# Monitoring cereal aphids to make management decisions

**By Melina Miles, AgriScience Queensland, DEEDI. Toowoomba.**
**Melina.miles@deedi.qld.gov.au**

In most seasons, aphids build up in winter cereal crops and then decline rapidly without any intervention. The activity of natural enemies – predators, parasitoids and occasionally disease – are responsible for this population decline.

It is early days in terms of our understanding of aphid thresholds. In other words, we still have a lot to learn about how many aphids, at which stage/s of cereal growth, have an impact on yield or quality. Aphid numbers alone are not necessarily an indication of whether control is warranted.

However, monitoring aphid numbers in a crop provides important information on whether the population is growing rapidly, static, or in decline. Recording aphid density, and the presence of natural enemies, over a number of visits will provide a clear picture of aphid population dynamics.

Figure 1 illustrates how rapidly a population can decline – a trial to nothing in two weeks! It also illustrates how a series of population estimates makes it possible to be confident about what the population is doing. Trying to make a decision on aphid control based on a single crop visit would not allow you to determine if the population was increasing or decreasing. Recording the presence of natural enemies adds to the understanding of how likely it is that the population may be controlled without a spray.

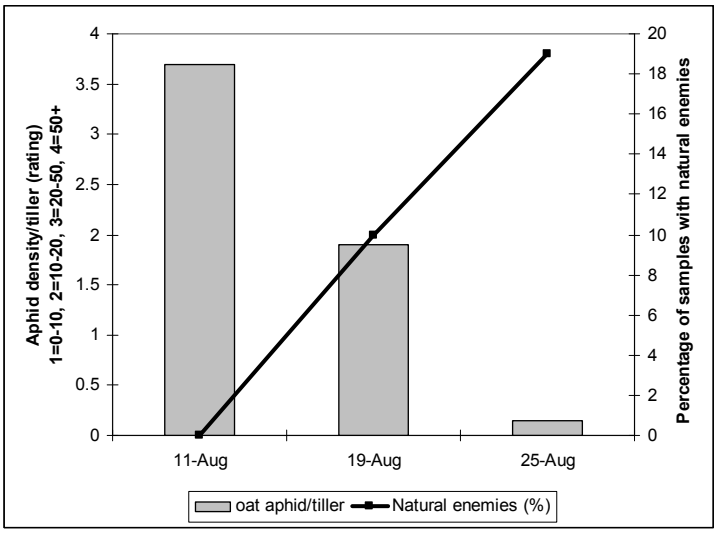



Figure 1. An oat aphid population in rapid decline, wheat, Dalby 2009.

Key natural enemies of cereal aphids are:
**The parasitoid wasps**; most frequently parasitoid activity is apparent from the presence of wasp pupal cases, commonly referred to as 'mummies' (Figure 2).

**Ladybeetles**, both adult and juveniles, are predaceous. Most common in cereal crops are the white collared, the three-banded and the transverse (Figure 3).

Adult **hoverflies** are often highly visible, flying in crops. Larvae are difficult to see, but are voracious predators and live in close association with aphid colonies (Figure 4).

## Aphids in Wheat and Barley – They are already there!

## By Tony Lockrey,Consulting Agronomist, Buy Smart Ag - Moree

As with a lot of things agricultural, we are learning actively as we go. We are continuing to attempt to drive our cereal cropping system harder to maintain it as a productive and profitable machine. We are also rapidly gaining a better understanding of aphid species, critical crop stages, predator to prey ratios and methods of treatment. Here is a sample of where we were in 1992; ***"If 27 out of 30 plants are covered with aphids and if there are less than 2 ladybird beetles or larvae, syrphid larvae or lacewing larvae per plant on each of the infested plants, then spray…dimethoate"*** ("Managing Insects & Mites in Field Crops, Forage Crops & Pastures" (QDPI 1992). Our current understanding would suggest that if that many plants are covered with aphids you have already done yield and quality damage to the crop.

The Northern Grower Alliance (NGA) and Qld Department of Primary Industries (DEEDI) have put in a lot of recent effort in identifying species as well as their timing of arrival, population build up and examining thresholds for management. Excellent work has been done identifying economic responses to timing and options for treatment.

Aphid pressure has increased over the past three to four years in the north western cropping area of NSW. We have seen economical crop damage from seedling pressure (caused by oat aphids on the crown and secondary roots reducing tillering and early crop vigour) and later in the crop when numbers of oat, corn and rose grain aphids have caused pinched grain and reduced yield due to sap sucking. Their impact on yield and quality is increased in dry years. These are common!

A guide to thresholds being evaluated by the NGA in conjunction with the Qld DPI indicates that a level of 10-15 aphids per tiller – and increasing- appears a realistic trigger population for control. Early in the crop, during the establishment phase, sample the crown and sub crown roots for oat aphid, particularly in years with a dry start. This threshold number will be lower if application costs are reduced by piggy backing on another in-crop spray. If a spray is timed too early or does not clean up the population sufficiently their numbers may flare again later in the crop.

Now that we have recognized the potential yield loss to aphid damage we are utilizing seed and foliar treatments. **Seed treatments** cost approximately $10-$11 per hectare and frequently give 70-100 days suppression of aphid numbers. In heavy aphid years, particularly if the infestation occurs early in the crop, there is a clear advantage using an aphicide seed treatment against not treating at all. In recent NGA trials an economic advantage of $25-$50 per hectare was realized from seed treatment in a

year with high pressure. However if aphid pressure was very low there would be an economic disadvantage to treating seed. If aphids came late and in high numbers a foliar spray may still be required to top up control. It appears now that with a couple of seed treatment registrations to choose from, lower per hectare cost and more regular aphid pressure, the seed treatments are coming back into contention. They are soft on beneficial arthropods because they are only picked up by sap feeders.

Some useful **foliar spray** options also exist for in-crop control. Products include conventional chemistry with some systemic activity as well as pirimicarb that has some fumigant activity (if it is warm enough) and is softer on beneficials. Cost of products are approx $5-$8/ha plus application with returns similar to the seed treatments of a $25-$50 per hectare in recent trials under moderate to heavy aphid pressure. The advantage of a foliar spray is that money is not spent until there is a clear advantage in doing so. Careful monitoring is required to ensure timing is correct. The correct product and rate along with adequate coverage are the keys to getting good control.

Management decisions need to be based on a number of key criteria as well as some more obscure ones that are still valid parts of the system and therefore the decision framework. The obvious criteria are **disease spread** (barley yellow dwarf virus), **aphid numbers** per plant or per tiller on average across the field and their likely build up, **predator and parasite numbers** and their likely build up, **cost of control** including application costs, **effectiveness of control** choice, **soil moisture and nutrient status, potential yield reduction** caused, and **expected value** of the commodity at time of sale.

Less obvious things to consider include: a crop with low vigour will not be as good a weed competitor, nor will it recover as well from being checked by a herbicide application or frost. Secondary root development (critical to subsoil moisture use and plant stability) appears to be affected by oat aphid. Stubble cover following the crop will be reduced in areas of heavy pressure. Management of operations on the farm must also be considered. Crop uniformity and timing to harvest can be affected.

Some of these criteria rely on an estimate of future events while others can be measured more objectively at the time of decision making. The overall cost of control can be reduced (thus reducing the threshold value) if the application cost is shared. Always ensure when mixing products they are compatible physically and chemically and won't result in crop phytotoxicity or burn.

When weighing up all of the above factors and making a recommendation to a grower I tend to favour the health of the crop. I am keen with all aspects of the crop to have it in the best condition economically possible to capitalize on potential upside with rain. This is when our most efficient and profitable crops are grown. If a low target yield is set and decisions are made that are too conservative, growers can miss the potential upside of the crop (into the profit zone) with beneficial rain.

Spending time in this current winter crop I am finding moderate numbers of oat aphids in the crown already. Most of our crop has just received adequate rain to initiate secondary roots and meet up the moisture. This should avoid any impact of

aphids on establishment and tillering. We will just need to keep watching to see what numbers develop in the crown and canopy from now on.

# APHID MANAGEMENT IN WINTER CEREALS – NECESSARY OR JUST AN ADDED COST?

**By Richard Daniel NGA**

### At a glance

- *Cereal aphids were found at all 14 trial sites planted during 2008 and 2009 but at, or exceeding, a 'provisional' threshold of 10-15 aphids/ tiller at 11 of the 14 sites*
- *Similar populations of oat and rose grain aphid were found in barley, wheat and durum*
- *Corn aphids were nearly exclusively found in barley*
- *In both years, untreated aphid numbers rapidly built up and then declined ~3-4 weeks later with high levels of beneficial insect activity seen particularly in 2009*
- *Seed treatment containing imidacloprid has consistently provided significant reductions in aphid numbers for ~70-90 days from planting*
- *Zorro seed treatment resulted in an average barley yield benefit of 220 kg/ha in 2009 (range -15 to 440 kg/ha) compared to 330 kg/ha in 2008 (range 239 to 439 kg/ha) under higher aphid pressure*
- *A well timed foliar insecticide application has provided similar yield benefits to an aphid active seed treatment*
- *Impact on grain quality has been much less dramatic than the yield impact in both years*

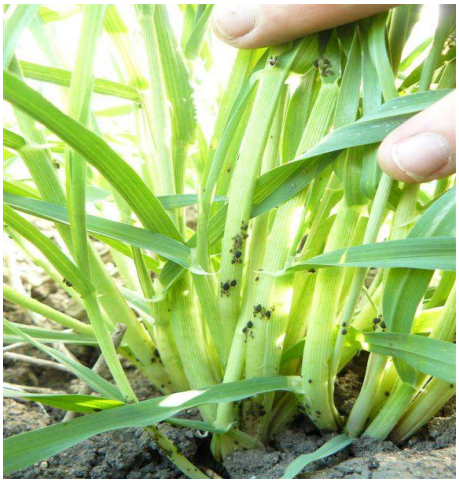
### Background

During the last two winters, NGA has been involved in a large number of trials to improve our understanding of the impact of aphids on winter cereal yields and the costs and benefits of different management approaches. The total of 14 trials have also benefited from collaborative activity with DEEDI (formerly QDPI&F) and I&I NSW – including the involvement of I&I NSW District Agronomists from Dubbo to Moree and the northern barley agronomy group led by Dr Guy McMullen.

### What have we found so far?

#### Aphid species and pressure

In nearly all trials we have found three different species of aphid. Generally the first detected has been the oat aphid (*Rhopalosiphum padi*). This aphid is often first found in the crown or sub crown internode before moving higher up the plant later in the season. Trial results in 2009



strongly indicate that this aphid species can reduce the number of viable tillers produced.

The corn aphid (*Rhopalosiphum maidis*) is a species which prefers the 'top' of the cereal plant and is nearly always found in the youngest unfurling leaf.

The third common species is the rose grain aphid (*Metopolophium dirhodum*). Rose grain aphids are easily identified, due to their pale colouring and prominent green stripe down the middle of their back. They are found throughout the canopy and frequently in dense colonies on the undersides of leaves.

**Crop preference ?**

Barley is often considered the most 'susceptible' of the winter cereals to aphid pressure and consequently the crop most often warranting management consideration. In 2009, 8 of the trials compared aphid pressure and impact on a similar maturity barley, bread and durum wheat variety. The general pattern was that all three cereals had roughly equivalent populations of the oat and rose grain aphids but corn aphid pressure was nearly exclusively associated with the barley variety in these trials. The apparent preference of corn aphids for barley and their obvious location at the top of the plant may explain why barley is often thought to experience more aphid pressure than bread or durum wheat.

### Population dynamics

All trials have been planted at sites randomly located throughout the northern cropping region. In 2008 we found high aphid pressure at all 4 sites (peak population >70 aphids/tiller at all sites). In 2009 the pressure was lower but aphids were still found at all 10 sites (>10 aphids/tiller at 7 of the 10 sites).

A common feature in nearly all trials has been the rapid build-up and then decline of the aphid population over a 3-4 week period. Figures 1 and 2 show examples of the aphid build-up and decline at Lundavra and Yallaroi in 2009. It is currently believed that beneficial insect activity (parasitic wasps and predators) is primarily responsible for this decline.

Figure 1 – Aphids on untreated Fitzroy barley, Lundavra Qld 2009

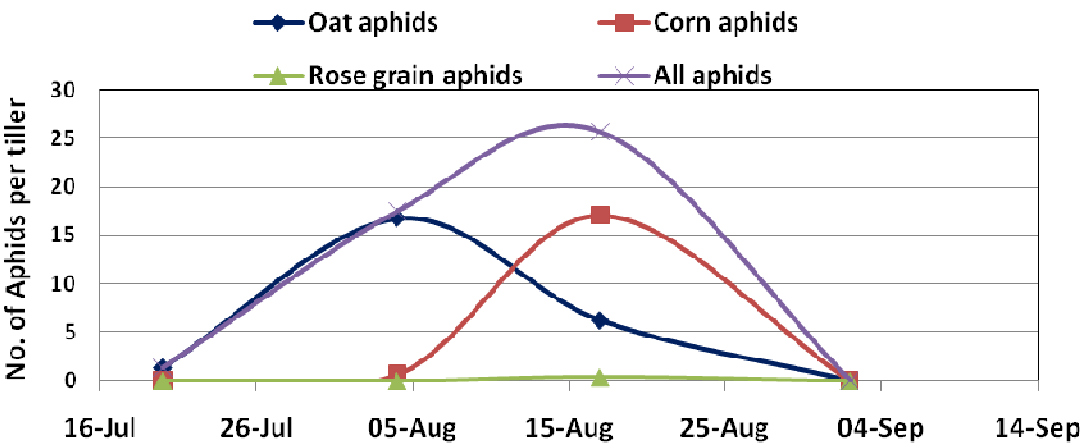
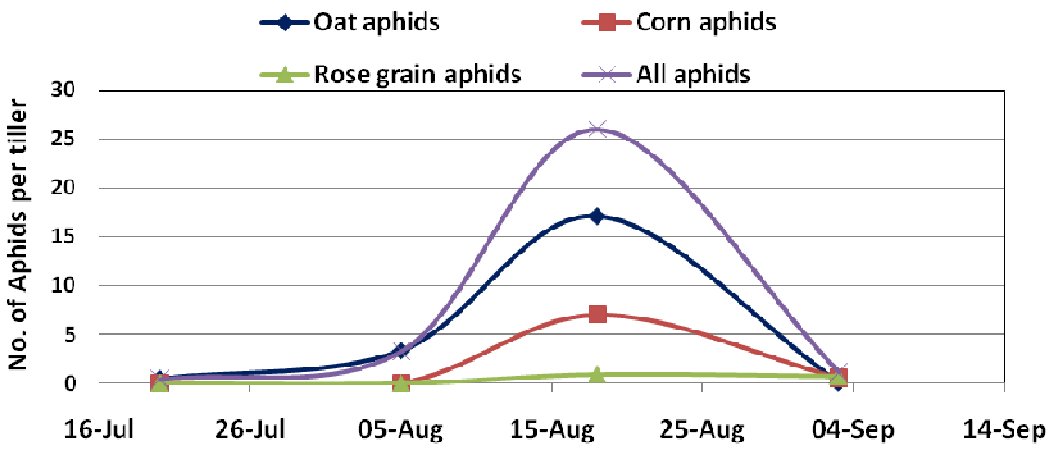



Figure 2 – Aphids on untreated Fitzroy barley, Yallaroi NSW 2009




Although neither of these sites had high levels of rose grain aphids, the apparent pattern of oat aphids being the first 'arrivals', followed by corn aphids and finally rose grain aphids has been common in many trials during both seasons.

Actual timing of population increase has differed markedly over the two seasons. In 2008 aphid pressure only began to be evident in late August with most pressure in September. This was a year with a very cold spell during early August. In 2009 - a season with milder late winter temperatures - aphid pressure built up in late July with most pressure experienced in August.

### Management approaches evaluated

In 2008, all four trials included Grout, Fitzroy and Gairdner barley and evaluated the impact of Zorro® seed treatment at 400 mL/100 kg seed (Zorro contains 180 g/L imidacloprid or 72 mL/100 kg seed) and foliar insecticide approaches (Pirimor® or dimethoate).

In 2009 two intensive barley sites were conducted comparing 8 approaches on both Grout and Fitzroy barley. In addition eight trials were conducted comparing the impact of aphids on Fitzroy barley, Livingston bread wheat and Bellaroi durum. Key treatments evaluated in 2009 included Zorro on barley at 400 mL/100 kg seed, Hombre® on wheat and durum at 400 mL/100 kg seed (both contain 180 g/L imidacloprid or 72 mL/100 kg seed), Emerge® on all crops at 240 mL/100 kg seed (Emerge contains 600 g/L imidacloprid or 144 mL/100 kg seed) and foliar application of Pirimor when provisional aphid threshold numbers were reached (~10-15 aphids/tiller). All treatments had an equivalent loading of basic fungicide seed treatment.

### How effective were the management options?

The Moree barley site was the trial with most frequent aphid assessment. This trial was sown on the 1st of June 2009. Figure 3 shows the total number of aphids in Untreated Fitzroy barley (only treated with Baytan fungicide at 150 mL/100 kg seed) over a 10 week period. The three separate 'peaks' in total aphid counts roughly show

the peak of each aphid species (oat aphid in early–mid August, corn aphid in mid-late August and rose grain aphid in early September).

The two lines marked Zorro and Emerge show the impact of the two rates of imidacloprid on total aphid numbers over the same period. Both imidacloprid rates gave high levels of suppression of the oat aphid population (1st peak) but with poorer activity by early September. The high rate of imidacloprid (shown by Emerge line) appeared to provide an additional 2 weeks of aphid suppression.

Figure 3 – Impact of seed treatment on aphid counts (Fitzroy barley, Moree NSW 2009)

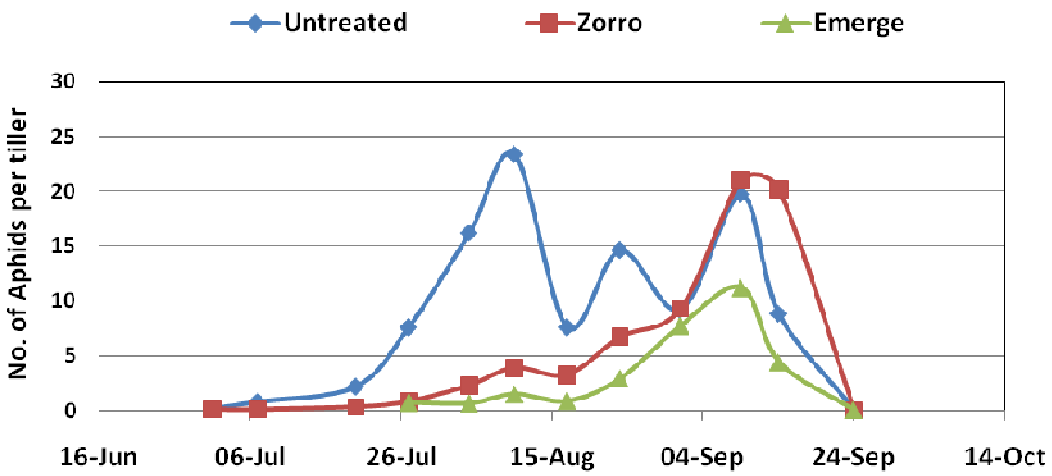
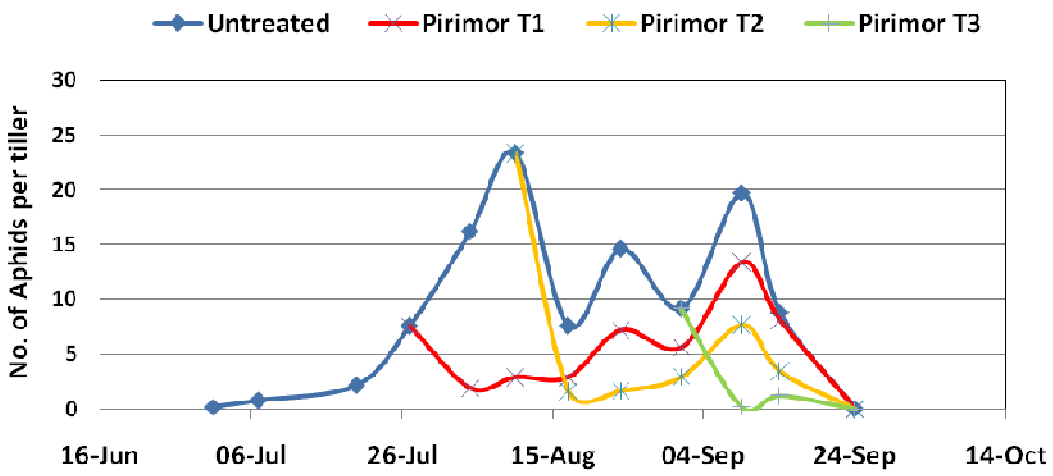



Figure 4 shows the impact from a foliar application of Pirimor. Each application timing was as a standalone treatment. Good levels of knockdown control were obtained from Pirimor at each timing.

Figure 4 – Impact of foliar application on aphid counts (Fitzroy barley, Moree NSW 2009)




**Beneficial insects**

Although both aphid active seed treatment and foliar insecticide application are effective management tools for aphids, we should not overlook the importance and impact of beneficial insects in managing cereal aphids. In a number of trials in 2009 aphid populations were kept below the 10-15 aphids/tiller threshold without any insecticide. The primary insect responsible appeared to be the parasitic wasp (*Lysiphlebus testaceipes)* seen in the photo below attacking an oat aphid

These small black wasps were present at high numbers, at many trial sites, throughout the crop canopy and reduced aphid populations to negligible levels within a couple of weeks. The characteristic sign of parasitic wasp activity is the presence of mummified aphids (see photo on right). These mummified aphids often appear as swollen brownish individuals, generally ~8-10 days after attack.

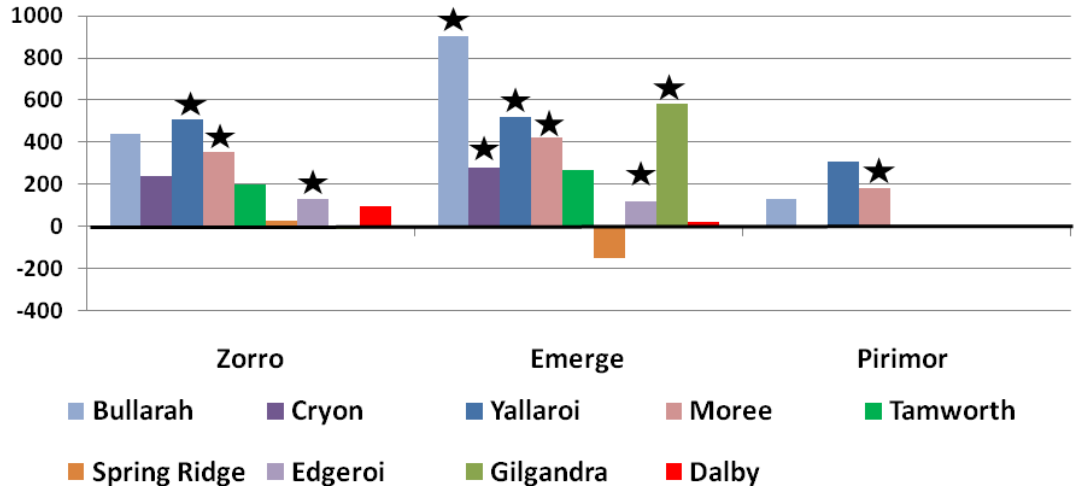
It is important to take account of beneficial activity when deciding whether to apply a foliar insecticide. Where mummies are already present and aphid populations are still below threshold, it is likely that no foliar application will be necessary. However a threshold taking into account the presence of mummified aphids or wasps still needs to be developed.

### Yield impact 2009

Figures 5-7 show the yield results obtained in 2009.

The most consistent benefit was seen in barley with an average yield benefit of 220 kg/ha from Zorro, an average yield benefit of 331 kg/ha from Emerge at 240 mL/100 kg seed and an average yield benefit of 156 kg/ha from Pirimor. Significant yield benefits were seen in 3 of 9 trials for Zorro, in 6 of 9 trials for Emerge and at 1 of 4 trials where Pirimor was applied (see Figure 5). No yield results were presented for the Lundavra site due to harvesting problems.

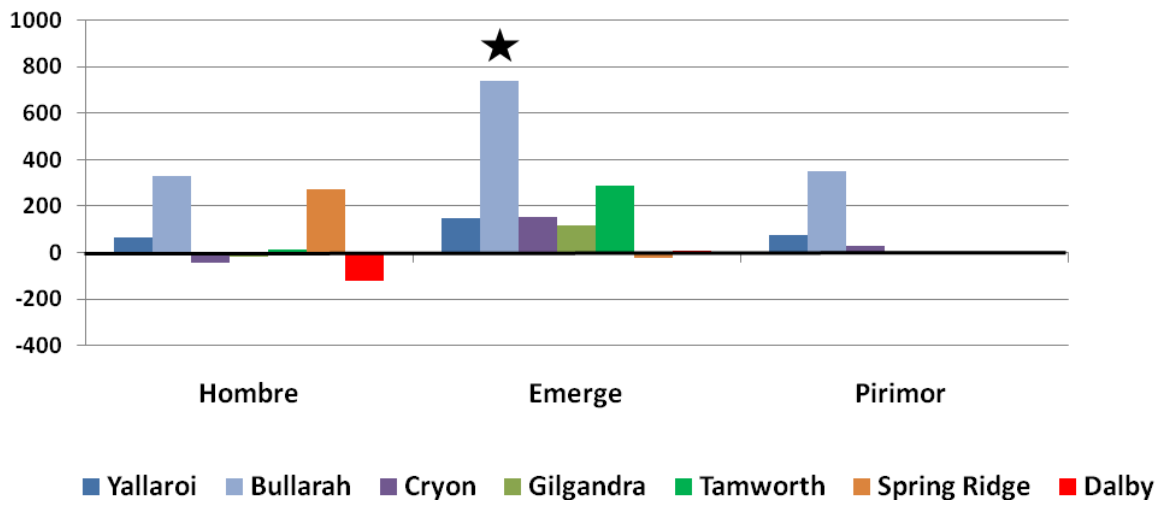
Figure 5 – 2009 Barley yield benefit/loss (kg/ha) compared to Untreated




★ = significant yield benefit versus Untreated
NB Sites are arranged from left to right in order of highest to lowest peak aphid population.
Pirimor only applied at Bullarah, Cryon, Yallaroi and Moree sites

Figure 6 shows the yield impacts recorded in bread wheat. Benefits were lower than seen in barley but still generally positive. An average benefit of 71 kg/ha was obtained from Hombre, 204 kg/ha from Emerge at 240 mL/100 kg seed and 151 kg/ha from Pirimor. Significant yield benefits were only seen in 1 of 7 trials for Emerge but at no site for either Hombre or Pirimor. No yield results were presented for the Lundavra site due to harvesting problems.

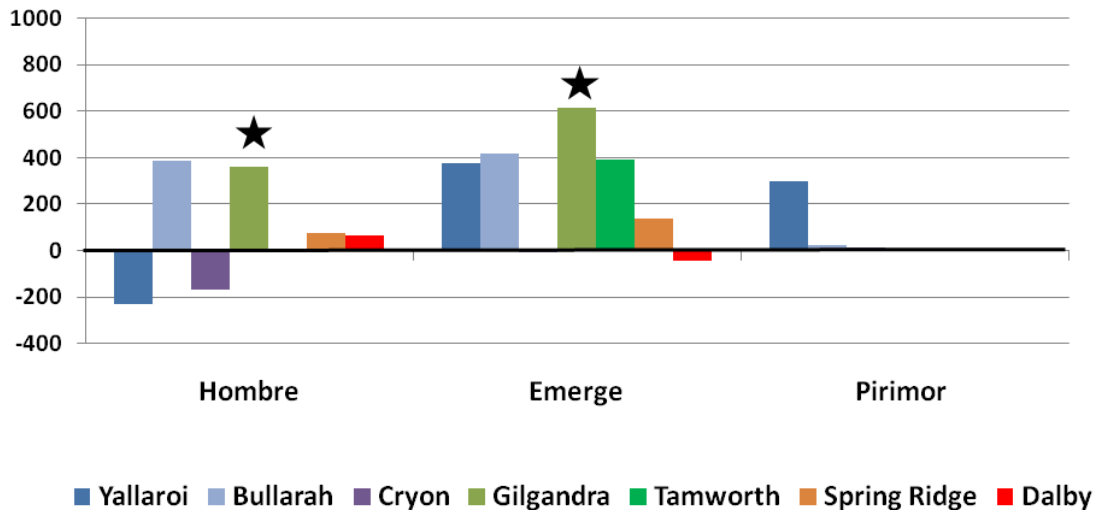
Figure 6 – 2009 Wheat yield benefit/loss (kg/ha) compared to Untreated




★ = significant yield benefit versus Untreated
NB Sites are arranged from left to right in order of highest to lowest peak aphid population. Pirimor only applied at Yallaroi, Bullarah and Cryon sites

Figure 7 shows the yield impacts recorded in durum wheat. Average benefits were similar to those achieved in bread wheat but with more variability. An average benefit of 70 kg/ha was obtained from Hombre, 270 kg/ha from Emerge at 240 mL/100 kg seed and 111 kg/ha from Pirimor. Significant yield benefits were only seen in 1 of 7 trials for both Hombre and Emerge and at no site for Pirimor. No yield results were presented for the Lundavra site due to harvesting problems.

Figure 7 – 2009 Durum yield benefit/loss (kg/ha) compared to Untreated




★ = significant yield benefit versus Untreated
NB Sites are arranged from left to right in order of highest to lowest peak aphid population. Pirimor only applied at Yallaroi, Bullarah and Cryon sites

### Economics 2008 and 2009

Barley has been the most evaluated crop but also has shown the most consistent benefit from aphid management. In 2008 - under higher aphid pressure - Zorro at 400 mL/100 kg seed resulted in a **net benefit of $37/ha over 4 trials** (range $25 to $50/ha, assuming a grain price of $125/t). In 2009 - under lower aphid pressure - Zorro at 400 mL/100 kg seed resulted in a **net benefit of $28/ha over 9 trials** (range -$7 to $72/ha, assuming a grain price of $152/t).

In contrast for both bread and durum wheat the average net benefit in 2009 from the use of Hombre at 400 mL/100 kg was only ~$8/ha. Although still positive this only represents a low return on investment.

The higher rate of imidacloprid (Emerge at 240 mL/100 kg seed) was only evaluated in 2009 but did provide encouraging results for both length of aphid suppression and economic result.

Foliar application has resulted in similar returns to an aphid active seed treatment when timed on increasing aphid populations.

### Key points

1. Thresholds: a threshold of ~10-15 aphids/tiller - and increasing - appears a suitable commercial trigger for aphid management in winter cereals.
2. Monitor for early populations of oat aphids by pulling up plants and examining crown and sub crown regions

3. However only consider foliar sprays when majority of oat aphids have moved above ground into lower canopy
4. Best results from foliar sprays when aphid population is close to threshold and increasing
5. Beneficial insects can provide very effective aphid control in winter cereals. Consider beneficial presence or activity before making spray decisions
6. Consider aphid active seed treatments for use in barley or areas with consistently higher aphid pressure

**Project activity 2010**

NGA have established an additional 4 sites to further examine the impact of aphids on bread and durum wheat in comparison to barley. This work should help further clarify the cost and benefits of aphids in the key winter cereal crops.

**Contact details**

Richard Daniel
Northern Grower Alliance
Ph: 07 4639 5344
Email: richard.daniel@nga.org.au