Forewarned is forearmed

> *"Adopt practices that protect the azole mode of action group."*

Roots
Sugar beet

The season will dictate whether cercospora will be added to the list of woes troubling sugar beet growers. But if it does, what can we learn from Europe where the disease has been prevalent for much longer? *CPM* finds out.

By Rob Jones

Cercospora leaf spot is a formidable foe, according to Andreas Mehl, Bayer senior fellow and global fungicide resistance research and management lead. If his opening comment doesn't provide much in the way of reassurance, his follow up sums up why there is so much discussion surrounding the disease at the moment.

"Unfortunately, there aren't too many examples of how this disease has been successfully controlled on the continent without any fungicide resistance issue, but there is plenty of experience of just how damaging it can be," he adds.

Cercospora, caused by the fungus Cercospora beticola, first came to Andreas' attention roughly 10 years ago when the Austrian sugar beet industry reported that growers were having difficulty controlling the disease. Samples were received for analysis, and it was subsequently confirmed that the isolates had developed resistance to the Quinone outside Inhibitor (QoI) group of fungicides, commonly known as strobilurins.

"QoI resistance affects all fungicides in this group but efforts to communicate this to the growers, and the urgent need to promote anti-resistance tactics that involved mixing strobilurins with products belonging to different mode of action group, required either too much time or were even partly hampered by some repeated advice to continue the use of solo-applied strobilurin fungicides," he says.

Strobilurin resistance

Strobilurins are an important group of fungicides — their broad antifungal spectrum and low phytotoxicity means they can be used in a wide array of crops. In sugar beet, strobilurins and another group of single-site fungicides, triazoles, belonging to the DeMethylation Inhibitors (DMI) group of chemicals, provide the basis for foliar disease control strategies.

"Strobilurin resistance is highly concerning. It's based on a single site §mutation (G143A) which is the same as in *Zymoseptoria tritici* in the UK, as well as other pathogens from elsewhere around the world. Wherever this mutation occurs we see a strong shift in sensitivity to all strobilurin fungicides," explains Andreas.

Following the confirmation of resistant isolates in Austria, disease monitoring was expanded to other countries and within a few years isolates exhibiting 70-80% resistance to the strobilurin group were found in nearly all countries neighbouring Germany and Austria. Resistant isolates have also been confirmed in Chile, Japan and New Zealand.

A consequence of this has been to increase the pressure on triazoles. As yet, there have been no reported cases of triazole resistance from the field as observed with the strobilurins, but laboratory testing has found a wide range in sensitivities between products that suggests growers should take resistance management seriously.

Sensitivity shifts are calculated using the industry standard EC_{50} test. The result is the concentration needed to reduce growth by 50% relative to the untreated control.

"With triazoles we tend to see good to reasonable levels of intrinsic activity, but there is a broad range in the EC_{50} values. That gives reason to be cautious and adopt practices that protect the azole mode of action group," he says.

"Within the triazole group, prothioconazole shows the strongest activity and low susceptibility to sensitivity shifts. This is closely followed by epoxiconazole and ▸

In Europe fungicide resistance has hampered control of cercospora so anti-resistance strategies are crucial, believes Andreas Mehl.

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Focusing on a single pathogen alone may open the door to all the other diseases waiting in the wings, says Richard Robinson.

▸ cyproconazole, which offer slightly less activity but good stability under field conditions," claims Andreas.

"With difenoconazole we see good intrinsic activity but a broad range of EC_{50} values, whereas prothioconazole still shows a narrow EC_{50} range without regional differences. Mefentrifluconazole bears a similar chemical structure to difenoconazole, so we have to promote active resistance management for that product if it's to be protected for the long term," he adds.

The lack of fungicides conferring effective protection against resistant strains has prompted a reversion to a class of products previously considered outdated.

"In Austria and Germany, we've seen applications for the emergency authorisation of copper. Repeat applications of this metal are now the standard means of control. In America, where cercospora poses a similar threat, we see that growers have resorted to spraying tin. The use of both metals as a fungicide poses a long-term risk to the biology of the soil," he comments.

Changes to the climate and a reducing pool of chemistry mean cercospora is becoming a threat in the UK.

In the UK, Bayer has applied for an emergency authorisation for Propulse (fluopyram+ prothioconazole), a fungicide currently only approved in oilseed rape, for use in sugar beet crops this season. ■

A breeder's view

Sugar beet breeder SESVanderHave believes a multi-pronged approach is required to tackle all sugar beet diseases, using chemical, cultural and genetic means of control. Fungal disease infections in sugar beet crops can cause losses of around 20% of yield and compounded with viral infections, such as virus yellows, can be significantly more.

Variety choice is the foundation of any programme and while rust and powdery mildew have been traditionally seen as the main threats to the UK crop and the focus in UK breeding programmes, other diseases, such as aphanomyces, violet root rot, cercospora, stemphylium and downy mildew can also infect crops periodically. Rust has usually been the dominant disease, but in 2020 cercospora infections came on the back of poor establishment, variable weed control, drought and virus yellows in many crops.

As climate change occurs, the challenge is to breed and select for broad resistance across a full spectrum of diseases, says Richard Robinson, who leads the UK research and development programme for SESVanderHave.

"Because threats vary each season, plant breeders have to integrate resilience and durability into varieties. Otherwise, focusing on a single pathogen alone may open the door to all the other diseases waiting in the wings.

"Regardless of delivering genetic disease resistance, it's critical to get the crop established quickly and evenly to exploit its natural 'adult' maturity to resist pests and diseases. Mature plant resistance has been at the forefront of discussions on virus yellows strategy, but the same principles hold true for general crop agronomy and a wider range of diseases. Seed processing and treatment has a vital role in ensuring varieties have the best possible start and even establishment.".

Richard explains the company's worldwide breeding programmes look at genetic resistance, or tolerance, to specific disease challenges in laboratory and glasshouse bioassays. The resulting data must be translated into field performance against a natural cocktail of pathogens.

"Our UK strategy is two-fold. Firstly, to identify lines that are very tolerant to UK strains of specific diseases. Secondly, to integrate these into commercial hybrids and elite germplasm to deliver good combined resistance to all the foliar diseases.

"It takes around 10 years to identify the genes and breed varieties, so it's important the traits are stacked to provide durability. With environmental volatility due to climate change, it's essential not to fixate on a single threat. No two years are the same, so we also need to have a pretty robust, long-term view on our trait targets within our programmes," he says.

Plant breeders have made significant progress in developing relatively high levels of resistance. Historically, these dovetailed with fungicide programmes which were weak or strong on a particular pathogen. With chemicals being increasing limited, plant breeding programmes have been adapting.

"At SESVanderHave, hundreds of thousands of plot trials take place each year to test resistance in plots exposed to natural disease infections and growing conditions, including a range of fungicides and agronomic regimes.

"Despite advances in genetic tolerance, in the short-term growers can't depend on variety performance exclusively to protect against yield loss from the full spectrum of pests and diseases. An integrated approach will remain vital to guard against disease or pest mutations that could undermine the protection offered by variety or chemical treatment alone. Its old fashioned 'good agronomic practice," adds Richard.

Currently fungicides remain important to maximise yield potential and trials continue to demonstrate the benefit of a full disease control programme. While a single treatment applied around the end of July may be adequate for early lifted crops; for later harvesting, a two-application programme is recommended to protect the crop through to November.

BBRO's recommendation is to start fungicide programmes at the first sign of disease symptoms and match fungicide accordingly. It suggests starting with a triazole/strobilurin-based product, such as Escolta (cyproconazole+ trifloxystrobin), Mirador Xtra (azoxystrobin+ cyproconazole) or Priori Gold (azoxystrobin and difenoconazole) as a first spray option.

Depending on the disease pressure, especially where there is a high risk of cercospora, a second spray may be required at 21 days. This may mean that a 3-spray programme is a minimum requirement for later lifted crops. A second spray option may be a straight triazole such as Impact (Flutriafol) or even epoxiconazole (still within the use-up period if product is already on-farm). This would retain the option of a second triazole/strobilurin product as a third spray, according to BBRO's latest advice.