

APHIDS AND VIRUSES IN PULSE CROPS **FACT SHEET**

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Integrated control of aphids is required to minimise the virus risk in pulses

Aphids can damage crops by spreading viruses or causing direct damage when feeding on plants. Feeding damage generally requires large populations, but virus transmission can occur before aphids are seen to be present. Pre-emptive management is required to minimise the risk of aphids and their transmission of viruses.

KEY POINTS

- Viruses are widespread in pulse, cereal and oilseed crops throughout southern and western Australia and can cause significant economic losses, especially when extensive infection occurs in early crop growth.
- Aphids are the principal, but not sole, vectors of viruses in crops; some are also transmitted in seed.
- A few aphids can cause substantial damage if they are spreading viruses, especially early in the season. It takes large numbers of aphids to damage crops by direct feeding.
- Different aphid species transmit different viruses to particular crop types; species identification is important because management strategies can vary.
- Pulses are annual crops – aphids and the viruses they spread have alternative hosts between seasons.
- Aphid population development is strongly influenced by local conditions. Early breaks and summer rainfall favour early increases in aphids and volunteers that host viruses, resulting in a higher level of virus risk.
- Integrated management practices that aim to control aphid populations early in the season are important to minimising virus spread.



Killing the green bridge minimises host plants for viruses and aphids. Sowing into stubble, ideally inter-row, reduces the bare soil that is attractive to some aphids. Both of these are important practices to prevent young crops being infected by viruses introduced by aphids.

Virus damage in pulses can result in reduced yield and seed quality. To minimise virus damage in pulse crops it is important to control the spread of aphids.

Early season rainfall can trigger the germination and growth of weeds and volunteers that provide food and refuge for aphids and can act as a source of viruses. The source of viruses is likely to be greater if last year's crops were infected. The extent of the early build-up of aphid populations determines the level of seasonal risk. Diseased seed is another source of some viruses.

Using an integrated approach to both aphid and virus management is needed to reduce the risk of yield loss.

About aphids

Aphids are small, soft-bodied insects that grow up to 4 millimetres in length. Adult aphids can be winged or wingless – all immature aphids are wingless.

There are at least 18 aphid species found in broadacre crops across southern Australia, but not all of these are of economic importance to broadacre agriculture.

Some aphid species will colonise individual plants, while other aphid species will move through a crop and be very difficult to detect (see Identification).

Aphids' ability to infect a plant with a virus depends on the combination of aphids and virus (Table 1).

Aphid identification



PHOTO: SARDI

GREEN PEACH APHID (*Myzus persicae*)

Typically a pale green colour and found on the underside of older leaves. They cause less direct feeding damage than other aphid species. Green peach aphids spread relatively uniformly through a crop. They primarily attack canola, lupins and some other pulse crops.



PHOTO: DAFWA

PEA APHID (*Acyrtosiphon pisum*)

About 4mm long, pea aphids can be green, yellow or pink and have black knees and dark joints on their antennae. They attack faba beans, field peas and lucerne, but are often absent from pea crops.



PHOTO: SARDI

COWPEA APHID (*Aphis craccivora*)

Charcoal grey through to shiny black in colour, with black and white banded legs. These aphids tend to colonise single plants or groups of plants in hot spots within a crop, infesting the growing points. Cowpea aphids primarily attack medics, lupins, faba beans, lentils and vetch.



PHOTO: SARDI

BLUEGREEN APHID (*Acyrtosiphon kondoi*)

Bluish green in colour, they grow to approximately 3mm long. These aphids spread more evenly over a crop than cowpea aphids. Sometimes certain plants will host a heavy population of these aphids, while nearby plants may only have a few. They primarily attack annual medic and subclover pastures, lupins and lucerne.

Other aphids – such as corn aphid (*Rhopalosiphum maidis*), oat aphid (*Rhopalosiphum padi*), and rose-grain aphid (*Metopolophium dirhodum*) – are found in cereal crops and pasture grasses where they can cause substantial damage by spreading viruses such as the barley yellow dwarf virus. Cabbage aphid (*Brevicoryne brassicae*) and turnip aphid (*Lipaphis erysimi*) are frequently associated with feeding damage on canola.

Management strategies can vary depending on the aphid species and the virus it is carrying (see Management strategies).

Aphids can spread viruses persistently or non-persistently. Once an aphid has picked up a persistently transmitted virus – for example, beet western yellows virus (BWYV) – it carries the virus for life, infecting every plant where it feeds on phloem. Aphids carrying non-persistently transmitted viruses, such as cucumber mosaic virus (CMV), carry the virus temporarily and only infect new plants in the first one or two probes.

Important vectors for non-persistent viruses in pulse crops include green peach aphid, pea aphid, cowpea aphid and bluegreen aphid, which will colonise pulse crops. Turnip aphid, maize aphid and oat aphid, which are non-colonising species, will move through pulse crops, probing as they go and potentially spreading viruses.

Green peach aphid and pea aphid are also important in spreading persistently transmitted viruses, depending on the virus involved (Table 1).

If seed or host plants infected with viruses are not present, then aphids will only cause damage by direct feeding on sap and nutrients. This leads to wilting and yellowing of

plants and the secretion of honeydew, which supports secondary growth of sooty mould. These symptoms can help early identification of aphid hot spots in a crop.

Lifecycle

Aphids reproduce very quickly, giving birth to live young, and have winged (alate) and wingless (apterous) adult forms.

Over summer, aphids survive in low numbers on alternative host plants such as weeds and volunteer grasses along roadsides. A wet summer or irrigated crops will mean more green plants and larger populations of aphid surviving between winter growing seasons.

Hot dry summers and late breaks with cooler weather can lower the risk of autumn aphid infestations in newly sown crops.

Pre-season rainfall and availability of a green bridge of weeds and volunteers will favour an early increase in aphids, and these plants may also host viruses. The extent of this early build-up determines the level of seasonal virus risk.

Aphid migration starts in autumn when winged aphids fly into crop edges and start colonies of wingless aphids. Cold winter conditions slow reproduction until spring, when reproduction is rapid, leading to population outbreaks.

When host plants die, become unsuitable or overcrowded, aphids develop winged forms and migrate to other crops.

During heavy infestations, plants can be covered with white cast-off aphid skins.

TABLE 1 Transmission of one persistent and two non-persistent viruses by four aphid species.

Aphid species	Cucumber mosaic virus (non-persistent)	Pea seed-borne mosaic virus (non-persistent)	Beet western yellows virus (persistent)
Green peach aphid	✓	✓	✓
Pea aphid	✓	✓	
Cowpea aphid	✓	✓	✓
Bluegreen aphid	✓		

Viruses

Viruses transmitted by aphids to pulse crops occur in all rainfall environments, but not all are economically important.

The main non-persistently transmitted viruses are:

- cucumber mosaic virus (CMV);
- bean yellow mosaic virus (BYMV);
- alfalfa mosaic virus (AMV) and;
- pea seed-borne mosaic virus (PSbMV).

The main viruses transmitted persistently are:

- beet western yellows virus (BWYV) and;
- bean leaf roll virus (BLRV).

The same virus can infect several different species of pulses (Figure 1).

During summer and autumn, viruses survive in alternate host plants such as weeds, pasture legumes, lucerne and self-sown pulses.

Viruses are spread by aphids whenever they are moving in crops. Often the most significant spread coincides with a build-up of aphid populations before sowing and the early movement of winged aphids into young crops.

Some viruses are able to survive in pulse seed, which can create a source of infection within a crop. CMV, BYMV, AMV and PSbMV can all be transmitted by infected pulse seed.

The transmission rate of viruses from seed to seedlings varies widely depending on the virus and crop type. Up to 75 per cent transmission rates have been reported for CMV in lupins and PSbMV in peas.

All seed samples should be tested to determine if they are infected with virus.

A threshold of less than 0.1 per cent seed infection is recommended for sowing in high-risk areas, and less than 0.5 per cent seed infection for sowing in low-risk areas. The threshold with PSbMV in field peas is less than 0.5 per cent in high-risk areas.

BWYV and BLRV are not seed borne and can only be introduced to crops from external sources by aphid transmission.

Virus damage

Virus symptoms vary widely depending on the virus and crop combination. Symptoms range from mild mosaicing and yellowing to severe leaf deformation, wilting and stunting.

Plants can suffer up to 100 per cent yield loss from virus infection, especially if infected early in the season – usually within the first 10 weeks of emergence. Overall, crop loss is dependent on the growth stage at infection and the number of plants infected. Early and widespread infections result in the greatest losses.

Pulse crops damaged by viruses develop few and smaller seeds with reduced seed quality. Pea seed-borne mosaic virus discolours seed.

If a virus is introduced at low levels and late in the season, visible symptoms and yield reduction are unlikely. However, these visually non-detectable levels of infections can contribute to seed infection with viruses such as CMV, BYMV, AMV and PSbMV.

Virus transmission in chickpeas differs from other pulse crops, as the crop is not colonised by aphids. Winged aphids will move through a chickpea crop and probe individual plants while looking for a suitable host, leading to considerable virus spread throughout the crop.

Management strategies

An integrated management approach should be taken to reduce the risk of virus transmission by aphids.

Early monitoring of target crops for aphids is of limited benefit for virus control for two reasons. Firstly, non-colonising aphids may be involved and, second, even when colonising aphids are involved, critical early virus spread tends to occur before enough aphids are present to be observed.

Sticky traps might assist in identifying early aphid activity, as well as the presence of beneficial insects.

Beneficial insects – including hover flies, lacewings, ladybirds and parasitic wasps – will attack aphids and assist in preventing aphid levels from increasing. Beneficial insects can help reduce virus spread and spring feeding damage, but some virus spread will have occurred before aphid numbers subside.

The risk of non-persistently transmitted viruses can be reduced by an integrated disease management approach applied prior to seeding that includes a range of crop hygiene and management measures.

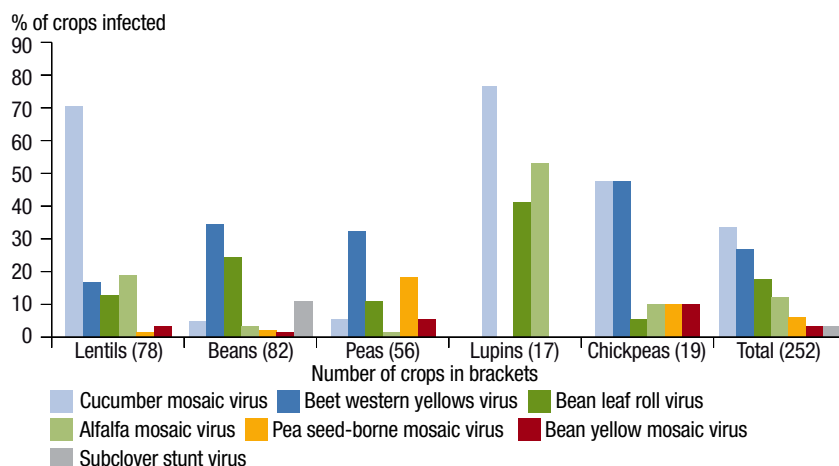
Insecticide applied as seed dressings will help control aphid attack and the spread of viruses.

Foliar insecticides applied soon after crop emergence can help control persistently transmitted viruses, but are of little benefit against non-persistently transmitted viruses. Preferably use a 'soft' insecticide, such as pirimicarb (registered for lupins only), that targets the aphids and leaves beneficial insects unharmed.

Integrated management to minimise virus transmission

- Minimise the pool of potentially virus-infected plant material near crops by controlling the green bridge of weeds, pastures and volunteer pulses that can harbour viruses and aphids over summer or between crops. This includes weeds around dams, tracks and the margins of crops.

FIGURE 1 An example of the level of viruses in different pulse crops. This data is for pulse crops grown in South Australia between 2001 to 2009



SOURCE: DPI VIC

- Source clean seed and test retained seed for viruses including CMV, BYMV, AMV and PSbMV. Sow tested seed with less than 0.1 per cent virus infection to reduce the pool of virus-infected material. Field pea seed should have less than 0.5 per cent PSbMV.
- Some varieties have virus resistance. Resistance to CMV seed transmission has been bred into many new lupin varieties including Jenabillup[®]. Yarrum[®] field pea has resistance to BLRV and PSbMV. Pulse Breeding Australia (PBA) is increasing its emphasis on developing pulse crop lines with increased virus resistance. Fabia bean lines with resistance to BLRV and field peas with resistance to BLRV and PSbMV have been identified and should be commercially available in the future.
- Some species of aphids are attracted to areas of bare earth. Use minimal tillage and sow into retained stubble, ideally inter-row to discourage aphid landings. This applies especially to minimising CMV spread in lupins.
- Consider using neonictinoid (Gaucho 350SD) insecticide seed

dressing on susceptible crops to prevent aphids attacking emerging crops and spreading the persistently transmitted viruses BLRV and BWYV early in the season.

- Alternatively, a foliar insecticide can be applied early based on forecast reports of the degree of risk. Preferably use a 'soft' insecticide, such as pirimicarb (registered for lupins only), that targets the aphids and leaves beneficial insects unharmed. There is debate over the use of synthetic pyrethroids (SP) as a foliar application – it is recommended to prevent BLRV transmission as it has so called 'anti-feed' properties that prevent early colonising of crops by pea aphids. However, discouraging colonisation may increase the spread of aphids and, potentially, virus through a crop.
- SP insecticides should not be used to control green peach aphid, an important vector of BWYV, as most populations of green peach aphid are resistant to this insecticide.
- Monitor crops and neighbouring areas regularly. Identify the species of aphid present and their numbers.

Control the aphids if virus spread and direct feeding damage is of concern.

Controlling direct feeding damage

Monitoring crops for direct feeding damage can be worthwhile. There is limited threshold information on aphid numbers to determine whether it is economically worthwhile to apply insecticides to prevent damage caused by feeding. Research in WA suggests spraying if more than 30 per cent of lupin growing tips are colonised by aphids from the flower bud stage through to podding, especially in aphid-susceptible varieties. Thresholds should only be considered as a guide as many factors influence the economics of spraying.

Routine spraying of SP insecticides should be avoided as repeated applications of these insecticides can result in resistance developing in other aphid species and will also kill many natural insect predators. A 'soft' insecticide such as pirimicarb (registered for lupins only), is an option for controlling direct feeding damage when aphid populations are increasing.

Useful resources:

- **Pulse Australia agronomists** www.pulseaus.com.au
- **Jenny Davidson, SARDI 08 8303 9389**
Email jenny.davidson@sa.gov.au
- **Kym Perry, SARDI 08 8303 9370**
Email kym.perry@sa.gov.au
- **Paul Umina, CESAR 03 9329 8817**
Email pumina@unimelb.edu.au
- **Ground Cover Direct** www.grdc.com.au/bookshop
free phone 1800 11 00 44
 - *Crop Insects: the Ute Guide – southern grain belt edition*
 - *Crop Insects: the Ute Guide – western grain belt edition*
 - *Back Pocket Guide to Beneficials*
 - *Lentils: the Ute Guide*
 - *Faba Beans: the Ute Guide*
 - *Field Peas: the Ute Guide*
 - *Winter Pulse Disorders: the Ute Guide*
- **GRDC Pest Links** www.grdc.com.au/pestlinks

- **Other related GRDC Factsheets** www.grdc.com.au/factsheets
- **CESAR Consultants** www.cesarconsultants.com.au/services/agriculture
- **Integrated Pest Management for Crops and Pastures (2008)**, Paul Horne and Jessica Page, Landlinks Press – copies available at www.ipmtechnologies.com.au
- **Virus control in chickpea – special considerations and Virus management in pulses** www.pulseaus.com.au
- **For insecticide registration:** www.apvma.gov.au/pubcris
- **Pest Genie** www.pestgenie.com.au
- **Seed testing laboratories**
 - SARDI Field Crops Pathology 08 8303 0360
 - TASAG ELISA and Pathology Testing Service 03 6233 6845
 - AgWest Plant Laboratories 08 9368 3721
 - Agrifood Technology 03 9742 0555
 - CASCO Agritech 07 4633 0599

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