SOUTHERN
SEPTEMBER 2018

GRDC GROWNOTES™

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

BARLEY

SECTION 7

INSECT CONTROL

INTEGRATED PEST MANAGEMENT | APHIDS | ARMYWORM | HELICOVERPA SPP. | BLUE OAT MITE (PENTHALEUS SPP.) | LUCERNE FLEA (SMINTHURUS VIRIDIS) | NGA TRIALS—MANAGING APHIDS

SECTION 7

Insect control

Insect and other arthropod pests that can pose a problem include blue oat mite (*Penthaleus* spp.), redlegged earth mite (*Halotydeus destructor*), *Bryobia* mites (*Bryobia* spp.), *Balaustium* mite, cutworms, aphids, earwigs, armyworms, *Helicoverpa* spp., pasture webworm, pasture cockchafers, grass anthelids, lucerne flea (*Sminthurus viridis*), leaf hoppers, slugs, snails, millipedes, slaters and locusts (Tables 1 and 2). Mice may also cause damage.

For current chemical control options, refer to the Pest Genie or Australian Pesticides and Veterinary Medical Authority (APVMA) websites. [1]

Table 1: Pests that pose a risk to cereal crops [2]

High risk	Moderate risk	Low risk
Soil insects, slug and snails		
Some crop rotations increase the likelihood of soil insects: • cereal sown into a long-term pasture phase • high stubble loads • above-average rainfall over summer–autumn • history of soil insects, slugs and snails Summer volunteers and *Brassica* weeds will increase slug and snail numbers Cold, wet establishment conditions expose crops to slugs and snails	Information on pest numbers prior to sowing from soil sampling, trapping and/or baiting will inform management Implementation of integrated slug management strategy (burning stubble, cultivation, baiting) where there is a history of slugs Increased sowing rate to compensate for seedling loss caused by establishment pests	Slugs and snails are rare on sandy soils
Earth mites		
Cereals adjacent to long-term pastures may get mite movement into crop edges Dry or cool, wet conditions that slow crop growth increase crop susceptibility to damage History of high mite pressure	Leaf curl mite populations (transmitters of *Wheat streak mosaic virus*) can be increased by grazing and mild wet summers	Seed dressings provide some protection, except under extreme pest pressure
Aphids		
Higher rainfall areas where grass weeds are present prior to sowing—higher risk of *Barley yellow dwarf virus* transmission by aphids Wet summer and autumn promoting survival of aphids on weed and volunteer hosts	Wet autumn and spring promote the growth of weed hosts; when weed hosts dry off, aphids move into crops Planting into standing stubble can deter aphids landing Use of seed dressings can reduce levels of virus transmission and delay aphid colonisation Use of SPs and OPs to control establishment pests can kill beneficial insects and increase the likelihood of aphid survival	Low-rainfall areas—lower risk of BYDV infection High beneficial activity (not effective for management of virus transmission)
Armyworms		
Large larvae present when the crop is at late ripening stage	High beneficial insect activity (particularly parasitoids) Rapid crop dry-down	No armyworm present at vegetative and grain-filling stages

1 DAF Qld (2012) Insect pest management in winter cereals. Department of Agriculture and Fisheries Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/ipm-information-by-crop/insect-pest-management-in-winter-cereals

2 NIPI. Winter cereals. NIPI IPM guidelines, http://ipmguidelinesforgrains.com.au/crops/winter-cereals/

More information

cesar: Insect gallery

NIPI: Insect identification aids

GRDC Update Papers: Don't forget the good guys—recognising and identifying beneficial insects in your paddock

cesar: PestFacts: Grass anthelids

GRDC Ute Guides: Insects

GRDC Update Papers: Insect pests—resistance, virus vectors and lessons from 2014

Table 2: Incidence of pests of winter cereals [3]

Present, present in crop but generally not damaging; Damaging, crop susceptible to damage and loss; snails are also a grain contaminant at harvest

	Crop stage			
	Emergence	**Vegetative**	**Flowering**	**Grainfill**
Wireworms	Damaging	Present		
Cutworm	Damaging			
Black headed cockchafer	Damaging	Present		
Earth mites	Damaging	Present		
Slugs, snails	Damaging			
Brown wheat mite		Damaging		
Aphids	Present	Damaging	Present	Present
Armyworm		Present–damaging	Present	Damaging
Helicoverpa armigera				Damaging

Stay informed about invertebrate pest threats throughout the winter growing season by subscribing to SARDI's PestFacts South Australia and **cesar**'s PestFacts south eastern.

Subscribers to PestFacts also benefit from special access to **cesar**'s extensive Insect Gallery, which can be used to improve skills in identifying pest and beneficial insects.

Use Tables 3 and 4 below to identify damage caused by key pests, and to assess risk and determine control measures for establishment pests.

Table 3: Crop damage pest identification key for the Southern Region—cereals [4]

Leaves or plants cut off and lying on the ground or protruding from small holes next to plants; brown caterpillars (up to 15 mm long) with black heads, present in web- lined tunnels; wheat or barley seeded into grassy pasture paddocks.	Webworm
Leaves or plants cut off and lying on the ground or protruding from small holes next to plants. Slender larvae, up to 35 mm long, construct silk-lined tunnels that protrude above ground to form chimneys.	Pasture tunnel moth*
Leaves or plants cut off and lying on the ground or protruding from small holes next to plants. Larvae are brown with black and yellow marking, covered in tufts of stout hairs and can grow up to 50 mm in length.	Grass anthelid*
Leaves of young seedlings fed upon or damaged; in severe cases seedlings are ring-barked at ground level causing them to drop. Adults are 3-5 mm long, round and dull brown resembling small clods of dirt.	Mandalotus weevil*
Plants eaten close to or below ground level causing plant death and bare patches within the crop.	Polyphrades weevil*
Larvae emerge from tunnels with rain events to feed on foliage. Can cause bare patches in crops during late autumn and early winter. 'C' shaped larvae with six legs and a black to brown head capsule.	Blackheaded pasture cockchafers*
Large portions of plants eaten and some leaves or plants cut off. Smooth, fat caterpillars up to 40 mm long usually found just under the soil surface and may curl up when disturbed.	Cutworms
Green material removed in irregular patches from one surface of the leaf leaving white window-like areas; paddocks may appear white; presence of dumpy, wingless, greenish yellow insects, which spring off plants when disturbed.	Lucerne flea
Leaves shredded or chewed, slimy trails.	Slugs and snails
Smooth, shiny brown animals with curved pincers at the end of the body. Damage irregular, often similar to slug damage, mostly in patches, when sown in heavy stubble.	Earwigs
Grasshoppers and locusts.	Grasshoppers and locusts

[3] NIPI (2014) Winter cereals. NIPI IPM guidelines, http://ipmguidelinesforgrains.com.au/crops/winter-cereals/

[4] GRDC (2012) I spy. Insects of Southern Australian Broadacre Farming Systems Identification Manual and Education Resource. GRDC, http://grdc.com.au/Resources/Bookshop/2012/11/I-SPY

Minor leaf chewing; presence of dark brown to black caterpillars up to 60 mm long with two yellow spots near posterior end.	Pasture day moth
Presence of tiny 8-legged (nymphs have 6 legs) velvety black or brown crawling creatures with orange-red legs, found on plants or on soil surface at the base of plants.	Redlegged earth Mite Blue oat mite Balaustium mite
Plants stunted and dying at emergence and up to tillering; chewing of seed and stem below ground; white legless larvae up to 7 mm long present near point of attack.	Spotted vegetable weevil or Desiantha weevil
Plants stunted or dying; roots eaten; slow-moving, soft bodied insects usually in a 'C' shape, cream-coloured apart from head and visible gut contents; found near roots.	Cockchafers African black beetle
Plants yellowing and withering; on light soils mostly on coastal plain; stems underground shredded; presence of elongated, cylindrical insects up to 75 mm long, first pair of legs adapted for digging.	Sandgropers**
Green and straw-coloured insect droppings like miniature square hay bales on ground; cereal heads on ground; some chewing of leaves and seed heads of weeds such as ryegrass. Smooth, fat caterpillars up to 40 mm long, with three stripes on collar behind head; found at base of plants or climbing plants.	Armyworm
Seeds chewed but heads not severed; caterpillars up to 40 mm long, sparsely covered with small bumps and bristles, may be various shades of green, yellow, orange or brown; found on seed heads.	Native budworm and related species
Presence of many grey- green insects approx. 2 mm long, with or without wings, on upper portions of stem. If heavy infestations, plants stunted; sticky with secretions, possibly black mould growing on secretions;	Aphids
Damage in fine pale dots in wriggly or zigzag lines. Yellow to green, 3 mm long wedge-shaped sucking insects that jump sideways when disturbed.	Leafhoppers

Table 4: Establishment pests of the Southern Region—risk assessment and management [5]

Pre-season	Pre-sowing	Emergence	Crop establishment
Earth mites and lucerne flea			
Assess risk. High risk when: • history of high mite pressure • pasture rotating into crop • susceptible crop being planted (e.g. canola, pasture, lucerne) • seasonal forecast for dry or cool, wet conditions that slow crop growth If risk is high: • ensure accurate identification • use TIMERITE® (redlegged earth mites only) • heavily graze pastures in early–mid spring	If high risk: • use an insecticide seed dressing on susceptible crops • plan to monitor more frequently until crop establishment • use higher sowing rate to compensate for seedling loss • consider scheduling a post-emergent insecticide treatment If low risk: • avoid insecticide seed dressings (esp. cereal and pulse crops) and plan to monitor until crop establishment	Monitor susceptible crops through to establishment using direct visual searches. Be aware of edge effects; mites move in from weeds. around paddock edges If spraying: • ensure accurate identification of species before deciding on chemical • consider border sprays (mites) and 'spot' sprays (lucerne flea) • spray prior to winter egg production to suppress populations and reduce risk in the following season	As the crop grows, it becomes less susceptible unless growth is slowed by dry or cool, wet conditions

[5] NIPI (2014) Establishment pests—Southern Region. 'Best bet' IPM strategy. NIPI IPM Workshops, http://ipmworkshops.com.au/wp-content/uploads/BestBet_EstablishmentSouth2014.pdf

Pre-season	Pre-sowing	Emergence	Crop establishment
Slugs			
Assess risk. High risk when: • high stubble load • annual average rainfall >450 mm history of slug infestations • canola being planted • summer rainfall • heavy clay soils	If high risk: • burn stubbles • cultivate worst areas • remove weeds in paddocks/ along fencelines at least 8 weeks before sowing • deploy shelter traps before sowing • sow early to get crop established prior to cold conditions • use soil compaction at sowing (e.g. press-wheels) • bait at/after sowing prior to emergence	Assess risk. High risk under cold conditions and with slow plant growth Use shelter traps or directly search at night when slugs are active to confirm slugs as the cause of seedling loss. If slug pressure is high, successive baiting may be necessary. Monitoring will guide bait use	As the crop grows, it becomes less susceptible unless growth is slowed by cool conditions. Resowing may be required if plant stands are unsatisfactory
False wireworm and true wireworm			
Assess risk. High risk when: • history of wireworm pressure • soils high in organic matter • high stubble and summer–autumn litter cover	Conduct direct visual search for adult beetles over summer and autumn. Search (in soil) for beetle larvae 2 weeks prior to sowing. If high risk: • reassess crop choice or timing of sowing • consider an insecticide seed dressing (particularly fipronil) or in-furrow treatment • use soil compaction at sowing (e.g. press-wheels) • consider higher sowing rate to compensate for seedling loss	Limited options for control once crop is sown. Consider resowing severely affected areas of crop	Damage to established crops is rare
Scarabs			
Assess risk. High risk when: • sowing crop into pasture, esp. with a high clover content • previous history of scarab damage to crop in that field • wetter than average seasons • minimum/no tillage Under high pressure: • spray African black beetle adults in spring • avoid overgrazing pastures	Dig soil within paddock to determine incidence of scarab larvae. If high risk: • cultivate land • avoid sowing grass pastures • use soil compaction at sowing (e.g. press-wheels) • consider higher sowing rate to compensate for seedling loss	Assess risk. High risk when dry conditions slow plant growth. Limited options for control once crop is sown. Larvae of most species do not emerge from the soil. For black headed pasture cockchafer, spray around heavy dews or light rainfall which will trigger larvae activity	Resowing may be an option, but some species have a 2-year life cycle, so larvae can persist through winter into spring. ID will guide this decision
Others—e.g. earwigs, slater, millipedes, weevils			
Assess risk. High risk when: • history of high pest pressure • minimum/no tillage • high stubble load • heavier soils Monitor in spring using shelter traps, direct searches and/or pitfall traps	If high risk: • burn stubbles • cultivate worst areas • use cracked wheat baits • avoid sowing canola	Monitor susceptible crops through to establishment. Directly search at night to confirm pest species as the cause of seedling loss (Note: large numbers of these pests can be found in paddocks without causing crop damage)	Damage to established crops is rare

More information

NIPI IPM Workshops: Establishment pests—Southern Region

NIPI IPM Workshops: Decision making for insect management in grain crops

7.1 Integrated pest management

Pests are best managed by using an integrated pest management (IPM) approach. Careful planning prior to sowing, followed by regular monitoring of crops after sowing, will ensure that potential problems are identified and, if necessary, treated early.

The IPM approach uses a range of management tactics to keep pest numbers below the level where they cause economic damage. It focuses on natural regulation of pests, particularly by encouraging natural enemies, and on using broad-spectrum chemicals only as a last resort. IPM relies on monitoring the crop regularly, having pests and beneficial insects correctly identified, and making strategic control decisions according to established damage thresholds. [6]

Key IPM strategies:

- Where the risk of establishment pest incidence is low (e.g. earth mites), regular monitoring can be substituted for the prophylactic use of seed dressings.
- Where establishment pests and aphid infestations are clearly a result of invasion from weed hosts around the field edges or neighbouring pasture, a border spray of the affected crop may be sufficient to control the infestation and allow the build-up of natural predators.

Insecticide choices:

- Redlegged earth mites, blue oat mites, and other mite species can occur in mixed populations. Determine species composition before making decisions because they have different susceptibilities to chemicals.
- Establishment pests have differing susceptibilities to insecticides (synthetic pyrethroids (SPs) and organophosphates (OPs) in particular). Be aware that the use of some pesticides may select for pests that are more tolerant.

Insecticide resistance:

- Redlegged earth mites have been found to have high levels of resistance to SPs such as bifenthrin and alpha-cypermethrin.
- *Helicoverpa armigera* has historically had high resistance to SPs, but *H. punctigera*, more common in the south, does not have SP resistance. The inclusion of nuclear polyhedrosis virus (NPV) is effective where mixed populations of armyworm and *Helicoverpa* occur in maturing winter cereals. [7]

7.2 Aphids

Aphids are vectors of *Barley yellow dwarf virus* (BYDV), a major problem in wet areas in southern growing regions.

Seasonal conditions have a major effect on aphid populations, which are ultimately controlled by natural predators. However, aphid populations can do considerable damage before other insects or heavy rains reduce or eliminate them. [8] Therefore, growers should consider seed treatment prior to sowing and/or in-crop foliar pesticide spraying to control aphids.

When winged cereal aphids fly into crops from grass weeds, pasture grasses or other cereal crops, colonies of aphids start to build within the crop. In Australia, all aphids in a cereal crop are females, able to give birth to live young without the need to mate. The immature aphid nymphs have several growth stages and moult at each stage into

[6] K Hertel, K Roberts, P Bowden (2013) Insect and mite control in field crops. NSW DPI Management Guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/284576/Insect-and-mite-control-in-field-crops-2013.pdf

[7] NIPI (2014) Winter cereals. NIPI IPM guidelines, http://ipmguidelinesforgrains.com.au/crops/winter-cereals/

[8] L Price (2010) Aphids in cereals. Goondiwindi Grains Research Update, Northern Grower Alliance, March 2010, http://www.nga.org.au/results-and-publications/download/19/grdc-update-papers-pests/aphids-in-winter-cereals/grdc-adviser-update-paper-goondiwindi-march-2010-.pdf

a larger individual. Sometimes the delicate, pale, cast skins can be seen near colonies. When host plants become unsuitable or overcrowded, winged aphids, called alataes, develop and migrate to other crops or plants.

Three types of aphid are commonly found in barley crops and they can all carry BYDV. In trials, aphids have been found to attack different parts of the barley plant at different times:

7.2.1 Oat or wheat aphid (*Rhopalosiphum padi*)

Oat or wheat aphids can be found on all cereals, and in most years of high infestation, they are the most abundant species. A vector of BYDV, the oat aphid colonises the lower portion of the plant with infestations extending from around the plant's base, up onto the leaves and stems as the crop starts elongation (Figure 1, Table 5). Mature adults are about 2 mm long and may have wings that are dark green and rounded or pear-shaped. Juveniles are paler and smaller. Both are characterised by a dark reddish patch on the tip of the abdomen.

Figure 1: Heavy infestation of oat aphids (Rhopalosiphum padi).

Table 5: Oat or wheat aphid management summary [9]

Scientific name	*Rhopalosiphum padi*
Description	Adults are 2 mm long, olive-green to black with a red rust patch at the rear end and may have wings. Antennae extend to half the body length. Nymphs are similar but smaller. Very similar to corn aphids
Distribution	An introduced species found in all states of Australia
Crops attacked	Barley, wheat and oats
Life cycle	Produces many generations through the growing season. Winged and non-winged forms occur
Damage	Aphids feed directly on stems, leaves and heads, and in high densities cause yield losses and plants may appear generally unthrifty. This type of damage is rare throughout the grainbelt. Aphids can spread BYDV in wheat and barley
Monitoring and action level	Aphids can affect any crop stage but are unlikely to cause economic damage to cereal crops expected to yield <2 t/ha (for virus damage) and <3 t/ha (for direct feeding). Consider treatment if there are 10–20+ aphids on 50% of the tillers
Control	Chemical control: Apply a foliar insecticide in late winter or spring to avoid direct damage to tillers and heads. To prevent losses from BYDV in virus-prone areas, control aphids early in the cropping year. Prevent infestation by applying a seed dressing to early-sown wheat crops and a foliar insecticide in high-pressure years if necessary (predator friendly). For current chemical control options, see Pest Genie or APVMA Cultural control: Controlling the green bridge (i.e. controlling weeds over the summer fallow) is an effective control measure to prevent aphid survival into the next season
Host-plant resistance	In virus-prone areas, use resistant plant varieties to minimise losses due to BYDV
Natural enemies	Predation by hoverflies, lacewings and ladybeetles and parasitism by wasps can reduce aphid populations, but this does not happen in every season. Heavy rain may reduce aphid populations significantly

7.2.2 Corn aphid (*Rhopalosiphum maidis*)

Corn aphids are most likely to be found in barley crops, but also occur in wheat. Corn aphids are more rectangular than oat aphids. Adults are 2 mm long and may have wings. The legs and antennae are typically darker than the green-blue body, which sometimes has a waxy appearance (Figure 2). Colonies generally develop within the furled emerging leaves of tillers, particularly the rolled up terminal leaf, and they can be difficult to see. Corn aphids can be important vectors of BYDV if they arrive early in crops (Table 6).

[9] DAF Qld (2011) Oat aphid, wheat aphid. Department of Agriculture and Fisheries Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/aphid-overview/oat-aphid,-wheat-aphid

Figure 2: Corn aphids (Rhopalosiphum maidis).

Table 6: Corn aphid management summary [10]

Scientific name	*Rhopalosiphum maidis*
Description	Up to 2 mm long, light to dark olive-green with a purple area at the base of small tube-like projections at the rear of the body. Adults are generally wingless. Antennae extend to about one-third of body length. Nymphs are similar, but smaller
Similar species	Other species of aphids
Distribution	An introduced species, probably Asiatic in origin, found in all states of Australia
Crops attacked	Sorghum, maize, winter cereals and many grasses Life cycle on cereals: A parthenogenetic species that undergoes many generations through the growing season. Both winged and non-winged forms occur
Damage	In cereal: Aphids feed on stems, leaves and heads, and in high densities cause yield losses. However, this type of damage is uncommon throughout the cereal belt Risk period: Most prevalent on cereals in late winter and early spring. High numbers often occur in years when an early break in the season and mild weather in autumn and early winter provide favourable conditions for colonisation and multiplication
Monitoring	Estimate percentage of plants infested and percentage of leaf area covered by aphids
Action level	Aphids are unlikely to cause economic damage to cereal crops expected to yield <3 t/ha. To avoid damage by direct feeding, consider treatment if there are ≥10–20 aphids on 50% of the tillers
Chemical control	Chemical control is cost-effective. See Pest Genie or APVMA for current control options Conservation of natural enemies: A range of parasitoids and predators will help reduce aphid populations. Predators of aphids include: ladybird larvae, damsel bugs, big-eyed bugs and the larvae of green lacewings and hoverflies. Wasp parasitoids mummify and kill aphids

[10] DAF Qld (2010) Corn aphid. Department of Agriculture and Fisheries Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/aphid-overview/corn-aphid

7.2.3 Rose-grain aphid (*Metopolophium dirhodum*)

The rose-grain aphid (Figure 3, Table 7) tends to colonise the underside of leaves higher on the plant. Adults are up to 3 mm long, and are large and pale aphids with a dark stripe down the midline of the back. Clusters of juveniles are common on leaves.

Figure 3: Rose-grain aphids (Metopolophium dirhodum), adult and nymphs.

Table 7: Rose-grain aphid management summary [11]

Scientific name	*Metopolophium dirhodum*
Description	Adults are 3 mm long, green to yellow-green with long and pale siphunculi (tube-like projections on either side at the rear of the body) and may have wings. There is a dark green stripe down the middle of the back. Antennae reach beyond the base of the siphunculi. Nymphs are similar but smaller
Similar species	Because of its distinctive colour, it is unlikely to be confused with other aphids
Distribution	An introduced species that has been recorded in New South Wales, Queensland, South Australia, Tasmania and Victoria
Crops attacked	Wheat, barley, triticale, oats
Life cycle	Undergoes many generations during the growing season; winged and non-winged forms occur
Damage	Adults and nymphs are sap-suckers. Under heavy infestations, plant may turn yellow and appear unthrifty. Can spread BYDV in wheat and barley
Monitoring and action level	Can affect any crop stage; assess the potential for direct-feeding damage in late winter. Estimate the number of aphids per tiller. Aphids are unlikely to cause economic damage to cereal crops expected to yield <3 t/ha
Control	Chemical control: Apply a foliar insecticide in late winter or spring to avoid damage to tillers. To prevent losses from BYDV in virus-prone areas, control aphids early in the cropping year. For current chemical control options see Pest Genie or APVMA Cultural control: There are no known effective cultural control methods for this aphid

[11] DAF Qld (2011) Rose-grain aphid. Department of Agriculture and Fisheries Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/aphid-overview/rose-grain-aphid

7.2.4 Thresholds for control

Inspect for aphids throughout the growing season by monitoring leaves, stems and heads as well as exposed roots. Choose six, widely spaced positions in the crop, and at each position examine five consecutive plants in a row. Research is under way into damage thresholds and control options for cereal aphids. Some research indicates that aphid infestations can reduce yield by ~10% on average. Current notional thresholds suggest that control is warranted when there are >10–20 aphids on 50% of the tillers.

The decision to control aphids on winter cereals depends on the size of the aphid population and the duration and timing of the infestation. Controlling aphids during early crop development generally results in a recovery of the rate of root and shoot development, but there can be a delay. Aphids are more readily controlled in seedling and pre-tillering crops, which are less bulky than post-tillering crops. Corn aphids in the terminal leaf tend to disappear as crops come into head, and other species usually decline in abundance about this time as natural enemy populations build up.

Always determine the level of natural enemy activity when making control decisions about aphids. The thresholds above are for aphid damage—there is not a threshold for BYDV transfer.

More information

GRDC Fact Sheets: Cereal aphids. Northern Region

cesar PestNotes southern: Oat aphid

cesar PestNotes southern: Corn aphid

7.3 Armyworm

Armyworms are the caterpillar stage of certain moths, and can occur in large numbers, especially after good rain following a dry period. Larvae shelter in the throats of plants or in the soil and emerge after sunset to feed on the leaves of all winter cereals, particularly barley and oats, generally during September and October. Leafy cereal plants can tolerate considerable feeding, and control in the vegetative stage is seldom warranted unless large numbers of armyworms are distributed throughout the crop or are moving in a 'front', destroying young seedlings or completely stripping older plants of leaves. The most serious damage occurs when larvae feed on the upper flag leaf and stem node as the crop matures, or in barley when the older larvae start feeding on the green stem just below the head as the crop matures.

Figure 4: Common armyworm (Leucania convecta). (Photo: DAF Qld)

The most prevalent species in the Southern Region are the common armyworm (*Leucania convecta*, Figure 4) and inland and southern armyworms (*Persectania dyscrita* and *Persectania ewingii*). Infestations are evident from scalloping on margins of leaves caused by feeding of the older larvae. Larvae target the stem node as the leaves become dry and unpalatable, and the stem is often the last part of the plant to dry. One large larva can sever up to seven heads of barley a day. One larva/m^2 can cause a grain loss of 70 kg/ha.day (Table 8). Larvae take ~8–10 days to develop through the final, most damaging instars, with crops susceptible to maximum damage for this period (Table 9).

Check for larvae on the plant and in the soil litter under the plant. The best time to do this is late in the day when armyworms are most active. Alternatively, look around

the base of damaged plants where the larvae may be sheltering in the soil during the day. Using a sweep net (or swing a bucket), check a number of sites throughout the paddock. Sweep sampling is particularly useful early in an infestation when larvae are small and actively feeding in the canopy. One full sweep with a net samples the equivalent of 1 m^2 of crop.

Early recognition of the problem is vital, because cereal crops can be almost destroyed by armyworm in just a few days. Although large larvae do the head lopping, controlling smaller larvae that are still leaf-feeding may be more achievable. Before using chemical intervention, consider how quickly the larvae will reach damaging size, and the development stage of the crops. Small larvae take 8–10 days to reach a size capable of head-lopping, so if small larvae are found in crops nearing full maturity–harvest, spray may not be needed, whereas small larvae in late crops that are still green and at early seedfill may reach a damaging size in time to reduce crop yield significantly.

Control is warranted if the armyworm population distributed throughout the crop is likely to cause the loss of 7–15 heads/m^2. Many chemicals will control armyworms. However, their effectiveness often depends on good penetration into the crop to achieve contact with the caterpillars. Control may be more difficult in high-yielding, thick-canopied crops, particularly when larvae are resting under soil at the base of plants. Larvae are most active at night; therefore, spraying in the afternoon or evening may produce the best results. If applying sprays close to harvest, be aware of relevant withholding periods.

Biological control agents may be important in some years. These include parasitic flies and wasps, predatory beetles and diseases. *Helicoverpa* NPV is not effective against armyworm. [12]

Table 8: Value of yield loss incurred by armyworm larvae (1 or 2/m^2) per day, based on various values for grain and an estimated loss, given 1 larva/m^2, of 70 kg/ha

Considering these results, and the relatively low cost of controlling armyworm, populations of >1 large larva/m^2 in ripening crops warrant spraying

Value of grain (AU$/t)	Value of yield loss ($) per ha per day	
	1 larva/m^2	2 larvae/m^2
$140	$9.80	$19.60
$160	$11.20	$22.40
$180	$12.60	$25.20
$200	$14.00	$28.00
$220	$15.40	$30.80
$250	$17.50	$35.00
$300	$21.00	$42.00
$350	$24.50	$49.00
$400	$28.00	$56.00

[12] DAF Qld (2012) Insect pest management in winter cereals. Department of Agriculture and Fisheries Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/ipm-information-by-crop/insect-pest-management-in-winter-cereals

Table 9: Armyworm management summary [13]

Scientific name	*Leucania convecta*—common armyworm
Description	Common armyworm: First-instar larvae are about 1 mm long. From the second instar, stripes develop along the top and sides of the larva and become more distinct as the larva grows. Crowded larvae are usually darker than uncrowded. The mature larva grows up to 40 mm in length and has three characteristic pale stripes on the head, collar (segment behind the head) and tail segment. They are smooth-bodied with no distinct hairs. The body also has lateral stripes. The forewings of the moth have a wingspan of about 40 mm and are fawn or buff-coloured
Similar species	Adults of the common and northern armyworms may be confused. Genitalia dissections by a specialist are required to separate the species. The larval stages likely to be encountered in cereals are all similar in appearance
Distribution	Common armyworm is a native Australian species, recorded in New South Wales, Queensland, South Australia, Tasmania, Victoria and Western Australia
Crops attacked	Common armyworm damages barley, oats, wheat, native pasture grasses and perennial grass seed crops
Life cycle	Common armyworms have three generations per year. The winter and spring generations damage cereals. Moths fly into cereal crops and lay their eggs in the folds of dried or drying leaves on grasses or cereals. Females lay up to 1000 eggs in irregularly shaped masses, cemented in tight folds of foliage. Eggs hatch as little as 3–4 days after laying and young larvae, with the assistance of wind, disperse through the crop on fine silken threads. The larvae feed on leaves and stems. Larvae usually develop through six instars but sometimes seven. Indicative development times at constant temperature are: egg-laying to hatch, 7 days at 20°C and 2.5 days at 30°C; larval stages (including pre-pupal stage) 34.2 days at 20°C and 17.2 days at 30°C. Larvae pupate in the soil. Pupal stage lasts 20.1 days at 20°C and 10.1 days at 30°C. Development time from neonate to adult emergence is 61 days at 20°C and 41 days at 30°C (Smith 1984)
Risk period and damage	Risk period: The greatest risk to cereals is spring. Moth flights occur in September and October, and the later stage larvae damage cereals often in the weeks prior to harvest. The mature larval stages of the winter generation will sometimes march in cereal crops in late winter and cause serious damage to crops, particularly on the edges of paddocks. Crops directly seeded into standing stubbles are susceptible to severe defoliation during the vegetative stage as the winter generation matures Damage: There are two distinct periods for economic damage. The first, defoliation during early vegetative development, is less common than the second through ripening. In southern Australia, the cereal head stays green later and armyworms feed along the heads and damage grain rather than excising the whole head
Monitoring and action level	Large numbers of armyworm moths are attracted to farm lights on warm nights in September and October. This provides the first warning of potential problems in cereals. Armyworm larvae are difficult to find in cereals crops because they hide at the base of plants or under clods of soil during the day. Search at the base of plants and under clods of soil to estimate the number of larvae per m^2. Presence of green–yellow pellet-shaped droppings of the larvae on the ground is usually a reliable sign of larvae. Monitor for larvae at dusk with a sweep net; sweep netting during the day can be unreliable Action level is 2 larvae/m^2 for barley
Control	Chemical control: A range of insecticides is registered for armyworm control in cereals. Insecticides should target larvae 10–20 mm long. Larvae >20 mm long can be difficult to kill and may require higher rates of insecticide. If possible, spray late in the day because larvae are active at night. See Pest Genie or APVMA for current control options Cultural control: Windrowed or swathed crops dry out rapidly, rendering them unattractive for the feeding of armyworm larvae. They are also less susceptible to wind damage (head shattering)

[13] DAF Qld (2010) Common, northern and sugarcane armyworms. Department of Agriculture and Fisheries Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/armyworm-overview/common,-northern-and-sugarcane-armyworms

Natural enemies	Armyworm larvae are attacked by a number of parasitoids that may be important in reducing the intensity of outbreaks. However, when armyworms are in numbers likely to cause damage, parasitoids are unlikely to give timely control. Predators include green carab beetles, populations of which increase dramatically in inland Australia in response to abundant noctuid larvae induced by favourable seasons. Other predators include the predatory shield bugs and perhaps common brown earwigs. Fungal diseases are recorded as causing mortality of armyworm

7.4 *Helicoverpa* spp.

Helicoverpa spp. are frequently found in winter cereals, usually at levels too low to warrant control, but occasionally numbers may be sufficiently high to cause economic damage. *Helicoverpa punctigera* is widespread in southern Australia and common on pulse crops and canola, but rarely found on cereal crops. *Helicoverpa armigera* (Figure 5) is primarily a pest in the northern grains region but does occur in the south, particularly in irrigated crops in northern Victoria. It can occasionally be found grazing wheat and barley heads. [14]

Larvae tend to graze on the exposed tips of a large number of developing grains, rather than totally consuming a low number of whole grains, thus increasing the potential losses. Most (80–90%) of the feeding and crop damage is done by larger larvae (the final two instars).

More information

cesar PestNotes southern: Native budworm

cesar PestNotes southern: Corn earworm

Figure 5: Helicoverpa armigera.

[14] GRDC (2102) Approaches to key insect pests of southern and western grains. Southern and Western Regions. Insecticide Management and Invertebrate Pest Identification Fact Sheet, GRDC, July 2012, https://www.grdc.com.au/~/media/23FC4F7A6F794888B239CB4080A1DAFF.pdf

7.5 Blue oat mite (*Penthaleus* spp.)

Blue oat mites (Figure 6) are important pests of seedling winter cereals. Adults and nymph mites pierce and suck leaves, resulting in silvering of the leaf tips. Feeding causes a fine mottling of the leaves, similar to the effects of drought. Heavily infested crops may have a bronzed appearance, and severe infestations cause leaf tips to wither and can lead to seedling death. Damage is most likely during dry seasons when mites in large numbers heighten moisture stress; control may be warranted in this situation.

Check from planting to early vegetative stage, particularly in dry seasons, monitoring several sites throughout the field (Table 10). Blue oat mites are most easily seen in the cooler part of the day, or in cloudy conditions. They shelter on the soil surface when conditions are warm and sunny. If pale-green or greyish irregular patches appear in the crop, check for the presence of blue oat mite at the leaf base.

Where warranted, foliar application of registered insecticide may be cost-effective. Check the most recent research to determine the likely susceptibility of blue oat mite to the available registered products. Cultural control methods can contribute to reduction in the size of the autumn mite population (e.g. cultivation, burning, controlling weed hosts in fallow, grazing and maintenance of predator populations).

Eggs laid in the soil hibernate throughout winter; therefore, populations of the mite can build up over a number of years and cause severe damage if crop rotation is not practised. The use of control tactics solely in spring will not prevent the carry-over of eggs into the following autumn.

Predators of blue oat mites include spiders, ants, predatory beetles and the predatory *Anystis* mite and snout mite. Blue oat mites are also susceptible to infection by a fungal pathogen (*Neozygites acaracida*), particularly in wet seasons. [15]

The blue oat mite is an important pest of seedling winter cereals. When infestations are severe, the leaf tips wither and eventually the seedlings die. Eggs laid in the soil hibernate over winter, allowing populations to build up over a number of years. This can cause severe damage if crop rotation is not practised.

*Figure 6: Blue oat mite (Penthaleus sp.). (Photo: A Weeks, **cesar**)*

[15] DAF Qld (2012) Insect pest management in winter cereals. Department of Agriculture and Fisheries Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/ipm-information-by-crop/insect-pest-management-in-winter-cereals

Table 10: Management summary for blue oat mite [16]

Scientific name	*Penthaleus major, P. falcatus*, *P. tectus*
Description	Adults are 1 mm long and have eight legs. Adults and nymphs have a purplish-blue, rounded body with red legs. They move quickly when disturbed. The presence of a small red area on the back distinguishes it from the redlegged earth mite
Similar species	Brown wheat mite, redlegged earth mite
Crops attacked	Mainly a pest of cereals and grass pastures, but will feed on pasture legumes and many weeds
Damage	Adults and nymphs pierce and suck on leaves resulting in silvering of the leaf tips in cereals. When heavy infestations occur, the leaf tip withers and the seedling can die
Monitor	Check from planting to early vegetative stage, particularly in dry seasons. Most easily seen in the late afternoon when they begin feeding on the leaves
Control	Foliar applications of insecticides may be cost-effective if applied within 2–3 weeks of emergence in autumn. The use of control tactics solely in spring will not prevent the carry-over of eggs into the following autumn. For current chemical control options see Pest Genie or APVMA
Natural enemies	Thrips and ladybirds

7.6 Lucerne flea (*Sminthurus viridis*)

Lucerne flea is an important pest of establishing crops. It is identified by its action of jumping between plants rather than flying. Early-sown crops are more at risk of attack. Frequent crop inspection from the time of emergence, and early control measures, are important because of the impact of seedling vigour on crop performance. Ensure that monitoring is sufficient to detect localised patches or 'hot spots'. Seek advice on management and spray strategies. [17]

*Figure 7: Adult lucerne flea (Sminthurus viridis). (Photo: **cesar**)*

7.6.1 Description

Adult lucerne fleas are globular, wingless insects, 2–3 mm long with green, brown and yellow markings (Figure 7). They appear yellow-green to the naked eye, although their

[16] DAF Qld (2010) Blue oat mite. Mites in field crops. Department of Agriculture and Fisheries Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/mites-overview/blue-oat-mite

[17] P Matthews, D McCaffery, L Jenkins (2015) Winter crop variety sowing guide 2015. NSW DPI Management Guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/272945/winter-crop-variety-sowing-guide-2015.pdf

globular abdomens are often a mottled pattern of darker pigments. They make jumping movements when disturbed. Nymphs resemble the adults except in size. [18]

7.6.2 Seasonal development and symptoms

Lucerne fleas hatch following periods of good, soaking autumn–winter rainfall and can cause significant damage to emerging crops and pastures at this time of year. They can also cause considerable damage to older crops if numbers build up under favourable conditions throughout the season.

Lucerne fleas have a wide host range. They will attack most broadacre crops, including canola, lucerne, pastures, cereals and some pulses. Feeding results in the appearance of distinctive transparent 'windows'. They are generally a problem in regions with loam or clay soils.

Crops should be inspected frequently at, and immediately following, emergence, when most susceptible to damage. Paddocks are most likely to have problems when they follow a weed-infested crop or a pasture in which the lucerne flea has not been controlled.

7.6.3 Impact

The cells of the upper surface of leaves and cotyledons are eaten, resulting in small 'windows' in the leaves. Severe infestations cause skeletonised leaves, with only the more fibrous veins remaining. This damage is quite distinctive and can be used to help identify lucerne flea as the key pest.

7.6.4 Management

Only when infestations are severe should lucerne flea be sprayed. In some instances, spot spraying with registered chemicals may be adequate. Several natural enemies such as mites, beetles and spiders prey upon lucerne fleas, and blanket spraying is harmful to these natural control agents. Seed dressing can also be a useful technique to prevent damage by lucerne flea. [19]

Snout mites (which have orange bodies and legs) are effective predators of lucerne fleas, particularly in pastures, where they can prevent pest outbreaks. The complex of beneficial species (including snout mites) should be assessed before deciding on control options. [20]

Several options are available to growers for controlling the lucerne flea. Foliar insecticides can be applied ~3 weeks after lucerne fleas have been observed in a newly emerged crop. This will allow for further hatching of oversummering eggs but will be before lucerne fleas reach the adult stage and begin to lay winter eggs. If spraying is required, do not use SPs.

In paddocks where damage is likely, a border spray may be sufficient to prevent movement of lucerne fleas into the crop from neighbouring paddocks. Lucerne fleas are often distributed patchily within crops; therefore, spot-spraying is generally all that is required. Do not blanket-spray unless the infestation warrants it.

More information

Agriculture Victoria: Lucerne flea

GRDC Grain Research Advice: Knowledge, timing, key to lucerne flea control

NIPI IPM Guidelines: Lucerne flea in winter seedling crops

GRDC: Canola best practice management guide. Lucerne flea (p. 51)

NIPI: I Spy Manual. Lucerne flea (section 4, pp. 63–64)

[18] CropPro. Lucerne flea. Pests in canola. CropPro, http://www.croppro.com.au/cb_pages/pests_in_canola_-_in_crop.php?category_id=2374

[19] CropPro. Lucerne flea. Pests in canola. CropPro, http://www.croppro.com.au/cb_pages/pests_in_canola_-_in_crop.php?category_id=2374

[20] **cesar** (2010) Lucerne flea. PestFacts south-eastern, Issue 3, 21 May 2010. **cesar**, http://www.cesaraustralia.com/sustainable-agriculture/pestfacts-south-eastern/past-issues/2010/pestfacts-issue-no-3-21st-may-2010/lucerne-flea/

infocus

7.7 NGA trials—managing aphids

7.7.1 Varietal resistance or tolerance

In 2008, the Northern Growers Alliance (NGA) in association with Industry & Investment NSW conducted trials at four locations on three barley varieties (Fitzroy(Þ), Grout(Þ) and Gairdner(Þ)), assessing the impact and economics of managing aphids. Trial results showed that oat, corn and rose-grain aphid populations were not influenced by barley variety. [21]

In virus-prone areas, growers are advised to use resistant plant varieties to minimise losses due to BYDV. [22]

7.7.2 Damage caused by pests

Aphids can damage barley crops in two ways: by stressing the crop, particularly if it is suffering from lack of moisture, and by spreading BYDV. In the absence of BYDV, aphids affect cereal plants by direct feeding, effectively creating a nitrogen sink, diverting nitrogen away from the developing and filling grain. Aphids use the nitrogen for their growth and reproduction. [23] Oat aphids appear to affect yield by reducing the number of viable tillers. [24]

Infection with BYVD in barley causes a characteristic bright yellowing of leaves (particularly older leaves) and interveinal chlorosis starting from the leaf tips and moving towards the base. In some varieties, reddening of leaf tips may also develop. Late infections do not result in severe stunting but young leaves may turn yellow. [25]

Early BYDV infections of cereal plants will mean that they have less aboveground biomass and a less extensive root system. Grain size may be reduced or grain may become shrivelled, which causes lower yields, higher screenings and reduced marketing options. Researchers in the northern grains region have found it difficult to detect symptoms of BYDV by visual inspection because the signs are similar to those of heavy aphid infestation or moisture stress. [26]

Aphids transmit BYDV from plant to plant. When aphids feed on plants, their mouthpart (stylet) penetrates the leaf epidermis and enters the plant's vascular system—the phloem. Within 15 minutes of feeding, the aphid contracts the virus if the plant is already infected, or transmits the disease to an uninfected plant. The infection is restricted to the phloem where it replicates and blocks phloem tissues, reducing transport of sugars through the leaves. BYDV is a persistent virus, which means that an infected aphid will transmit the virus for the rest of its life. The virus survives from one season to the next

21 R Daniel (2009) Aphids in winter cereals—just a nuisance or an economic pest? Northern Grower Alliance, Sept. 2009, http://www.nga.org.au/results-and-publications/download/39/australian-grain-articles/pests-1/aphids-in-barley-september-2009.pdf

22 DAF Qld (2011) Oat aphid, wheat aphid. Aphids in field crops. Department of Agriculture and Fisheries Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/aphid-overview/oat-aphid,-wheat-aphid

23 M Miles (2009) Winter cereal aphids—a researcher's view. Northern Grower Alliance, Sept. 2009, http://www.nga.org.au/results-and-publications/download/39/australian-grain-articles/pests-1/aphids-in-barley-september-2009.pdf

24 GRDC (2010) Aphid control in cereals can pay. Northern Region. Cereal Aphids Fact Sheet, GRDC, July 2010, http://www.grdc.com.au/uploads/documents/GRDC_FS_CerealAphids1.pdf

25 S Simpfendorfer (2010) *Barley yellow dwarf virus* widespread in northern NSW in 2009. GRDC Update Papers, 24 September 2010, https://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2010/09/BARLEY-YELLOW-DWARF-VIRUS-WIDESPREAD-IN-NORTHERN-NSW-IN-2009

26 GRDC (2010) Aphid control in cereals can pay. Northern Region. Cereal Aphids Fact Sheet, GRDC, July 2010, http://www.grdc.com.au/uploads/documents/GRDC_FS_CerealAphids1.pdf

in infected summer crops, weeds and host volunteer plants. It can only survive in living tissues and does not survive in stubbles or soils. It is not airborne. [27]

7.7.3 Thresholds for control

Evidence suggests there is a case to use seed treatments in barley. In NGA trial years of 2008 and 2009, the need to apply a foliar spray later in the season was high where a seed treatment was not used.

Aphids can affect any crop stage but are unlikely to cause economic damage to cereal crops expected to yield <3 t/ha. Consider treatment if there are >10–20 aphids on 50% of the tillers. [28]

NGA trials in 2008, 2009 and 2010 were designed in part to suggest a suitable aphid threshold for foliar insecticide application. A spray threshold of 10 aphids/tiller appears realistic, but spraying needs to be made on an increasing aphid population and where beneficial insect activity is limited. [29]

Note: Economic thresholds should be used as a guide to implementing a control strategy when the cost of the potential damage outweighs the cost of control. However, for aphids it can be difficult to determine thresholds because many factors will influence the damage caused by a given aphid density. For example, local weather conditions, the growth stage of the crop, the crop's yield potential, the time remaining until harvest and the potential transmission of aphid-vectored plant viruses can all be important considerations. For these reasons, economic thresholds for aphids have the potential to differ substantially between regions and over time. [30]

7.7.4 Management of aphids

Overall results from NGA trials in 2008, 2009 and 2010 showed that seed treatment provided more consistent yield and economic benefits than foliar applications in controlling aphids in barley, and that imidacloprid seed treatments should be considered as a management option for growers in situations of higher aphid pressure.

The trials evaluated the efficacy of seed treatments containing imidacloprid, the insecticidal active ingredient in Bayer CropScience products Hombre® (tebuconazole + imidacloprid), Zorro® (triadimenol + imidacloprid) and Gaucho®. The manufacturer claims that its own trials in Australia proved imidacloprid to stimulate the plant's production of 6-CNA, an inherent growth booster, which can be limited by environment stresses such as extended dry periods. The manufacturer also claims that Hombre® and Zorro® can be used to improve yields of wheat, barley and oats. [31]

These claims appear to be supported by the NGA results.

The results are summarised below.

Aphid population:

- Aphid pressure was rated as moderate in 2009, with >10 aphids/tiller at six of 10 sites and peak counts at 25–50/tiller.

[27] GRDC (2013) Management tips to avoid yield penalties. Southern Region. Barley Yellow Dwarf Virus Fact Sheet, GRDC, August 2013, https://www.grdc.com.au/~/media/A4741C713F5C486B9907F96745BF2EEE.pdf

[28] DAF Qld (2011) Oat aphid, wheat aphid. Aphids in field crops. Department of Agriculture and Fisheries Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/aphid-overview/oat-aphid,-wheat-aphid

[29] NGA. Aphid management in winter cereals 2009–2010. Northern Grower Alliance /GRDC, http://www.nga.org.au/module/documents/download/79

[30] **cesar** (2009) Aphid monitoring and thresholds. PestFacts south-eastern. **cesar**, http://cesaraustralia.com/sustainable-agriculture/pestfacts-south-eastern/past-issues/2009/pestfacts-issue-no-9-4th-september-2009/aphid-monitoring-and-thresholds/

[31] K Blowers (2009) Imidacloprid, the insecticidal active ingredient in Hombre and Zorro is more than just an insecticide. GRDC Update Papers 16 Sep 2009, https://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2009/09/IMIDACLOPRID-THE-INSECTICIDAL-ACTIVE-INGREDIENT-IN-HOMBRE-AND-ZORRO-IS-MORE-THAN-JUST-AN-INSECTICIDE

- Aphid pressure was rated as low in 2010, with ~5–10 aphids/tiller found at all four sites.
- Three different aphid species were found at nearly all sites, but varied in population dynamics and timing.
- Oat and rose-grain aphids were found in similar numbers in wheat, durum and barley crops, but the corn aphid was almost exclusively found in barley.
- Populations generally built up and naturally declined within about 3–4 weeks.
- High levels of beneficial insects (wasps and ladybirds) were seen at a number of sites and appeared to initiate population declines.

Aphid control:

- The standard label rate of imidacloprid seed treatment (e.g. Zorro® at 400 mL/100 kg) provided extended aphid control of ~70–90 days after planting.
- The high label rate of imidacloprid seed treatment (e.g. Emerge®) at 240 mL/100 kg) extended aphid suppression by about an additional 10–14 days.
- Pirimor® (pirimicarb) provided good levels of knockdown control.

Yield and grain quality impact:

- The standard rate of imidacloprid resulted in mean yield benefits of ~6% (150–200 kg/ha) at sites with aphid pressure of >5 aphids/tiller during both 2009 and 2010.
- In 2008, with higher aphid pressure (>70 aphids/tiller at all four site), the same rate provided yield benefits of about 10% (330 kg/ha).
- Increased yield benefit was obtained with the high rate of imidacloprid.
- Level of benefit was reduced at sites with low aphid pressure (unsprayed sites).
- Pirimicarb resulted in mean yield benefits of ~2–4% or 100–150 kg/ha.
- No consistent impact was found on grain quality from any treatment.

Net economic benefit:

- The standard rate of imidacloprid resulted in mean net benefits of about $20–30/ha at sites with aphid pressure of >5 aphids/tiller during both 2009 and 2010.
- In 2008, with higher aphid pressure (>70 aphids/tiller in all four trials), the same rate provided net benefits of about $37/ha at a grain price of $125/t.
- Mean net benefit was about $9/ha at unsprayed sites with low aphid pressure.
- Increased net benefit was obtained with the high rate of imidacloprid.
- Mean net benefit from pirimicarb was about $5/ha in both years.

Trials have shown that a greater understanding of the aphids' natural enemies is required to ensure that foliar spraying is not applied when predation by insects (including hoverflies, lacewings and ladybirds) and parasitism by wasps can reduce aphid populations. However, killing or driving out of aphids by other insects cannot be relied upon in every season. Heavy rain may reduce aphid populations significantly.

More information

NGA: Aphid management in barley 2008