Barley needs a boost?

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Technical Disease delve - barley

The loss of chemical options for barley disease control may have left barley genetics relatively exposed. *CPM* takes a detailed look at how the key pathogens play out in current programmes.

By Mike Abram

Developing effective genetic resistance to key barley diseases may have been overlooked in favour of yield by plant breeders, perhaps in part because of the strong options for disease control from fungicides such as prothioconazole.

But as resistance starts to bite and chemical options diminish, it's an area that may well need to be prioritised in future, suggests Dr Neil Havis, crop protection team leader at Scotland's Rural College (SRUC).

"For many years, yield has been king," he says. "It's a characteristic breeders chase more than anything because if you get a variety which yields 2% above the standards on the AHDB Recommended List it gets on automatically.

"The breeders are beginning to look at the bigger picture and helping growers produce profitable crops in a sustainable way with a sustainable level of inputs, reducing the environmental impact of farming, instead of just chasing yield."

As yet that hasn't resulted in better resistance traits coming through for three of the four main barley disease threats: ramularia, rhynchosporium and net blotch. Only brown rust has varieties with an eight or higher for resistance on the RL.

That means emphasis is still on fungicides for control of most diseases, but the cracks are showing, not least with a stalwart of barley disease control, chlorothalonil, no longer available.

Without it, control of one key barley disease, ramularia leaf spot, is likely to be a major challenge as other chemistry only offers limited control.

Ramularia

"For the past 20 years chlorothalonil has been a mainstay of barley disease control programmes," Neil says. "So growers are looking at what to do in its absence, especially against ramularia."

In terms of fungicide options, the toolbox is rapidly emptying for ramularia control options, with resistance evolving to all the single target-site modes of action.

Strobilurins were the first to succumb during 2002, when the G143A mutation within the *Ramularia collo-cygni* population conferred complete resistance to the chemical group.

The first warning signs of trouble ahead for SDHIs was in 2014 when single isolates with slightly decreased sensitivity were discovered in France and Germany. But it was 2017 when the major shift happened with a complete collapse in field performance from not only SDHIs but also azole fungicides, he says.

This was caused by separate mutations, with one affecting azoles and another SDHI chemistry. While the SDHIs now appear to have completely lost their activity against ramularia, the same is not quite true of azoles, Neil says.

"In 2019 we saw a little bit of residual activity from the azoles. We think the hot summer of 2018 pushed some of the pathogen population back to be more sensitive.

"Some of these mutations incur a fitness penalty, where the fungal isolates are not able to withstand other stresses, and we think in that hot dry summer they died off and resulted in a shift back to more sensitive isolates."

Last season, ramularia was mostly non-existent as a threat. "With two months where there was no rain it was too dry. The fungus grows in the spaces between plant cells and needs available moisture to be present, and if the plant is water stressed there isn't going to be any for the fungus."

"So the big question around azoles is what will we see in a year with higher ramularia pressure?"

From the AHDB fungicide performance curves in 2019, the BASF azole mefentrifluconazole has the most activity, giving around 75-85% control from a half dose, while a half dose of Proline (prothioconazole) was nearer 50%, Neil says.

"The other question is what is the value ▸

Growers are looking for what to do to control ramularia in the absence of chlorothalonil, says Neil Havis.

Rhynchosporium shows itself as large, pale green watery oval lesions on the leaf blade that turn pale brown and develop a darker margin.

▸ of the one remaining multi-site, folpet, to the value of the barley programme?

"This is a contentious question among plant pathologists. The product is approved for rhynchosporium control and our work has shown there is some intrinsic activity against ramularia in controlled conditions, but in the field it is nowhere near the levels of CTL.

"On a good day it will give maybe 30-40% control, but its value in the programme is when it is combined with other chemistry from an anti-resistance development point of view."

Currently there are no standout spring barley varieties with better resistance to ramularia, he says. "All are moderately-susceptible, so that has put more pressure on the chemicals."

Finding varietal resistance has moved up breeders' target lists and Neil has a PhD student looking for genetic factors that point towards resistance, but it's not likely to be a short-term solution.

Alleviating stress through nutrition or biostimulants is another research area, he adds. "We know the disease is exacerbated by stress, with the ultimate stress being flowering as that changes the physiology of the crop.

"But so far there is very little independent evidence to show direct benefits for ramularia control. We do know that if you can delay senescence you get reduced symptoms, so there is a question about whether biostimulants can influence senescence, and mean ramularia comes in later and for a shorter period."

How to identify ramularia

Ramularia is easy to misidentify, Neil says. "Follow the five R guide. If it satisfies all of the five Rs then you're probably looking at ramularia."

1. Ringed with yellow margin of chlorosis
2. Rectangular shape
3. Restricted by the leaf veins
4. Reddish-brown colouration
5. Right through the leaf

Net blotch

Net blotch, which can easily be mistaken for ramularia, is a growing threat, particularly in winter barley in some parts of the UK, Neil suggests. It's favoured by wet and warm spring and summers and tends to be seen more in England than Scotland.

"There are a number of possible reasons why it has been increasing — it's both trash and seed-borne, and we've lost seed treatment products, such as Raxil Star (prothioconazole+ tebuconazole+ fluopyram) in spring barley, which is putting more emphasis on the foliar fungicides."

With less effective seed treatments, growers home-saving seed should consider getting seed tested especially if the disease has been seen in the seed crop, he advises.

Like ramularia it is also adept at producing mutations that impact on the efficacy of fungicides, although currently it is reduced sensitivity rather than outright failure.

"There have been SDHI mutants recorded in Europe, although as yet we haven't seen too many strains in the UK.

"Both Imtrex (fluxapyroxad) and Proline (prothioconazole) have performed well in the AHDB fungicide performance work, while there is a drop in efficacy from Kayak (cyprodinil), which could be a problem for growers in future who have been using it as a cheap option early in the programme."

Insensitivity to strobilurin fungicides is present, but it is a different mutation, F129L, to the G143A one that causes complete loss of control in ramularia and septoria in wheat. Efficacy has declined but, generally, field performance is still useful in a programme, he says.

Growers using a min-till establishment technique are potentially more at risk, again especially if previous crops had high levels of net blotch infection. "You don't want to be sowing into a dirty seedbed."

Thick crops also create a favourable micro-climate for net blotch so higher seed rates can be a problem, he adds.

Varietal resistance is again lacking — there's nothing above a disease score of six

Brown rust most prevalent barley disease?

Within the AHDB Recommended List winter barley trials brown rust has been the most prevalent disease for the past three seasons, says Katie Murray, Syngenta area manager for Scotland.

"It's probably due to the mild winters, and warm, humid springs. It survives on the green bridge and spreads into crops. In barley you need to control it earlier than in wheat but we do have the chemistry to do so."

Elatus Era (benzovindiflupyr+ prothioconazole) in Syngenta's portfolio is known as a strong choice against rusts, she notes. "If you have brown rust coming in at T1, it's an obvious choice."

The product is strong against all the other key barley diseases, but it's best position in winter barley programmes will depend on which disease is the main risk, she says.

For net blotch, as well as early infections of brown rust, typically that would be at T1, while for rhynchosporium it would usually be T2 usually in mix with folpet. "The folpet is there to provide protection against ramularia."

Where net blotch and rhynchosporium threaten, there could be a place for Kayak (cyprodinil) at T0, she adds.

Brown rust has been the most prevalent disease in winter barley the past three years, says Katie Murray.

In spring barley, in low disease situations where a single shot of fungicide will suffice, she recommends Elatus Era plus folpet at GS37-39. "If it is higher risk for ramularia, we would suggest an alternative SDHI plus azole plus folpet at T1, and following up with Elatus Era plus folpet at GS45-49."

for winter barley and no scores for spring barley.

"AHDB has switched some of the trials that were on yellow rust into net blotch in an attempt to provide more information on varietal resistance," notes Neil.

Rhynchosporium

Breeding is also behind the curve in providing genetic resistance to the other key barley disease, rhynchosporium.

"There's nothing in spring barley that is currently above a disease score of six. When Fairing came through it was a nine, it's now a six, although we've seen in the field in some years that it can perform better than a six.

"More resistant varieties could allow growers to cut back on fungicide inputs in spring barley. If you've got clean crops and no visible disease, on a variety with decent rhyncho resistance there is a question mark about T1 in spring barley."

That's not the case in winter barley, where the disease has more time to develop. "With yield potential set early on, you need to control disease early on when the grain sets are forming."

Fortunately, there are good fungicide options. "There has been a gradual decline in the efficacy of azole fungicides over the past 20 years, but the bulk of activity in Siltra Xpro (bixafen+ prothioconazole) is coming from the SDHI."

Strobilurins are effective against rhyncho with only occasional G143A mutations recorded across Europe, while cyprodinil also has some activity.

"I've not seen any data that suggests folpet contributes strongly to rhynchosporium control, but application at T2 may also help control ramularia," Neil adds.

Brown rust

Brown rust may be the most common disease in winter barley by some measures (see panel on p14), but it is probably the easiest to control and least worrying in terms of yield loss, Neil says.

"It's another one that likes warm and humid conditions.

With net blotch, small, dark brown lesions develop into short brown stripes or irregular blotches which consist of a network of brown lines.

In those conditions it can take off, but we have the chemistry to control it."

SDHIs, strobilurins and azoles all provide good control, with bar the occasional isolate showing slight insensitivity to SDHIs, which has had no impact on field performance, there are no resistance concerns, according to the latest Fungicide Resistance Action Committee report.

Varietal resistance in winter barley is a bit better than for other diseases with Jordan rated an eight, and multiple other varieties rated as sevens, Neil says. "But there's nothing above a five for spring barley." ■

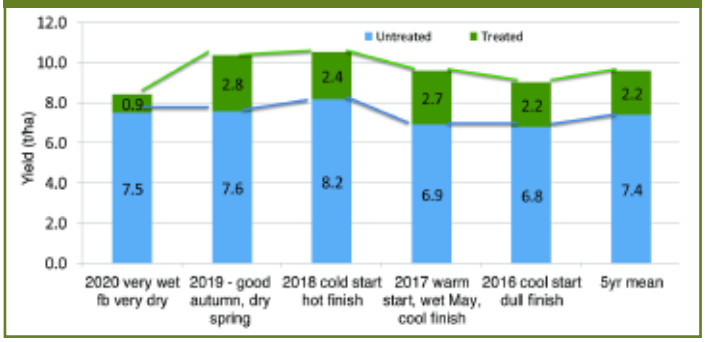
Prevalence of winter barley diseases in past four years

Source: AHDB Recommended List Harvest Data 2017-2020

Average yield responses to fungicides in spring barley

Source: AHDB spring barley RL control varieties

Fungicide yield response in winter barley related to conditions



Source: AHDB winter barley RL control varieties

Disease delve – barley

Knowing your enemy is the first line of defence against disease — stay a step ahead and you maintain better control. But it's an evolving picture with cereal diseases — varietal susceptibilities shift, pathogens mutate, research moves on and our understanding changes. It's easier to manage a problem if you know more about it. So *CPM* has teamed up with Syngenta to bring growers bang up to date.

In barley, growers are lucky to have several fungicide modes of action to choose from, to deliver a multi-pronged attack on key diseases.

As a popular foundation in barley, Elatus Era has gained ground. Combining the reassurance of prothioconazole with the persistent green leaf area protection of the SDHI Solatenol, its label approval covers net blotch, brown rust and rhynchosporium. Plus, it can be used on malting and feed barley, as well as wheat.

Meanwhile while the multi-site folpet may not yet be fully established in barley, it's becoming a compelling proposition. Trials have shown that adding folpet to an already robust SDHI/prothioconazole/cyprodinil programme cut ramularia infection by an additional 40%.