Supporting better decision making for BYDV control

More than 30 years of research and development into how best to quantify the risk of barley yellow dwarf virus has culminated in the launch of a new web-based decision support tool. *CPM* takes a closer look...

By Janine Adamson

With growers reporting a significant increase in barley yellow dwarf virus (BYDV) symptoms in cereal crops this past season, some might argue that now would be the prime time to launch a new decision support tool.

And whether it's a happy coincidence or not, that's exactly what's happened, following the introduction of AHDB's new BYDV tool.

According to AHDB's Dr Sacha White, the loss of neonicotinoid seed treatments in 2018 left growers dealing with a problem that they'd not had to consider too concertedly. However, with relatively 'kind' conditions up until recently, it seems this past season has been the first year where the impact of the virus has truly been apparent for many.

"With neonicotinoid seed treatments, they offered up to eight weeks of control of BYDV, so for many growers, it was an all-in solution. The knock-on effect of their revocation has been increased pressure on foliar sprays, namely pyrethroids, and subsequent resistance issues.

"For the two aphid vectors of BYDV in winter crops, work conducted by Rothamsted Research indicates there have been target-site mutations noted in some grain aphid samples, although bird cherry-oat aphid remains sensitive with no evidence of resistance."

RESISTANCE CONCERNS

"So the fear remains that without seed treatments, during conditions conducive to larger aphid populations such as this season, pyrethroid use may rise and thus increase the chemistry's vulnerability to resistance. If that happens, it leaves the industry with a big problem," he explains.

While the new tool from AHDB was only launched in August, its development is rooted in work that took place around 30 years ago, adds Sacha.

"In 2018, the Game and Wildlife Conservation Trust undertook a one-year project funded by AHDB that involved reviewing existing decision support tools for BYDV,

Small yet significant gains
According to AHDB's Dr Sacha White, the new BYDV tool illustrates what relatively small shifts in drilling date can do.

some which had been first created in the 1990s. This identified two potential contenders for the UK.

"These were then taken forward in a subsequent four-year project that began in 2019, and combined and developed to create what later became the ACroBAT model."

It was during this project that a body of work was undertaken by ADAS to improve integrated pest management (IPM) approaches for aphid control and BYDV risk management. This resulted in two primary outcomes – improved monitoring, and, the test and development of ACroBAT.

"Regarding monitoring, a key finding was using molecular testing developed by Rothamsted Research to understand the percentage of aphids that actually carry the virus each autumn. This was a big step change because before, growers had to assume all aphids carry BYDV.

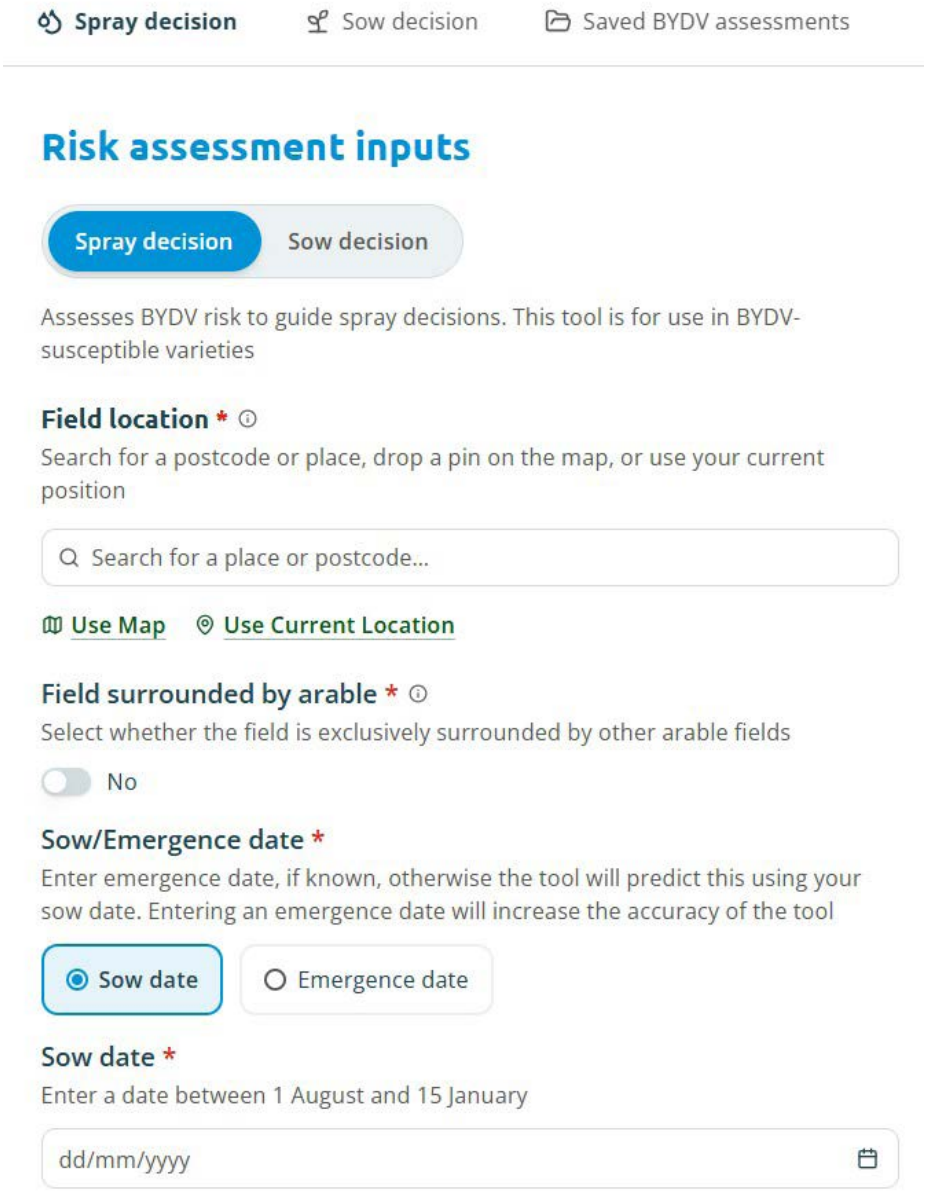
"Then for ACroBAT, this was tested in field trials and found to do a good job overall. It accurately predicted BYDV symptoms in surveys of untreated crops as well as being tested against the T-sum calculation. It was found that the ACroBAT model performed as well, if not better than T-sum, resulting in half as many insecticide sprays," explains Sacha.

NEW TOOL

Fast forward to present day and the new AHDB BYDV tool has been revealed, built around a modernised version of ACroBAT. Web-based, it takes into account decades of aphid biology science, virus epidemiology and computer modelling, to deliver two key functions: risk-based spray decisions, and, indicating how drilling date affects BYDV risk.

Specifically, the tool uses regional data on bird cherry-oat aphid numbers and infectivity (historic and actual) from suction traps in GB (run by the Rothamsted Insect Survey) and NI (run by the Agri-Food and Biosciences Institute). This is then benchmarked against virus screens conducted over several autumns, which suggest about 20% of aphids carry BYDV on average.

ACroBAT was trained on the bird cherry-oat aphid because it's now known to be the most significant BYDV vector in the autumn and winter in most situations. Exceptions include crops that are sown very early or where there is poor green-bridge management, where grain aphids can also be problematic.



Tool inputs

Field-specific inputs are required to run an assessment: field location, crop type, sowing date and whether the field is exclusively surrounded by arable land. Screenshot taken during development phase.

Sacha says while ACroBAT in its original guise was effective, it wasn't particularly operator friendly. "So this year, ADAS undertook a project to develop a user interface that could be accessed, free-to-use, from the AHDB website, across devices," he comments.

Dave Skirvin leads the development of models and tools for agro-ecosystem management at ADAS. Having worked on the AHDB BYDV tool this year he says finessing was required to ensure it'd perform effectively and reflect current growing conditions and production challenges.

"Recent updates include updating the five-year averages for both weather parameters and aphid catches from the Rothamsted suction trap network, as well as reviewing all available data on aphid biology and reproduction. We've also converted the system to an API so that it can be web-based and accessed across various devices," he explains. "There has been a lot of work behind the scenes to ensure this tool performs."

Looking in further detail at the tool, specifically the spray assessment, this indicates the date when the next spray decision is required according to the economic threshold, which is the predicted point at which the economic loss due to reduced yield equals the treatment cost.

The tool includes default values for

average UK-cropping situations, which cover plant population density, expected yield and grain price, insecticide treatment cost and whether the farm is receiving Sustainable Farming Incentive (SFI) payments for not using insecticides.

Field-specific inputs are required to run an assessment: field location, crop type, sowing date and whether the field is exclusively surrounded by arable land, lists Dave. The defaults can also be changed by the user to make them field-specific.

The output is then a 'risk now' screen, which predicts infection impacts for several weeks, with the next seven days particularly critical for management, if the tool flags the risk as high. The output gives an option to view the effect of BYDV on yield and financial loss too.

"The tool allows users to see the result of spray decisions to date, alongside what would occur if an insecticide was sprayed at the next suggested decision point," explains Dave. "We have added spray persistence into the tool based on manufacturer data, to better represent the true impact of sprays on the aphid population."

As for the tool's sow-date assessment, this reveals how BYDV risk could change when crops are drilled earlier or later than the farm's standard target sowing date. Sacha believes this is important given the tool should be used in conjunction with the principles of IPM.

"It won't be ground-breaking news that the general advice is the later you can sow, the better. But what this tool does, is illustrate what relatively small shifts in drilling date can do; there can be a substantial reduction in risk by delaying the sowing date by around one week or more."

As well as the work by ADAS, AHDB has also been liaising with farmer groups this year to gather feedback to ensure the tool is practical, intuitive and impactful. One grower involved was Kent-based Andrew Cragg, who farms 600ha of winter wheat, oilseed rape, spring wheat and peas.

He says because he drills the farm's wheat crops from mid-October onwards, mainly due to blackgrass pressure, this naturally reduces the risk of BYDV infection. However either way, he wouldn't want to gamble, therefore applies insecticides if required.

"Winters are milder now and more growers seem to be being caught out by BYDV, equally, we've had patches of it in the past so know it's possible on the farm. I know this year has been a bad year for the virus, it's certainly in people's minds."

As such, Andrew believes it's timely for AHDB to launch a new tool. "Rather than a knee-jerk reaction to a bad BYDV year, we should be managing insecticide sprays effectively. I think the T-sum tool is highly regarded and shows the overall dynamics of aphid behaviour, but it doesn't really do the rest of the work.

"Actionable insights are missing – mainly the potential cost of the impact of BYDV. But with the new tool, the spray assessment particularly provides a much better view of the risks involved. Growers should definitely use it – after all, any tool is useful above simply guessing."

INTEGRATED APPROACH

While any new solution is undoubtedly exciting, Andrew urges growers to keep utilising the full suite of cultural controls. "This is a tool to support decision-making and should always be grounded in the principles of IPM."

> ***"Hopefully this may reduce the quantity of insecticides being applied to crops and therefore mitigate risks associated with over-reliance on chemistry."***

Sacha echoes the sentiment: "Yes, the tool is helpful, but there are other non-chemical options to use including variety selection, managing the green bridge and keeping grassweeds under control. We have a lot of confidence in the tool, but it has to be used as part of a broader suite of tactics."

Equally, Dave believes users should exercise a level of caution, mainly due to currently modest nationwide coverage for the suction trap data. "The new tool is far better than the previous T-sum calculation, as it includes representation of both aphid and virus population dynamics. While we want the model to be used widely, it's important to be aware of its limitations.

"The new model tends to predict a much later first spray date than T-sum, and depending on drilling date and location, in some cases, no spray at all. Hopefully this may reduce the quantity of insecticides being applied to crops and therefore mitigate risks associated with over-reliance on chemistry."

Because the tool is the result of decades of research and development, of course, the work doesn't necessarily stop now. According to Sacha, the future may involve including varietal tolerance and resistance.

"With BYDV, there are so many moving parts that impact its significance, but the new tool should help to integrate a lot of those variables into one, to support more targeted control and better informed decision making," he concludes.

Farmer feedback

Kent grower Andrew Cragg was involved in the farmer groups that provided feedback to ensure the new tool is practical, intuitive and impactful.

Research roundup

From Theory to Field is part of AHDB's delivery of knowledge exchange on grower-funded research projects. *CPM* would like to thank AHDB for its support and in providing privileged access to staff and others involved in helping to put these articles together.

For more information about this project and to use the tool, visit ahdb.org.uk/bydv