

“Predators are highly susceptible to autumn applied pyrethroids.”

AHDB

from theory
to field

Researchers are looking at ways to improve systems for monitoring and managing the rising threat of BYDV in cereal crops. CPM finds out their conclusions so far and the work that still needs to be done to better understand the many factors that could be used to manage this complex disease.

By Lucy de la Pasture

Controlling the spread of plant viruses has just got harder with the demise of neonicotinoid seed treatments putting the emphasis back on pyrethroids for vector control. Oilseed rape growers have been denied neonics for a while, but until this season sugar beet and cereal growers have been able to benefit from the protection they offered.

This autumn the importance of BYDV rises up the agenda and researchers have been looking at ways to mitigate the risk the disease poses to cereal crops. With moderate levels of pyrethroid resistance already present in one of the aphid species that carry the virus, a more integrated approach is being sought to avoid driving selection for resistance by avoiding unnecessary spraying.

Charlotte Rowley, who manages pest

research at AHDB, says that in wheat, yield loss from BYDV averages 8% but can be as high as 60%. It's estimated that 82% of the crop area could be at risk from infection if untreated which is a potential loss of £136 million/year, she points out.

Urgent need

“There's an urgent need to find an IPM strategy for BYDV so that growers have the confidence to minimise the use of pyrethroids. These will come under increasing pressure in the absence of the neonicotinoids and risk driving resistance in the grain aphid (*Sitobion avenae*), one of the principle vectors of BYDV.”

Prof John Holland, head of farmland ecology at the Game and Wildlife Conservation Trust (GWCT), has been leading a pilot study looking at field monitoring methods that may be useful to help growers and agronomists assess the risk of BYDV in cereal fields.

“The risk of BYDV is likely to rise in the short term after the loss of the neonicotinoids. In the longer term, rising global temperatures will allow aphids to be more active in winter which will further increase the risk and spread of BYDV,” he explains.

The latest predictions are that insect pests in crops will rise by at least 50% by 2050 with associated yield reductions of (on average) 22%, so gathering intelligence on the aphids that carry BYDV will play an important part in managing the risk to crops, he believes.

“At the moment the aphid monitoring information available is from the Rothamsted Research network of suction traps but this doesn't cover the whole of the country.”

A literature review was conducted within the pilot study to see if there is any potential for already published decision support tools for BYDV management in crops. It also went a step further and assessed the existing practices for managing aphids with a specific focus on integrated crop management, says Agrii R&D projects coordinator, Dr Francesca Salinari, who conducted the review.

“The review identified two decision support systems developed in the UK which could potentially provide the basis for a new support service. It also highlighted that the use of aphid count catches is a better system of monitoring than assessing aphid infestation on plants,” she explains.

This early research has already ►



John Holland explains that in field studies there were three and a half times as many aphids in the headlands compared with further within fields.



According to studies, aphid count catches bring a better system of monitoring than assessing aphid infestation on plants, says Francesca Salinari.

► identified some further research that needs to be carried out, points out Francesca. "The efficacy of yellow sticky traps as a means of providing field specific input on the initial migration of aphids into crops needs further evaluation. We also need to better understand how many plants become infected and how this relates to expected yield loss," she adds.

"The feasibility of using yellow sticky traps as a method of monitoring is

something which we've been looking at in the pilot project," says John. "We've then been using this local information in combination with the AHDB's BYDV management tool or Agrii BYDV Alert app (both use T-sums to predict the timing of pyrethroids) to control the spread of BYDV."

Locating traps

Sticky traps are already used for some crop pests, such as pollen beetle and carrot fly. Recent GWCT studies have found that using them located horizontally on the ground is an effective way of sampling winged cereal aphids.

Last autumn the sticky trap system was trialled by eight growers or agronomists to assess their practicality in a commercial situation. Two sticky traps were placed per field and growers were given a basic aphid identification guide, but no actual training was given.

"The farmers liked the sticky trap approach, though the practicalities of the system would need improvement if it were to be rolled out as a monitoring tool. The identification of different aphid species was found to be difficult so a better guide with high quality pictures or even a video would be needed," he comments.

Being able to correctly identify aphids is



Yellow sticky traps can be placed in crops, horizontally to the ground, to catch aphids as they're on the wing.

important. It's mainly the bird cherry-oat aphid (*Rhopalosiphum padi*) and grain aphid that carry the BYDV virus and these either migrate into the crop from surrounding habitats or survive from the previous crop on a green bridge.

One of the interesting findings of the study was the spatial variation of aphids within fields and, in particular, the influence the surrounding boundaries appears to have this, highlights John.

"We looked at grids of sticky traps across

Agronomists are dealing with risk

Agronomists are at the sharp end of BYDV management and spray decisions ultimately come down to risk, highlights Will Foss, technical adviser at Agrii.

"I totally agree that this sort of research is important to improve our understanding of the threat of BYDV and to ensure accuracy of advice to farmers and accuracy of use of foliar insecticides or adoption of cultural control techniques.

"We're all striving to improve the quality of crop production systems and the loss of neonicotinoids creates a particular challenge insofar as the risk of increased use of foliar insecticides could lead to negative impacts on beneficial insects and increased risk of pyrethroid resistance development in aphids," he says.

But Will also acknowledges that, when push comes to shove, growers need to protect their crops from BYDV. Any new decision support system will need to be shown to be robust before risking leaving a crop unprotected, he comments.

"If it's sufficiently accurate and robust then a decision support system should both prevent unnecessary use of foliar insecticides, but also correctly and adequately protect farmers'

yields and profits.

"The work so far highlights how complex a problem this is. Existing 'decision support systems' provide some idea of aphid movement i.e. Rothamsted suction trap network. But there are clearly holes within the network and it doesn't account for smaller scale landscape effects.

"This information when combined with crop observations by farmers/agronomists and TSum170 forecasting tools does help identify the need for and correct timing of any foliar insecticide spraying. It's proved to be an effective system to date," he says.

Will says the finding that the majority of aphids were found on the headland field edge is interesting but not entirely surprising.

"This can't be interpreted as headland spraying being the best course of action to limit aphid spread into the crop. It's not as straightforward as that. Many insecticides are not allowed to be legally used around the edge of the field either due to LERAP restrictions (adjacent to watercourses) but more importantly due to label restrictions protecting 'non-target arthropods' which precludes spraying within 5 or 6m of the edge of the crop.



Will Foss says growers shouldn't be tempted to spray headlands and breach any statutory buffer zone requirements because of the findings of the study.

Will is keen to see further research on timing of drilling as a management strategy for BYDV. "There's been a move towards later drilling to aid grassweed control but later drilling also tends to reduce the risk of BYDV, so this factor ought to be incorporated into thinking and future research."

two fields and found most of them landed around the field edges. Sticky traps were also deployed in over 60 fields with traps in the headland and at 70m from the crop edge. Where aphids were caught there were three and a half times as many in the headlands compared with numbers further within the fields.

"Aphids are weak fliers and it's likely they're deposited downwind of hedgerows/woodland edges by wind currents flying over them and down into the crop. This gave rise to a clear boundary effect, with more aphids found within 10m of landscape features such as hedges or woodland edges," he adds.

Other landscape factors influence the risk of BYDV, and these include uncropped land such as grassland, moorland and wasteland where virus levels are generally found to be higher than in areas where arable crops are dominant.

"Grasses, including maize, provide an alternative site for the BYDV vectors with a consequent increase in numbers. Traditionally western regions of the UK have been at higher risk of BYDV because there is more grassland than in the East, but a recent study in France has shown that having more maize in the landscape increases the numbers of aphids infesting wheat crops."

It's something to bear in mind as more maize is being grown for AD production in areas of the country where it hasn't previously been a part of the rotation, he suggests.

When it comes to the infectivity of aphids then the situation is no more clear-cut. John says an MSc student studied the percentage of aphids that were infected. Sampling was carried out at two sites and aphids weren't found to be



The bird cherry oat aphid is one of the main vectors of BYDV in cereal crops.

carrying BYDV at one site, yet at the other which was only two miles away, 5.4% were infected.

"Generally only a small proportion of the aphid population carry the virus. Many perennial and annual grasses are infected with BYDV, but wild grasses are generally considered to be a poor source of virus," he explains.

More work needs to be done to look at different tillage systems and their correlation with the likely infection of crops with BYDV. "In studies carried out in the 1990s, aphid colonisation was found to be less in min-till/no-till tillage systems. Aphids are attracted to the presence of the crop, so where crop residues are left on the soil surface it may make the new cereal crop less obvious to the aphids and they land elsewhere."

Current studies at GWCT are showing that the extra debris in min-till system may be providing opportunities for web-spinning spiders (eg *Linyphiidae*) that can help control aphid infestations, adds John.

"These predators are highly susceptible to autumn applied pyrethroids so any effect they have on aphid numbers is likely to be nullified where insecticide is applied for BYDV control."

Further evaluations of the current AHDB study results will compare the effects of different tillage practices on aphids and the natural enemies. In a new research call, issued by AHDB last month (July), aphid monitoring and decision support will be investigated further to help develop a simple risk-based decision support tool that can be used by farmers and agronomists to prioritise treatments and help them implement an IPM strategy.

According to Charlotte, the pilot work has laid the foundation for the development of more accurate decision-support tools.

"The information on virus levels is particularly novel. This autumn, we will



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work with Rothamsted Research and publish weekly information, via Aphid News, on the presence of BYDV in aphid samples collected from five suction traps.

"The new work will also look closely at the reasons behind the differences in aphid pressures, between and within fields, found in the pilot study. It will help us get a better handle on what causes the variability and put us one step closer to decision-support tools for targeted treatment." ■



Landscape features, such as hedges and woodland edges, create a 'boundary effect', where more aphids are deposited in crops on downward air currents.

Research roundup

AHDB Project No 21120077: 'Field monitoring of BYDV risk in winter cereals (pilot study)' runs from Oct 2018 to Sept 2019 at a cost of £60,000. It's led by Game and Wildlife Conservation Trust in partnership with Agrii.

This early work has just been followed by a call from AHDB for a further three-year project looking at 'Management of aphid and BYDV risk in winter cereals' which will receive funding of up to £190,000. Its primary objective is to improve

risk assessment methods for aphids and BYDV in winter cereals and investigate means of reducing this risk through integrated pest management.

The AHDB's BYDV management tool can be found at ahdb.org.uk/bydv

More Information on the management of viruses in cereals and oilseed rape can be accessed via ahdb.org.uk/co-aphids