SOUTHERN AUSTRALIA FOCUS

COVERING CROPPING SYSTEMS OF SOUTHERN NSW, VICTORIA, TASMANIA, SOUTH AUSTRALIA & WESTERN AUSTRALIA

THE RESEARCHER'S VIEW

Strategic control of insect pests

By Paul Umina (CESAR), Judy Bellati and Ken Henry (SARDI)

Long-term prophylactic use of broad-spectrum pesticides for insect (and allied forms) control is not sustainable. The grains industry has highlighted the need to move towards strategic and selective control options that better target the pests of concern. Integrated pest management (IPM), in its simplest form, is a control strategy in which a variety of biological, chemical and cultural control practices are combined to give stable long-term pest control.

As growers progress forward with the desire to do something different, and change the way they tackle pests, agribusiness will need to undertake and actively engage in a 'transformative' learning process.

Advisers and consultants must gain confidence in – and adopt – a new set of tools in the decision making process which encompasses a whole systems approach for sustainable insect management.

IPM principles are now well documented. But when and how to intervene remain the key questions for most growers and advisers. In order to move away from chemical-based control strategies, the utilisation and worth of economic thresholds as the front line for decision-making needs to be re-visited.

AT A GLANCE…

- A change in mindset on how to tackle pests coupled with the development of a new set of decision-making tools is critical for sustainable insect management;
- Economic thresholds are not static but flexible;
- Monitoring programs and record keeping for pests and beneficial insects is required over a temporal scale; and,
- Long-term investment into ecosystem services can provide economic benefits.

Getting a grip on thresholds

An economic threshold (ET) is the critical pest density causing damage equal in value to the cost of control (pesticide and application). The ET is a quantitative measure and usually specified as the number of pests found per unit of crop area using a specified (standard) sampling technique. Yield loss and quality reduction are usually the critical

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Consultants' Corner

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factors (threshold types) governing control decisions.

An ET is not a static number. Thresholds are, at best, flexible guidelines that require constant revision and up-to-date knowledge based on system changes. These can include, but are not limited to:

- Changing management practices (such as minimum-till);
- Environmental constraints;
- New varieties;
- New pest incursions and/or multiple pest species;
- New market standards; and.
- Cariations in market value.

In addition, the economic importance of a particular pest species will vary with crop type and developmental stage.

Whilst ETs are a key component of IPM that provide a rational basis to the decision making process, it is important to understand the flexible nature of thresholds – how they are developed and the factors that can cause them to vary.

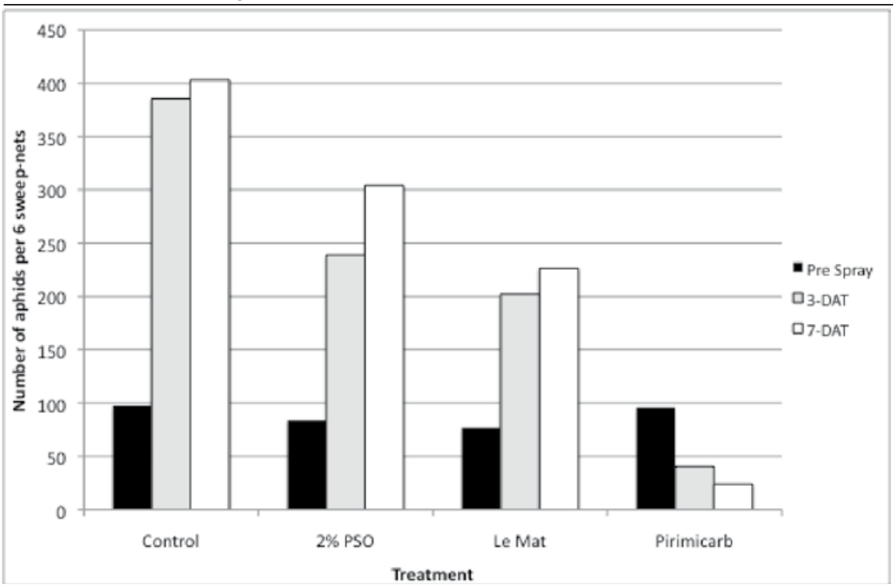
This helps build confidence around the utilisation of ETs as a supportive management tool and how to adjust them in different regions and cropping situations.

Unfortunately, the lack of entomological broadacre research in the southern grain belt over the past couple of decades has seen many ETs become outdated and somewhat irrelevant to current economic costs and management practices.

Effective monitoring and record keeping over time

For thresholds to be most effective, estimates of pest (or damage) levels must be accurate, and reliable assessments of insect populations (or percentage of damage) and their distribution within crops is needed.

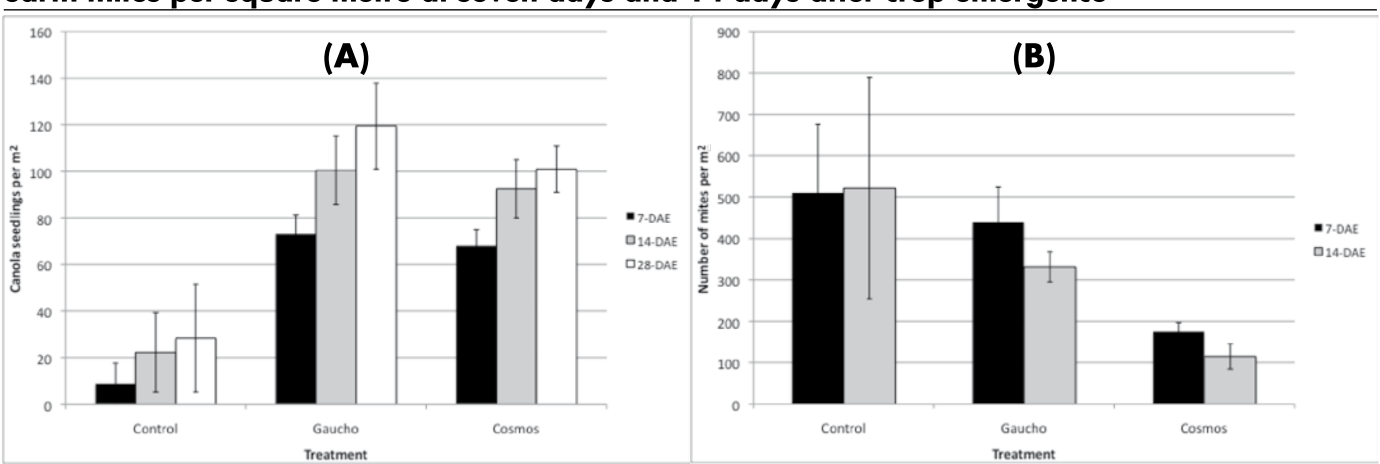
FIGURE 1: Preliminary field trials assessing the effect of 'soft' chemical options as a means of controlling cabbage aphids in canola at Elmore, Victoria in 2008



Control = unsprayed canola. 2% PSO = 2% (v/v) Canopy® spray oil. DAT = days after treatment application. (Umina & McColl, unpublished).

Adult diamondback moth.

FIGURE 2: Preliminary field trials assessing the effect of seed treatments as a means of protecting emerging canola at Ballarat, Victoria in 2008. A) Average number of seedlings per square metre at seven days, 14 days and 28 days after crop emergence. B) Average number of redlegged earth mites per square metre at seven days and 14 days after crop emergence



Control = untreated seed. Error bars = standard error of the mean. (Umina & McColl, unpublished)

This can only be achieved through frequent and unbiased (random) monitoring across representative parts of each paddock.

It is important that growers have complete monitoring records that document information on key pests, as well as other general field information such as crop health/stage, paddock history, weather patterns and the presence of weeds. Naturally occurring beneficial species play a vital and often unnoticed biological control role in many cropping systems.

Their presence (diversity and relative abundance) also needs to be recorded over a temporal scale (time period), with this information feeding back into the decision making process.

Recording and reviewing a series of consecutive data checks (versus single checks) is essential for making management decisions. We need to look at the trends and patterns in species population growth (abundance) and assess these changes over time. This 'temporal assessment' approach will build confidence and provide the best measure of whether control is warranted. It will also help refine thresholds and management guidelines applicable to localised situations and practices.

Standardised sampling techniques are essential. There is a range of monitoring methods available depending on the type of insects you are looking for. It is important each is used correctly and in a repeatable manner. Knowledge of the life-cycle and habits of each species will allow you to choose the most appropriate technique.

Softer chemicals

Although chemical control is still an important part of an IPM strategy, there needs to be a shift from using broad-spectrum pesticides to more selective alternatives if available. Broad-spectrum chemicals invariably kill non-target organisms.

The use of more selective or 'soft' pesticides (such as, pirimicarb and Bt sprays) is an effective management tool that facilitates – rather than disrupts – the natural biological control that already exists (Figure 1). By specifically targeting plant-feeding invertebrates, they allow beneficial species to remain in the system to help suppress pest numbers.

Seed dressings (such as Gaucho, Cosmos) may also be an alternative control option and will delay applications of foliar sprays giving beneficial insects time to build up (Figure 2). Seed dressings need thinking through in terms of potential pest pressures prior to sowing, as many different dressings are available. Seed germinating baits are a quick and effective monitoring method to assess potential soil inhabiting pests that attack seeds and seedlings.

Ecosystem services

There is a growing awareness of the utilisation of ecosystem services for long-term sustainability of agro-ecosystems and the ability of these services to generate economic and ecological benefits. Extensive research overseas has demonstrated the value of manipulating landscape features for pest control.

Landscape ecology can be manipulated in such a way that promotes natural enemies and aids IPM strategies. The use of windbreaks in providing a reservoir for key functional invertebrates and their impact on pest species is a relatively new area being examined. Research has demonstrated that pest numbers (for example, redlegged

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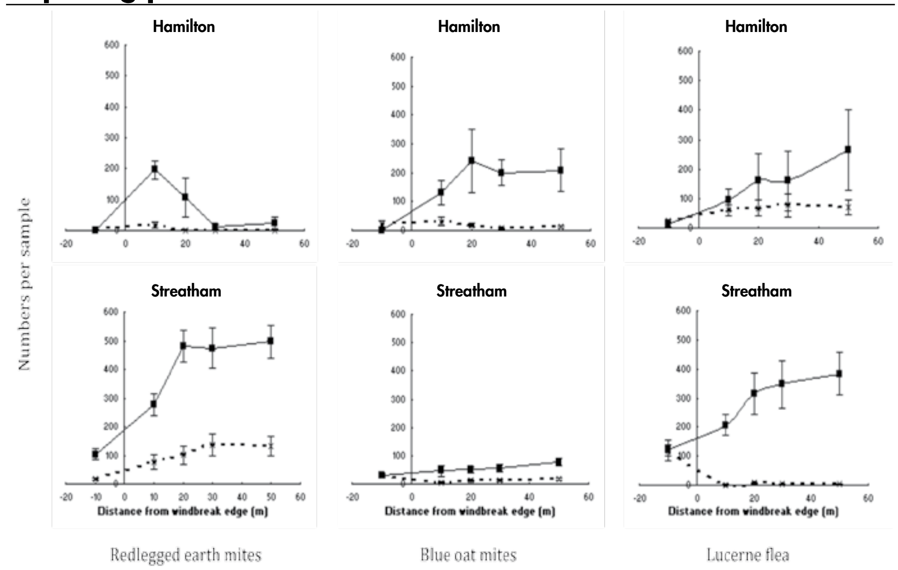
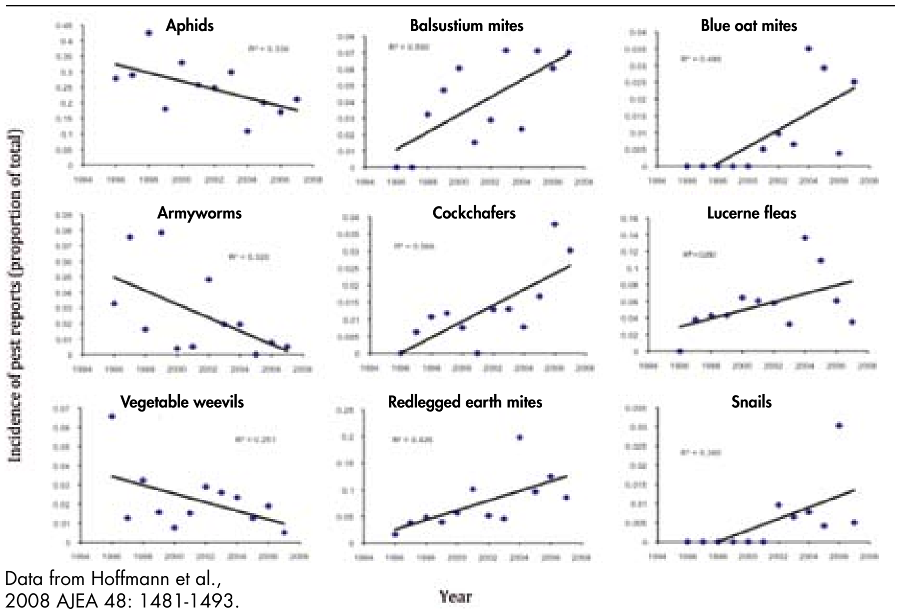
FIGURE 3: Number of pest species in windbreaks and in adjoining pasture



Transect points are marked as negative when extending into the windbreak and positive into the adjacent pasture. Closed squares and solid lines = simple shelterbelts. Crosses and dashed lines = complex shelterbelts. Error bars are standard errors for transect points.
Data from Tsitsilas et al., 2006 AJEA 46: 1379-1388.

FIGURE 4: The incidence of outbreaks of some important pest species that have changed in relative importance between 1996–2007



Data from Hoffmann et al., 2008 AJEA 48: 1481-1493.

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earth mites, blue oat mites and lucerne flea) in adjacent paddocks can be reduced by predators and other beneficials residing in windbreaks.

The windbreak composition/ecology is important, with long grasses and shrubs offering complexity, which in turn provides more niches for important beneficial invertebrates such as spiders, predatory mites, parasitoids and pollinators (Figure 3). This means relatively simple measures, such as management of windbreak understorey can be used to maximise the use of naturally occurring biological control.

Emerging insect pests

Changing management practices and climate change are having an impact on the type of pests being found in the Australian grain belt. A comparison of pest outbreak reports from southern Australia has revealed changes in pest outbreak patterns over the past 10–20 years (see Figure 4). These changes can be attributed to both management and climatic factors.

In some cases the introduction of minimum and no-till systems has been accompanied by increased pesticide use, accelerating selection pressures for resistance in pest species. Other management strategies that can affect the incidence of certain pests include irrigation, paddock rotation strategies and cropping intensity.

Many of the changes observed in pest species over the past few decades could have been driven by increases in chemical use, particularly the use of synthetic pyrethroids. Pests such as blue oat mites, Balaustium mites and lucerne flea have a relatively high tolerance level to synthetic pyrethroids routinely used in the grains industry.

Diamondback moth is a case where spray coverage, which plays a crucial role in chemical effectiveness, is not working effectively.

In Mandalotus weevils, the development of sustainable management options is hindered by a lack of biological studies conducted on this species complex.

In future, even more significant changes in the distribution and status of some pests are likely as conditions become drier, migration patterns of pests change and insect pests and their natural enemies respond differently to climate change.

The importance of extension

The adoption (communication and extension) team at GRDC's National Invertebrate Pest Initiative (NIPI) has been funded until 2010, which will see the continuation of PestFacts services and diagnostic support. The PestFacts services draw on the field observations of consultants, growers and industry specialists across the southern grain-belt region, with a new on-line observational reporting proforma which has been developed to assist with reporting and to track pest occurrences, distribution and insect pressures over time.

Through feedback from the diagnostic services and insect identification workshops that have been conducted in the past, a training manual is currently being developed to complement current identification workshops for the southern and western grain-belt regions. ■

THE CONSULTANT'S VIEW

By Bill Long, Ag Consulting Co

There are plenty of benefits in moving towards Integrated Pest Management (IPM). More growers are beginning to see the benefits and we're starting to see a shift away from over-use of insecticides, particularly the prophylactic applications that have been commonplace in the past decade.

The ideal 'stick' approach in prompting growers to adopt IPM would be high insecticide prices, but insecticides remain relatively cheap to use. Partially or completely eliminating insecticide use would make little difference to the bottom line profitability of farm operations.

But economics does not need to be the main driver behind adoption of IPM principles. Many growers are keen on IPM for the social and environmental benefits it brings. For example, growers generally don't like using insecticides. They know they're dangerous chemicals to handle and apply, and recognise there is a higher health risk associated with their use. Any system which enables growers to use less insecticide less often is going to be very popular. Growers are also very conscious of the impact of most of these chemicals in the natural environment, and as good stewards of the land, they're seeking alternatives.

Growers are also increasingly aware it's not a good practice to kill beneficial insects which can prey on pest insects. In days gone by growers pretty much saw almost every insect as a pest, but many are now learning to recognise beneficial species and the roles they play in cropping environments, and how to keep the balance.

Changing what we perceive as pest management

This means growers need to change the way they think about insect pest damage to plants. Growers are learning to tolerate a certain degree of pest insect damage to their crops at early growth stages while giving time for predatory insects to build up their numbers. This has been made much easier with recent advances in crop establishment – better seeding equipment and better seed placement are helping to establish crops more quickly, and these healthy seedlings can tolerate high levels of insects without economic loss for the grower at harvest time.

If plants can withstand pressure from livestock grazing up to a certain growth stage without yield loss, they can also withstand some insect 'grazing' effects. Many of the spray thresholds developed in the past need re-examination under more modern farming practice.

An important 'carrot' associated with IPM is the benefit of increased pollination and its positive impact on pulse crop yield. Growers and advisers are becoming more aware of the need to allow bees and other pollinating insects to do their job. Repeated pesticide applications are most certainly reducing pollinating insect numbers in the environment.

A good outcome from this shift towards IPM is improved biodiversity. Growers now understand the importance of maintaining remnant and native vegetation, which often harbours beneficial invertebrates as well as other creatures which prey on pest insects, like birds.

One barrier to greater adoption of IPM is the availability of selective, softer chemicals. Growers have demonstrated they're prepared to pay more for selective insecticides – such as pirimicarb – that target particular pest species while leaving beneficial insects relatively unharmed.

A greater selection of specific insecticides coupled with good IPM practice provides a triple bottom line outcome with better returns, a safer environment in which to work and live, and spray operators having much less exposure to dangerous insecticides.