APHIDS IN CEREALS

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Key words

Wheat, Barley. Aphid, seed treatment, insecticides

GRDC code

NGA00001: Validation and integration of new technology through grower groups in north-west NSW and south-west Queensland grain growing zones
NGA00002: Validation and integration of new technology through grower groups in north-east NSW grain growing zones
DAN00131: Northern Barley Agronomy

Take home messages

- Lower aphid pressure occurred in 2009 than in 2008
- Aphids cause yield loss in barley wheat and durum
- 3 species of aphid on Barley, 2 species on wheat
- Parasites and predators will control aphid populations but speed of control can be a problem
- Oat aphids appear to affect yield by reducing the number of viable tillers.
- Seed treatments give economic control. Average net benefit was up to $36/ha.
- Foliar sprays effective if timing is right.

Background

In 2008 NGA conducted trials at 4 locations on 3 barley varieties to assess the impact and economics of managing aphids. Three different species of aphid were found with economic net benefits averaging $33-37/ha from either an aphid active seed treatment (imidacloprid) or a well timed foliar insecticide.

The 2008 activity provided some information on benefits and approaches to consider in a high aphid pressure season. However it highlighted our limited understanding of the impact of aphids in winter cereals. The following were among the issues that needed to be addressed:

- What impact do aphids have on bread wheat and durum?
- Do all three aphid species have a similar economic impact?
- Understanding the population dynamics of the different species
- Can an IPM approach assist in lowering/ delaying pest pressure?

Trial activity 2009

NGA conducted two intensive ‘in-house’ trials at Moree and Edgeroi evaluating a range of management options on Grout and Fitzroy barley. In addition eight trials were conducted in collaboration with I&I NSW and DEEDI at Dalby, Lundavra, Yallaroi, Bullarah, Cryon, Tamworth, Spring Ridge and Gilgandra. These trials compared the impact of aphids on a barley, bread wheat and durum under the same conditions.

The imidacloprid seed treatment did not give season long control in 2008. In 2009 a higher rate of imidacloprid was included in all trials. All treatments had the equivalent loading of fungicide seed treatment (triadimenol (Baytan®) in barley and tebuconazole (Raxil®) in wheat and durum).

Key treatments in all 2009 trials were:

- Imidacloprid at ‘low’ label rate (Imid 1x) - Zorro® on barley, Hombre® on wheat and durum, both at 400 mL/100 kg seed
- Imidacloprid at ‘high’ label rate (Imid 2x) - Emerge® at 240 mL/ 100 kg seed on all crops
- Foliar applications of pirimicarb (Pirimor®) when the aphid population was at 10/tiller and rising

Aphid species

At all sites three species of aphid were found. Numbers and ratios of the aphid species varied at the sites.

Oat aphid (*Rhopalosiphum padi*) was found at all sites on all crops. Generally found in similar numbers on barley, wheat and durum. This aphid was initially found below ground or in the crown of the plant, with first detections from early July. In early August the aphids migrated from the crown to the lower 10 cm of the canopy.

In untreated plots the population rose rapidly in early August then crashed just as rapidly 2 – 3 weeks later. Parasitic wasps (*Lysiphlebus testaceipes*) appeared to be the main factor in the population decline.

Corn aphid (*Rhopalosiphum maidis*) was found at all sites but predominantly on barley. Low numbers were seen in the durum and very few in the wheat. This species colonized the unfurled leaf at the top of the canopy, hiding in the whorl. These aphids were 1st found in early August and numbers increased until flag leaf emergence. When the flag leaf opened the aphids had nowhere left to hide and became exposed to the same parasitic wasp (*Lysiphlebus testaceipes*) that had attacked oat aphid and the population quickly declined. Mummies of parasitized aphids were then very obvious at the top of plants.

Rose Grain aphid (*Metopolophium dirhodum*) was found at all sites and on all crops in similar numbers. These aphids were generally the last to appear in late August/ early September. Colonies of this species were generally on leaves in the mid to high canopy. These aphids were parasitized by two different wasps (*Coruna* & *Aphidius* spp.). Predatory insects such as ladybirds also played a part in the population decline in mid September.

Population dynamics

Peak aphid populations varied from <1/tiller at Dalby to 45/tiller at Bullarah. This contrasted with 2008 results where peak populations were between 70 and 110 aphids/tiller at all 4 sites.

At the Moree site the populations of all three species were assessed weekly. Patterns of the rise and decline of each species were almost identical on the two barley varieties, indicating that the phenology of the barley had little impact on its attractiveness to the aphids.

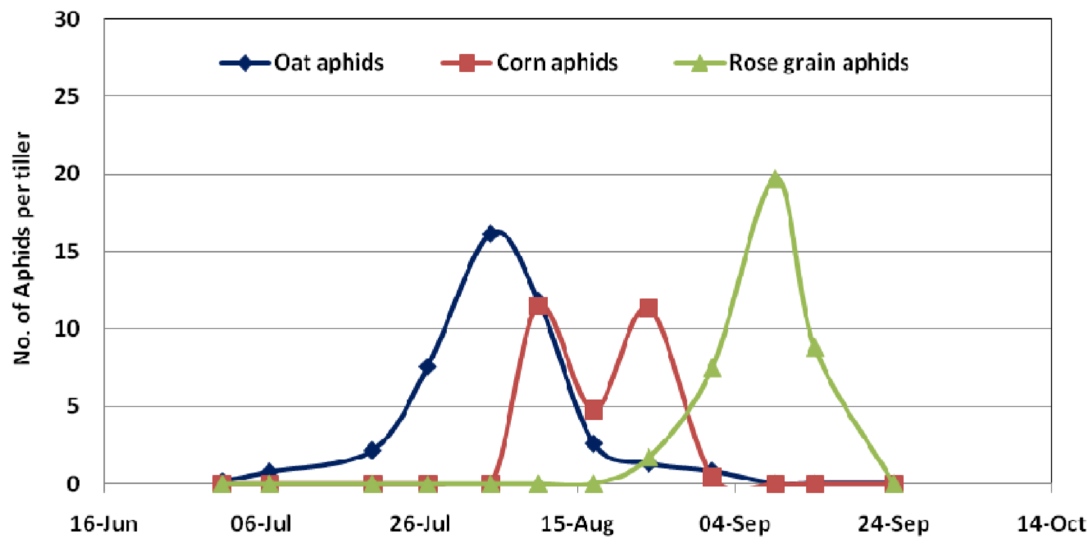


Figure 1: Aphid population dynamics on Untreated Fitzroy at Moree 2009.

What can be seen are 3 distinct patterns with each aphid species building up rapidly then declining just as rapidly. Flag leaves opened in late August corresponding with the decline in the corn aphid population.

Figure 2 shows how imidacloprid rate affected the aphid populations in the Moree trial. Baytan is the fungicide only treatment that has no effect on aphids.

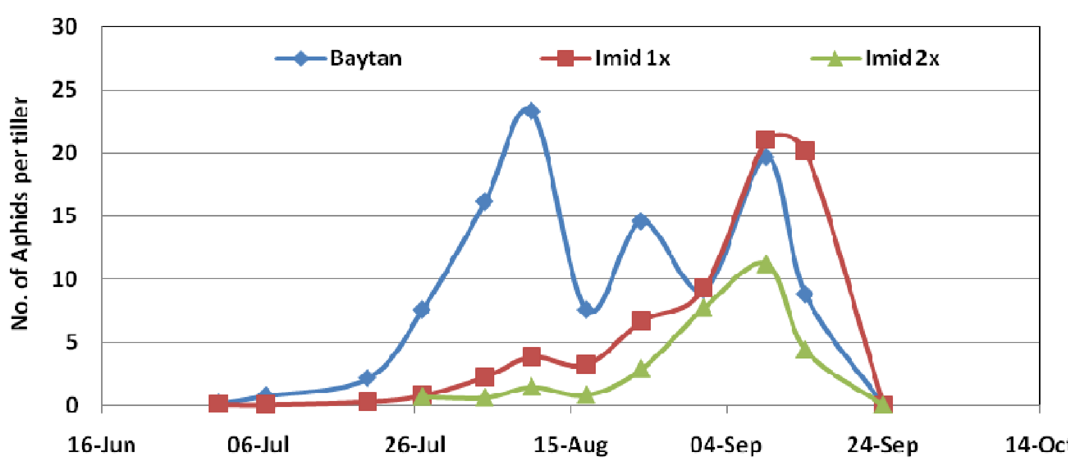


Figure 2: Efficacy of imidacloprid rate on total aphid population at Moree 2009.

Both imidacloprid rates gave good suppression of the oat aphid population (1st peak) but with poorer activity by early September. The high rate of imidacloprid appeared to provide an additional 2 weeks aphid suppression.

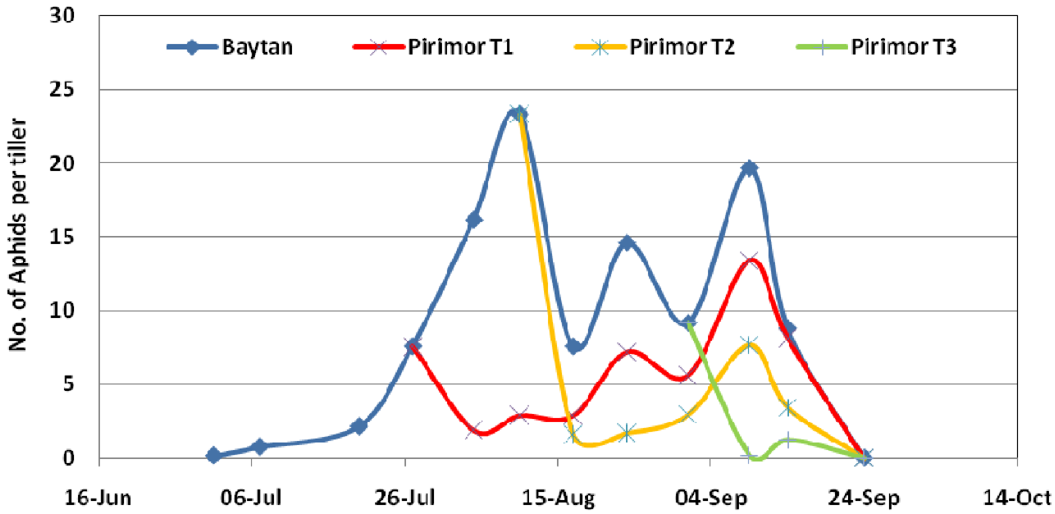


Figure 3: Efficacy of pirimicarb foliar sprays on total aphid population at Moree 2009.

Efficacy of pirimicarb treatments is shown in figure 3. Sprays were aimed to hit populations of each species when they were building up and at around 10 aphids per tiller. The spray aimed at oat aphid (T1) also had to wait until the aphids moved from below ground into the lower canopy. It can be seen that all Pirimor treatments gave quick knockdown of the targeted populations.

Effects on head counts

Head counts were conducted at 5 of the trials. Three of these sites experienced sufficient aphid pressure to warrant a Pirimor spray. At the other two sites, aphids were present but never rose above a population of 10 aphids/tiller.

Table 1: Effect of seed treatments and pirimicarb foliar sprays on cereal head number 2009.

	% increase in head number following insecticide treatment	
Treatment	Sprayed sites (n=3)	Not-sprayed sites (n=2)
Imid 1x	111	103
Imid 2x	108	107
Pirimor T1#	110	

#Applied when the oat aphid population reached ~ 10 per tiller and had moved to above ground.

Key points:

1. All treatments including the foliar spray increased head number by around 10% at the 3 sprayed sites.
2. The % increase in head number tended to be higher at the sprayed sites (higher aphid pressure).
3. Aphids were still found at the not-sprayed sites but did not exceed the spray threshold level.

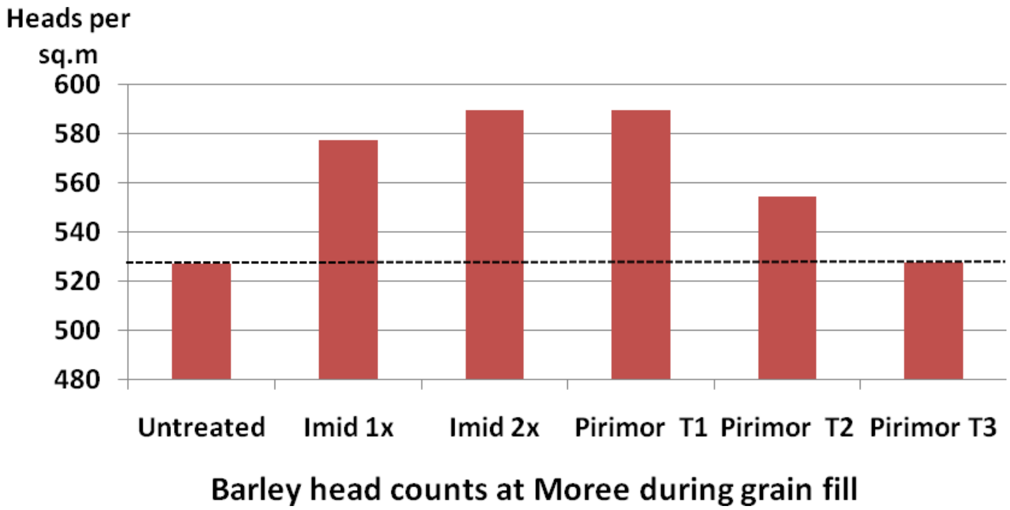


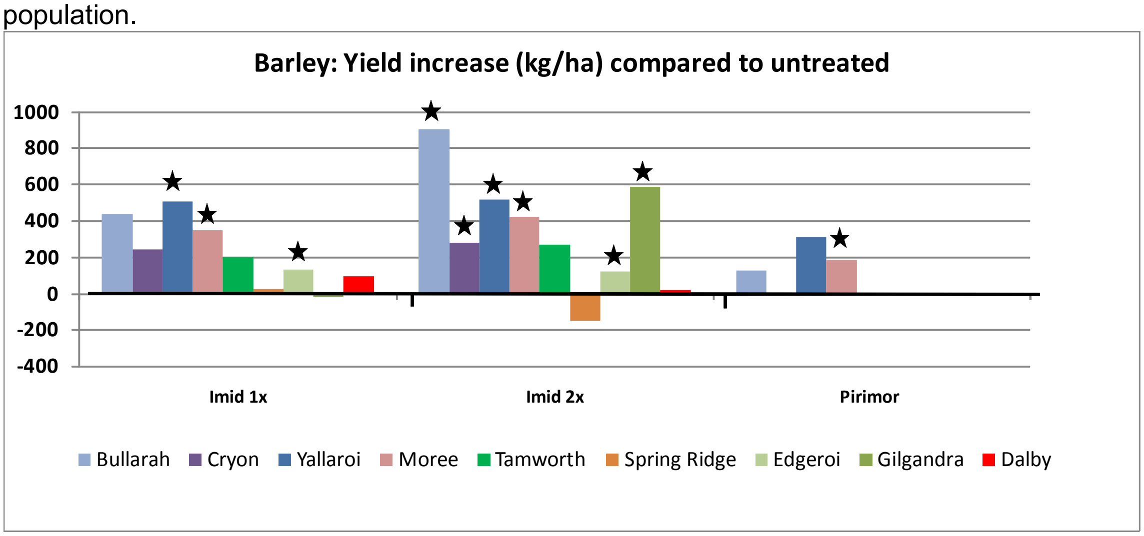
Figure 4: Effect of seed treatments and pirimicarb foliar sprays on cereal head number at Moree 2009.

These Moree results appear to show the increase in head numbers is caused by treatments that have controlled oat and corn aphid. When the foliar spray aimed at Corn aphid (T2) was applied some oat aphid were still present. Only Rose-grain aphid were present when the T3 application was made suggesting that these aphids did not affect tillering.

Yield

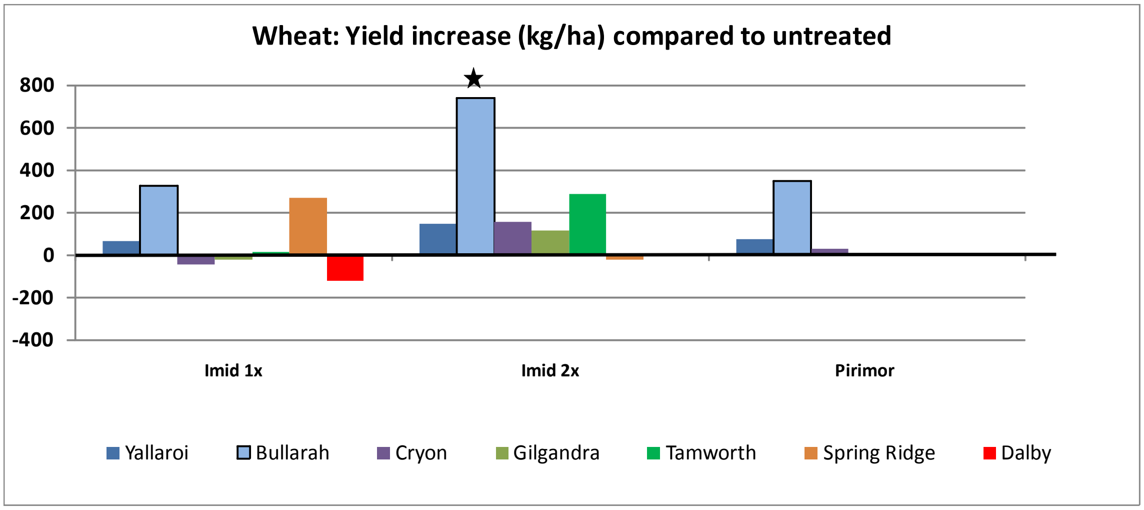
Cereal yields ranged from around 0.4 t/ha for durum at Dalby to over 5 t/ha of barley at the Spring Ridge site. To be able to compare sites gain (or loss) in yield as kg/ha are presented in figures 5, 6 & 7.

In each figure sites are arranged from left to right in order of highest to lowest peak aphid population.



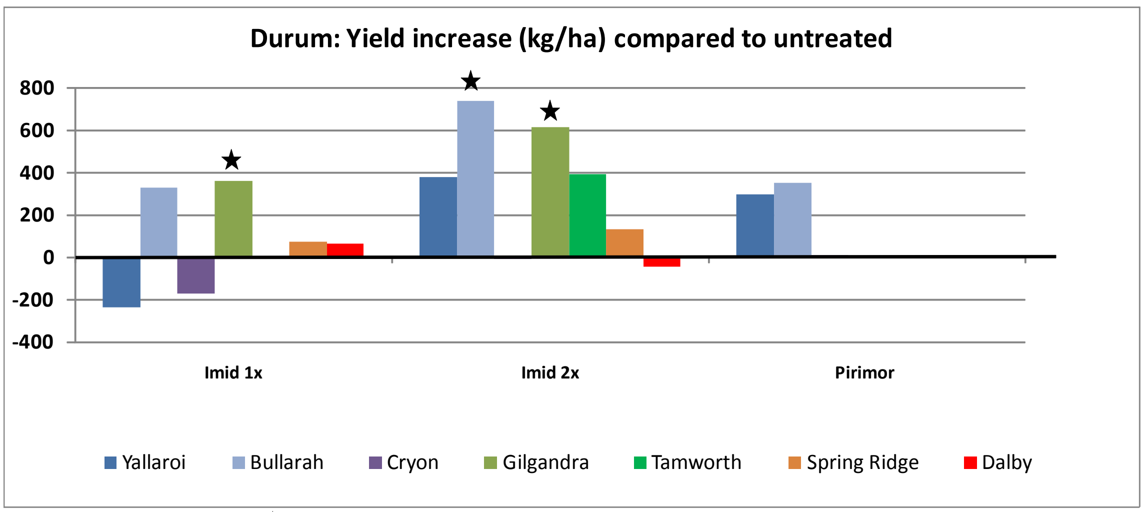
★ Indicates significant difference from untreated

Figure 5: Barley yield increase kg/ha compared to untreated 2009



★ Indicates significant difference from untreated

Figure 6: Wheat yield increases 2009



★ Indicates significant difference from untreated

Figure 7: Durum yield increases 2009

Key points

1. Greater yield increases can be expected where aphid pressure is higher.
2. Significant yield benefits were most common in barley, however they also occurred in wheat and durum

Economic return

The economic returns for aphid control treatments in 2009 are shown in tables 2, 3 & 4.

Table 2: Returns from aphid control in barley 2009.

	Economic return ($ net gain per hectare over untreated)#					
	All sites		Sprayed sites		Not-sprayed sites	
	Mean	No of sites +ve	Mean	No of sites +ve	Mean	No of sites +ve
Imid 1x	**$28**	7 of 9	**$53**	4 of 4	**$8**	3 of 5
Imid 2x	**$39**	7 of 9	**$70**	4 of 4	**$15**	3 of 5
Pirimor T1			**$4**	3 of 4		

 # After chemical and application costs. Moree delivery price of $152/tonne Nov 2009

Table 3: Returns from aphid control in wheat 2009.

	Economic return ($ net gain per hectare over untreated)#					
	All sites		Sprayed sites		Not-sprayed sites	
	Mean	No of sites +ve	Mean	No of sites +ve	Mean	No of sites +ve
Imid x1	**$8**	3 of 7	**$15**	2 of 3	**$2**	1 of 4
Imid 2x	**$24**	5 of 7	**$49**	3 of 3	**$6**	2 of 4
Pirimor T1			**$11**	1 of 3		

 # after chemical and application costs. Moree delivery price of $172/tonne, Nov 2009

Table 4: Returns from aphid control in durum 2009.

	Economic return ($ net gain per hectare over untreated)#					
	All sites		Sprayed sites		Not-sprayed sites	
	Mean	No of sites +ve	Mean	No of sites +ve	Mean	No of sites +ve
Imid x1	**$6**	4 of 7	**-$9**	1 of 3	**$17**	3 of 4
Imid 2x	**$43**	5 of 7	**$53**	2 of 3	**$36**	3 of 4
Pirimor T1			**$23**	2 of 3		

 # after chemical and application costs. Moree delivery price of $172/tonne Nov 2009

Key points

1. 2009 was a lower aphid pressure year than 2008 yet all seed treatments averaged a positive net return.
2. Yield benefits were highest in barley however economic returns for wheat and durum were still worthwhile due to higher grain prices
3. Over all the trials in a low aphid pressure season imidacloprid at the low rate gave a net benefit in 61% of comparisons, with an average net gain of $15/ha.
4. The higher imidacloprid rate at cost of ~ $11/ha gave the greatest net economic return, giving a positive return in 74% of cases and an average benefit of $36/ha.
5. After product and application costs the net return for Pirimor® sprays was $12/ha. A positive return on investment was achieved in 60% of comparisons. This return was reduced by poor results at the Cryon trial.

Conclusions

This data suggests insecticidal seed treatments will give an economic benefit on all 3 crop types.

The seed treatments returned a net benefit, even at sites where the aphid pressure was low (average net benefit $14/ha). Where aphid pressure was higher a net $ benefit was achieved in 75% of cases, with an average return of $41/ha.

These results show that foliar sprays for aphid control can give an economic benefit. If the sprays can be combined with other paddock operations or cheaper products used these benefits could be higher. In these trials a threshold of 10 aphids per tiller was used assuming the aphids were above ground and that the population was increasing.

2008 trial results showed a trend towards increased screenings following the use of imidacloprid seed dressings. No such trend was seen in 2009. If anything there were less screenings and increased test weight following the use of imidacloprid.

Aphid populations varied dramatically at different sites. The very low numbers at Dalby could be linked to drought conditions. We have no explanation for the variation between other sites.

Parasitism by wasps effectively controlled all untreated aphid populations reducing them to negligible levels within a couple of weeks of the population explosion. However it appears that in the meantime damage to the cereals was sustained from which the crops did not recover. A threshold taking into account the presence of mummified aphids or wasps needs to be developed. It is not known why wasp build up happened more rapidly at some sites.

Acknowledgements

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