain an option for controlling rhynchosporium,” reports Fiona Burnett. “We now have a good picture of the population of the pathogen, and the probes set up to do the screening. So we can continue this at a low level and crank up the testing if required.”

Seed-borne work

The seed-borne work has looked more closely at how the disease develops within the plant. “If it comes into the plant via the seed, how soon does it start to affect it?”

What the researchers discovered was that there was a period during which the plant was infected, but showed no visible symptoms. “We were finding that even resistant varieties were carrying quite high levels of the disease in the leaves, but showed no visible symptoms. What’s more, there was a measurable yield loss, although not as extreme as with a full-blown infection.”

The findings meant they could revisit the variety ratings. “It told us a lot more about the relative resistance of varieties to the pathogen. Previously many varieties



Researchers now understand more about how diseases develop within the barley plant, says Fiona Burnett.

had been given a 5 for rhynchosporium. But we could now rate them confidently over a wider scale and give growers a better idea of those that are truly resistant.”

The research has further implications for early season management of the disease. “The major risk is over-wintering of the disease on barley crops, and the correlation with yield loss. It makes an earlier spray more important, particularly on weaker varieties, such as Saffron and Cassia.”

Weather has a big influence on how much of a difference it makes, but this season there’s a strong case for disease control to start much earlier. “We’ve had a warm autumn with lots of rhynchosporium. A lot of crops would benefit from a T0.”

She suggests a non-azole based application, with cyprodinil and perhaps a strobilurin to reduce the pressure on azole chemistry that will be used later in the season. If T1 is timed at the beginning of stem extension (GS30), the T0 spray should come 3-4 weeks earlier during mid-tillering.

Considerably less is known about ramularia, having only recently been identified as a pathogen in the last 10 years, but now a major priority in barley, points out Fiona Burnett. “Most varieties show as a 4/5 moderate susceptibility,



Rhynchosporium costs the industry an estimated £2.5m/year, says Paul Gosling.

and there’s a very small spread. But we can’t be more definitive — all breeding programmes at the moment share a common heritage and resistance wasn’t being bred into varieties 20 years ago.”

The CORACLE project brings together agchem manufacturers and plant breeders with some common objectives:

- Refining of a risk forecast, based on lower-risk areas of England compared to high-risk regions in the north of the UK
- The role of seed infection in the spread of disease
- Breeding for resistance
- Developing a fundamental understanding of the pathogen.

Spore-trapping is being used to develop a risk forecast. “Ramularia is ▶

Research round-up

HGCA project 3645, Screening for QoI resistance in UK populations of *Rhynchosporium secalis*, was an 18-month project that started in June 2009. Its aim was to screen for QoI fungicide resistance in UK populations of *R. secalis* from winter and spring barley crops, and its cost was £55,266.

HGCA project 3370, Rhynchosporium on barley: understanding the relationship between barley varietal resistance, fungicide resistance and the influence of seed-borne infection, ran from Aug 2007 to July 2011. Its aim was to understand the role rhynchosporium seed infection plays on varietal resistance and fungicide resistance. Total cost was £694,000 of which HGCA contributed £179,000. Project partners were Rothamsted Research, BioSS, Queens University Belfast, Scottish Agronomy and SEERAD.

HGCA project 3441, Control Of RAMularia leaf spot in a Changing CLimateE (CORACLE) runs from May 2009 to April 2014. Its aim is to improve barley production in a changing climate by reducing losses to ramularia leaf

spot. Total cost is £910,000 of which HGCA is contributing £200,000. Led by John Innes Centre, project partners are Defra, Sustainable Arable LINK, The Arable Group, SAC, SCRI, BASF, Bayer Crop Science, KWS, LSPB, Masstock, Limagrain, Saaten Union, Sejet, SW Seed and Syngenta Seeds.

HGCA project 3458, Improving resource use efficiency in barley through protecting sink capacity runs from Jan 2009 to June 2012. Its aim is to identify mechanisms of fungicide effects on sink capacity, resource-use efficiency and yield of high quality grain, to guide treatment decisions. Total cost is £714,000 of which HGCA is contributing £96,000. Led by ADAS, project partners are Defra, Sustainable Arable LINK, Agrovista, BASF, Bayer Crop Science, CSC, Masstock, CRD, SEERAD, SAC, UAP

Further information on all HGCA-funded barley disease work, including the Fungicide Performance trials, is available at www.hgca.com/diseasecontrol

Distilling drive

On one side of Wolfstar Farm at Ormiston, East Lothian, stands Baird Malt, while on the other is an Alexander Inglis grain store, that holds supplies for distillers. So there are few surprises about what makes up the majority of the cropping on the 360ha of undulating medium-loam soil that lies in between.

“Barley’s always been our main cash crop, and we’ve always concentrated on malting,” says grower Alex King. “It suits the farm and it suits our area. We aim for low N barleys for the distilling trade, and in most years get a reasonable quality.”

Spring barley makes up 162ha of the arable area, while there’s another 27ha of winter barley. “Two-thirds of the spring barley area is Optic, that we’ve grown for 14 years. There’s a lot of luck with it and it tends to brackle, so at harvest you have to take it when it’s ready. The rest is Braemar, that’s earlier by a week and produces big, bold grains, so suits our lighter land.”

The aim is to get a yield of 7.5t/ha and grain

nitrogen below 1.65%, or even 1.5% on some contracts. “The lower the better for distillers. You want to get as much starch into the grain as you can, so the less disease in the plant, the more it will photosynthesise. Anything that restricts sunlight will reduce grain quality.”

This means a fairly robust fungicide strategy that’s put together with agronomist Andrew Gilchrist from Scottish Agronomy. “Timings are all important, and they’ve evolved to encompass new chemistry, and to keep on top of ramularia.”

This often starts with a very early tillering low-dose fungicide to help any low-level mildew or rhynchosporium. “T1 comes at mid-late tillering, not GS31, and is prothioconazole-based.

“T2 is the main ramularia timing — Bravo (chlorothalonil) is excellent for it, and this will be mixed with prothioconazole, Tracker (boscalid+epoxiconazole) or one of the SDHIs. Awns visible, before the head’s fully out, is the key timing. Otherwise the pollen can aggravate the ramularia on unprotected leaf.”



A clean crop, and using latest technology to best effect, are crucial to get the quality Alex King is looking for.

A fourth-generation farmer, Alex King is keen to stay ahead of new disease developments and the technologies used to combat them. “We first woke up to ramularia in 2002. Since then we’ve always been very conscious of it and adapted our spray strategy, and I think we’re targeting inputs better as a result. The greening effect of new fungicides helps with sub-clinical levels of disease and prolongs the life of the crop to give us that vital grain quality.”

► closely related to septoria — the risk of disease depends on the presence of spores and the weather. So we can use leaf wetness and spore data as criteria for regional warnings.”

But the disease is also seed-borne, she

stresses. “We know it sits in the plant and is symptomless for much of the season. It’s only towards the end of its cycle that it breaks out of the plant and shows symptoms. How much and how badly it breaks out is critical to yield loss.”

The key to managing the disease and developing resistant traits that can be bred into future varieties lies in understanding how the disease develops in the plant as well as in the wider environment, says Fiona Burnett.

advert removed

“We think it’s always lived in parallel with the crop but has only become problematic now we’ve extended the barley-growing season with chemistry which keeps the crop greener for longer,” she explains.

“The chemistry itself is also important — morpholines, for example, create additional stress on the plant which acts as a trigger for the disease to break out. So if we want to prevent this, we want to ensure we apply crop-kind chemistry to barleys.”

Resource efficiency

The other LINK project, that concludes this year, aims to identify how fungicides affect yields and promote the efficient use of resources. The theory is that, unlike wheat, boosting barley yield has much more to do with maximising its capacity to store food in the grain than the source that generates it — the leaves and stem. Experiments involving shading spring barley crops for different periods after flowering have shown that the canopy needs protecting for about four weeks after the start of ear emergence. Fungicides applied at flag-leaf emergence or booting can give this duration of protection.

“While prolonging flag-leaf lifespan is important in wheat, yield becomes limited much earlier in barley and fungicides applied after ear emergence have little effect on yield, even though they prolong the green area.

“Moreover, field experiments have shown you can get yield and quality responses to fungicide treatment that bear little relationship to the amount of visible disease present. Although it’s proved difficult to pinpoint the mechanisms responsible, our research has shown that even on resistant varieties with little or no visible disease, useful yield responses can occur to azole plus strobilurin fungicides applied at either T1 or T2.”

Refining our understanding of how barley plants respond to fungicides and how diseases develop are the routes that should unlock higher yields and quality, believes Fiona Burnett. “Fungicides will come under more pressure from resistance. We can slow it down, but we’ll struggle to avert a disaster. So we should always look for alternative ways to boost yield.

“Varietal resistance will help, and more accurate risk prediction will mean growers can target inputs better. You could argue



Seed-borne infections mean earlier treatment of the crop is more important, researchers have found.



One of the aims of the CORACLE project is to define variety resistance ratings for ramularia.

the case for longer rotations, but the economic reality is that you need a balance of short-term measures and longer-term objectives. Research has to knit into this.” ■

advert removed