



“The EC₅₀ value only measures a change in fungicide sensitivity, but it’s not a measure of resistance.”

Septoria

‘Soft’ guys prevail

The reporting of fungicide sensitivity data can be alarming, but all may not be as it first seems. *CPM* digs deep into the results of Bayer monitoring data.

By Lucy de la Pasture

Fungicide resistance is never far from the top of the agenda at the technical briefings which characterise late winter. While the sprayer is being fettled in the shed ready for spring, agronomists are making sense of fungicide data and getting a feel for how best to tackle septoria in the field.

A downward shift in the performance of SDHIs and a further decline in the efficacy of prothioconazole (PTZ) against septoria grabbed the headlines when the latest fungicide performance data was presented at AHDB’s Agronomist’s Conference last December.

The work looks at the efficacy of fungicides used as single actives used alone, and since 2001 PTZ (full rate) has been used as the reference the DMIs. Despite year-on-year variation, the gradual efficacy loss is clear — with 2021 registering the poorest control so far, explained ADAS’s Jonathan Blake.

He goes on to explain that, in practice, the situation is complex. “The loss of sensitivity is due to various mutations, with the presence of these highly variable across the UK. There’s also a relatively large variation in performance of active

ingredients in this group.

“The addition of mefentrifluconazole data to the chart in 2021 illustrates this point, with performance recorded at levels not observed with prothioconazole for over a decade (though at levels below PTZ when it was first introduced).”

Sensitivity monitoring

The situation in the SDHI group of chemistry is also showing a loss of sensitivity. Following a period of relative stability (2008–16), monitoring started to detect significant shifts in sensitivity to SDHIs in 2017, using fluxapyroxad as the reference active.

“The recorded full-dose control level in 2021 was around half the level achieved in 2016, offering on average around 30-40% control of septoria, but with a large variation between sites. The SDHIs are less robust and reliable than they used to be,” comments Jonathan.

However, the fungicide performance data is not without its critics who caution that the trials don’t reflect field practice and, consequently, the control achieved using a programmed approach. So sensitivity monitoring — conducted by fungicide manufacturers — adds another useful piece to the puzzle to give a better ‘big picture’ of their likely performance in the field. Bayer’s Andreas Mehl presented the company’s results to the industry in a webinar last month.

As part of ongoing efficacy monitoring, Bayer conducts EC₅₀ analysis on septoria isolates collected throughout Europe, in conjunction with molecular analysis to keep an eye on mutations at the fungicides target sites.

It’s the position of these mutations that

affects how well a fungicide works, and this is reflected in the sensitivity of the septoria population — represented by the EC₅₀ data, he explains.

When it comes to interpreting the data, Andreas believes ‘resistance factor’ is a more helpful way of looking at the evolution of resistance in the septoria population. For that reason, the company has adopted an approach to monitoring which focuses on the single isolate level and genotyping to identify the mutations present.

“It’s not the same as resistance testing results presented by other companies but it provides a better overview of what’s happening in the field. The EC₅₀ value only measures a change in fungicide sensitivity, but it’s not a measure of resistance,” he explains. ▶



Results from UK monitoring in 2021 showed the sensitivity to PTZ was generally unchanged in the septoria population, with a slight trend towards higher sensitivity in the West, says Andreas Mehl.

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► To get an indication of the extent of a 'shift' in sensitivity, it's necessary to establish a baseline. So instead of solely looking at EC₅₀ data, Andreas takes the mean EC₅₀ for a reference range of key isolates each season. That enables him to express the sensitivity of isolates tested as a quotient of this figure. This provides its 'resistance factor', which better highlights where there's a trend in the wrong direction which could indicate resistance.

"It's how far individual isolates have shifted from the baseline population of septoria that

matters and using a resistance factor is a way of indicating this. Using this system, I'd be concerned if the resistance factor reaches 30-40," he says.

The resistance mechanisms employed by the septoria pathogen depends on the mode of action of the fungicide. Azole fungicides act on fungal cells by inhibiting membrane synthesis and they do this by targeting an enzyme *CYP51*, which affects membrane structures.

"Results from UK monitoring in 2021 showed the sensitivity to PTZ was generally unchanged in the septoria population, with

New sulphur-based fungicide launched

Vertipin, a sulphur-based fungicide recently introduced to the UK, boosts and protects new chemistry, increasing yields and giving a significant margin over cost, according to results from the latest ADAS trials. Already used in Europe, Vertipin contains sulphur as the active ingredient and terpenes.

In trials carried out by ADAS at three sites in Wales, Herefordshire and Devon, Vertipin provided protection when used on its own but achieved an extra 30-40% reduction in septoria and an average of 0.34 t/ha increase in yield when used at 3 l/ha with a standard programme that included Revystar XE (mefentrifluconazole+ fluxapyroxad) at T2, says Stewart Woodhead of Sipcam.

"Vertipin added useful septoria control and gave a clear yield response. Farmers might consider simply increasing the rate of a good

single site fungicide, such as Revystar, but the trial data was consistent on all three trial sites and showed a greater benefit in adding Vertipin instead," says ADAS' Jonathan Blake.

"Using Vertipin at 3 l/ha at T1 and T2 added £40/ha to the margin over fungicide cost (based on wheat at £180/t) compared with the best Revystar-only treatment. It also adds resilience to the fungicide programme because products with multisite activity are less likely to suffer reduced efficacy and help to protect the single site fungicides over time."

Stewart adds: "When applied at 2 l/ha, Vertipin is just as effective as other multisite products available in the UK. The dose response continues up to 3 l/ha, so when conditions are very challenging it

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a slight trend towards higher sensitivity in the West, while mean EC₅₀ data was a little higher in the East than in 2020.”

DMIs stable

The monitoring in France and Germany gave a very similar picture to the UK. Andreas highlights that in 230 field trials conducted within Europe, PTZ was giving comparable field efficacy to results in 1998 (when used twice at full rate and evaluated 2-3 weeks after the second application).

“The conclusion of FRAC, where all the fungicide

manufacturers present and discuss resistance testing results to reach a consensus, is that DMI fungicide efficacy was stable in 2021 and comparable with previous years,” he adds.

Andreas stresses that azoles must be protected as the MoA group is very important as part of an anti-resistance strategy, in particular for using in mixture with actives from a different MoA group – as evidenced by PTZ’s inclusion in a number of co-forms from other manufacturers. So how can the industry look after azoles so they’re around for a very long time? ▶



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Independent trials data



Vertipin was applied at T1 and T2 in three treatments – applied alone at different rates; with Ascra XPro (bixafen+ fluopyram+ prothioconazole) at T1 followed by Revystar XE (mefentrifluconazole+ fluxapyroxad) at T2; and lastly, with Aviator XPro (bixafen+ prothioconazole) followed by Librax (fluxapyroxad+ metconazole). n=4 cross site/leaf layers

Source: ADAS/TEAGASC, 2021

may be beneficial to use this rate.

“Vertipin has added advantages provided by its high-quality formulation. The adjuvant effects

provided by the terpenes make it a good partner for other products and spray operators can be confident it will be easy to use.”

Learn more at cropscience.bayer.co.uk/ascra



*Source: 2021 Kynetec – Based on Wheat Panel Data for harvest year 2021 using GBP on-farm value. AscraXpro contains prothioconazole, bixafen and fluopyram. Ascra is a registered Trade Mark of Bayer. Use plant protection products safely. Always read the label and product information before use. Pay attention to the risk indications and follow the safety precautions on the label. For further information, including contact details, visit www.cropscience.bayer.co.uk or call 0800 1969522. © Bayer CropScience Limited 2022

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► "I'm not a fan of ever using straight azoles alone and prefer to see them used in mixtures. The value of alternating them in the program very much depends on the azole. This is because of the incomplete cross-resistance that's been demonstrated," explains Andreas.

"In a research study, epoxiconazole and PTZ were shown to be different to tebuconazole, difenoconazole and mefentrifluconazole in terms of cross-resistance. So it makes sense to mix these with PTZ or to alternate azoles but it's not so useful to use the azoles with higher levels of cross-resistance in the same way."

SDHI mutants

In 2021, Bayer used its pipeline SDHI, isoflucypram, to monitor for changes in sensitivity within the septoria population. In the UK, ten isolates were found to have 'tough' mutations (12% of isolates tested), resulting in a resistance factor of greater than 30 and 54% were found to have 'soft' mutations, with a resistance factor in the range 10-30.

The most commonly detected mutations were the 'soft' mutants, C-T79N and C-N86S. Data from the resistance testing shows that different mutations have a different impact on SDHIs. So why is this?

It's all to do with the position of the mutation on the target site — in the case of the two most frequently detected mutants this is position 79 and 86, says Andreas. SDHIs act on the fungal cells' 'power houses', the mitochondria responsible for the pathogen's energy production. The target enzyme of SDHIs is SDH, (so-called complex II in the mitochondrial respiration chain), which is a functional part of the tricarboxylic cycle and linked to the mitochondrial electron transport chain.

SDH consists of four subunits (A, B, C and D) and the binding site of the SDHIs (the ubiquinone binding site) is formed by the subunits B, C and D where mutations can occur. Target site



The breakdown of genetic resistance in Firefly last season was a sharp reminder of how devastating septoria can be.

mutations conferring reduced sensitivity can develop in all three subunits, which is the reason for the complex nature of resistance patterns to SDHI fungicides compared with the QoIs, explains Andreas.

Bayer has used this to its advantage, putting two SDHIs together in Ascra XPro (bixafen+ fluopyram+ prothioconazole). "Our sensitivity monitoring demonstrates incomplete cross-resistance between bixafen and fluopyram. It's one of the reasons we believe Ascra is still performing well in the field, even with the shifts in septoria sensitivity. But it's also a well-balanced formulation with PTZ," he says.

Andreas is less convinced of the value of adding the multi-site folpet to Ascra. "It may help in resistance management but it's not as effective as chlorothalonil was, so it's only beneficial in septoria programmes if the rate of DMI is kept as high as possible. The danger is that the rate will be cut to 'make room' for the folpet, but it's actually better to use a higher rate of DMI in the mix than to reduce and include folpet."

The good news is that the real 'tough guys' — and C-H152R in particular — remains at low frequencies in the UK, indicating a fitness penalty has kept them in check in the six years since they were first reported. ■

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