

Appropriate dosing essential to safeguard SDHIs

Technical Disease control

The breaking news in December was the discovery of new strains of septoria with reduced sensitivity to the SDHI group of fungicides. What exactly does that mean for growers? *CPM* canvasses some expert opinions.

By Lucy de la Pasture

Although we're getting used to living with resistance issues, there's no room for complacency when it comes to fungicide resistance. This is especially important as there's absolutely no new chemistry in the pipeline to provide a lifeline if the worst were to happen and SDHI chemistry breaks down, warns Bayer technical manager, Gareth Bubb.

"The SDHI and azole groups of chemistry are the only fungicides we have available with any eradicant activity

against septoria (*Zymoseptoria tritici*). Losing the effectiveness of our newest fungicides is something we need to avoid by carefully managing the situation before it's too late."

Septoria pathogen

So what exactly does 'managing the situation' entail? He believes that in order to get the best out of fungicides and protect them for the future, it's important to understand the septoria pathogen itself and how the fungicide is working, so we can use their strengths and protect their weaknesses.

Septoria overwinters on current crops and on crop debris and all crops are likely to be infected already by airborne spores, which are the result of sexual reproduction. "As soon as you introduce sex into the equation, things become complicated," says Fungicide Resistance Action Group (FRAG-UK) chair and SRUC plant pathologist, Professor Fiona Burnett.

"Sexual reproduction results in a recombination of genes which can give rise to new strains of the pathogen. Strains which can reproduce sexually can change at a faster rate and are more adaptable.

Septoria will reproduce both sexually and asexually in the course of a season, which makes it rapidly able both to adapt and spread," she explains.

"It will reproduce clonally via conidia which will splash upwards in the crop and via ascospores (from sex) which can spread further afield. It's this ability to change that results in a shift in the genetic population of the septoria pathogen and is what happens when we apply selection pressure by relying on fungicides to control the disease."

In Nov, Rothamsted Research reported low frequencies of SDHI insensitive strains in UK field populations. The significance of the announcement by Teagasc, a month later, is that a new isolate had been found in the field that behaves differently than the others, notes Jonathan Blake of ADAS.

"These have a mutation (C-H152R) in the SDHI target site, a particular concern because it's a step change in sensitivity compared to any of the isolates we've seen so far. How large that step is, we just don't know yet, but laboratory studies indicate that this strain will likely show cross-resistance to other SDHI fungicides." ►

“The more we use them, the faster we'll lose the SDHIs.”



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Losing the effectiveness of our newest fungicides is something we need to avoid, urges Gareth Bubb.

► This new Irish isolate is approximately 100 times less sensitive in laboratory tests than a broad range of field isolates collected previously, which shows how potentially serious this could be, he adds. Currently the only detection of this more insensitive strain is in Ireland, where Teagasc are also investigating a further, as yet unidentified, strain which is exhibiting SDHI insensitivity but has a lower resistance factor.

"As yet, we don't know if these strains

have a fitness penalty over the winter. If they do, then they may stabilise at low levels, or if we remove the selection pressure, they may disappear altogether," says Jonathan Blake.

The alternative is that this could mean the beginning of a decline in efficacy for the SDHI fungicides. The message from across the industry is that stewardship measures are absolutely vital to slow down any decline. When it comes to fungicide programmes, that means using azoles and multi-sites to protect SDHI chemistry, says Bayer's Gareth Bubb.

"A robust rate of azole should be included to protect the SDHI chemistry, otherwise you're leaving it to do the majority of the work and increasing the resistance selection pressure. The selection pressure for azole resistance is greater the more times you apply an azole, irrespective of the dose, but with SHDIs, the situation is different," he explains.

"Selection for resistance is dependent on dose and on frequency of use. Using a robust rate of azole 'spreads the load' and helps both groups of chemistry protect one another."

The decline in activity of the azoles has been much reported over the past

few years, with prothioconazole and epoxiconazole just about keeping their head above water. Jonathan Blake believes care is needed over exactly how growers interpret the data from fungicide response curves when it comes to azole activity.

Efficacy decline

"Over the past nine years, there's been a decline in efficacy of the azoles. In a septoria-eradicator situation, the fungicide response curves are indicating both epoxiconazole and prothioconazole are now giving around 35-40% control (on average over the past three seasons)," he explains.

There are a number of reasons why performance may be better than this in a field situation. "The response work looks at multiple applications of a single active ingredient, which puts the fungicide under enormous pressure and is not how you'd apply it on farm," he comments.

"Generally fungicides are applied just after a leaf has emerged, in the case of leaf one and leaf three, or 10-12 days after a leaf has emerged in the case of leaf two. The aim is to apply fungicides early in the latent period of the disease

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(when infection has occurred but symptoms aren't visible). The activity we're getting early in the latent period is greater than at the mid-point, as represented by the dose response trials. So the curative activity that we're getting in practice may exceed the 40% or so shown in these trials and provide useful control that'll help protect the SDHIs."

On top of the curative activity they have, the azoles still have good efficacy in a protectant situation, even though this now sits at around 60% control. It's even more important to get timings right, stresses Gareth Bubb. "Growers should aim to



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avoid using fungicides in a curative situation because this increases selection pressure. Identifying the leaf layers is really important to identify timings because if there's a delay in application, there's a higher probability curative activity will be needed.

"As a rule of thumb, work backwards from the T2 timing, when the flag leaf is emerging. This is governed by day length so occurs predictably each season, generally May 16-20. Leaf three usually emerges about a month before but it can be earlier in a warm spring, in which case you need to watch the interval so that leaf two isn't left completely unprotected as the T1 spray runs out of steam," he says. "T0 timing is 3-4 weeks before the third leaf comes out, so generally mid-late March."

Because the number of times a fungicide is used in a season affects selection for resistance, using an SDHI just once in the programme will help alleviate the pressure, adds Gareth Bubb. AICC agronomist, Luke Cotton, is aiming to try to avoid using an SDHI at T1, unless he absolutely has to.

"In situations where crops were drilled early with septoria-susceptible varieties then I'll have to use an SDHI plus azole plus chlorothalonil (CTL) at T1. Where I've



The isolate found in a field by Teagasc represents a step change in sensitivity, notes Jonathan Blake.

late-drilled Crusoe (rated 6 for septoria) then I won't be rushing to put an SDHI on," he says.

"It'll be a case of taking a view on the weather and disease situation at the time but where I do go in with an SDHI, it'll be partnered with a robust rate of epoxiconazole or prothioconazole.

"The triazoles, although they're not great in an eradicant situation, are still effective. We all need to be responsible with how we use fungicides. If we make a mistake with ▶

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Use a dose large enough to control the disease but no larger than is actually needed, says Fiona Burnett.

► herbicides then we've a weed problem on the farm. With diseases, any mistakes quickly become everyone's problem because spores are airborne so spread far and wide."

There may be some interesting debates in the coming season, he reckons. "The pressure on prices means pressure not to spend unless we have to, which is what we try to achieve as agronomists anyway. The trouble is, how do you cut the fat out of an already lean program?"

"There'll be an inclination not to apply fungicide at T0 and T3 but we can't allow disease to develop and then use an SDHI at T1 because this'll put more pressure on resistance. It's important to make use of the multi-sites, CTL and folpet, as much as we can to help keep inoculum down and reduce selection pressure."

The use of the multi-sites and azoles alongside SDHI chemistry whenever possible is something Jonathan Blake advocates. "Strobilurins which still have some activity on septoria may also have a possible role in slowing selection for SDHI resistance. The important thing to remember is that the more we use them, the faster we'll lose the SDHIs."



Identifying the leaf layers is really important to identify timings.

What growers should not be tempted to do, is to cut out the azole from the programme because they think it's not working well anymore and it's just another cost in the mix, says Clare Tucker of BASF. "The azole still has a valuable role to play because it gets into the leaf and works by preventing the mycelium from developing inside the plant. CTL stays on the surface of the leaf and stops spores from germinating so is acting in a very different way. Some of the septoria fungus will escape the CTL barrier and enter the plant where CTL can do nothing about it," she explains.

Dip in activity

According to Gareth Bubb, prothioconazole and epoxiconazole showed a dip in activity 2010-2012 but have been relatively stable since, in spite of high septoria pressure in 2014, so they're still having a useful effect. The view from BASF is broadly similar, according to Clare Tucker.

"There's been a gradual shift in septoria sensitivity to the top triazoles; epoxiconazole, prothioconazole and metconazole, but they're still playing an active part in control and yield contribution," she says.

"There's no getting away from the fact that the effectiveness of the SDHIs is driving yield at the moment, but the azoles have an important supporting role to play. Also don't forget about other diseases such as yellow rust where the triazole is the mainstay for control and SDHIs are relatively weak.

"Although it does mean spending a little



The performance of azoles may be better in a field situation than the fungicide response curves are indicating.

more, septoria affects everyone so to keep the efficacy of SDHI chemistry we all need to work together. If your neighbour cuts corners, then it's going to affect you."

When it comes to fungicide dose, appropriate and balanced rates of partner products should be used, according to Fiona Burnett.

"Fungicide resistance is Darwinian, so the more fungicide used then the stronger the selection pressure. Using lower doses means exerting a lower selection pressure but the dose needs to be appropriate. That means a dose large enough to control the disease but no larger than is actually needed," she explains.

New FRAG guidelines issued

FRAG-UK recommends the following measures to reduce the risk of fungicide resistance development and extend product life. These guidelines apply to both spring and winter cereals where SDHI foliar applications are made:

1. Follow the statutory requirement to limit the number of applications to two SDHI fungicide-containing sprays.
2. Always use SDHI fungicides in mixture with at least one fungicide from an alternative mode of action group which has comparable efficacy against the target pathogen(s).
3. Tank mixing two SDHI fungicides is not an anti-resistance strategy. In any tank mix the SDHI should be applied in a balanced mixture with at least one fungicide with comparable efficacy against the target pathogens from an alternative mode of action group.



Always use SDHI fungicides in mixture with at least one fungicide from an alternative mode of action group.

"Adding multi-sites into programmes reduces the selection pressure on the higher risk partners azoles and SDHIs and because multi-sites carry a low risk of resistance, they represent a good way of protecting other groups."

In practice a crystal ball would be useful to get this right every time, but Fiona Burnett says the important thing to remember for stewardship is balance. "Dose rates are a personal decision and depend on your actual situation — the farm history, the season, the variety, timeliness of application and risk of disease."

"You want the SDHI to be strongly supported by the azole. So if you make the judgement that disease risk is high and SDHI rates need to be high, then it's important to also use an increased rate of the partnering azole to fully support it. If you judge disease pressure is low, make sure you're using proportionally lower rates of the SDHI."

All manufacturers of co-formulated SDHI products are confident that they have the right balance, so it'll be up to individual agronomists to decide which SDHI product is appropriate in any given situation because they do vary in the amount of azole they deliver.

Bayer's Aviator 235 Xpro (contains bixafen) at 1 l/ha delivers 80% of the full dose of prothioconazole. BASF's Adexar (contains fluxapyroxad) used at 1.5 l/ha delivers 75% of the full dose of epoxiconazole, while Librax (contains fluxapyroxad) used at 1.5 l/ha delivers 75% if the full dose of metconazole. Syngenta's Keystone (contains isopyrazam) used at 1 l/ha delivers 80% of the full dose of epoxiconazole.

The biggest area of concern is perhaps where SDHIs are available as straights, such as Imtrex (fluxapyroxad) and Vertisan (penthiopyrad). Any misuse of the straight products could have potentially serious consequences, although manufacturers point out they offer the flexibility to match azole rate to specific situation.

"The important thing is that in a high septoria situation, if you don't use enough azole then the SDHI is being relied on to do most of the work which will increase the resistance pressure on it," adds Gareth Bubb.

Although disease control from the SDHIs is still expected to be good in 2016, there's a responsibility on the industry to move towards varieties that have a better resistance to septoria, believes Luke Cotton. "We need to send a message to breeders

that we don't want septoria-susceptible varieties which are costly to grow. In the future we'll have to rely massively on varietal characteristics to help with disease control."

Currently there are only two varieties of the RL with a rating of more than 6 for Septoria tritici, both newcomers for 2016-17 which is encouraging, he adds. Septoria has always been a tricky disease to control and according to the Defra commercial crop winter wheat disease survey, 61% of crops were infected with septoria in June last season. And that's in a year of lower than average disease pressure and SDHI chemistry functioning at its glorious best. The concern in the industry is that septoria is a disease some growers are failing to control fully, even with an active chemistry set to call upon. ■



Luke Cotton is aiming to try to avoid using an SDHI at T1, unless he absolutely has to.

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