Controlling barley diseases: learning from the Emerald Isle

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Barley disease control
Lessons from Ireland

Barley is by far the most important cereal grown on farms in Ireland, where the country's unique maritime climate means a robust disease control programme is essential to maximise crop potential. *CPM* examines what British growers can learn from the Irish example.

By Paul Spackman

With its proximity to the Gulf Stream, bringing warm, moist air across the Atlantic, Ireland generally experiences excellent growing conditions for the 274,000ha of cereal crops produced annually.

Barley is by far the most important cereal, with the 2021 area of 184,000ha accounting for around three-times that sown to wheat. Spring varieties for malting and livestock feed sectors have traditionally dominated, and still account for almost two-thirds of the Irish barley area, although genetic improvements have seen a substantial increase in the amount of winter barley grown for livestock feed over the past decade.

While the higher annual rainfall, which ranges from 750-1000mm in eastern areas to 1000-1400mm in the west — double that of southeast England — and milder temperatures create good growing conditions, they can also be an ideal environment for disease pathogens.

Wet weather

Wet weather diseases like rhynchosporium and net blotch are the main threats to winter and spring barley in most seasons, however, the risk from mildew and ramularia can also be significant depending on conditions and varieties grown, says Dr Steven Kildea, senior research officer at Teagasc.

"Managing the disease threats in barley is all about building integrated cultural and chemical control strategies around the specific risk factors in individual situations."

This begins with assessing the strengths and weaknesses of the varieties grown, and includes other factors such as barley's rotational position, risk of disease carryover and the weather (past and forecast), he says.

KWS Cassia, for example, is an established favourite among Irish growers due to its consistent quality, stiff straw and proven performance. But it does have weaknesses against rhynchosporium and mildew (rated five for both) that need to be managed, Steven says.

Rotation is equally important when assessing disease risk, as growing consecutive barley crops increases the risk of inoculum carryover, particularly for rhynchosporium and net blotch. "Ideally you'd avoid growing varieties with weaknesses to those diseases in that situation, but if you have to, then you

Managing barley disease hinges around integrated cultural and chemical control, tailored to specific risk factors, says Dr Steven Kildea of Ireland's advisory service Teagasc.

Barley fungicide tips

- Assess disease risk based on variety scores, rotation, weather
- Tailor product choices to risk, adjusting plans according to the season
- Alternate chemistry and use different modes of action to reduce resistance risks
- Consider a three-spray programme in higher disease pressure situations:
  - T1 Tillering (GS 25-30) - early spray to prevent tiller loss
  - T2 Stem extension (GS 31-33) - comprehensive spray to protect main leaves
  - T3 Flag leaf/ booting (GS 39-49) - broad spectrum fungicide
- Be prepared to invest in barley to maximise yield potential.

In-field experience with ramularia suggests growers need to start thinking more in terms of managing the disease rather than controlling it.

need a suitable fungicide programme to manage the risks."

Barley yields are driven by tiller number, so protecting crops during the primary development phase is critical to prevent tillers being lost to disease, compromising yield potential.

Although individual spray programmes depend on location, variety and seasonal weather, Steven says many winter barley crops, particularly those grown in milder, wetter parts of southern Ireland, often require a three-spray fungicide strategy to protect tillers and maximise grain fill by maintaining a healthy canopy as long as possible.

Three-spray programmes

Timings for a three-spray programme typically see the first application at the end of tillering, a second at stem extension (growth stage 31) to protect leaves two and three, and a final spray around booting/awns emerging to reduce the risk of ramularia developing later in the season.

"In spring barley, the whole growing season is condensed into a much shorter period, but the focus should still be on maximising tillers and protecting the upper canopy," he adds.

This usually involves a two-spray programme, with the first at the end of tillering/start of stem extension and a second fungicide as awns emerge.

David Leahy, BASF's business development manager in Ireland says some growers tend to prioritise the T2 fungicide in barley and often neglect the importance of the T1.

"This strategy can work, but if you don't fully control disease at that first timing,

Net blotch shows some level of resistance to all the main fungicide types, so chemistry and rates must be chosen carefully.

there's always a risk of losing tillers and compromising yield, plus it will put extra strain on the later chemistry. In a post-chlorothalonil era, robust disease control at both timings is important as it helps mitigate the threat from ramularia later in the season. This is largely down to ramularia being a stress-induced disease.

"Barley can be just as rewarding as wheat if managed correctly. This is not purely due to disease control, but equally down to good basic agronomic principles. If the disease risk is there, growers should invest in the crop to push yield and gross margin."

Despite the recent loss of the important multisite chlorothalonil, Steven says barley growers still have access to a wide range of SDHI, QoI (strobilurin) and azole-based chemistry, which should be "mixed and matched" according to varietal strengths and weaknesses.

"Look at the disease risk in individual fields and tailor product choice accordingly at each spray timing. There's no single answer to suit every situation." ▸

Understanding the chemistry

So what is it that makes fluxapyroxad (marketed as Xemium) so effective against rhynchosporium, and mefentrifluconazole (marketed as Revysol) such a good option against ramularia?

BASF says Xemium has been developed with a formulation technology that allows quick and complete coverage of the leaf surface, with spray droplets adhering firmly, resulting in higher retention on the leaf.

This allows the active to quickly penetrate the leaf and once inside, it is highly mobile, distributing systemically to other areas, giving a "powerful and immediate" curative effect.

Its lipophilic properties also allow a proportion of Xemium to remain on the leaf surface, with molecules congregating and crystallising to prevent them being washed off by rain. Molecules are then slowly released into the leaf, providing lasting protection to new growth after application. This ability to adjust between lipophilic and hydrophilic environments, by changing its polar properties with different conformations, lies behind Xemium's significant mobility.

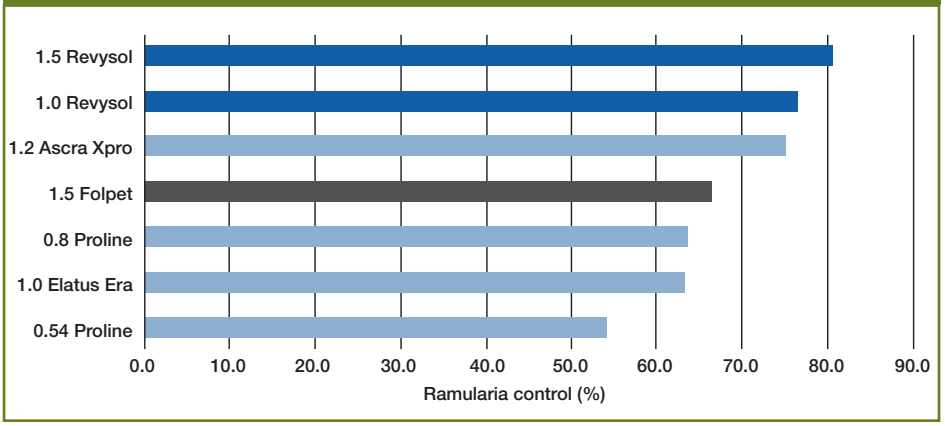
Revysol is the first of a new azole type called an isopropanol-azole, discovered and developed by BASF. The firm says it has "unique structural stability" that is unlike other azoles and gives "powerful binding properties even when target site mutations have occurred".

"We have experienced outstanding Septoria efficacy despite progressed sensitivity losses towards azole chemistry; which you would never expect from pure ED50 lab tests. A similar phenomenon seems to be true for ramularia, where we could see an erosion of performance for prothioconazole over time, but stable and reliable high performance with Revysol," David Leahy notes.

Revysol can be rapidly taken up by the leaf, which makes it one of the most rainfast actives on the market, he adds. "Its longevity is also really interesting. It forms reservoirs within the leaf interior that gradually release the active into the plant's water transport system over many weeks, protecting parts not reached by the initial application. This could be very beneficial where there is long-lasting disease pressure."

Some growers tend to prioritise the T2 fungicide in barley and often neglect the importance of the T1, notes David Leahy, BASF's business development manager in Ireland.

Ramularia control (% efficacy on 2nd leaf)



EuroBarley 2021: four trials in Denmark, Ireland, Scotland and Bavaria in Germany. Source: Lise Nistrup Jorgensen; Aarhus University.

▸ Furthermore, to ensure the longevity of the products available he says it is important to alternate chemistry and use at least two or three different modes of action to minimise resistance pressure — rhynchosporium, net blotch and ramularia all have issues in terms of resistance.

Some level of resistance to all the main fungicide types has been found in net blotch, so chemistry and rates must be chosen carefully to control the threat, says Steven.

Traditionally, many growers have looked to prothioconazole as the most effective azole against net blotch, however robust rates are now needed to achieve reasonable efficacy, he says.

Although resistance to strobilurin fungicides caused by the F129L mutation is an issue within the European net blotch population, some products still offer good control, he continues. Pyraclostrobin is the most effective, as it is not affected by the F129L mutation, so will even control resistant strains, he adds.

Priaxor EC (pyraclostrobin + fluxapyroxad) is the main option in Ireland. Using it in a programme with Revystar XE (fluxapyroxad + mefentrifluconazole) allows growers to tackle all the main barley diseases and reduce the reliance on prothioconazole, he notes.

The European withdrawal of chlorothalonil in 2020 was a big blow for ramularia control as the multisite had been the go-to option for many years.

Ramularia management

Ramularia resistance to all three main fungicide groups has been confirmed, limiting their efficacy, but Steven says good control can still be achieved.

EuroBarley trials at four locations in 2021 have shown Revysol (mefentrifluconazole) — as in Revystar XE — to offer the best ramularia control out of all the azoles (see chart).

"Prothioconazole offers moderate control, which can be improved with the addition of folpet, but there's historically been a lot of reliance on prothioconazole in barley, so we should try to take some of the workload off this active."

Given the issues with fungicide resistance in ramularia, he suggests barley growers may have to accept it will become harder to completely eradicate the disease in future. "There's a certain period after flowering where we need to maximise green leaf, but maybe we shouldn't try to keep everything completely green right to the end of the season. It seems we're moving more towards managing ramularia rather than controlling it."

Minimising crop stress can help reduce the risk of ramularia developing, he notes. "Growers can't do a lot about the weather, but we can try to establish crops well in the first place and keep them clean and well-nourished to reduce the risk of stress later in the season."

Prothioconazole has been a key azole for controlling rhynchosporium on many farms, and while it still offers decent control, Steven reiterates the need to reduce reliance on the active to protect future efficacy.

Of the SDHIs, he regards Imtrex (fluxapyroxad) as being the most effective, offering very good protectant and curative activity, while the strobilurin pyraclostrobin is a good protectant against rhynchosporium and offers an alternative mode of action to SDHIs and azoles.

Mildew tends to be a more seasonal and variety-specific issue, with winter barley generally at greater risk than spring-sown crops. Steven says prothioconazole can give useful mildew control, however in higher-pressure situations a specific mildewicide may be required.

"In spring barley, a lot of varieties have really good mildew resistance, which means we can target fungicides to the big diseases and not have to worry so much about mildew." ■

UK and Ireland barley stats ('000 ha)

All barley ('000 ha)	2020	2021	2022
UK	1,388	1,149	1,130
Republic of Ireland	193	184	186
Winter barley			
UK	312	404	420
Republic of Ireland	52	67	67
Spring barley			
UK	1,076	745	710
Republic of Ireland	142	116	119

Source: 2022 figures estimated by Andersons and Teagasc. Historic Data from Defra and Daera.