Annual Project Report
September 2018 to June 2019

<table>
<thead>
<tr>
<th>Project title</th>
<th>Field monitoring of BYDV risk in winter cereals (pilot study)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project number</td>
<td>21120077</td>
</tr>
<tr>
<td>Start date</td>
<td>1 October 2018</td>
</tr>
<tr>
<td>End date</td>
<td>30 September 2019</td>
</tr>
</tbody>
</table>

**Project aim and objectives**

Barley yellow dwarf virus (BYDV) is mainly transmitted to cereals in the autumn by aphids (bird cherry–oat aphids and grain aphids). These migrate into the crop from surrounding habitats or the previous crop, via a ‘green bridge’. Secondary spread by wingless aphids is responsible for BYDV incidence within the crop and is strongly correlated with accumulated temperature (the number of day degrees).

Following the withdrawal of three neonicotinoid seed dressings in December 2018, there is likely to be greater use of foliar applications of pyrethroid insecticides. With resistance to pyrethroids already present in grain aphids, it is vital a monitoring system is developed quickly to optimise pesticide use as part of an integrated pest management (IPM) programme.

The project will:

- Assess the feasibility of developing a field-specific decision-support system for BYDV
- Evaluate the use of field-specific monitoring methodology for aphid vectors of BYDV and the use of a degree day tool to predict spray timings and BYDV infection levels
- Test whether landscape composition, aspect and type of tillage affect immigration of aphids
- Provide key messages on BYDV management
- Provide recommendations on further research needed to develop field-specific monitoring and a decision-support system

**Key messages emerging from the project**

An online survey (182 respondents) revealed that 47% of farmers and 29% of agronomists relied on seed dressings alone to protect cereals and will now most likely use foliar sprays.

Drilling date and assessments of aphids on plants are the most commonly used methods to guide spray decisions. Agronomists also often used temperature summation (Tsum) models.

The results described in this summary report are interim and relate to one year. In all cases, the reports refer to projects that extend over a number of years.

While the Agriculture and Horticulture Development Board seeks to ensure that the information contained within this document is accurate at the time of printing, no warranty is given in respect thereof and, to the maximum extent permitted by law, the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document. Reference herein to trade names and proprietary products without stating that they are protected does not imply that they may be regarded as unprotected and thus free for general use. No endorsement of named products is intended, nor is any criticism implied of other alternative, but unnamed, products.

AHDB Cereals & Oilseeds is a part of the Agriculture and Horticulture Development Board (AHDB).
Both the online survey and farmer feedback from testing a sticky trap system confirmed the need for a farm/field-based monitoring system.

Field trials that used sticky traps consistently recorded considerable variation in the levels of immigrating cereal aphids, within and between fields, supporting the need for a local monitoring system.

Between fields, the extent of variation was very high. No or very few aphids were found within 80% of the fields. Of the remainder, some fields had far higher levels. Further data analysis may help reveal what drives such variation. Previous work indicates this is likely to be due to the surrounding land-use or distance from the coast.

Within fields, on average, 3.5 times more cereal aphids were caught on sticky traps located in the headland (5m from crop edge) compared to the mid-field (70m from crop edge).

Natural enemies caught on sticky traps were primarily spiders and parasitic wasps (>95%). Both of these groups are highly susceptible to pyrethroid insecticides. Selectively spraying areas of the crop would help reduce insecticide usage and protect natural enemies.

A student project revealed that the proportion of aphids carrying BYDV was 5.4% at one site but 0% at another site only 2.5km away. The levels are in agreement with previous studies and, given the variability over such a short distance, indicate that there is little benefit in widespread virus testing.

Aphids captured on the sticky traps can be used for virus testing but collection within a week is recommended.

The sticky trap system was popular but needs to be improved. In particular, better training and a guide (including aphid identification) is required to ensure accurate results are obtained. The system is probably better suited for use by agronomists.
Summary of results from the reporting year

A online survey was carried out to capture the most common practices for aphids and BYDV management adopted prior to the withdrawal of neonicotinoids seed treatment in winter cereals and what further support will be needed following the ban.

The survey was completed by 182 people (60% agronomists and 40% farmers or farm managers).

Those who solely relied upon the insecticide coated seed to provide protection against aphids (47% of farmers and 29% of agronomists) will be the most affected by the ban. These respondents will have to either adapt their practice or accept the risk of previously unexperienced level of yield loss due to BYDV.

Among those who already based their aphid control strategy on insecticide foliar applications, the most common criteria for deciding if and when to spray were the drilling date and aphids seen on crops. Agronomists also frequently relied on the crop phenological stage and the temperature summation (TSum) threshold (i.e. the Agrii BYDV App and the AHDB BYDV management tool).

In terms of decision support, the survey showed that there is a high potential for adoption of a tool that integrates field risk factors with current and refined practices, such as the use of weather data and monitoring at field and wider scales.

A literature search aimed to identify the potential for applying or adapting decision support tools. These were evaluated in relation to the nature of their input, output and readiness to application. Based on the preliminary results of this project, attention focused on models that used input information from either suction traps or traps in a local field.

The sticky trap system was tested by eight farmers/agronomists across England. The sticky trap approach was liked, although the practicalities of the system would need improvement for widespread use. In particular, better aphid identification guidance is needed. The farmers recognised the need for field-specific monitoring and stated they would be willing to use sticky traps in at least four fields on their farms. The approach raised awareness about how variable aphid levels could be. In three cases, farmers reduced insecticide usage based on the numbers seen in traps.
Across all traps, where sampling was conducted in the headland (5m from crop edge) and mid-field (70m from crop edge), there were 3.5 times as many cereal aphids on sticky traps located in the headland compared to the mid-field area. The trend occurred for all three aphid species monitored: grain aphids, bird cherry–oat aphids and rose–grain aphids. Natural enemy numbers were 1.8 times greater in the headland.

The number of aphids captured on the sticky traps varied hugely between fields, even on the same farm. Of the 48 fields with headland areas, for which we had data from early to mid-November, no aphids were captured in 16% of the fields, <5 per trap per day were caught in 64% and 19% had >5 per trap per day. From mid-November to early December, the same proportion had no aphids, 83% had <5% and none had over this level. In the mid-field areas there were fewer aphids, with 24% having no aphids for both periods, 72% having less than 5% and only 4% having >5, but only early to mid-November.

Aphids from two of the farms with the highest levels of aphids were tested to determine whether they were carrying BYDV. The tests were conducted by Lucy Bates, a MSc student at Harper Adams University, using the latest PCR-based approach developed at Rothamsted Research. At one field, 5.4% of aphids carried the BYDV virus, while at the other, which was 2.5 km away, none was carrying it. These findings are in agreement with previous UK studies conducted in the 1990s and funded by MAFF & HGCA (HGCA Report 205).

The natural enemies were from two main groups – spiders and parasitic wasps. In the headland-located sticky traps, 76% were parasitic wasps and 19% spiders, whereas mid-field there were more spiders (38%) compared to parasitic wasps (59%).
Has your project featured in any of the following in the last year?

<table>
<thead>
<tr>
<th>Events</th>
<th>Press articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation and farm walk, CFE event on &quot;Boosting Beneficials&quot; 8 July 2019, Silchester, Berkshire.</td>
<td></td>
</tr>
<tr>
<td>Farm walk, CFE event on “Beneficial Insects” 9 July 2019, Gringley on the Hill, Doncaster.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conference presentations, papers or posters</th>
<th>Scientific papers</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Other</th>
</tr>
</thead>
</table>