

Silverleaf whitefly – the IPM enforcer!

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The 2008–09 season saw silverleaf whitefly (*Bemisia tabaci* B-Biotype) reaching potentially problematic levels in the Namoi, Gwydir and Mungindi regions for the first time. Many growers and consultants have asked why the problem occurred and how can they prevent it happening again.

An IPM approach to managing whitefly

Hugh Brier, Queensland Primary Industries and Fisheries, has called silverleaf whitefly (SLW) the ‘IPM enforcer’ for soybeans. As there are no effective control options registered in soybeans, IPM becomes a necessity not an option. Given the potentially high cost of controlling whitefly and the risk of them developing resistance, the best strategy for cotton is to be prepared to control but aim not to have to, by using a range of IPM tactics. The added benefit is that strategies that reduce the risks of creating a whitefly problem also reduce the risk of flaring other secondary pests such as mites and aphids.

Whitefly control requires looking at the whole farm system – both at the local and regional scale.

At the local scale, SLW needs hosts to feed on through winter. Reducing on-farm



“Good whitefly management is good for management of other secondary pests,” Zara Ludgate, QPIF.

hosts for SLW and other secondary pests through good weed control in fallows and in winter crops will help reduce local survival. Whitefly numbers build exponentially, so the greater the starting population in

spring, the more likely there will be a pest problem later in the season. Host weeds include sowthistle, marshmallow, bladder ketmia, cow and bell vine, wire weed and cucurbit weeds.

Cotton volunteers or ratoons, especially large plants often found along channel banks, will not only harbour SLW but host a range of other pests and diseases.

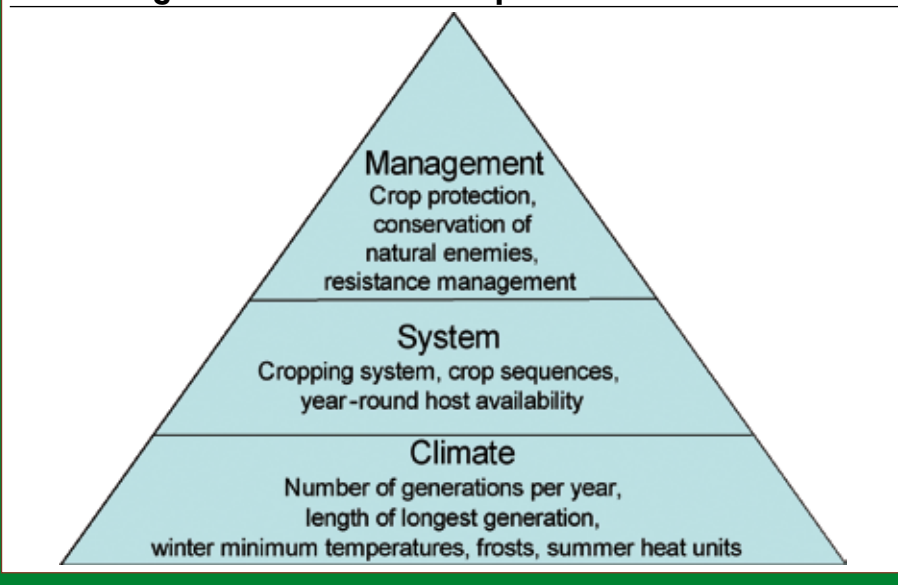
At the regional scale an area wide approach to IPM is important because SLW will move from crop to crop and farm to farm. Working with neighbours will help avoid having a wide planting window of whitefly hosts such as cotton, soybeans, and cucurbit crops, such as melons, and pumpkins.

As earlier planted crops finish off, whitefly will leave, seeking new food. Late planted crops are likely to be colonised by these migrating whitefly – sometimes over weeks, making control difficult. This is especially a problem for late planted soybeans – for which no effective control options are registered.

Variety choice can also impact on SLW populations. A survey of SLW numbers late in the 2008–09 season showed that

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FIGURE 1: For an outbreak to occur, whitefly require a suitable climate (especially mild winters), a favourable system of suitable hosts (winter weeds or alternative crops) in sequence and management in terms of disruption of natural enemies

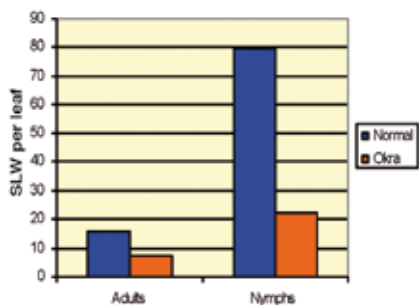


okra leaf varieties had about half as many whitefly as normal leaf varieties (see Figure 2). An additional benefit is that mite populations also increase more slowly on okra leaf varieties.

Every control decision should consider the impact on beneficials. A range of beneficials, including parasites and predators can control or severely retard development of secondary pest populations especially SLW, and they do it for free.

In the 2008-09 season parasitoids of SLW were collected in almost all paddocks from all cotton growing regions but at varying levels ranging from 50–70 per cent in Emerald and St George and as low as five per cent parasitism from Narrabri. These beneficials offer the most value when secondary pest populations are at low, sub-

FIGURE 2: Counts of SLW from CSIRO trial at 'Wyadrigah', Mungindi, March 2009



(Lewis Wilson and Tanya Smith, CSIRO Plant Industry)

economic levels by slowing down the rate of exponential growth of the population – so their conservation needs to begin from seedling emergence, not begin once there is a problem.

Dr Mary Whitehouse has shown that 54 per cent of mirid sprays were applied to sub-threshold populations for no gain in yield compared with treating at or above threshold. Further, these below-threshold sprays increase the chance of flaring pests like mites. (see Figure 3).

Effective sampling using published recommendations is therefore important for all pests. When control is required, use the most selective, effective option available and adhere to the resistance management guidelines. A cheap broad-spectrum spray that induces an expensive whitefly problem is not really a cheap spray in the long term.

Know what the whitefly population is doing, in terms of composition (for example, what biotypes are present, SLW, Q or Australian native) as well as population growth. The Toowoomba Entomology Unit, QPI&F offers a diagnostic service for distinguishing the different biotypes that make up the *Bemisia tabaci* species complex.

They can also help with identifying glasshouse whitefly (GHW). Use the recommended sampling and thresholds and apply control options promptly when needed. There are very clear and comprehensive guidelines for thresholds and control options for whitefly available in the Cotton Pest Management Guide.

It is also important to remember that

GHW and SLW are different and that GHW poses little threat. In many cases you can have large numbers of GHW adults, but few nymphs as they have moved off weeds as they mature.

Counting adults is a way of estimating total whitefly numbers (adults plus nymphs) and assumes that if there are many adults then there will also be many nymphs. Therefore, using total whitefly adult (GHW + SLW) counts will potentially see you breach the action threshold and apply an expensive spray unnecessarily.

It is important to understand the chemical options available for SLW control and the population and day degree zones where their use will be most effective. Diafenthiuron (Pegasus) for example can control or provide useful suppression of low-medium density populations, but it may not give satisfactory control once SLW populations exceed 45 per cent infested leaves. Its efficacy is also dependent on good coverage and environmental conditions (exposure to sunlight – so it will not be as effective in cloudy weather).

The insect growth regulator (IGR), pyriproxifen, (Admiral) is able to target high density populations when the crop is between 1450 and 1650 day degrees. Pyriproxifen is an important tool in SLW management in cotton as it is very selective, allowing survival of predators and parasitoids.

There is a very high risk of SLW developing resistance to pyriproxifen where more than one application is used within a season. Resistance levels causing spray failure have already occurred in horticultural situations as a consequence of multiple uses within a season.

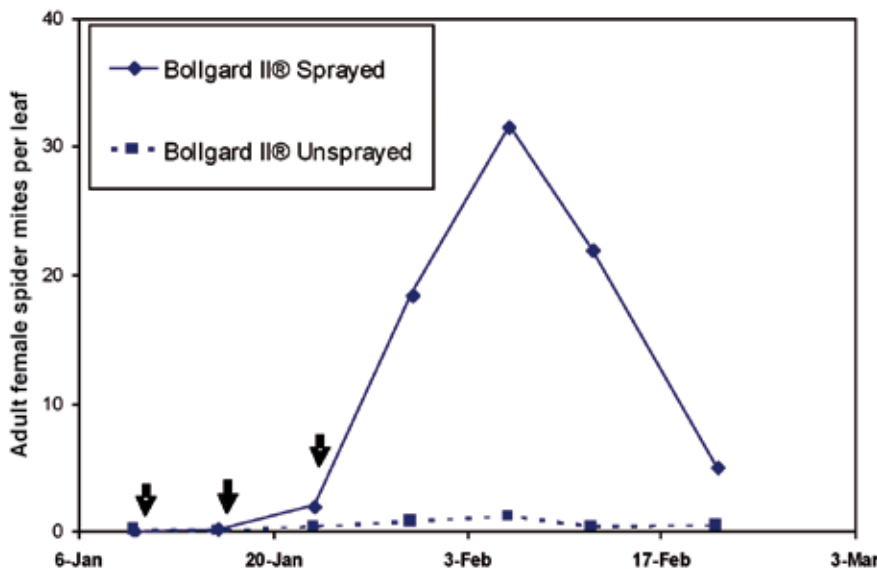
Abide by the IRMS guidelines which state a maximum of one application of Admiral per season. IGRs break the SLW lifecycle, but timing is critical – too early and the population may come back and too late (it takes about 10–14 days to see a drop in population after the application of the IGR) may result in stickiness.

In the future it is possible that other tools will be available to help manage SLW, such as the bio-pesticide and semiochemical products being developed by Dr Robert Mensah (NSW DPI) and insecticides from the various agrichemical companies. In the meantime it is critical to practise effective IPM to manage SLW and preserve the efficacy of existing products.

Why was silverleaf whitefly a problem in NSW regions in 2008-09?

The NSW climate is suitable for a SLW

FIGURE 3: Build-up of mite populations of Bollgard II cotton sprayed three times with fipronil (at 125 mL/ha) over a three week period compared with unsprayed.



outbreak. The hotter the temperature, the more generations of whitefly per year. For a SLW outbreak to occur there needs to be about seven generations per year. In the Namoi, the number of generations per year averages about eight, so the climate is suitable for a SLW outbreak. Similarly southern regions, such as the Macquarie have the potential for about six to eight generations per year, so SLW would have the potential to become a problem.

The system was favourable for whitefly build-up with plenty of alternative crops and winter weeds. The management conditions also favoured an increase in SLW population with disruption of natural enemies through the use of broad spectrum insecticide for control of mirids etc.

So, a suitable climate, favourable system and disruptive management style were all present in NSW during the 2008–09 season. Which begs the question, why has there never been a SLW outbreak before in NSW now considering Emerald has been dealing with whitefly since 2001?

In the cotton regions there already existed the Eastern Australian Native *Bemisia tabaci* (EAN) which was neither a problem nor resistant to insecticides. Research by Dr Paul De Barro and colleagues has shown that, initially when SLW enters an area and its populations are low, competition between SLW and EAN prevents SLW from dominating. But Dr De Barro and colleagues have subsequently shown that several factors gradually create a bias toward SLW:

- Males of SLW are more aggressive in interfering with mating of EAN than vice versa so gradually this lead to a shift in favour of SLW;
- Females of SLW increase their frequency of copulation leading to a higher proportion of female progeny whereas EAN does not – so if mating interference occurs, the generation of more males means SLW mates more and can ultimately produce more female progeny than EAN females;
- EAN does not do well on cotton while SLW does – hence providing a habitat where mating interference is low; and,
- Spray regimes tend to eliminate predators and parasites which allows SLW populations on cotton to increase unchecked – they also eliminate EAN which does not have the resistance of SLW which will accelerate the speed at which SLW dominates.

These factors combined mean that SLW gradually displaces EAN in a region. This is likely what has happened in the north-

ern NSW valleys this season – SLW has replaced the EAN, and the combination of climate, system and management was suitable to allow populations to develop to problem levels. The time from when SLW was first detected in the cotton regions (about 1994) to the first outbreaks is shorter in the warmer regions where there are more generations and SLW displaces EAN faster.

A third biotype in the *Bemisia tabaci* species complex, Q biotype was recently identified in Australia by Dr Robin Gunning. While climate and systems factors are expected to impact on Q biotype in a similar manner to B biotype (SLW), management and in particular the use of IGRs and neonicotinoids, are likely to influence whether B or Q biotype dominate in the future. Overseas experience indicates that outside of Q biotypes normal range in the Mediterranean Basin, it does not tend to be a field pest except where there are poor management practises.

This has been the experience in the US where Q biotype never really became a pest in the field, and soon disappeared from glasshouses. But poor management practises in some countries have selected for the more resistant Q biotype. Research in the US and Europe shows that B would be normally expected to displace Q except

where the use insecticides for which Q has greater resistance shifts the balance in favour of Q.

Does this mean that they will be a recurrent pest in the NSW regions?

The experiences from other regions in Qld suggest that SLW populations are likely to be recurring, and that growers and consultants will need to proactively manage the factors they can control – the system and management.

The key management strategies for avoiding a SLW outbreak are:

- A tight planting window;
- Destruction of alternative hosts;
- Conservation of natural enemies through avoiding broad spectrum insecticides; and,
- Careful sampling and timely application of insecticide.

CONCLUSIONS

Silverleaf whitefly can be a huge problem, but, experiences from Emerald, the Darling Downs and St George show that with careful management they need not be particularly difficult or expensive to manage. The benefit of adopting this proactive approach is that the same principle applies to reducing problems from other secondary pests.

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