Dairy Australia

Fall Armyworm Field Guide

How to use this guide

Over the past five years, the most significant crop and pasture losses have occurred when agronomists and farmers weren't aware of the risk posed by Fall Armyworm (FAW), didn't monitor crops and pastures effectively and were unable to identify FAW as the cause of plant damage.

This guide provides practical information to prepare farmers and agronomists to avoid major crop and pasture losses caused by FAW.

Use this guide to:

1. Understand your risk of a damaging Fall Armyworm infestation.
2. Monitor crops and pasture to ensure early detection of Fall Armyworm.
3. Identify Fall Armyworm eggs and larvae in the field.
4. Identify signs of Fall Armyworm infestation (crop and pasture damage).

Consult the 'Assessing Fall Armyworm risk on dairy farms' resource for more information on identifying FAW and assessing infestation and action threshold.

Dairy Australia acknowledges that all photos in this document belong to the Queensland Department of Primary Industries unless stated otherwise.

Contents

Introduction to Fall Armyworm (FAW)

Fall Armyworm (*Spodoptera frugiperda*, Lepidoptera:Noctuidae) is a recent exotic incursion into Australia, first detected in early 2020 in North Queensland and northern Western Australia. FAW has now been detected in all states, except South Australia. Native to southern and central America and the southern United States, FAW is a tropical pest with a strong preference for feeding on C4 and C3 grasses.

FAW is capable of long-distance migrations up to 2,000km, and 400km in a night. Currently, the patterns of FAW migration in Australia are not well understood. FAW are active all year round in northern regions, and absent from more southerly regions, or at very low densities, in winter and early spring. It is likely that spring-summer FAW populations in regions with cold winters are initiated by moths migrating from northern regions when conditions are suitable for movement. Once regional populations are established, these are most likely the source of ongoing infestations locally, although the relative contribution of locally generated compared to migrations through summer and autumn is not yet known.

Like other pests, the intensity of FAW activity varies from year to year. In the summer of 2023-24 many regions across NSW and Victoria saw significantly higher levels of FAW activity and significant crop losses, particularly in late summer. This 'outbreak' season occurred because conditions were good for FAW, but also because not all environmental drivers for the outbreak have yet been identified. Unfortunately, it isn't yet possible to predict outbreak years.

Fall Armyworm caterpillars defoliate crops by feeding directly on leaves and stalks. Larvae will also damage developing cobs and filling-maturing grain when infestations persist into the reproductive crop stages. FAW will feed on most fodder and sown grass pasture species grown in Australia. Maize, sorghum, white French millet, oats, barley, wheat, kikuyu and annual ryegrass are all susceptible to damage by FAW. For many dairy farmers, FAW is the first very damaging caterpillar pest they have encountered.

To date, FAW has not been reported to cause major losses in legumes, brassicas and other broadleaf fodder species.

Second instar FAW larva

FAW lifecycle

FAW have egg, larval (caterpillar), pupal and moth stages of development. Female moths lay clusters of eggs usually on the underside of leaves. The female moths cover the eggs with a layer of scales from their body; the density of the covering can vary. When larvae hatch from eggs they disperse by 'ballooning' on silks to other plants or walk up the plant to the leaf axils and whorl. The larvae grow through six instars, (the distinct developmental stages of an insect larva) moulting between instars. FAW larvae develop more quickly in mid summer than they do in spring or autumn. The duration of the larval stage can be as short as 14 days and longer when days and nights are cool (see Table 2 page 12 for regional development rate estimates).

When larvae are fully developed, they leave the plant and burrow into the soil to pupate, at a depth of 2cm to 8cm. During pupation they develop into moths inside a pupa (cocoon). Pupal development can take as little as seven days under optimal temperatures. The moth emerges from the pupal case and burrows out of the soil. Within a couple of days of emergence, female moths will mate and then start laying eggs. A female can lay up to 2,000 eggs in her lifetime and may live 10-20 days.

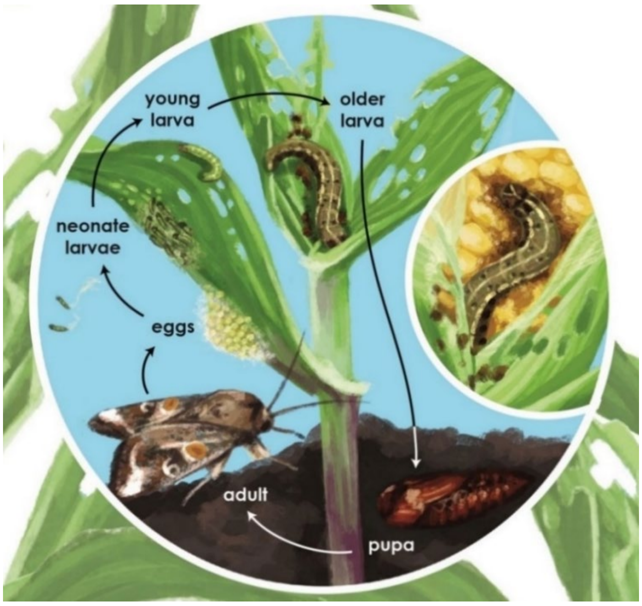


Figure 1 Fall Armyworm lifecycle. Illustration by Elia Pirtle, Cesar Australia. Source: Kearns et al. 2020. Fall Armyworm Continuity Plan: Australian Grains industry

Female FAW moth

Identification of FAW

Moths

Fall Armyworm moths are active at night (nocturnal) but are often encountered resting in the whorl of crops during the day. Moths are approximately 17mm long. Females have mottled grey-brown forewings and a paler hindwing (not visible when resting). Males have grey-brown forewings with patterning and a distinctive white patch on the tip of each forewing.

Female FAW moth

Female resting in a leaf whorl during the day

Male FAW moth

Note: Pheromone traps can be used to help in identifying FAW.

Pheromone traps attract only male fall armyworm, but may also attract other moths (bycatch) depending on the lure used and location. The distinguishing feature of male fall armyworm moths used to identify them in pheromone traps, where the wings may be damaged, is to look for the white hair pencils extruded from the tip of the abdomen. The most common bycatch species, *Leucania loreyi* (False armyworm) has brown hair pencils.

White hair pencils extruded from the abdomen of a male FAW moth – diagnostic for FAW

Eggs

Fall Armyworm eggs are laid in clusters that can range from 50–200 eggs. Typically, these clusters are covered with scales by the female moth after she has laid them. The density of the covering can vary from sparse to very thick.

When first laid, eggs are a bright white. Within 24 hours in summer, the eggs change to brown, and within two to four days dark brown to black as the Fall Armyworm larva develops and the dark head capsule becomes visible inside the egg.

White egg masses with light scale cover

Brown egg mass with moderate scale cover

Brown egg mass with the dark head capsule of developing larvae visible in some eggs

Egg masses with heavy scale cover

Eggs are most frequently deposited on the undersurfaces of leaves and towards the bottom of the plant. When FAW activity is high, eggs will be deposited on upper surfaces of leaves.

Egg mass on the lower leaf surface of a maize seedling

Larvae

Fall Armyworm larvae have six instars, moulting between each instar to allow for growth. As the larvae grow, they eat more and can cause more plant damage. Over the life of a caterpillar, 80-90% of what it will consume is eaten in the fifth and sixth instars.

Small larvae (1st–2nd instar, 1–4 mm long)

First instar larvae hatch from eggs and will eat the egg 'shells' leaving no sign of the egg mass.

First instar larvae hatching from an egg mass

First and second instar larvae are yellow-green coloured and translucent with a shiny black head capsule. On close examination, small larvae have lines of black dots running across the body and a reddish line along the side of the body.

Second instar FAW larva

Note: Small FAW larvae are similar to larvae of several other species. To improve confidence in identifying very small larvae, consider collecting these larvae, along with host leaf material, into a container. Keep the larvae for a few days until the key diagnostic features of FAW are visible, or another species can be identified.

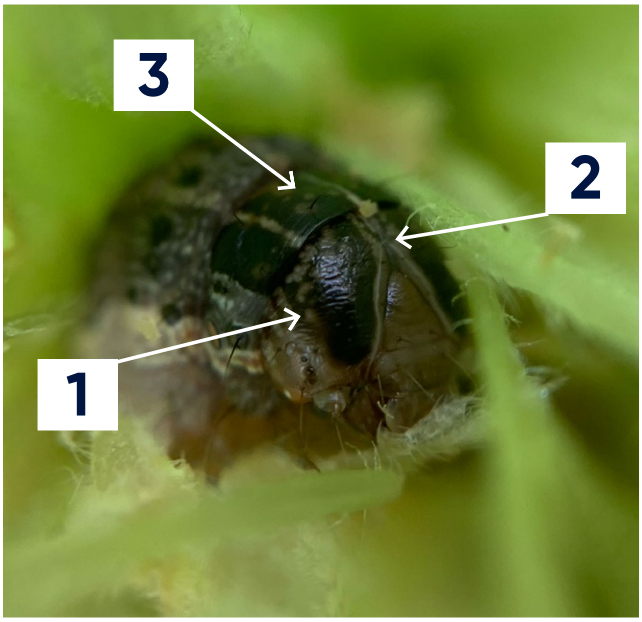
Medium and large larvae (3^{rd}–6^{th} instar, 5-35+ mm long)

FAW larvae are variable in colour, from brown through to light and dark green and grey.

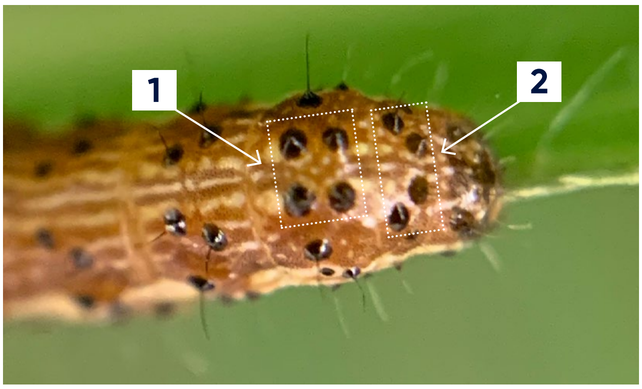
The key diagnostic features of FAW larvae are clearly visible in medium and large larvae, regardless of colour:

- Dark spots on the rear segments in a square pattern (abdominal segment eight) and a trapezoidal pattern (abdominal segment nine). Whilst there are other spots on the larva, these spots are typically raised and darker.
- The head and thoracic shield are the same colour.
- The head capsule has a white or pale, inverted Y on the upper surface and mottling on the sides.

There are additional diagnostic characteristics that require a microscope. For more information on FAW diagnostics visit **thebeatsheet.com.au**.



FAW head showing mottling on the head capsule (1), the inverted Y (2) and the thoracic shield the same colour as the head capsule (3)



The rear end of a large caterpillar showing a pattern of dark, raised spots with four spots arranged in a square (1) and the trapezoid of spots on segment nine (2)

Pupae

FAW generally pupate in the soil, however, under very high densities, pupation can also occur on maize plants in frass (larval droppings) and leaf debris in leaf axils. Larvae may pupate in loose soil near the surface, or burrow up to 8cm to create a chamber in which to pupate. When moths are fully developed, they emerge from the pupal case, crawl out of the chamber/soil and inflate their wings.

Top: FAW pupal chamber entrance at the base of a maize plant
Bottom: FAW pupa extracted from the soil

Note: FAW pupae look very similar to the pupae of other Noctuid caterpillar species (e.g. Helicoverpa, Common Armyworm).

Other caterpillar species found in crops and pastures

FAW caterpillars may be confused with several other common caterpillar pests of fodder crops and pastures. Importantly, if FAW is at densities likely to cause significant crop and pasture loss, they will be much more numerous than these other species. At lower densities (not causing crop or pasture loss) there may be several species present.

Being able to distinguish FAW from these other species is critical because:

- FAW is typically more damaging than other common caterpillar species,
- FAW larvae will not be controlled with insecticides used to target native armyworm and cutworm, for example,
- If it is not FAW, then monitoring and management responses are different.

The caterpillar species (other than FAW) that may be found in fodder crops and pastures are:

- Common cutworm (*Agrotis infusa*)
- Native Armyworm species
  - Common Armyworm (*Mythimna convecta*),
  - Dayfeeding Armyworm (*Spodoptera exempta*),
  - Beet Armyworm (*Spodoptera exigua*),
  - Lawn Armyworm (*Spodoptera mauritia*)
  - False Armyworm *(Leucania loreyi*)
- Cluster Caterpillar (*Spodoptera litura*) – in broadleaf crops

Almost all these species are nocturnal (feed at night) and may be difficult to find during the day when they shelter in leaf litter and soil at the base of plants. **This is another reason that decisions cannot be made just on visible damage to plants.**

For assistance with identifying other catepillar species contact local agronomists or refer to Identifying Armyworm larvae chart (**thebeatsheet.com.au**).

Common natural enemies of FAW eggs and larvae

FAW eggs and larvae have natural enemies that impact their survival. To date, there are limited surveys and in-paddock observations to determine which are the natural enemies.
There are predators (ladybirds, spiders and bugs) and fungal pathogens that should be noted as possible enemies.

Spined predatory shield bug nymphs (Oechalia schellenbergii) attacking FAW larvae

A FAW larva killed by the pathogenic fungi, Metarhizium rileyi

Assessing risk

Regional risk

Fall Armyworm is a tropical species, and the warmer regions of Australia (north, east coast) experience persistent populations throughout the year. However, even in the warmest regions, FAW activity wanes in the cooler months and increases over summer and autumn. In more southerly regions, the cooler conditions mean that FAW is largely absent in winter and spring, and local populations build up more slowly through summer and into autumn. Figure 2 describes the three proposed zones that capture these differences.

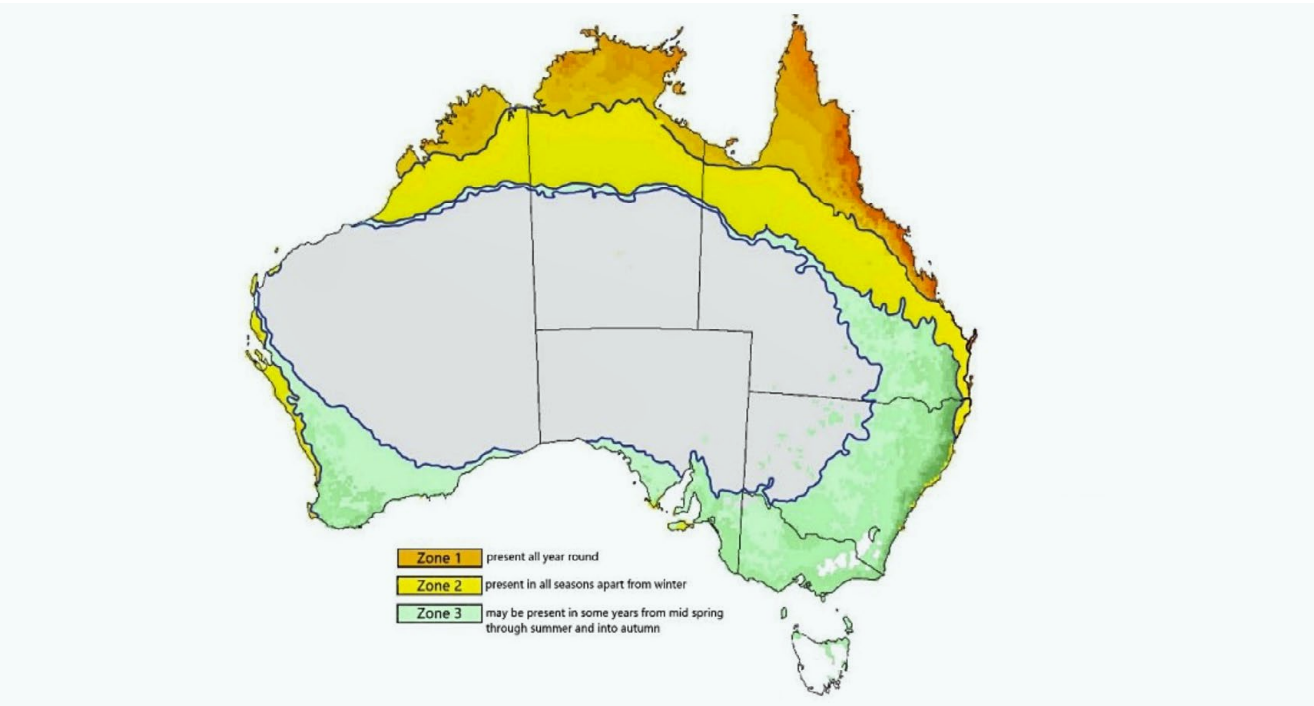
The Australian experience has been that the earlier in the spring-summer FAW infestations are detected in Zone 2 or 3 region, the greater the risk that populations will build up and be more damaging by late winter and spring. In some regions, FAW impacts can be largely avoided by adopting the earliest possible planting window, and ensuring crops are cut or harvested before FAW populations reach damaging levels.

Once FAW populations peak in late summer and autumn, the risk of ongoing, damaging infestations declines more rapidly in cooler regions (Zones 2 and 3) as temperatures drop. FAW development slows and egg and larval survival declines with the cooler conditions.

Seasonal risk

Seasonal conditions vary across regions each year, and several weeks of warm, favourable weather can significantly increase FAW populations by speeding up larval development. For example, extended warm conditions in Autumn 2024 across the Queensland and New South Wales dairying regions led to a rapid build-up of FAW numbers and severe damage to emerging winter forage crops.

Figure 2 FAW risk prediction map



Source: Kearns et al. 2020. Fall Armyworm Continuity Plan: Australian Grains industry

Crop/pasture susceptibility

The likelihood of significant crop or pasture loss caused by FAW is highly dependent of what species, when, where and how it is planted. Table 1 categorises the general susceptibility of commonly grown crop and pasture species. However, even preferred hosts like maize and oats can be grown without forage losses if they are grown when FAW activity is low. Crops and pastures that are typically not heavily infested by FAW can be severely damaged if FAW are 'forced' to feed on them.

Some commonly grown crop and pasture species are regularly infested by FAW, and crop or pasture loss can occur under moderate – high FAW activity (preferred hosts). Non-preferred hosts are not damaged significantly, even without control, even though small or short-lived populations of FAW may be observed. The risk of crop or pasture loss is increased by some established agronomic practices and in outbreak years.

Table 1 Preferred and non-preferred FAW hosts

Preferred hosts
• Maize • Sorghum (grain and forage) • White French millet • Oats • Annual ryegrass • Wheat • Barley
Non-preferred
• Legumes (e.g. lablab, soybean, clover) • Brassicas • Chicory (Asteraceae) • Millets other than White French
Records of crop and pasture loss* in specific instances
• Lucerne • Rhodes grass (at establishment when FAW active) • Annual ryegrass (sown with oats, oversown into FAW-infested kikuyu) • Kikuyu (sown late summer)

*losses in outbreak seasons, or when sown during peak FAW activity (late summer – autumn).

Recent Australian experience

Experience in Australia with FAW is relatively limited, the following is a list of situations where FAW impact and crop and pasture loss has been increased/induced by agronomic practices:

- Loss of oats, wheat and barley crops or pastures in autumn when sown early (February – mid March) when FAW activity is still high.
- Annual ryegrass damaged at emergence – establishment when sown in mixtures with oats. FAW laid eggs and larvae developed on the oats, and then moved onto the ryegrass when the oats were no longer available.
- Limited nutrition and/or moisture slowing plant recovery from FAW defoliation resulting in plant death with ongoing FAW feeding.
- Quickly sowing a susceptible crop or pasture into a paddock still infested with FAW larvae. This could be following a crop failure (e.g. severe FAW damage at establishment) or immediately following a crop cut for silage.
- Oversowing a susceptible crop and pasture (e.g. annual ryegrass) into a kikuyu pasture already infested with FAW.

Critical Growth Phases

Establishing maize and winter forage crops requires regular monitoring in the early growth stage, as severe FAW damage can cause plant death with little chance of recovery. This may result in costly re-sowing and significant delays in forage production.

Once maize reach the vegetative stage of six to ten fully expanded leaves, they can generally tolerate minor leaf damage and are more likely to recover.

For maize grown for silage, protection is particularly important from tasselling through to early cob development to maintain a high grain proportion in the cob, which directly affects silage quality. As the cob matures, maize becomes less attractive to FAW. Important to observe the chemical withhold period for harvesting or feeding to milking livestock when sprayed at this late stage of growth.

Crop and pasture monitoring

Monitoring is essential for the early detection of FAW infestations, before crop and pasture loss occurs. Regular monitoring of crops and pastures like maize, sorghum, oats and sown pastures for insect pests has not been as critical as it is now in regions affected by FAW.

FAW development rates to inform monitoring frequency

If growing susceptible crops and pastures when FAW is active (spring to autumn) in subtropical and temperate regions (zones 2 and 3, Figure 2), they must be monitored at least weekly or guided by the rate of development of FAW in the region and time of year they are grown (Table 2). The duration of the egg – end of third instar stages is the window in which infestations can be detected before significant crop damage occurs from that infestation. The risk of crop loss increases exponentially for larvae from fourth instar (80+% of feeding done in instars five and six). It is critical that infestations are detected before larvae reach this stage to limit the risk of significant crop loss, particularly in emerging and establishing crops.

The duration of the later period of development (fourth instar – end of sixth instar) provides guidance around how much more crop damage might accumulate if no treatment is applied.

The recommended in-crop monitoring strategy

The patchy distribution of larvae when FAW activity is low to moderate arise from hatching larvae distributing to adjacent plants from the infrequent egg masses deposited on plants.

Patchiness makes decisions more difficult because it requires an evaluation of the proportion of the crop that is infested and damaged. It is also challenging to avoid biasing this assessment because one's eye is drawn to the damaged plants.

In a fodder crop planted in rows, you can reduce this sampling bias by following a pre-determined transect through the crop (a W or Z path) sampling the field edges as well as the centre of the field. Along the transect, sample at a set number of paces (e.g. every 50 steps), or throw a 1m piece of conduit into the establishing pasture and sample plant/s closest to where it falls.

Table 2 Predicted development time (days) for FAW life stages at key fodder production locations relevant to the Australian dairy industry

		Development time (days)*							
Location	**Period of development**	**JUL**	**AUG**	**SEP**	**OCT**	**DEC**	**FEB**	**MAR**	**APR**
Cohuna, NSW	Egg - end of 3rd instar			34	23	12	11	16	39
	4th - end of 6th instar			32	20	10	9	13	43
Singleton, NSW	Egg - end of 3rd instar			23	17	11	11	13	24
	4th - end of 6th instar			21	15	9	9	11	21
Taree, NSW	Egg - end of 3rd instar			22	18	12	12	13	20
	4th - end of 6th instar			21	16	10	9	11	18
Oakey, QLD	Egg - end of 3rd instar		32	20	16	11	11	12	20
	4th - end of 6th instar		29	18	13	9	8	10	17
Gympie, QLD	Egg - end of 3rd instar		24	16	13	10	10	11	15
	4th - end of 6th instar		21	14	12	8	8	9	13
Atheron, QLD	Egg - end of 3rd instar	25	20	15	11	10	11	12	
	4th - end of 6th instar	24	18	13	9	8	9	10	

*Predictions developed using DARABUG2 (cesaraustralia.shinyapps.io/darabug2/). Mean temperatures calculated from the 2000-2024 period. Development starting 15th of each month (eggs, 4th instar)

Figure 3 Example 'W' pattern to be used for monitoring in solid planted crops

The number of plants, or the number of metres of consecutive plants, to sample is guided by the level of infestation. When the infestation is low and patchy, the priority is to determine what proportion of the field is infested. When the infestation is moderate to high most plants will be infested. In these situations, the priority is to determine the number of egg masses and the number and size of the larvae per plant to determine the risk of crop loss.

The most reliable way to assess egg and larval infestations is to:

- Randomly select plants as traversing a transect of the paddock.
- Individual plants, or several consecutive plants can be examined.
- Pull up plants (or cut off at the base) and examine all leaves for eggs – holding the plant upside down and look at the lower leaf surfaces.
- Pull leaves back from the stem to examine leaf axils.
- Unroll the whorl.
- Record the number of egg masses, larvae (categorised as small, medium or large) and the level of plant damage.
- It is not necessary to count first instar larvae; it is sufficient to record them just as present. Mortality of very small larvae is very high, and they do not contribute to plant damage at that stage.
- Monitoring frequency is guided by the rate of FAW development in your region (Table 2). As a rule of thumb, monitor at least weekly.

Even if feeding damage is visible, it is important to dissect the plant to confirm that larvae are still actively feeding and to quantify the infestation (number and size of larvae). This is especially important when making a post-treatment assessment when larvae may have died, but the recent feeding damage remains visible.

Larval mortality (death) can be caused by the activity of natural enemies (e.g. predators, parasitoids, pathogens), monitoring the progression of an infestation provides useful information on the ongoing risk to the crop or pasture.

A table to record FAW monitoring data is available through dairyaustralia.com.au.

Additional considerations when monitoring in establishing crops and pasture

In establishing crops or pasture, where the plants are too small (or too damaged) for larvae to remain in the canopy during the day, they may shelter in the soil or leaf litter. When larvae cannot be found in or on plants during the day, but damage is still occurring, it may be necessary to visit the crop or pasture at night and/or use a trowel to look in the soil around the base of damaged plants.

Larvae in the soil at the base of plants, particularly larger larvae (fourth to sixth instar) pose a major risk to establishing plants. These larvae will feed on the stalk below ground, often damaging the growing point or severing the stem entirely. Wilting is the first sign of this type of damage to seedlings.

Sweep net sampling in pasture

In established pasture, a sweep net can be useful to make a rapid assessment of the caterpillar population in a crop. If a consistent method is used (e.g. 10 sweeps per sample x 20 samples across the field), this is an effective way of assessing the species of caterpillars present, and their number and size.

Be aware that FAW and other pasture pest caterpillar species are nocturnal (e.g. Common Armyworm) and may not be in the canopy during the day. Combining sweep net sampling with examination of the soil at the base of damaged plants is a comprehensive sampling methodology for FAW and other caterpillar species that occur in pasture.

A sweep net

FAW larvae collected using a sweep net in established oats

Pheromone traps

Pheromone traps have been deployed across Australia to detect FAW moth activity. The traps attract only male FAW using a lure that releases a synthetic female pheromone. Male moths enter the trap and cannot escape, allowing numbers to be assessed at weekly (or more frequent) intervals.

The data from the trap network has informed our understanding of regional differences in the patterns of FAW activity through the year, but with just a small number of traps deployed (e.g. one per farm or three per district) they cannot predict the size of the FAW larval infestation in nearby crops. Pheromone traps are not a tool for making management decisions. At best they can prompt in-crop monitoring.

Note: Be aware that FAW infestations are frequently detected in crops before FAW are detected in pheromone traps.

Running a pheromone trap (or several) in your district throughout the year, and over several years, will provide insights into when FAW arrive (migration) and how they build up during the season, perhaps in response to the availability of host crops.

For information on sources of traps and lures, directions on how to set up and position a trap on-farm, and seasonal trap data – see The Beatsheet (**thebeatsheet.com.au**).

A manual bucket-style pheromone trap

Signs of FAW activity in crops and pasture (damage)

Watch for

- Pasture/crop not emerging as expected, or patchy emergence
- Seedling establishment slower than expected
- Pasture established, but bare patches evident and expanding
- Weeds emerging, indicative of bare patches

Inspect plants looking for

- Seedlings with small, clear ‘windows’ in the emerging leaves
- Seedling emerged but wilting – look for damage below ground
- Expanding leaves and whorl with holes, scalloped edges or whole leaf blades missing
- In the most severe cases, seedlings reduced to stumps.
- Caterpillar frass (poo) visible in the whorl and leaf axils, and/or on the ground around the base of plants

Action threshold

Assess Risk (Low or High) depending on whether FAW threshold levels have been reached.

Maize & sorghum

Emergence to four fully expanded leaves (V4)

Note: One large medium-large larva per plant can cause seedling death.

Early growth stages can tolerate some defoliation and may require no action.

Large larva (15+ mm) can severely defoliate seedling plants and plant death can occur when these larvae feed on the stem, including below ground, killing the growth point.

Plants that are establishing more slowly because of dry or cool conditions are at increased risk.

V4 to tasselling/head emergence

Crop loss occurs when FAW feeding impacts crop growth for an extended period (more than 2 weeks).

Preliminary threshold (maize & sorghum) = an average of 1 large larva per plant at 2 consecutive checks.

Check Assessing Fall Armyworm risk chart for required Action if threshold is reached.

Pastures

Assess whether the pasture is vulnerable to loss due to age or intensity of infestation, early growth stages can tolerate defoliation.

Plant death is likely if medium-large larvae are present, or the infestation is very high density.

No Australian derived thresholds.

US threshold: 2-3 FAW larvae per square foot (=21-32 per square metre).

Action

The impact of FAW on the crop or pasture must be considered in the context of the crop or pasture, the rate of growth and capacity for recovery, which is largely related to available moisture, temperature and radiation.

In the case of severe defoliation and plant death, delay resowing until the FAW risk is lower is suggested.

Where damage is minor and/or patchy, continue to monitor five to seven day intervals.

Early grazing or cutting to utilise the biomass before FAW defoliate is an option for established stands.

Maize and sorghum FAW damage



‘Windowing’ in third & forth expanded leaves of maize plants (left, middle). The windowing is caused by small-medium FAW larvae feeding in the whorl or on the expanded leaves (right). The signs of FAW feeding at this stage are very similar in maize and sorghum.


Severely damaged maize (left) resulting from prolonged, high-density infestation that was not controlled.
At eight to ten fully expanded leaves (V8-V10) sorghum can yellow in response to FAW infestations, even where defoliation is low to moderate (right).

When large larvae feed in the whorl, large, jagged holes are visible in expanded leaves (left). Feeding in the whorl can also result in large portions of the leaves breaking off (centre), further reducing functional canopy size and giving the crop the appearance of having been 'slashed' (right).

Mid vegetative stage maize heavily infested with severe defoliation and plant death (left). Plant death occurs when large larvae burrow into the base of the plants damaging the growth point (right).

Severely damaged maize that had a prolonged and high-density infestation impacting yield though reduced canopy. Tassels were damaged in the whorl, but this is less likely to impact yield than the defoliation impacts on crop growth.

Damage to cob (left) and pre-flowering sorghum head (right).

Oat pastures

Patchy stand caused by FAW feeding on emerging and establishing oats. This pasture was planted in late summer (February) when FAW were still very active in the district.

Large larvae can sever oat plants at the base – like the damage caused by common cutworm.

Feeding by small-medium FAW larvae create windowing in oat leaves (left). Scalloping on the leaf margins (centre) and severing of the whorl (right) caused by FAW feeding in established oats.

Pasture

Ryegrass and chicory sown into kikuyu before (left) and after (right) a FAW infestation (Dr. Neil Moss, Scibus).

Insecticide resistance in FAW – implications for management

The Australian FAW population arrived with established resistance to two key groups of insecticides currently used to control caterpillar pests in crops and pasture.

Screening by Dr Lisa Bird (NSW DPIRD) in 2021 (Bird *et al.* 2022):

HIGH resistance to synthetic pyrethroids (e.g. alphacypermethrin, deltamethrin).

MODERATE resistance to carbamates (e.g. methomyl).

The use of synthetic pyrethroids and carbamates to control FAW is NOT recommended.

In practical terms, a high level of resistance means that it is very likely that application of an insecticide from this mode of action (MOA) will result in a control failure. If using a product to which FAW has moderate resistance, control failure is likely if targeting larger larvae but control may be adequate at low densities or when targeting small larvae.

In 2024, no resistance to other MOAs had been detected in FAW populations from across Australia.

Annual updates on FAW and Helicoverpa (heliothis) resistance screening are available on the Beatsheet website **thebeatsheet.com.au**.

Further information and resources referenced

Dairy Australia website (**dairyaustralia.com.au**)

The Beatsheet website (**thebeatsheet.com.au**)

Cesar Australia: DARABUG2 – Insect growth rate and development simulator (**cesaraustralia.shinyapps.io/darabug2/**)

Bird L, Miles M, Quade A, Spafford H (2022) Insecticide resistance in Australian *Spodoptera frugiperda* (J.E. Smith) and development of testing procedures for resistance surveillance. PLoS ONE 17(2): e0263677. **https://doi.org/10.1371/journal.pone.0263677**

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