techtalk

Tackling BYDV

Here at RAGT, we're rather proud of our new Genserus range of wheats. These ground-breaking varieties are resistant to BYDV, removing the reliance on autumn-applied aphicides to control this potentially devastating disease. In this Tech Talk, we delve into the disease in depth, and outline the key benefits thatvarietal resistance offers growers.

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Protection from day one

What if growers never needed to worry about BYDV ever again? *CPM* explores whether that dream could soon become a reality.

By Janine Adamson

Barley yellow dwarf virus (BYDV) can cause yield losses of up to 60% in winter wheat and, in some cases, result in total crop failure. For many years, neonicotinoid seed treatments provided protection, but their withdrawal in 2019 left a lone chemical control option — pyrethroids.

With milder autumns offering the perfect breeding ground for aphids, the BYDV carrier, what can growers do to ensure their crop's protected without over-spraying the one remaining insecticide?

Seed trade expert, RAGT's Lee Bennett discusses how the solution lies in genetics in what he believes is a socially responsible way to protect crops from the disease.

What's BYDV?

BYDV is a plant virus vectored by infected aphids, mainly the bird cherry-oat and grain aphid. It's transmitted when the insect feeds on the phloem (sap) found in a plant's foliage, stems and flowers.

The virus is introduced in two ways – indirect and direct transfer. The most common is indirect transfer from grass or cereal volunteers by winged aphids, whereas direct transfer is by wingless aphids that overwinter on the green bridge.

Symptoms-wise, the clue's in the name — dwarfing. Early signs include leaf discolouration, with stunted plant growth as the season progresses. Red tipping, or blushing, can also occur as a result of the stress the plant is enduring. Crucially, early season infection can result in severe crop losses.

As well as the obvious barley host, wheat and oats also succumb to the virus, making it a significant cereal crop disease. It has huge economic impact for UK growers, particularly those in the south where temperatures are warmer and aphid populations proliferate.

Worryingly, farming has perhaps become complacent because BYDV's threat was removed by neonicotinoid seed treatments. But they aren't available anymore and the virus is very much still out there.

How's it controlled?

As with all good pest management, control begins with monitoring. In this case, that's using sticky traps to observe site-specific aphid activity and infectivity. There's also online support from AHDB and Rothamsted Research on

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BYDV is a plant virus vectored by infected aphids, mainly the bird cherry-oat (pictured) and grain aphid.

forecasting to help ascertain risk levels.

For actual control, there are cultural methods that can be deployed. Delayed drilling makes the most of cooler temperatures when aphid numbers are less likely to multiply, whereas destroying the green bridge removes a host. Beneficial insects, such as predatory beetles and spiders, help to reduce actual aphid numbers, although don't eradicate the virus.

There's also value in optimising rotations — selecting lower risk fields, such as those with minimal grassland in the periphery.

Beyond this, a chemical control option does remain in the form of pyrethroid insecticides. Best practice is to use the chemistry alongside the T-sum calculation to optimise timings. This is calculated by subtracting 3°C from the average temperature each day and adding the result to the running total. When T-sum hits 170, spawning occurs and the second generation of aphids emerge.

Every T170, and there could be multiple in a season, there's a hatch. This is when the damage really occurs. Of course the earlier the crop is drilled, the quicker T170 is reached and with each individual aphid at a different point in its lifecycle, this is happening all of the time.

Why is insecticide use undesirable?

Historically, insecticides have been very indiscriminate and non-selective. Although pyrethroids are much improved compared with chemistry from the past, there'll be a level of impact on beneficial insects. These don't just play a role in BYDV control but control other insect pests within the crop.

Pyrethroids can also break down very quickly in sunlight, anywhere between 24hrs and seven days. This means protection is rather limited, the crop is soon exposed to infection again and the sprayer will have to return.

And of course, the higher the frequency of spraying, the greater chance of resistance. This is because when an active ingredient is overused, it initiates a natural selection process within the target pest where the tolerant insects mate, producing resistant offspring. Research has shown that the grain aphid first presented with pyrethroid resistance back in 2011 — more than 10 years ago. This is why it's so important to use the T-sum calculation to only use pyrethroids when really necessary.

Farmers care about the environment and how they're perceived so resistant varieties are a way to overcome a problem without compromise, says Lee Bennett.

Finally, the government is incentivising farmers to not use insecticides, but going without poses a huge risk for the farmer. There has to be something to fill the gap and support growers. ▸

An aphid paradise

Sandy beaches, fossil cliffs and cream teas — but it's not just tourism that proliferates in Devon, it's aphid numbers too.

Aphid flights begin in the spring when temperatures rise above 11°C. With fewer frosts in coastal regions, the chance of the pest overwintering is much higher too, making mild Devon a high-risk area for BYDV.

This is something that Matford Arable Systems' Neil Potts knows all too well. Working as an agronomist in the area since 1981, he's experienced life before, during and after neonicotinoid seed treatments.

"Having been an agronomist since before the introduction of seed treatments like Redigo Deter (prothioconazole+ clothianidin), I know that beneficials couldn't control aphids back then, when we had far more helpful insects in the fields," he says. "We've now come full circle but with less beneficial insects, so growers have to have an alternative tool to combat the disease."

This resulted in Neil exploring the impact of BYDV-resistant varieties such as Wolverine. He's already introduced the variety across some of his farms, which he says has been invaluable during bad weather.

"Wolverine has been a godsend for those farmers growing wheat who couldn't travel due to the rain. Of course, advice has to include that it isn't suitable for those with a septoria problem, it really is for targeting BYDV."

Last autumn was especially mild for Neil's growers. This meant for those who planted wheat around 10 September, they hit the T-sum threshold four times on the bounce. Neil believes this fully justifies the use of resistant varieties.

"In theory, those growers should've been out spraying four times or more for adequate protection. Of course they couldn't due to the wet weather, which left the crop exposed. Some could only manage one spray, with a few not getting out at all.

"Using a resistant variety to cover the crop from day one makes complete sense. It's protected from the moment it's planted."

And according to Neil, for those without a blackgrass problem, this could mean no travel at all once the crop is up and going. "If you're lucky to not be in a blackgrass area, other than spraying a pre-emergence herbicide, in theory you wouldn't need the sprayer out at all. Having the right genetics ticks a lot of boxes, as long as it includes the key agronomic traits too."

The alternative is back-to-back pyrethroid sprays, which as well as being unachievable, isn't the right thing to do, believes Neil.

"Blanket sprays are definitely a backwards step and we should be thinking beyond this approach. Losing Deter meant life with BYDV became tricky again, but we have to avoid going for the obvious solution for a range of reasons, from sustainability through to improving efficiencies."

Neil Potts has found BYDV-resistant varieties invaluable during bad weather, when customers were unable to spray.

Overcoming the virus: top tips

- **Use genetic resistance** – this protects wheat plants against BYDV from planting through to harvest
- **Prepare to monitor aphid activity** – when using conventional varieties, use cultural controls and stick to T-Sum calculations to optimise timings and avoid unnecessary sprays
- **Beware of mild autumns** – this is when pest management is essential, unless opting for a resistant variety

How can genetics help?

One cultural control method is genetic resistance. Whereas insecticides have to be sprayed regularly throughout the season, resistant varieties are protected from the moment they go into the ground.

How this works for BYDV is, rather than preventing aphid populations or the transmission of the virus, a gene prevents its replication within the plant. The virus itself cannot manifest, instead it's constrained to the level at which the initial transmission took place. This is alternative control — a true resistance mechanism with virus at a level where the plant can still perform.

This resistance gene *Bdv2* has been in development by scientists for two decades. It originates from a distant relative of wheat, *Thinopyrum intermedium*. It's taken time to create a variety suitable for the UK market, whereas it's been commercialised in Australia for more than 20 years.

In 2013, RAGT produced the cross that became RGT Wolverine, Europe's first BYDV-resistant wheat launched to the market in 2019. This became the first in the Genserus range of varieties.

How has this breeding evolved?

Although genetic resistance is highly sought after, it doesn't offer a tremendous amount if the agronomic traits of a variety don't match up. The *Bdv2* gene has been harnessed, so it's now about making constant improvements through new crosses to achieve the required 'sweet spot'. It's a continual journey, using learnings from the past 20 years or so, all the while retaining that crucial BYDV resistance.

Late last year, RGT Grouse was promoted to the AHDB Candidate list 2023 as a Group 4 hard variety with BYDV-resistance. What makes this variety special is that it not only fights back against BYDV but also has resistance to orange wheat blossom midge (OWBM). RAGT is now looking to offer this double resistance package in a new bread quality variety. This would mean risk-free, insecticide-free wheat for human consumption. A game-changer.

In the past, breeders have been criticised for yield lag, in that there's a yield trade off in having resistant genes. To investigate this, RAGT conducted trials comparing BYDV-resistant with non-resistant varieties. With no insecticidal intervention, the resistant varieties rose to the top in terms of yield. In some cases there's a 1.7t/ha yield advantage, bringing into question whether a yield lag exists.

What are its advantages?

Compared with insecticides, using resistant varieties means there are no worries about spray conditions and timeliness. With wind and rain, there's rarely a good opportunity for spraying these days. A knock-on benefit from that is improved time management.

Also, inputs are expensive. RAGT has calculated that having the *Bdv2* resistant gene in a variety equates to just one spray of a pyrethroid, from a cost perspective. For those in the south, they might hit the T-sum threshold four times or more, so that's a considerable saving.

Importantly, as an industry, farming has to do the right thing. Repeated use of a sprayer doesn't look amazing to the wider public, as they can associate it with 'toxic' pesticides. Farmers do care about the environment and how they're perceived, resistant varieties are a proactive way to overcome a problem without compromise.

Ultimately, farmers can drill a resistant variety and pretty much forget about BYDV. It's doing all of the work for you. ■

Compared with insecticides, using resistant varieties means there are no worries about spray conditions and timeliness (resistant vs susceptible lines).

RGT Grouse was promoted to the AHDB Candidate list 2023 as a Group 4 hard variety with resistance to both BYDV and OWBM.

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