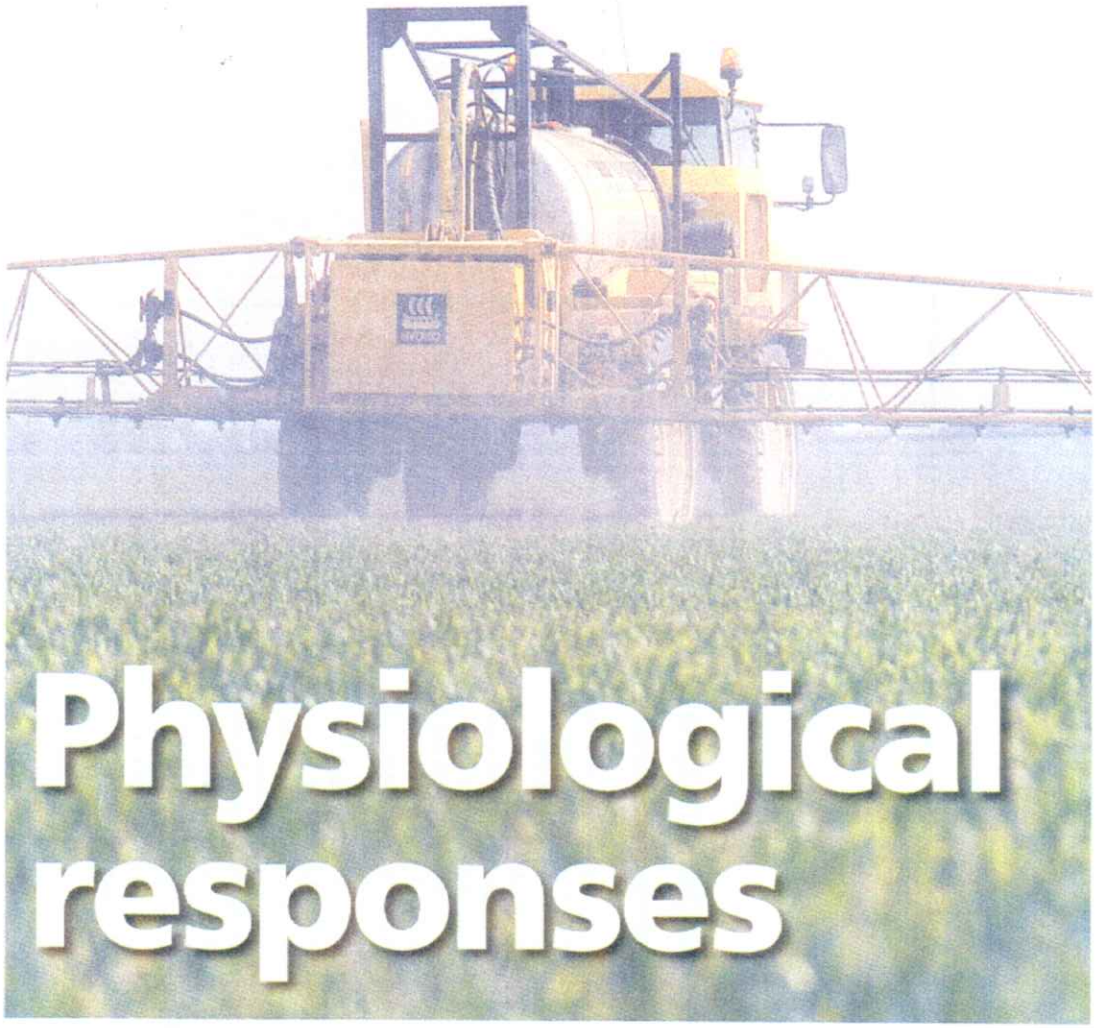

Physiological responses

Mildew gone, septoria nearly gone. But physiological responses to strobilurins remain. So when, what for and which products should you use? **Mike Abram** seeks best advice

AT LEAST one leading agronomist believes that strobilurins give virtually no control of either septoria or mildew now. But that doesn't prevent yield responses of around 7-9% from strobilurin programmes over a triazole-based one.

"About 90% of that extra yield comes from physiological benefits," claims Keith Dawson from CSC Cropcare. "Smart strobilurin programmes, where good disease control is achieved by other products, are still proving to be more profitable than a triazole-based programme, even in high resistance situations."

So exactly what are these physiological benefits? And much more importantly, how can growers exploit them to their advantage?

Broadly they break down into three areas: better nitrogen utilisation, improved tolerance to stresses like drought and abiotic spotting, and increased carbohydrate production (see panel). But all are inter-related and play a role in the so-called greening effect growers have seen from strobilurins, leading to increased yield and quality.

Growers shouldn't worry too much about how these effects are achieved, says Bayer CropScience's Alison Daniels. "It's about as relevant as understanding the ins and outs of how triazoles work. What really matters is that green leaf area is retained for as long as possible, and yield and quality are delivered in a consistent and reliable fashion."

And for that to happen the starting point is good disease control, says BASF's Tony Grayburn. "To get a physiological response growers need to get the basic programme right. You don't get it by having a dead flag leaf."

So assuming growers achieve good disease control, where should they target their strobilurin for optimum physiological benefit? Perhaps not surprisingly, given that physiological responses are difficult to quantify exactly, both visual and as yield in trials, there's a divergence of opinion.

Agrovista trials on a light, drought-prone soil in Cambridgeshire suggests spraying a T1/T2 programme is more effective than spraying at T2/T3. "At ear emergence you could spot the treatment that had a strobilurin at T1," says technical manager Mark Hemmant. "It was greener with more biomass, and that came through to yield, giving an extra 0.5t/ha average over four varieties."

He puts the yield increase almost entirely down to physiological effects, particularly reduced drought stress, as disease pressure was extremely low at the site. "It shows that you need to get the strobilurin on before the crop gets drought stressed."

Bayer's Tim Nicholson agrees with that. "Buffering against drought stress with a T1/T2 approach is something we'd advise for trifloxystrobin. The T1 timing also increases photosynthesis early on, which in thin crops ensures maximum tiller survival and grain site initiation."

Increasing nitrogen uptake is also important in thin crops, adds BASF's Steve Waterhouse. "Thin crops have a sub-optimal canopy size for maximum yield, and have an increased dependence on lower leaves for yield contribution. Applying Landmark (kresoxim-methyl + epoxiconazole) at T1 will help keep those lower leaves contributing by removing the bottleneck of nitrogen uptake and utilisation, which occurs as plant growth takes off. This means that even where nitrogen supply is abundant, growth can be promoted."

Responding to strobs

- Three main effects: better nitrogen use, improved stress tolerance and enhanced photosynthesis
- Hierarchy for strobs for physiological response
- Debate over timings
- Optimum rates still to be proved

But Syngenta's Paul Varney suggests effects on nitrogen uptake are only relevant when nitrogen is limited or scarce. "That's more likely to be later in the season. At T1, shortly after nitrogen application, nitrogen is unlikely to be limiting except in take-all situations. When nitrogen is limiting, Acanto (picoxystrobin) shows enhanced root growth, but when it's not, there is no real effect."

"To get a physiological response growers need to get the basic programme right. You don't get it by having a dead flag leaf."
Tony Grayburn, BASF

Later applications will be beneficial where the crop is unlikely to suffer from early senescence, for example on heavy soils with late maturing varieties, and in northern areas with longer day lengths, says Mr Nicholson. "The extra photosynthesis from a T3 application can contribute to extra yield and protein."

And just to confuse the issue further, Dr Dawson suggests in northern environments T1/T3 sprays are best, now strobilurins no longer give any septoria control. "T1 is when the plant is in overdrive in terms of growth, and so is a key point for boosting physiological effects, like nitrogen and carbon dioxide use. If you wait until the flag leaf comes out those effects will be sub-optimal.

"But T3 is also important for drought resistance and ethylene suppression (see panel), as well as controlling other diseases."

So are all strobilurins the same in terms of their physiological responses? Not according to Dr Dawson. "I firmly believe there are differences in physiological response, just as there are in disease control." He claims the Syngenta strobilurins Amistar (azoxystrobin) and Acanto give less response in

his trials than kresoxim-methyl, pyraclostrobin (Comet) and trifloxystrobin (Twist).

Agrovista trials work supports that claim. "We didn't see the same greening effects at T1 from Amistar or more importantly yield responses, as we did with Opponent (pyraclostrobin + kresoxim-methyl + epoxiconazole)," says Mr Hemmant.

And rate? Dr Dawson suggests growers need around one full dose in total of strobilurin in a programme now, rather than the 1.5 times full dose when septoria was being controlled. "But gram for gram not all strobilurins are the same."

Mr Grayburn admits there isn't enough information on the optimum economic rate for strobilurins, now septoria control is less reliable. "Finding the dose rate for optimum physiological response is going to have the biggest influence on pricing." ■

Crops Feedb@ck

Are strobilurins worth using for physiological benefits? How much are you willing to pay for physiological benefits? Send your feedback to **crops@rbi.co.uk**

What are the physiological responses?

1 Better nitrogen utilisation
Nitrogen use is controlled by how quickly the plant can convert nitrate it takes up from the soil into a usable form in the plant. Strobilurins have been shown to increase the rate of the enzyme controlling this step, nitrate reductase. This leads to more starch and protein in the plant, better plant development and ultimately higher yields and better quality.

Keeping lower leaves green to conribute to yield is more important in thin crops, says BASF's Steve Waterhouse

2 Improved stress tolerance
a) Plants respond to stress, such as drought, by producing ethylene, as an emergency reaction, which causes the plant to produce seeds as quickly as possible. That results in shrivelled grain, reducing yield as survival instincts take over. Some strobilurins inhibit ethylene production, which delays leaf senescence.
b) Strobilurins remove other leaf surface colonisers, which, while not causing disease, start energy sapping defence reactions, leading to abiotic spotting, premature senescence and yield loss.
c) Sunlight and drought stress can also cause physiological spotting, by triggering the plant to produce free radicals. These damage cell walls and allow cell contents to leak resulting in spotting.

Strobilurins almost act like an anti-ageing cream by increasing the activity of the enzyme, superoxide dismutase, which suppresses production of free radicals, and preventing premature ageing.
d) Strobilurins have been shown to reduce the amount of water vapour leaving through the leaf, which could increase drought tolerance.

3 Enhanced photosynthesis
a) Plants use carbon dioxide during the day to produce carbohydrates (photosynthesis), which are used by the plant as energy for growth. Strobilurins can help make carbon dioxide use more efficient by increasing carbon dioxide uptake during the day and slowing it down at night, with obvious growth benefits.
b) Strobilurins have been shown to increase the plants ability to use light efficiently, by stimulating parts of the photosynthesis process, and increasing carbohydrate production.