

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.

BYDV is transmitted by aphids. Infection occurs in two ways:

- Primary infection: when winged aphids fly into crops carrying the virus.
- Secondary infection: when aphid offspring spread the virus within the crop.

BYDV vectors

The main aphid species transmitting BYDV in New Zealand are:

- Bird cherry-oat aphid (*Rhopalosiphum padi*).
- Rose grain aphid (*Metopolophium dirhodum*).

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.

Flight patterns

- Autumn peak: mid-March to mid-June.
- Spring peak: 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 flight: 14–15°C (affected by humidity and wind).
- Virus transmission: stops below 12°C.
- Aphid development: 5.8°C.

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

Do all aphids carry BYDV?

No. Aphids are not born carrying the virus.

- Aphids must feed on infected plants to acquire BYDV.
- Virus is not transmitted to offspring.
- International data suggests less than 30% of aphids typically carry the virus.

However, infection rates vary depending on:

- Aphid species.
- Season.
- Proximity to grasses or infected hosts.

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.

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

BYDV hosts

If aphids aren't born carrying the virus, where does it 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).

When are the risk periods?

The impact of BYDV depends heavily on timing of infection and crop growth stage. Critical growth stages:

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

Infections early in the crop's life cycle cause the greatest yield loss.

Other key risk factors

- Proportion of infected plants.
- Duration and intensity of autumn aphid flights.
- Percentage of aphids carrying BYDV.
- Virus strain.
- Sowing date (earlier sowing generally increases exposure risk).

Why is BYDV a problem?

- Reduces plant vigour and tillering.
- Leads to patchy crops and uneven development.
- Symptoms often include yellowing or reddening of leaves, depending on crop type.
- These symptoms can result in yield loss, particularly from early infection, as it prevents the plant from photosynthesising effectively.

The virus is particularly difficult to manage because:

- It can look like other diseases or nutrient deficiencies.
- It relies on mobile aphid vectors.
- It persists in alternative hosts year-round.
- Infection is often invisible before damage occurs.

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.

Can BYDV be managed?

Yes, but management requires an integrated approach rather than reliance on a single tactic.

Key strategies include:

1. Sowing date management

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

2. Green bridge control

- Remove volunteer cereals and grass weeds before sowing.
- Break the virus lifecycle between seasons.

3. Monitoring aphid activity

- Crop walking or use tools like Aphid Chat.
- Aphid Chat can help track flight timing and highlight infection risk.

4. Insecticide use

- Seed treatments or foliar sprays may be used strategically.

5. Crop and paddock planning

- Consider crop rotation to reduce inoculum sources.

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>.

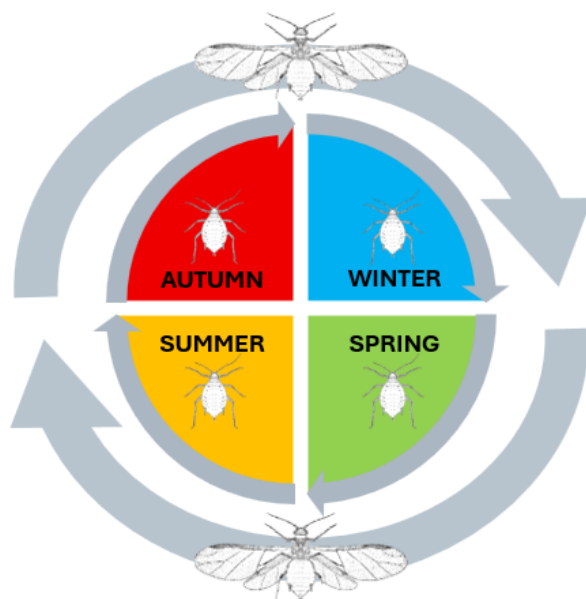


Figure 1. Life cycle of the bird cherry oat aphid, *Rhopalosiphum padi*.

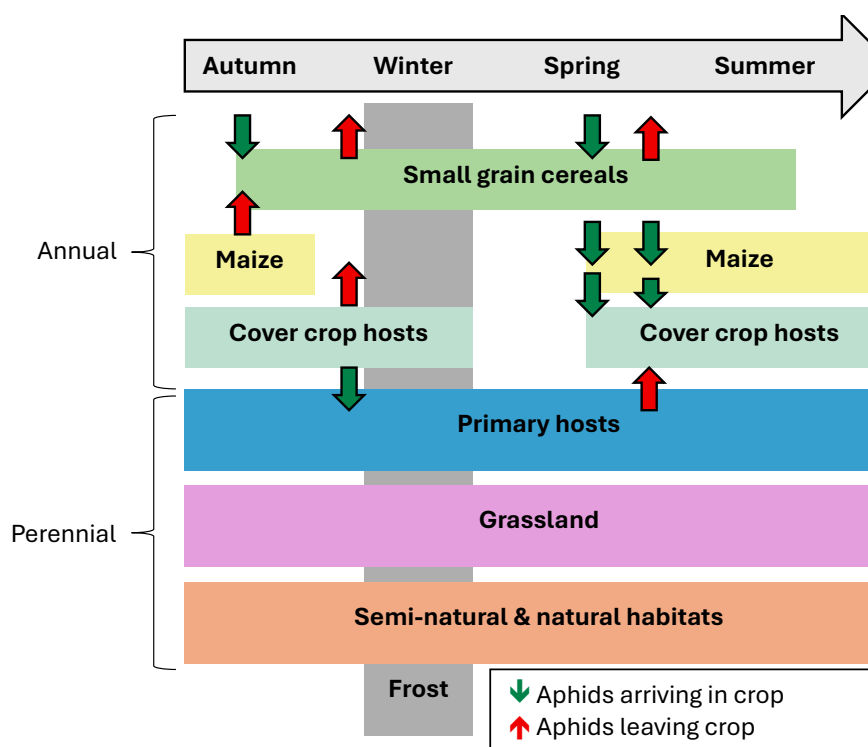


Figure 2. Overview of the hosts of cereal aphids throughout the year. At different times cereal aphids migrate from one host to another. The green arrows show when aphids enter and leave a host crop. Adapted from Van den Eynde *et al.* 2020.

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