A whitefly post-mortem for Emerald

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The explosion in numbers of silverleaf whitefly (SLW) in the cotton fields of the Emerald Irrigation Area (EIA) in the 2001–02 season was a nightmare come true for cotton growers. Scientists are now looking at what happened and why so they can assess the risk of similar outbreaks happening in other Australian cotton growing areas.

Two critical factors in the occurrence of any outbreak are climate and cropping systems — unless both of these are favourable an outbreak of SLW is unlikely.

Climate

Emerald's climate is equivalent to parts of coastal Queensland where SLW is an established pest and is thus climatically suited to SLW. But are other cotton growing areas likely to be affected by outbreaks similar to this year's in the EIA?

Narrabri has the fewest SLW generations per year with an average of eight while Kununurra and Broome have 16 (Table 1). As Bundaberg, with an average of nine generations, has a significant whitefly problem from September to March, it would appear that, based on generation numbers, even Narrabri could be susceptible to outbreaks.

But the critical factor may not be the number of generations, but the length of the longest — which is usually the last of a season. In this generation, juvenile SLW (nymphs) are more at risk because:

• They are immobile and vulnerable to events such as rainfall and frosts. The longer they remain nymphs the greater the risk from climatic factors;

• Temperatures are becoming cooler so leaves may senesce before development has been completed;

• They are exposed to natural enemies for longer; and,

• A combination of these factors is likely to lead to higher mortality than in warmer months.

Scientists are working out the reasons behind the whitefly explosion in Emerald and assessing the risk of the same thing happening in other cotton growing districts.

TABLE 1: Numbers of generations for silverleaf whitefly across a range of locations

Location	Average no. of generations/year	Longest generation
Narrabri, NSW	8	122 days (Apr 15–Aug 15)
Goondiwindi, Qld	8	118 days (May 15–Sept 10)
St George, Qld	9	102 days (July 1–Sept 10)
Biloela, Qld	9	92 days (June 1–Sept 1)
Emerald, Qld	10	77 days (May 15–Aug 1)
Richmond, Qld	13	61 days (May 15–July 15)
Katherine, NT	15	30 days (June 15–July 15)
Kununurra, WA	16	30 days (June 15–July 15)
Broome, WA	16	30 days (June 15–July 15)
Bundaberg, Qld	9	87 days (July 1–Sept 25)
Bowen, Qld	12	45 days (June 1–July 15)
Ayr, Qld	12	45 days (June 1–July 15)
Gatton, Qld	8	108 days (May 15–Sept 1)

FIGURE 1: The cumulative rate of increase of silverleaf whitefly across the Emerald irrigation area

When both whitefly numbers and the lengths of generations are considered, cooler areas such as northern NSW, Darling Downs and St George are likely to be less suitable for whitefly outbreaks whereas regions north of Biloela are more likely to suffer outbreaks.

Cropping System

The other important influence on SLW numbers is the availability of host plants —the more continuous the supply, the higher the probability of an outbreak. The EIA is at risk because suitable hosts are available for all but two months of the year.

Possible hosts include horticultural crops, native and exotic pasture legumes (such as glycines and butterfly pea) grain legumes and sunflowers. Potential northern production areas such as Kununurra will have a similar risk to Emerald because of the near continuous availability of suitable hosts.

The combined effect

The combination of cropping system and climate would suggest that northern NSW and the Darling Downs face a low risk of outbreak. St George, due to the presence of horticulture faces a somewhat higher risk, but the cooler winters makes outbreaks less likely. Central Highlands will have outbreaks, the extent of which will vary depending on host continuity.

The 2001–02 Emerald season and its implications

The discovery of SLW infestations in several late cotton crops in March and April 2001 was the first indication of a possible outbreak in the following cotton season. Surveys of regrowth cotton in July and August confirmed the presence of widespread, but low populations of SLW across the EIA. Whiteflies were also widely distributed on sow thistle, a common weed, and areas of winter vegetables such as potato and pumpkin provided small high density populations along the east edge of the EIA.

From October 2001, cotton was sampled monthly and the results demonstrated the importance of area wide control programs for SLW. The highest numbers of SLW were recorded on the eastern side of the EIA — an area where vegetable growing is also important. Concentrating on control in cotton alone would not have worked.

There were also some heavily infested crops around Foley Road which may indicate pockets of whiteflies persisting on non-crop hosts such as

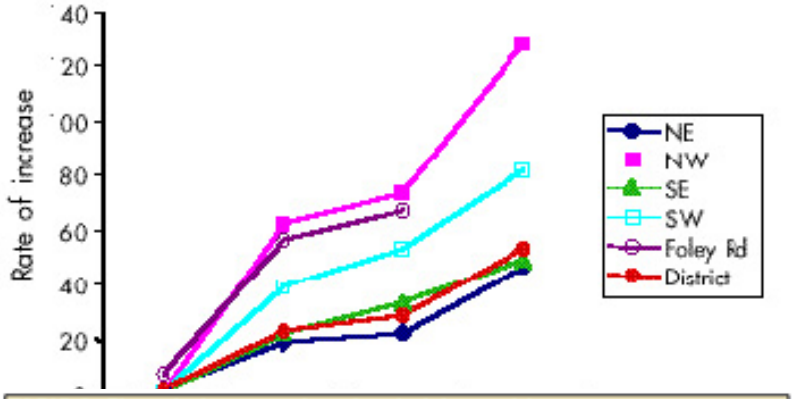

TABLE 2: The relative quantity of trehalulose with respect to sucrose, glucose and fructose

	Sucrose	Glucose	Fructose
Fresh honeydew	2.66	3.58	1.76
Lint, sooty mould	nil	0.37	0.43
Lint, no sooty mould	0.99	0.42	0.43

pasture legumes. The records show that whitefly numbers were low in October and November but by December had increased by an order of magnitude and the outbreak had spread to all parts of the EIA (see Figure 1).

Late sown crops were particularly affected and these acted as sinks for whitefly. The rapid November–December build up and subsequent spread of whiteflies across the district emphasises the need to focus on whitefly infestations early, to suppress populations early and to plant in as narrow a window as possible.

Will it happen again?

Was this season a one off or is it a sign of things to come? Since 1985, Emerald has experienced 10 years, including 2001, that have been warm enough for 11 generations to develop and this suggests that conditions for outbreaks are likely to be an ongoing occurrence.

High temperatures in November and December accelerate an outbreak as this is when the extra generation develops. This suggests that whiteflies need to be effectively controlled before the November–December acceleration in development.

These conditions are likely to persist in Emerald for the foreseeable future so it is prudent to suggest that during the November–December period, insecticides such as the organophosphates be avoided where at all possible as they act to help flare whiteflies which are generally resistant to this class of insecticides.

Emerald and sticky cotton: What is the likely outcome?

Because of its high disaccharide content (particularly trehalulose), SLW honeydew is stickier than that produced by aphids. So it is harder to remove from lint. The issue for EIA growers was whether the SLW outbreak would affect the ginning qualities of their cotton.

Based on evidence from the south western US, the level of honeydew contamination experienced in the EIA suggested a high likelihood of significant lint contamination. But so far, few of the bales processed have been penalised for stickiness.

The reason possibly lies in what is happening to the honeydew in the field. When SLW honeydew from contaminated lint was analysed, the large quantities of disaccharide sugars had declined markedly when compared with fresh honeydew samples. For example the relative quantity of

trehalulose to glucose declined by a factor of 10 (Table 2).

If, as these results suggest, the disaccharides are being broken down in the field then, over time, there could be a considerable reduction in the amount present. The experience from the EIA runs counter to that from the south western US.

The reasons are unknown, but the higher humidity found in the EIA may be a key contributing factor. Work is now underway to further investigate this phenomenon.

Summary

The key factors in SLW outbreaks are:

• Climate, especially temperature, and the duration of the longest generation time over winter are critical for an outbreak. The longest generation time needs to be shorter than 100 days and probably closer to 90 days;

• Suitable hosts. Long periods of continuous availability of suitable hosts are essential for outbreaks. The discontinuity of host availability in northern NSW and the Darling Downs is a major factor in reducing the likelihood of outbreaks. In contrast, the almost continuous availability of suitable hosts in the EIA acts synergistically with climate to make further outbreaks probable; and,

• The probable breakdown of disaccharides, particularly trehalulose under the hot, humid conditions found in the EIA may reduce the problem of sticky cotton and enable growers to tolerate higher whitefly densities.

Experience with SLW suggests that extensive outbreaks such as this one in the EIA will not occur in northern NSW. Isolated outbreaks may occur in the Darling Downs and St George especially when winters are mild. But Comet, Biloela and Theodore could well experience outbreaks of a scale experienced this past season in the EIA. The key issue will be how well SLW survive the winter and that remains to be seen.

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