

# GETTING THE BEST OUT OF SDHIs AND AZOLES IN WHEAT



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Andrew Flind, Fungicide Development Manager and Dr Alison Daniels, Campaign Manager for combinable fungicides at Bayer CropScience, give some clear advice as to where and how the new SDHI fungicides such as bixafen deliver their best performance.

## Tank mix or co-formulation?

You might think it doesn't matter whether you buy fungicide active ingredients separately to tank mix or within a co-formulation, but there are good reasons why the latter generally perform better in the field.

Each fungicide active ingredient has its own unique properties which define how readily they can enter a plant leaf, move within it, and how quickly they penetrate and act on the target fungus.

But sometimes these properties can work against each other and extra help is required to get the best performance. This is no less true of the new generation SDHI and azole fungicides, and why advances in formulation technology made by firms such as Bayer CropScience have really started to make a difference in field performance.

Adjuvant systems developed by Bayer CropScience within co-formulated EC products manipulate the speed of entry and/or movement of different active substances to help tailor their movement together inside the leaf. This enhances their efficacy on the target fungus and helps optimise 'physiological' benefits.

The best example of this is Bayer's Leafshield formulation system in Aviator<sup>235</sup><sub>xpro</sub> (prothioconazole + bixafen). Prothioconazole is very well suited to co-formulation with bixafen within the Leafshield formulation system making it possible for both to occur and move together inside the leaf. This means that neither active is left to fight disease alone and helps minimise resistance development.

These new advanced formulations are also a reason why it is wrong to draw comparisons in activity between a straight prothioconazole, Proline<sup>275</sup>, and the prothioconazole in a co-formulation such as Aviator<sup>235</sup><sub>xpro</sub>.

In addition to the benefit of enhanced performance, co-formulations are tailored to deliver the right amount of each fungicide component. A 50% azole dose is no longer enough even in low disease pressure situations to support the SDHI component, which is at a high risk of developing resistance if used inappropriately.

Only Aviator<sup>235</sup><sub>xpro</sub> is able to deliver a robust azole dose of 75% together with

the right amount of SDHI fungicide reducing resistance risk and delivering consistent performance at realistic on-farm prices.

## Wheat, barley or OSR?

The biggest yield responses for new SDHI fungicides such as bixafen come from wheat, specifically at the flag leaf timing. This is because the flag leaf generates the largest proportion of wheat yield. Aside from a clear need to manage *Septoria* and brown rust at this critical spray timing, the flag leaf stage is also a key generator of "physiological" benefits from the SDHI active ingredient, such as bixafen, which optimise plant health and yield.

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Examples of physiological benefits include:

- Helping keep the flag leaf photosynthetically active under conditions of drought stress
- Enhancing photosynthetic activity in the absence of, or in very low disease situations
- Protecting grain sites to increase spikelet fertility for more grains per ear
- Indications of lodging benefits at T2
- Enhanced nitrogen utilisation.

Barleys require less SDHI fungicide than wheat because of the way they deliver yield from all lower leaves and stem. Siltra<sub>xpro</sub> (prothioconazole + bixafen) delivers the right amount of each active ingredient specifically for barley so you're not paying for active substance that's not needed.

Prothioconazole is the cornerstone of barley disease control. SDHI fungicides, like bixafen, complement and extend that activity on regionally important diseases such as *Rhynchosporium*, Net Blotch and *Ramularia*, and increase green leaf area where water is less of a limiting factor.

A comprehensive trials programme this season has clearly shown that SDHI fungicides cannot substitute for prothioconazole, and that strobilurins such as fluoxastrobin and trifloxystrobin are still very valuable for extending disease spectrum in different scenarios.

In oilseed rape, new SDHI fungicides are excellent fungicides and they are best co-formulated with an effective azole in order to protect them against development of less sensitive populations of key target diseases such as *Sclerotinia*.

Work is on-going to establish if SDHI fungicides also help develop yield in the absence of disease as seen in wheat.

## Wheat – which spray timing and what rate?

Trials have confirmed that SDHI + azole co-formulations used at the flag leaf timing deliver the highest yields and best return on investment. Physiological effects and the control of *Septoria* and brown rust are key at this timing.

Aviator<sup>235</sup><sub>xpro</sub> is the best of a very strong bunch on brown rust, with good persistence. For both yellow and brown rust, timing is critical and the best products will all struggle in highly curative situations.

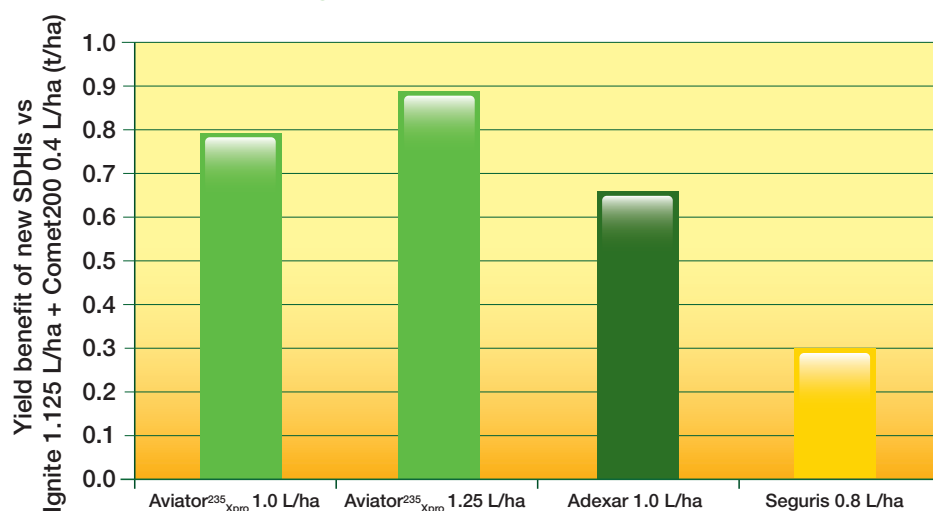
Yellow rust control begins with an understanding of varietal resistance. T0 is critical on susceptible varieties since this is an early spring disease which has often overwintered from the autumn. This single inexpensive spray can define the success of the yellow rust programme, allowing more time if the all-important T1 is delayed. If you get things wrong early in the programme, it will continue to be a problem at T2. In effective programmes Aviator<sup>235</sup><sub>xpro</sub> is excellent, but if you find yourself in a 'catch-up' situation, then adding a rust-active strobilurin or tebuconazole to the 1.0 L/ha Aviator<sup>235</sup><sub>xpro</sub> rate may be appropriate.

## Which SDHI at T2 in winter wheat?

So how do you choose which SDHI fungicide to use at T2 and at what rate? Bayer CropScience's view is that the choice is between Aviator<sup>235</sup><sub>xpro</sub> and Adexar (epoxiconazole + fluxapyroxad). Seguris (epoxiconazole + isopyrazam) lags behind these two but ahead of existing strobilurin + azole chemistry.

## New SDHI T2 yield benefits vs azole + strob

21 trials 2012 show strengths of Aviator<sup>235</sup><sub>Xpro</sub> ratio and formulation

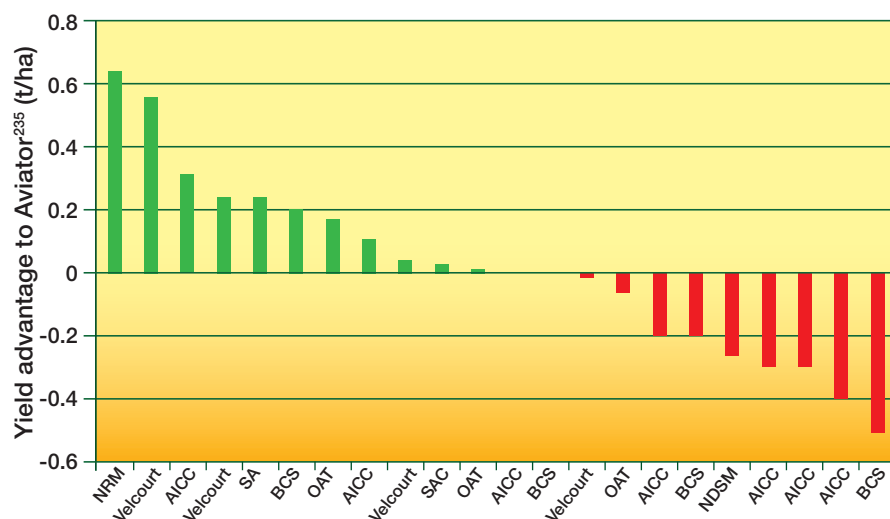


Source: 21 independent and BCS trials 2012. T1 = Azole + Strob + CTL.

Average yield in untreated = 6.2 t/ha.

## 2012: Aviator<sup>235</sup><sub>Xpro</sub> 1.0 L/ha vs Adexar 1.25 L/ha

22 independent and BCS trials show technical equivalence at stated doses.

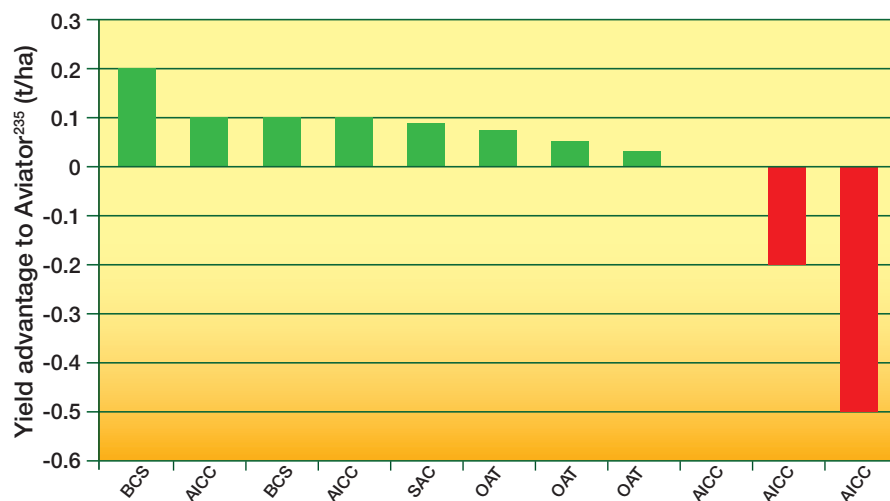


Source: 22 independent and internal comparisons. Dominant disease = *Septoria tritici*.

No regional or varietal trends.

## 2012: Aviator<sup>235</sup><sub>Xpro</sub> 1.0 L/ha vs Adexar 1.5 L/ha

11 independent and BCS trials show robustness of 1.0 L/ha Aviator<sup>235</sup><sub>Xpro</sub>



Source: 11 independent and internal comparisons. Dominant disease = *Septoria tritici*.

No regional or varietal trends.

Comparing equivalent doses in 2012 trials to present, Bayer found 1.0 L/ha Aviator<sup>235</sup><sub>Xpro</sub> to be similar to 1.25 L/ha Adexar, but at less cost/ha. Full label rates also found them performing similarly but with cost in favour of Aviator<sup>235</sup><sub>Xpro</sub>.

A significant number of trials also put the 1.0 L/ha Aviator<sup>235</sup><sub>Xpro</sub> rate ahead of 1.5 L/ha Adexar, with even greater cost benefit to Aviator<sup>235</sup><sub>Xpro</sub>.

It would appear that while Adexar is a slightly faster starter in early assessments, it perhaps doesn't have the longevity or robustness of Aviator<sup>235</sup><sub>Xpro</sub>. Bayer CropScience believes this extra persistence and robust disease control is down to the correct ratio of azole and SDHI fungicide, and the Leafshield formulation system making sure their individual performance is optimised.

## So what about T1 use of SDHIs?

The difficult season of 2012 in terms of delayed timings and extreme disease pressure meant that azole performance came into question. But doses were in some cases too low and timings stretched putting undue expectation on curative capabilities of the fungicides.

So it's quite natural that the focus might turn to SDHI-containing fungicides at T1 based on 2012 experience. At T1 their physiological benefits are not fully exploited due to the stage of plant development, so their use is largely for disease control only.

Independent and Bayer CropScience in-house trials have rarely showed a clear technical or cost benefit over 75% prothioconazole + chlorothalonil (CTL) in 'normal' *Septoria* scenarios at T1. Small benefits in favour of Aviator<sup>235</sup><sub>Xpro</sub> are observed when *Septoria* pressure is unusually high at T1, or when T1s are unavoidably delayed. In such cases, a two spray Aviator<sup>235</sup><sub>Xpro</sub> programme works very well.

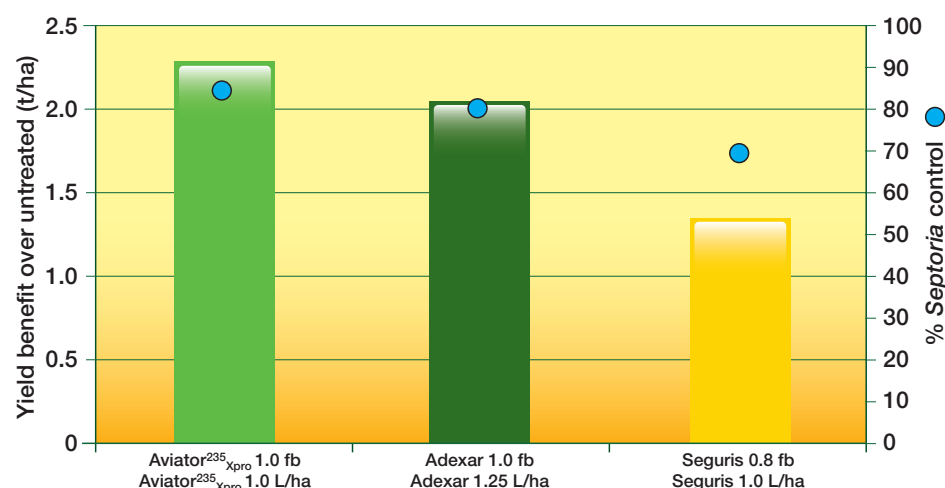
Just like T2, it's not worth using rates less than 1.0 L/ha Aviator<sup>235</sup><sub>Xpro</sub> at T1, as this reduces the azole dose and dilutes the critical formulation components important for crop coverage and rainfastness.

At T3, there are no justifiable reasons to use Aviator<sup>235</sup><sub>Xpro</sub>. Compared with prothioconazole, there is no significant activity from bixafen on ear blight, and



## 2 Spray SDHI programmes T1 + T2

### 5 AICC trials 2012 show Aviator<sup>235</sup><sub>Xpro</sub> is the best 2 spray



Source: 5 AICC trials 2012. Untreated disease = 20% *Septoria* Lf 3. Untreated = 6.6 t/ha.

the ratio is not designed for this spray timing. For effective *Microdochium* and true *Fusarium* suppression, 150-200g/ha prothioconazole is required which will also give a foliar top-up for *Septoria*.



Brown Rust

If rusts have been allowed to escape into the ear spray timing, then this is a justifiable reason to use strobilurins. However, tebuconazole may be a cheaper option. Stacking tebuconazole with effective doses of prothioconazole in products such as Prosaro, Kestrel (prothioconazole + tebuconazole) and Cello (prothioconazole, tebuconazole + spiroxamine) may also be a useful precaution at this spray timing to help reduce pressure on the lead azole.

### Wheat – best practice *Septoria* stewardship?

2012 showcased to growers for the first time, what has been known for several years – that 50% azole fungicide rates are no longer robust enough to offer either long-term protection (the more active substance on the leaf, the longer it lasts), and more importantly, curative activity.

This was no surprise to Bayer CropScience as it has always claimed that 0.55 L/ha of Proline<sup>275</sup> was needed

to deliver the full spectrum of robust *Septoria*, yellow rust and stem base complex or ear blight inoculum management, depending on timing.

Even in late drilled crops which will quickly push through growth stages in the spring with leaf layers in close proximity, the risks of all these disease are still present as weather is rarely predictable, and disease epidemics even less so.

Bayer CropScience recommends that Proline<sup>275</sup> should now be routinely used at 0.55 L/ha, with chlorothalonil at T1 and following a T0 including chlorothalonil. Strobilurins and/or bixafen should be additive to this core prothioconazole dose at T1 and T2.

However, the addition of chlorothalonil to Aviator<sup>235</sup><sub>Xpro</sub> is not recommended as it has been shown to reduce curative performance on *Septoria* and rusts.

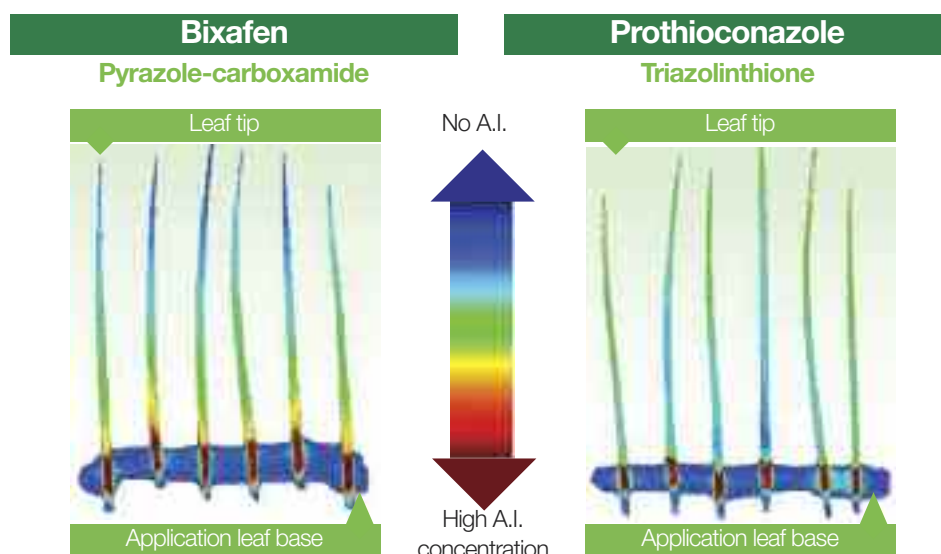
New highly *Septoria* active SDHI fungicides such as bixafen are at risk from *Septoria* becoming resistant to them, via single gene mutations as seen in the case of strobilurins. *Septoria* insensitivity to azole fungicides such as prothioconazole is controlled by more than one gene and produces a gradual reduction of sensitivity over time.

SDHI and azole fungicides protect each other in resistance terms. Therefore tank mixes with straight SDHIs need to be very carefully thought through with a robust core azole fungicide dose to increase the chances of killing 'outliers' and 'just enough' SDHI to minimise selecting any naturally resistant isolates already in the population – which is how single site resistance generally develops.



Septoria

Chlorothalonil may be beneficial when the azole and SDHI ratio and formulation are not optimised, leading to epoxiconazole not providing sufficient support to the SDHI fungicide in the mix. Stacking azoles at effective doses may also be useful tank mix partners to straight SDHIs.



Co-aligned movement of azole and SDHI in leaves (BCS radiolabelled studies)