



# techtalk

## Managing barley diseases

With mounting resistance to single-site chemistries making the control of barley diseases increasingly difficult to achieve, Adama is keen to highlight the importance of including a multi-site fungicide in spring spray programmes – not only to ensure crops are adequately protected, but also to prolong the effective lifetime of at-risk products and to boost yields.



“Single site resistance has become an issue as we’ve moved away from multi-site use.”

# Multi-site fight

**Barley diseases are posing more than just a challenge as single site modes of action have taken a battering in recent years. But through careful management and using multi-site actives, growers can take the fight to the diseases. CPM investigates.**

*By Melanie Jenkins*

**Barley is a staple in most arable rotations, but disease resistance to single site chemistry is causing some headaches, especially when quality is compromised as well as yield.**

And when ineffective chemistry is used or good chemistry is badly timed, it can mean throwing good money after bad.

But focusing on careful management of effective chemistry and adopting cultural controls can help to prolong the life of the available actives and keep disease to a minimum.

CPM discusses the pathology of barley diseases with SRUC's Dr Neil Havis and how to best manage them with Adama's Andy Bailey.

## How has fungicide resistance evolved?

Single site resistance has become an issue as we've moved away from multi-site use. The benefits of single sites are their specificity and initial strength against diseases, but they are also far more susceptible to resistance.

Strobilurins have variable efficacy against rhynchosporium now, but it was in the early 2000s we saw the G143 resistance to them first confirmed.

When the disease is at very low levels it doesn't cause massive issues and strobilurins can still work — some better than others.

Azoles are still fairly effective against rhynchosporium, with most

chemistry working pretty well, but there have been instances of variable performance. SDHI fungicides are showing a stable level of activity but there is still always a resistance risk developing with single site products.

Net blotch has shown some resistance to strobilurins, with field performance declining in recent years and now it's variable at best so this mode of action should never be used on its own.

The azole group of chemistry has seen sensitivity shifts in the net blotch pathogen over time, but now chemical control is pretty stable, with both prothioconazole and Revysol's (mefentrifluconazole) performance remaining good.

Several mutations conferring reduced sensitivity to SDHI fungicides have been detected in the UK net blotch population in recent years. Careful management is required to slow resistance development.

Ramularia presents a more challenging situation. There's been reduced sensitivity to azoles for a while — prothioconazole was working well up until four or five years ago and suddenly there was a big sensitivity shift. Though it still offers some level of field performance, it's reduced.

However, the newer azole, Revysol, is active against ramularia but this is rate related, with higher rates working well.

Ramularia has developed mutations and shown greatly decreased sensitivity to SDHIs, so is a challenge. Though SDHIs would normally be mixed with an azole to get better performance, even this has reduced. Where prothioconazole performance used to be quite high, it's now only achieving 30-50% reduction.

There are now G143A mutations in ramularia which affect strobilurin efficacy and 100% of the UK population is affected. Essentially, strobilurins don't work against it anymore and they can be described as ineffective.



*Andy Bailey highlights that unlike single sites, there's been no recorded disease resistance to folpet in cereals since its launch ten years ago.*



*Ramularia exists without presenting symptoms and by the time they appear it's too late.*

Chlorothalonil was the most effective chemistry for control of ramularia left to growers, but this was lost in May 2020.

## How can this be managed?

Make the most of all methods available, with an integrated pest management approach as important as chemical use. With this in mind, think about varietal resistance as this is very important for the management of many diseases. If you use a variety with genetic defence and tailor fungicide programmes to them, chemistry can be more effective, and resistance may be less likely to develop.

Ensure that seed is clean and appropriately treated as some infections are seed borne and can be reduced through seed treatment, such as rhynchosporium and net blotch. Unfortunately, seed treatments aren't effective against ramularia.

Reduce trash as much as possible as diseases can exist on trash. If barley is grown successively, inoculum on green bridges of volunteers can further the spread.

Look at resistance elicitors — compounds you can put on

the crop to enhance its natural defence mechanism and ideally cut back on fungicide use, which is also environmentally beneficial.

Mix and alternate chemistry to avoid resistance build up. Never be tempted to use straight products on their own as this means resistance is more likely to develop. Using multi-sites in programmes, such as folpet, will also help efficacy and protect single site products.

And think about always doing different things with chemistry. Fungicides always work better in a protective situation rather than a curative one, so plan this into the fungicide programme by looking at variety and known disease challenges.

## Why is ramularia of concern?

Of all the pathogens, ramularia is the one we don't have effective genetic resistance against at the moment. We were over-relying on chemistry and we lost the most effective chemical control when chlorothalonil's use was revoked.

We are left with limited single site chemistry with label approvals that can be used in conjunction with an azole or SDHI, but we've always seen resistance build up



*Chlorothalonil was the most effective ramularia control growers had left before it's use was revoked, says Neil Havis.*

fairly rapidly in ramularia.

The difficulty with ramularia is that it can be present in seeds without growers knowing it's there and seed treatments don't control it. So it can be present in plants from the start of the growing season and is influenced strongly by growing conditions — when it's wetter and warmer, higher disease levels occur. Ultimately, this helps the fungus move within the plant.

Ramularia behaves as an endophytic organism — existing without presenting symptoms — with a trigger required for the ▶

## Managing barley diseases – Top tips

- **Tailor fungicide program to variety** – each variety will be slightly different and fungicide programmes should be tailored accordingly
- **Utilise well-timed mixed modes of action** – for good control and to protect against resistance
- **Use multi-sites** – these make life harder for diseases as they act on multiple bio-chemical processes within the pathogen cells, which is why the risk of resistance is so low.

## Management in practice

Barley diseases don't just rob growers of yield, but also vital quality that is especially important for those aiming for the malting market, says David Cairns of McCreath, Simpson and Prentice Agriculture.

Working across North Northumberland and throughout north-east Scotland, David and a team of in-house agronomists advise growers on everything to do with growing barley, from seed selection to harvest and disease management.

"We work with thousands of farmers and, at the end of the day, being end-users we have a vested interest in yield, quality, traceability and sustainability," he explains. "We want barley to be sustainable and profitable for our farmers to grow."

Mildew, rhynchosporium and ramularia are the main disease

threats David's growers come up against. Ramularia is a big concern for maltsters as it can affect the quality of their end product. "It can increase screenings, resulting in higher nitrogen contents and this affects the quality," he explains.

"After the recent shifts in chemistry and the demise of chlorothalonil, we've had to re-evaluate ramularia control. It's a disease that's difficult to predict as it's so linked to environmental factors. Both growers and agronomists are concerned about it as we don't have the products, we used to have to control it."

Through agronomic advice, he aims to minimise the stress to his growers' crops — ensuring they get off to a good start and have the right nutrients — and he tries to use alternative means of chemistry to help keep

plants healthy.

"Nutrient deprivation is very localised, so we try to ensure any issues are dealt with at the earliest possible stage — as spring barley has such a short growing season," explains David.

The key things to get good disease control are ensuring timings are correct when applying fungicides, and that different modes of action are used, he advises. "I recommend at least two different modes of action in a tank-mix, but preferable three, and I'd always advocate a two-spray strategy in barley to make sure you're putting on little and often. But the main timing for ramularia is T2."

At T2 he includes a standard effective dose of folpet in all of his growers' programmes. "It's an alternative mode of action that makes



*David Cairns works closely with growers to optimise barley yield and quality.*

up part of our anti-resistance strategy," says David. "We're aiming it at general disease, with rhynchosporium being the key one, but we know from trials and through what we've seen, that it does have a perceived effect on ramularia.

"We saw a lot of ramularia late last year and having an effective fungicide strategy did delay its onset, which helped maximise grain fill."



► organism to become pathogenic. By the time symptoms appear it's too late for chemistry to be applied and yield and quality are compromised.

There's also still a lot to learn about this disease, such as how it interacts with its host and the environment.

## Why use a multi-site?

FRAC recommendations highlight that multi-sites are at low risk of developing resistance and as well as prolonging the lifespan of

single sites, they provide multiple levels of disease control and can hinder the development of pathogens.

With multi-sites, the first and most important characteristic is that they should add efficacy. To do their resistance management job, they need to be effective against a disease and provide a return on investment (ROI).

In the past 10 years there has been no concurrent resistance to barley diseases developed against multi-sites. They might

work at a lower level than single sites but year on year their performance stays constant.

Though chlorothalonil has been lost, there are other multi-site options for growers to use in their fungicide programmes — such as folpet, which has a label recommendation for protection against rhynchosporium; and sulphur, with a label that permits use against powdery mildew in barley.

Folpet should be added to protect against rhynchosporium because it has activity against the disease so will help protect any single site chemistry, prolonging its effective life. Even though ramularia isn't yet a label recommendation, there's evidence that it appears to have an effect, so it can also be used as a tank-mix partner at the T2 timing to help reduce the risk of resistance development.

Folpet has limited activity on net blotch, which isn't on its label.

biggest benefit, yielding 8.32t/ha, compared with 7.23t/ha in the control and 7.69t/ha with the Siltra programme alone.

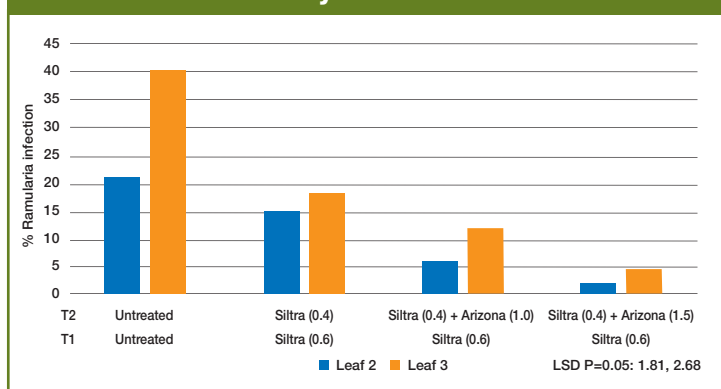
## When are the key timings?

Applying a well thought out fungicide programme is always important, and the key timing for ramularia control is T2.

Whatever growers do to tackle ramularia, chemistry works best when applied as close before flowering as possible because the physiological stress can trigger its pathogenic effects. If chemistry is applied really early against it, it won't work and is a waste. So apply at T2, between GS39-49 — or the paintbrush time — to get the best control.

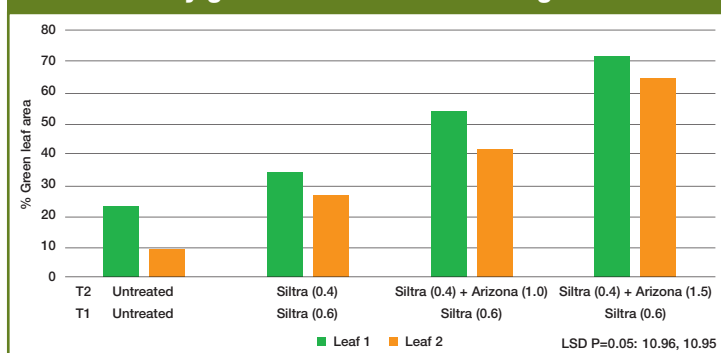
There can be benefits from applying a mix, including a multi-site at T1, which is traditionally the most important time to protect the components of yield in barley against net blotch and rhynchosporium. ■

### Arizona in winter barley at T2



Source: Adama winter barley trials, 2021

### Winter barley green leaf area when using Arizona



Source: Adama winter barley trials, 2021

### Yield benefits of Arizona on winter barley



Source: Adama winter barley trials, 2021

## What do trials show?

Trials conducted by Adama in 2021 in Norfolk, looked at the impact of including the multi-site Arizona (folpet) in a barley disease management programme with Siltra Xpro (bixafen+ prothioconazole), and the yield benefits of using a multi-site were notable.

An application of Siltra at 0.6 l/ha at T1, followed by a further 0.4 l/ha with Arizona at 1.5 l/ha at T2, showed the greatest level of control over ramularia, with infection levels below 5% on leaf three, compared to 40% in the untreated crop. The infected leaf area was around 18% when only Siltra was applied and 12% with Siltra plus 1.0 l/ha of Arizona.

Green leaf area was far higher in the Siltra plus 1.5 l/ha Arizona trial, almost 20% higher than the lower rate Arizona, showing dose rate has a big impact.

But when it comes to yield benefit and margin over fungicide cost (MOFC), the 1.0 l/ha application of Arizona plus Siltra demonstrated the

## Sponsor message

Arizona (500 g/l folpet) is a cost effective, multi-site fungicide which not only protects against key cereal diseases such as septoria, ramularia and rhynchosporium, but can also protect at-risk single site active ingredients. Arizona helps crops to stay ahead of diseases and ensures each successive leaf stays greener for longer by providing longer-lasting protection.

### Arizona's key benefits:

- **Effective:** provides reliable and robust protection against key wheat and barley diseases
- **Valuable efficacy:** pays for itself through improved green leaf area retention and higher yields
- **Resistance:** folpet's multi-site mode of action has been proven to prolong the effective lifetime of at-risk single site fungicides
- **Protection:** reduces the initial disease burden and lessens the impact of later infections
- **Flexible:** can be used at multiple timings to provide season-long protection

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