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Arable Update

Cereals: Issue 237

Understanding barley yellow dwarf virus (BYDV)

Background

BYDV is a complex, aphid-transmitted disease that poses significant risks to cereal production in New Zealand. The greatest damage occurs when infection happens early in crop development. Because aphids and alternative hosts are widespread, eradication is not feasible—but risk can be significantly reduced through timing, monitoring, and integrated management practices.

BYDV is part of a broader group known as Yellow Dwarf Viruses (YDV), which affect cereals and grasses. These viruses belong to different families:

- BYDV – *Luteovirus* family.
- Cereal Yellow Dwarf Virus (CYDV) – *Polerovirus* family.
- Maize Yellow Dwarf Virus (MYDV) – *Polerovirus* family.

Key points

- BYDV is a complex, aphid-transmitted disease that poses significant risks to cereal production.
- The impact of BYDV depends on timing of infection and crop growth stage.
- Because aphids and alternative hosts are widespread, eradication is not feasible.
- Management requires an integrated approach rather than reliance on a single tactic.

Why is BYDV a problem?

BYDV is a problem because it reduces plant vigour and tillering leading to patchy crops and uneven development. Symptoms often include yellowing or reddening of leaves, depending on crop type, and these symptoms can result in yield loss. Yield losses are likely to be higher in crops where infection occurs early, as early infection prevents the plant from photosynthesising effectively.

The only way to confirm BYDV is using real-time PCR. Testing is retrospective. It will determine whether BYDV was present and the virus strain. It does not provide a means to manage BYDV in subsequent seasons.

BYDV transmission

BYDV is transmitted by aphids. The main aphid species transmitting BYDV in New Zealand are bird cherry–oat aphid (*Rhopalosiphum padi*) and rose grain aphid (*Metopolophium dirhodum*).

Infection occurs in two ways. Primary infection is carried into the crop by winged aphids flying into crops carrying the virus, while secondary infection is spread by aphid offspring within the crop.

Winged aphids migrate into crops from surrounding grasses and crops, establishing colonies of wingless aphids. When plants become overcrowded or unsuitable, new winged aphids develop and disperse to new hosts.

The peak times for aphid flights are autumn (mid-March to mid-June) and spring (September to November). These flights establish new aphid colonies, which can survive through mild winters and drive secondary spread of BYDV in autumn-sown cereals.

Temperature thresholds

Aphid populations can persist year-round if temperatures allow, resuming activity once conditions improve (Figure 1).

- Aphid flight: 14–15°C (affected by humidity and wind)
- Virus transmission: stops below 12°C
- Aphid development: 5.8°C

Do all aphids carry BYDV?

No. Aphids are not born carrying the virus. They must feed on infected plants to acquire BYDV and the virus is not transmitted to their offspring. International data suggests less than 30% of aphids typically carry the virus. However, infection rates vary depending on aphid species, the season and crop proximity to grasses or infected hosts.

Interestingly, virus-free aphids may preferentially settle on infected plants. Because New Zealand data is limited, tools like Aphid Chat take a precautionary approach and assume all detected aphids are potentially infected.

Where does BYDV come from?

BYDV affects a wide range of crops and grasses. Primary hosts include wheat, barley, oats, rye and triticale. Alternative, or green bridge hosts include grasses (including weeds), volunteer cereals, maize and some cover crops.

These hosts allow the virus and aphids to persist between seasons, maintaining continuous infection pressure in agricultural systems (Figure 2).

BYDV risk periods and risk factors

The impact of BYDV depends heavily on timing of infection and crop growth stage. Infections early in the crop's life cycle cause the greatest yield loss. Critical growth stages:

- Highest risk: Emergence to early tillering (GS 11–21)
- Moderate risk: Up to GS 31
- Low risk: After GS 31

Other factors which impact on the risk and severity of BYDV spread include the proportion of infected plants, the duration and intensity of autumn aphid flights, the percentage of aphids carrying BYDV, the specific virus strain and sowing date. Earlier sowing generally increases the risk of exposure.

Managing BYDV

BYDV is particularly difficult to manage as it can be hard to identify (symptoms may be confused with other diseases or nutrient deficiencies), and infection is often invisible before damage occurs. The mobility of its aphid vectors and its ability to persist year-round in alternative hosts compound these problems. Management requires an integrated approach rather than reliance on a single tactic. Key management practices include:

Sowing date management

Avoid early sowing of autumn crops where high aphid pressure is expected. Later sowing reduces exposure to autumn aphid flights.

Crop planning and green bridge control

Look at your crop rotation to reduce in-field inoculum sources and remove any volunteer cereals and grass weeds before sowing to help break the virus lifecycle between seasons.

Monitor aphid activity

Walk and search your crop for aphids and use tools like Aphid Chat to help track flight timings and infection risk periods.

Insecticide use

Seed treatments or foliar sprays may be used strategically.

Van den Eynde, R, Van Leeuwen, T, Haesaert, G. 2020. Identifying drivers of spatio-temporal dynamics in barley yellow dwarf virus epidemiology as a critical factor in disease control. *Pest Management Science* 76: 2548-2556. https://doi.org/10.1002/ps.5851

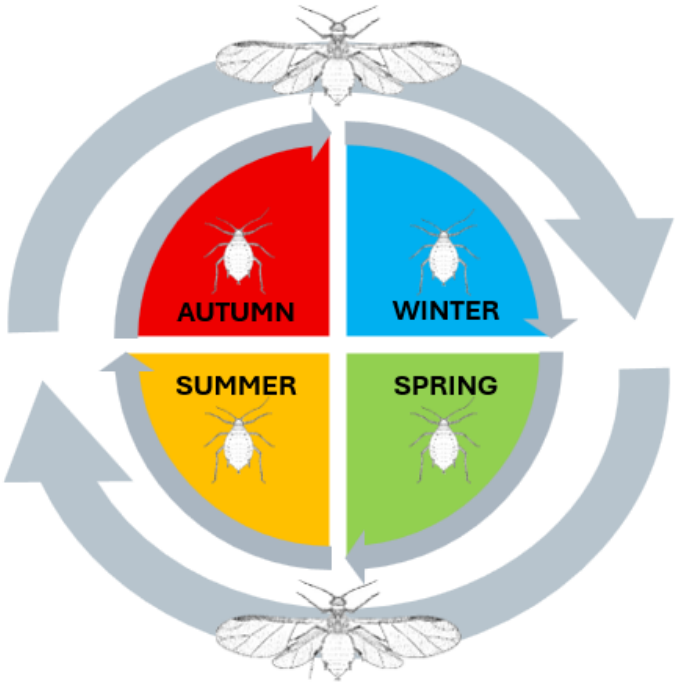


Figure 1. Life cycle of the bird cherry oat aphid, *Rhopalosiphum padi*.

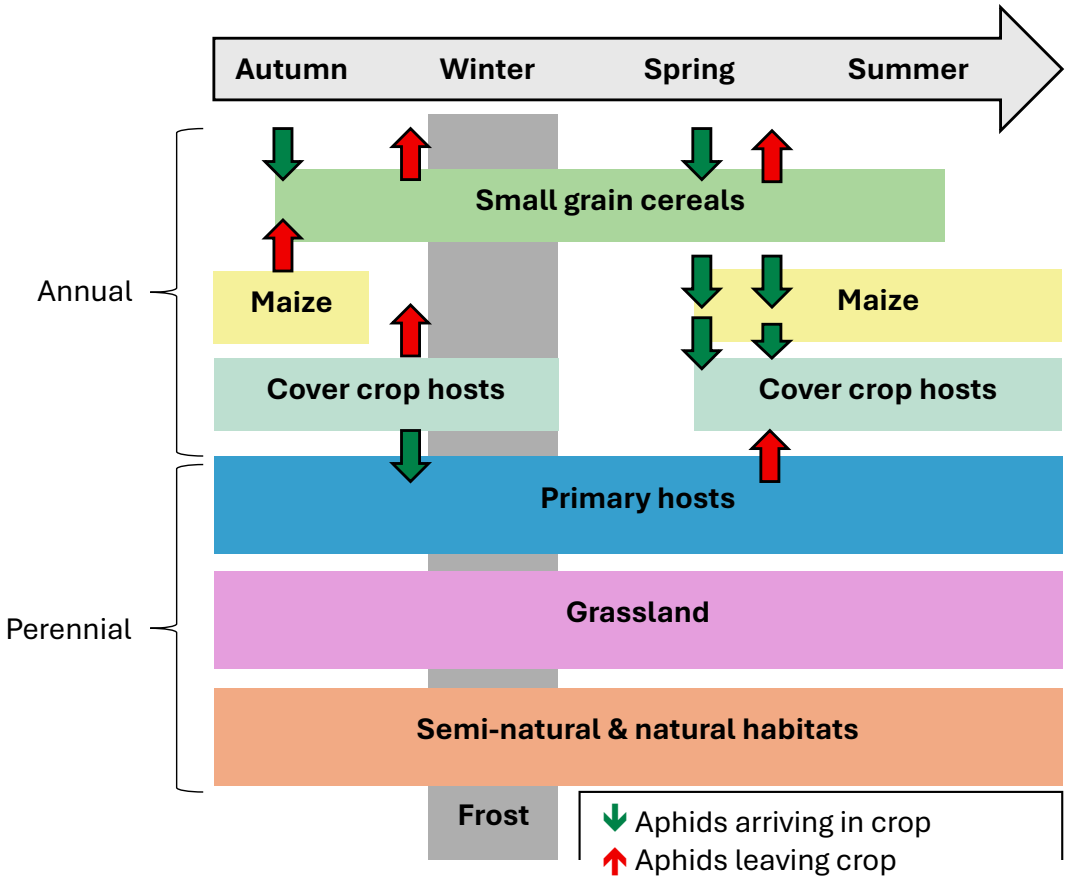


Figure 2. Overview of the hosts of cereal aphids throughout the year. At different times cereal aphids migrate from one host to another. The green arrows show when aphids enter and leave a host crop. Adapted from Van den Eynde *et al.* 2020.

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