Experts disagree on azole use

Technical Disease control

There's a debate between academics raging over the Irish Sea and best use of azole chemistry is the focus. *CPM* looks at both sides of the argument.

By Lucy de la Pasture

Ever since news broke last November of septoria with reduced sensitivity to SDHIs, there's been much discussion in the research community over how best to preserve the chemistry.

But agronomy practices are arguably all based on the interpretation of data which has been generated in support of a hypothesis. When enough supporting data is available then the hypothesis becomes accepted, but nothing is ever proven beyond doubt. So where does that leave best practice for fungicide use this spring?

On one side of the Irish Sea is Teagasc, the country's advisory service that has been monitoring septoria for insensitivity to fungicides, both in trials and in the field. Teasasc plant pathologist, Dr Steven Kildea, explains that in 2015, septoria isolates were found in trials at Oak Park that had the same mutation that had previously only been created in the laboratory.

Reduced sensitivity

"It's a concern because it means there's a mutation present within the septoria population that has a reduced sensitivity to SDHI chemistry. It's currently only present at very low levels, but highlights the emergence of a resistant strain that has cross-resistance to all the SDHIs, though it may still die out by random processes," he explains.

The aim must now be to guard the activity of SDHIs by making sure these resistant strains remain at low levels within the overall septoria population or if they do increase, to at least make sure that they increase slowly, believes Steven Kildea. This is something that the whole agricultural community is in agreement over.

According to Teagasc's head of crop science department, John Spink, the attitude to fungicide resistance in Ireland has changed in recent years. "People didn't take fungicide resistance as seriously as herbicide resistance because there appeared to be a less direct link to their farm practices and the development of resistance. There was a 'make hay while the sun shines' mind set, mostly because of a belief that even if they did everything by the book on their farm, they would still be affected by whatever their neighbour was doing," he says.

"That's changed now because we understand that fungicide resistance operates on a much smaller scale than this. Each fungicide application on farm will have an effect on the next fungicide spray because you're selecting from a diverse population of septoria right from the start of the season, taking out the more sensitive strains to be left with the ones that are more difficult to control at the most important T2 timing."

It's impossible to consider SDHI chemistry without considering the fungicide resistance status of its main partners from the azole group of chemistry, believes Steven Kildea. "The azoles are currently progressing through the selection phase, where resistant isolates increase as a proportion of the whole septoria population due to the application of a fungicide. This means that how we use the azoles in the field will still have an effect on their efficacy," explains Steven Kildea.

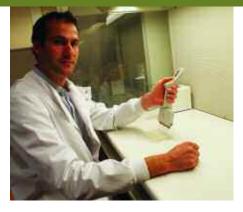
Foremost in the advice coming from

yield and the choice of fungicide at this early timing must take this into account. The upper canopy contributes the most to yield, so the T1 and T2 timings are most important," says Steven Kildea.

In the view of Teagasc, applying an azole at T0 is likely to compromise the effectiveness of the azole at the more important T1 timing.

"The septoria population contains strains that are able to overcome the azole, so by applying an azole at T0, you're selecting for strains which aren't as easy to control at the next spray timing," explains Steven Kildea.

"It's important to understand that as well as putting the azole under more pressure at T1, you could also be compromising the SDHI. You need the azole to be doing something in the mix to protect the SDHI."



Steven Kildea warns that putting the azole under more pressure at T1 could also be compromising the SDHI.

John Spink comments that at Teagasc, trials showed more disease by the T2 timing in plots that had been treated with an azole at T0 than where nothing had ►



66 You need the azole to be doing something in the mix to protect the SDHI. **99**



Septoria isolates were found in trials at Oak Park that had the same mutation that had previously only been created in the laboratory.

Teagasc is that they're strongly against the use of azole fungicides at the T0 timing for septoria control. That goes against the trend in the UK, where T0s are widely applied to keep disease at a low level in the base of crops and this is where opinions begin to diverge.

"We've found no benefit in applying T0 fungicide applications in our trials. An early spray will give you more flexibility on the T1 timing but the lower canopy doesn't create

- crop production magazine march 2016 (9)



In the view of Teagasc, applying an azole at T0 is likely to compromise the effectiveness of the azole at the more important T1 timing.

been applied at the early timing. "There's always enough septoria inoculum around to cause an epidemic under the right conditions and you can't 'damp it down' by keeping leaf four clean," he says.

Some experts in the UK, however, take a different view. NIAB's technical director, Bill Clark, doesn't dispute that there isn't likely to be a clear yield benefit from applying a T0 spray for septoria control but believes that a T0 can provide a crucial degree of flexibility to growers when it comes to applying a T1 spray.

"The reality is, in a practical situation, that the majority of T1 sprays are badly timed even though it's absolutely critical to get this application on the correct leaf," he says. "I've been conducting training courses over the winter and have been staggered how few people can correctly ►

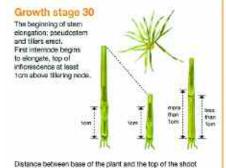
Wheat growth stage ID tricky but vital

Ireland has had similarly warm and wet conditions over the winter and crops are looking forward coming into the spring, says John Spink. "Crops are forward in growth though not in development, although T1 may be fractionally earlier this year. The switch into stem extension requires vernalisation, which happens at temperatures between 2-12°C, and increasing day length so the winter period won't have a large effect," he says.

"Plants will often produce an extra leaf in seasons like this which makes it extremely important to dissect plants to determine their development. It may be that crops have leaf three emerging at GS33 rather than GS32 so you risk applying your T1 to leaf four, leaving leaf three without protection. This is what we think happened in 2012, which was also a mild and wet winter, and septoria control was poor."

Accurately identifying wheat growth stages can be tricky to get right, but crucial for ensuring successful disease protection, agrees BASF's Ben Freer.

"Getting the early spray timings spot on will set you up well for the rest of the season. If you see septoria infection on the tip of leaf three at GS39, then you didn't get the spray timings quite right. Either you've gone too early with your T0 spray or too late with your T1, leaving too long a gap between the applications. If your leaf three is clean, you have your timings bang on."



apex on the main stem is form or more, but the length of the fat internode is less than form. His 'how to' advice for accurate growth-stage identification is to select the main tiller, slice through the stem to see where the nodes are and what stage each leaf emergence has reached. His practical rules of thumb are as follows:

• Less than 1cm from base node to first node = GS30, the leaf emerging is leaf four and rolled in the leaf sheath; this is too early for T0 sprays.

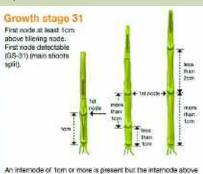
• More than 1cm from base node to first node, the gap from first node to second node is less than 2cm, and leaf four is well or fully emerged = GS 31, the time to apply TO spray.

• The gap from first to second node is now 2cm or more, leaf three fully emerged = GS32, the time to apply a T1 spray. Treat any crops that haven't had a T0.

• Flag leaf (leaf one) fully emerged = GS39, time to apply the T2 spray.

"It's easier to slice the stem with a knife and measure the distance than try to unpick the leaves as you can inadvertently miss the tiny flag leaf at GS 31-32. This can make you think leaf three is emerging when actually it's leaf four. This season, plants may produce an extra leaf so it'll be doubly important to be absolutely sure which leaf is emerging to get spray timings spot on," he explains.

"Tracker (boscalid+ epoxiconazole) is a good, cost-effective all-rounder at T1 giving you good septoria control. What's more the boscalid will



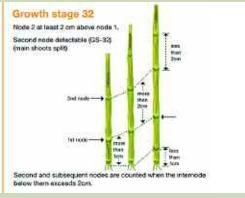
is less than 2cm.

This season, it'll be doubly important to be absolutely sure which leaf is emerging to get spray timings spot on, explains Ben Freer.

give you good protection against eyespot and epoxiconazole will deliver yellow rust control," he says.

DuPont's Mike Ashworth says that their SDHI, Vertisan (penthiopyrad), in mixture with an azole offers eyespot control equal to that of Tracker which makes it an ideal choice for the T1 timing.

"Studies at the University of Nottingham have also shown that there's an increase in rooting of up to 30% where penthiopyrad is used on crops. This can be of benefit later in the season when it can help buffer the effects of a dry spell," he adds.



Source: BASF

Chemistry



ATLANTIS WG

"For the most effective black-grass control, choose your moment."

If you want to maximise black-grass control, you've got to get the timing right. Be prepared to take advantage of any window of opportunity to spray. Atlantis WG provides the best control when applied at the 1-3 leaf stage. So keep monitoring black-grass emergence and be ready to swing into action.

For optimum control, start planning with the Black-Grass Task Manager at www.bayercropsicience.co.uk/bgtm



www.bayercropscience.co.uk/bgtf

Atlantis is a registered trademark of Bayer. Atlantis WG contains mesosulfuron and iodosulfuron. 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, please visit www.bayercropscience.co.uk or call Bayer Assist on 0845 6092266 (calls cost 5p per minute plus your telephone company's network access charge) or 01223 226644. © Bayer CropScience Limited 2016.



It's more important that growers adopt three-way mixes than try to alternate azoles, says Bill Clark.

define the T1 timing when asked, so there may be a general gap in knowledge when it comes to actual timing, even though we talk about T1 all the time."

That's a view echoed by the researchers at Teagasc. "Agronomists should be dissecting plants to work out which leaf is emerging and not just using nodal development or even worse, dates," explains John Spink.

"There's a lot of talk about the three-week window of protection and sometimes advice to top up at GS37, in between T1 and T2, if the flag leaf hasn't emerged in the three-week timeframe.

"But if the T1 was applied at the correct timing, leaf three fully emerged on the main stem, and it takes 28 days for the flag leaf to emerge because there have been cooler conditions, then both disease development





Alternating azoles is only an effective strategy if using azoles from a different cross-resistance group, adds John Spink.

and fungicide degradation will have also slowed down," he explains.

"It's better to adapt your T2 treatment than to add in an extra spray. Where there's talk of applying a T1.5, this is the slippery road to ruin. All you're doing is selecting for the septoria isolates that you can do nothing about. Using enough fungicide as necessary and as infrequently as possible is a better strategy for both disease control and resistance management."

Bill Clark's view is that in a practical situation under high septoria pressure, it's better to have a T0 spray applied in case the T1 timing is off. This spray doesn't always have to include a triazole and straight chlorothalonil is often used. Even if the growth stage of the crop can be correctly identified, the weather can cause the T1 spray to be poorly timed, especially when there's a large crop area to cover and rain or wind stops play.

Agrii agronomist and technical adviser, Will Foss, does subscribe to the theory of using a triazole at T0. "We're using a mixture of chemistry where a T0 is applied, which our trials show not only gives the best disease control and yield response, but also the biggest return on investment. We do what we can about managing resistance but we also have to consider what's best for the crop given the disease pressure it's under in any one season," he says.

The Irish advisers acknowledge that a T0 may be warranted for yellow rust control, although in Ireland this isn't as much of a problem as in some regions of the UK. "Where yellow rust is targeted at T0 it's possible to treat without using an azole by opting for a strobilurin or, if eradicant activity is required, add a morpholine to the tank as well," advises Steven Kildea.

Bill Clark believes that yellow rust >

With or without disease AMISTAR[®] PAYS

it's a no-brainer!

The renowned greening effect of proven AMISTAR® Technology ensures a positive return on your investment in OSR.



For tips on growing OSR follow #iOSR



Stay in Control. **Choose Proven** AMISTAR Technology.



syngenta.

Syngenta UK Ltd CPC4, Capital Park, Futbourn, Candodge CB21 5XE Tel: 01223 983400 Fax: 01223 982415 Technical Enquiries Tel: 0800 169 6058 E-mail: customer.services@syngenta.com Website: www.syngenta.co.uk

AMISTARIE is a Registered Trademark of a Syngenta Group Company. AMISTAR (MARPH0444) contains acoxystrobil. Crop safety and product efficacy in instature have not been tested and remain all file user's own tisk. Use plant protection products safety. Always read the label and product information before use. For further product information including warning phrases and symbols refer to www.syngenta.co.uk @Syngenta.AG.January 2016. Guaranteed increases in yield and oil content are when compared to an untreated crop. GD 06355.



Yellow rust has been active in some susceptible varieties, especially Gallant and Reflection, since Nov.

pressure in the UK does warrant the use of an azole in many cases and 2016 is already shaping up to be a high pressure season.

"Chlorothalonil (CTL) will form the base of most T0 sprays, but crops with active yellow rust will need an azole. We need the persistence because yellow rust can remain active throughout this period if conditions are mild," he says.

"It's possible to use a morpholine for quick knock-down but the effect is only very short lived and in a season like this, where yellow rust is very active, an azole is a better option." Yellow rust has been active in some susceptible varieties, especially Gallant and Reflection, since Nov and some growers applied a first fungicide pre-Christmas. "Those that didn't get on at the end of the year, and had active yellow rust, now have a huge amount of disease in their crops and were unable to travel at the beginning of 2016," says Bill Clark.

"Where crops are a bit thin, or waterlogged and struggling, yellow rust is a pressing problem because it causes leaf loss and makes plants more susceptible to frost. These crops need fungicide ►

The difference a day makes

The contribution to yield from the flag leaf and the two leaves below it has been proven in countless experiments over decades. What's interesting about the time-lapse photography work on Bayer sites at Callow, Herefordshire and Chishill, Cambs is that they give a slightly different perspective to the effects of the season on yield potential and the contribution of the flag leaf.

Installed in both treated and untreated plots from March through to Aug, the cameras take photos every 20 minutes during daylight hours. The clever bit is the analysis, conducted by ADAS plant pathologist, Catriona Walker.

"We quantify and track remaining green leaf area (GLA) through the season from the whole image, representing all of the upper canopy, and the flag leaves only," she explains. "We can compare this analysis of GLA to differences in yield and, with the benefit of local meteorological data, look at the timing of disease pressure for that season."

The experiment has run over two seasons in the West and although it's too early to draw firm conclusions, warns Catriona Walker, in both seasons the contribution from the upper canopy to yield in the fungicide-treated plots was 0.5t/day for every day GLA was extended, or 0.2t/day from the flag leaf.

"To put this into context, 2014 was a season with high septoria pressure and there was a difference in decline in GLA of 15 days between the treated and untreated plots. This equated to a yield response of 7.23t/ha," she explains. "In 2015, the disease pressure came in much later and wasn't as severe. The difference in decline in GLA was just eight days and the fungicide gave a yield response of 3.4t/ha.

"We'll need another year of results to confirm that the yield contribution from the canopy appears to be constant, regardless of the season. What is clear to see is the importance of maintaining GLA at the critical grain fill stage by using fungicides and that by using Aviator (bixafen+ prothioconazole) at T2, the flag leaf retained the maximum GLA for as long as possible until natural senescence — contributing to approximately 0.2t/ha per day at grain fill."

The rate of decline in GLA in both seasons was more rapid once it commenced in the fungicide-treated plots than in the untreated. Explaining her thoughts on the reason for this, Catriona Walker says, "We think the decline in the fungicide-treated plots was steeper because the plants were pushed as close to their potential as they could go."

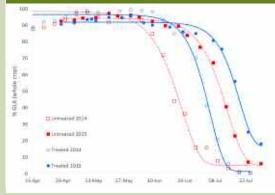
Bayer's Gareth Bubb reckons the time-lapse work really shows the importance of keeping as much GLA as possible in the period leading up to grain fill, with actual weather at grain fill being a key determining factor. "In 2015, a relatively cool grain-fill period contributed towards retention of GLA and therefore bigger yields. Fungicides maximised this opportunity by limiting loss of GLA due to disease in the extended grain fill period.

"In these past two very different seasons, retention of GLA for just an extra four days is all that's needed to pay for the entire fungicide programme," he concludes.

Standard fungicide programme

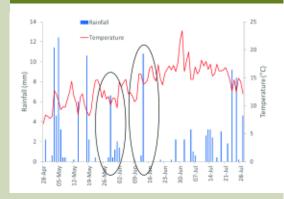
 $\begin{array}{l} \text{T0}=0.4 \ \text{I/ha} \ \text{Folicur} \ (\text{tebuconazole}) \ \text{plus} \\ \text{1.0 \ I/ha} \ \text{Bravo} \ (\text{chlorothalonil}) \\ \text{T1}=0.55 \ \text{I/ha} \ \text{Proline} \ (\text{prothioconazole}) \\ \text{plus} \ \text{1.0 \ I/ha} \ \text{Bravo} \\ \text{T2}=1.0 \ \text{I/ha} \ \text{Aviator} \\ \text{T3}=0.55 \ \text{I/ha} \ \text{Proline} \end{array}$

Effect of season on treated and untreated crops



In 2014, fungicides prolonged the GLA of the crop more than in 2015, when there was less disease pressure. The rate of decline in GLA in both seasons was more rapid once it commenced in the fungicide-treated plots than in the untreated. Source: Bayer

Weather data, 2015



Septoria came into crops late last season. The circled weather data shows when this happened at the Callow site.

DRAXIM



A new active ingredient for potatoes
Broad spectrum weed control
Safe to all varieties of potatoes
Safe to use on all soil types
Application up to cracking of the ridges
A wide range of following crop options

weed control in potatoes

High Voltage



USE PLANT PROTECTION PRODUCTS SAFELY ALWAYS READ THE LABEL AND PRODUCT INFORMATION BEFORE USE For further information on product hezard warnings, risk and safety phrases consult it, wiresite www.belchim.co.uk Bekchim Grop Protection Ltd. 1b Fenice Court, Phoenix Park, Eston Scioon, 81. Neds, County, PE19 8EW, Tel: 01480 403333, Fax: 01480 403444, Web, www.belchim.co.uk Praxim contains metobromuron and is a registered trademark of Belchim Crop Protection NV/SA.



The most important thing with rusts is to use a high enough rate of azole – anything less than half rate isn't enough, says Will Foss.

application as a priority."

Agrovista's technical manager, Mark Hemmant, agrees that the trouble with yellow rust is that it's a season-long problem, which means the strobilurinsare best saved for the later sprays at T1 and T2, when green leaf retention is most important.

"That leaves morpholines and azoles for early season yellow rust control and we're being forced down the route of using our best septoria azoles in this spot because there's has been a label change to tebuconazole. Straight cyproconazole is no longer available as a straight so unless already in stock in the spray shed, that leaves epoxiconazole as the only practical early rust control option," says Mark Hemmant.

The new Folicur (tebuconazole) label states that it can't be applied before GS30 and most now available in the market is new stock. According to Bayer's Gareth Bubb, there may still be some generic tebuconazole products available which are yet to go through the re-registration process.

Best septoria cards

Asked whether he really wants to play one of his best septoria cards early in the season, Mark Hemmant says the answer is a firm no. "The trouble is, in practice, there aren't any options, a morpholine will give knockdown but no persistence and you don't want to be spraying yellow rust every week," he adds.

When crops reach T0, another possibility is to opt for one of the pre-formulated mixtures, advises Agrii's Will Foss. "Where you want activity on a broad spectrum of disease, Vareon (prochloraz + proquinazid + tebuconazole) with the addition of a multi-site has activity on stem-based diseases, mildew, rusts and septoria. The most important thing with rusts is to use a high enough rate of azole — anything less than half rate isn't enough."

To further complicate matters, 2016 is also looking like being a brown rust season. "Brown rust has come into crops very early this season and it's not just susceptible varieties like Crusoe that are showing symptoms," he says.

"Brown rust is actually more difficult to control than yellow rust. I would definitely reserve strobilurin applications until T1 and T2 because brown rust is exacerbated by warm weather. For yellow rust, I would consider using a strobilurin at T0 as yellow rust is far more likely to dry up later in the season."

The rate of decline in sensitivity of the different azoles has produced a number of different strategies for azole use in the programme. So what is best practice? The choice seems to be to mix azoles, alternate different azoles or simply pick one of the two that appear to still have superior levels of control — epoxiconazole

and prothioconazole.

A paper by Dooley et al, published in Plant Pathology (2015) may provide some answers to these important questions. "What we found was that mixtures of azoles gave the best levels of control but were also the most effective way of driving resistance so we wouldn't advise using a mixture of azoles unless you're not using an SDHI at T1," explains Teagasc's Steven Kildea.

"The research showed that alternating the azole was the best overall strategy and provided a delay to resistance build-up without a negative impact on disease control."

But alternating azoles is only an effective strategy if using azoles from a different cross-resistance group, adds John Spink. "There's no point in using epoxiconazole at T1 and following with prothioconazole at T2. There'll be no benefit because both actives have the same cross resistance.

"A better strategy is to aim epoxiconazole or prothioconazole as the partner to your SDHI plus multi-site at T1 and then follow with metconazole as your azole partner in the mix at T2. This is because metconazole has a different cross-resistance sensitivity than the other two actives."

But that's another area where there's a difference of opinion within the scientific community. Bill Clark believes that there's no real evidence to support moving away from using the two most effective azoles, epoxiconazole and prothioconazole, at T1 and T2.

"The data from Ireland on metconazole isn't, in my view, directly transferable to the situation in the UK. Metconazole isn't as effective against septoria as epoxiconazole or prothioconazole, so as tank-mix options I'd always plan to use the most effective products at T1 and T2. Having said that, the pre-formulated combination of metconazole and fluxapyroxad (in Librax)

AZAKA & RUBRIC RUBRIC The building blocks for cost-effective disease control when formulation matters

Prover reliability and performance • Tank mix compatibility www.headland-ag.co.uk



Please read the product labels fully, Use Pesticides Safely.

Azaka^{III} contains 250 g/l azoxystrobin. Rubric^e contains 125 g/l epoxiconazole.

is a very effective product.

"The Irish data is based on using the azoles on their own. In practice this doesn't happen, they'll always be used alongside CTL and an SDHI at T1 and T2. It's more important that growers adopt these three-way mixes than try and alternate azoles in order to reduce selection pressure on the septoria population," he adds.

The addition of CTL or folpet at key timings to create a three-way mix is something everyone is agreed on as being the best way forward to slow selection for resistance in both azole and SDHI groups of chemistry.

Value of the azole

"I'm often being asked what the value of the azole is when you're using an SDHI," comments Steven Kildea. "We're still getting a benefit in terms of disease control from the inclusion of the azole. If we're selecting for SDHI resistance, we'll still be getting activity from the azole and by using a multisite as well, there won't be a risk of total failure in disease control, even if the level of control is reduced."

DuPont's Mike Ashworth acknowledges that it's a challenge to suggest spending more money on fungicides when grain prices are low, and production needs to be economic. "The question is how do you make sure the books balance — by cutting inputs or creating greater output?"

According to a model developed by Bill Clark, the wheat price has relatively little impact on optimum fungicide level. "Wheat price has to fall a long way before you make radical changes to your programme. Even at £100/t, the optimum fungicide input only changes slightly," he says.

"Many farmers think they can spend less money, but that's a risk because nobody can predict what the future disease risk is going to be. Margin loss from spending too little in a high disease year is, on average, three times the margin loss from spending too much in a low disease year," he adds.



The best septoria azoles may have to be used for early yellow rust control because there's been a label change to tebuconazole.

Mike Ashworth would be very cautious about leaving out a T0 spray or 'cutting back' when it comes to T1. "We've no idea what the future may hold in terms of disease pressure when making fungicide recommendations, so early season timing of fungicides is crucial. If programmes are light at this early timing, then growers may find themselves in the same situation as 2012 and 'revenge spraying' at the tail end of the season."

While some scientists and agronomists may continue to bang heads about the best use of azoles within the programme, DuPont's Mike Ashworth says it's a challenging area for advisers to know they're actually doing the right thing.

"We're reliant on the academic institutions to give good informed opinions but these aren't necessarily aligned, which can be confusing," he says. "We have to hope



Mike Ashworth would be very cautious about leaving out a T0 spray or 'cutting back' when it comes to T1.

there's enough diversity in fungicide usage to cover all the bases in terms of both efficacy and resistance management."



Total Crop Nutrition

- Solution fertilisers
- Suspension fertilisers
- Foliar fertilisers

Accurate liquid application is efficient and effective and reduces handling and storage costs. Speak to our specialists today.



Call 01526 396000

O @OMEXCompanies O/OMEXCompanies