

# Integrating pest management

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A project to develop guidelines for integrated pest management (IPM) in southern cropping systems is re-focusing attention on the benefits of IPM and how they might be achieved.

With the guidelines expected to be available early next year, it is emerging that the goal of effective IPM in southern grain crops may be closer, and more achievable, than many thought.

Effective integrated pest management (IPM) has the potential to benefit growers and the industry through reduced chemical use, resulting in lower costs, reduced risk of chemical residues and less likelihood of pest populations developing chemical resistance.

IPM is well established and effective in cotton, for example, but has generally been considered a difficult, possibly even unachievable concept, for southern grain crops.

However, some farmers are already having success with IPM in southern cropping systems and, given the importance of good management in an IPM program, many growers already have the foundations of a robust IPM system in place, according to Melina Miles.

In IPM terms these management measures are 'cultural controls', which are integral to any successful pest management program.

"Good management is the foundation of an effective IPM program because how paddocks and surrounding areas are managed influence the likelihood of pest problems developing and beneficials thriving in and around the crop," said Dr Miles, a Queensland entomologist who is co-ordinating development of the new IPM guidelines.

"Many growers have the management elements of a successful IPM program in place as part of their established decision-making and management practices and would easily be able to overlay other IPM elements like monitoring, accurate identification of pests and beneficials and good decisions about whether or not there is a need to spray.

"Decisions about crop rotations, variety selections and pre-seeding paddock management are integral to an IPM program because they determine the environment in which the crop is grown.

"For example, sowing canola straight into sprayed-out pasture increases the risk of



MELINA MILES 'BEATING' FABIA BEANS TO SAMPLE FOR HELICOVERPA. (PHOTO: D MURRAY)

damage from lucerne flea and earth mites because that approach gives little opportunity to control the pests ahead of seeding. A period of fallow between the pasture and the canola could reduce the risk of pest infection and subsequent damage to the canola quite substantially.

"Similarly, a grower who, say, uses the TIMERITE system to time sprays to control red-legged earth mite (RLEM) in the year before the paddock is returned to cropping may reduce the mite population so much that the pest has no impact on the canola crop."

However, to take the step up to IPM and access the benefits that will bring, many southern growers will need to develop additional skills in the area of risk assessment, crop monitoring, pest and beneficial insect and mite identification, Dr Miles said.

"Southern farmers are aware of IPM concepts and many are keen to implement IPM systems but don't have access to the information, and consequently the

confidence, they need to put an effective system in place.

"Nor do they have confidence in the natural systems that provide the base of any IPM program.

"IPM is widely seen as using natural enemies to control pests, and growers typically ask whether or not it is possible to make natural enemies of pests a functional part of their pest management systems, how great an effect they can have and whether or not they can be relied on to always be present and effective," she said.

"The impact and reliability of beneficials are both uncertain, particularly in the highly variable conditions of the southern cropping zone, but can be improved through managing the cropping environment to encourage and support robust populations of beneficials, although in many areas we simply don't yet know how to achieve that."

Evidence is emerging that management of areas outside cropping paddocks can



DR NANCY SCHELLHORN.

influence the balance between crop pests and beneficials.

Results from current research by CSIRO senior research scientist Dr Nancy Schellhorn suggest that areas of non-cropping vegetation support populations of beneficial insects and other invertebrates that can suppress pest populations.

Dr Schellhorn, who is in the final year of a three-year project exploring the habitats in which pests and their natural enemies breed, has found that native vegetation rarely harbours insect pests of crops but supports populations of beneficials including spiders and insects such as lace wings and lady beetles that feed on crop pests.

Weeds, on the other hand, often harbour pests.

These findings highlight the importance of maintaining and managing native vegetation remnants, she said.

Dr Schellhorn will use her findings to generate models of interactions between crop pests and their natural enemies at paddock, farm and landscape scales and guidelines for managing on-farm native vegetation to maximise biological pest control benefits; which has the potential to reduce production costs by limiting the need for insecticides.

Dr Miles' experience suggests that, without a well-structured IPM system in place, growers will apply insecticides as soon as they see crop damage. Some will

spray ahead of any damage as a means of preventing damage from a pest expected to infest their crops.

However, she points out, crop damage and crop loss are not always the same thing, and deciding not to spray can be a valid, and economic option.

“Visible damage to crops can often be compensated for by the crop. In some cases surviving plants grow larger because neighbouring seedlings have been lost. In other instances damaged plants replace flowers and buds consumed by pests or develop larger seed in remaining pods where other pods have been damaged.”

The most accurate way to determine whether a particular pest density will result in economically significant loss, she suggests, is to compare the pest infestation with an economic threshold.

Pest density is determined by monitoring using techniques appropriate for the pest. Monitoring techniques range from laying baits under tiles or slates for slugs to using a sweep net or ‘beat sheet’ – a sheet laid under the crop, which is then beaten or shaken to dislodge insects onto the sheet – for insects.

Economic thresholds – the point at which the cost of spraying matches the losses caused by the pest damage – are derived from research that evaluates the crop losses caused by pest infestations and attributes an economic value to this loss.

“Thresholds provide a good starting point

for considering whether or not a spray is needed and can be a valuable decision-making tool when complemented by the knowledge of an experienced agronomist or grower,” Dr Miles said.

“Thresholds change with the value of the crop. In many instances it can be more economically astute to carry some crop damage and save the cost of spraying than to go out and spray because opting not to spray saves money and allows the beneficials to build up and do their work.

“We don’t have economic thresholds for all insect pests, but in most crops there are proposed thresholds for major pests. These are a good starting point for making decisions.”

If a chemical is used the choice of product needs to take account of its effect on the beneficials in the crop as well as its impact on the pest, with aim of maximising survival of the beneficials, Dr Miles said.

“Where a grower decides an insecticide is needed it makes sense to choose a product that will be effective against the target pest but have minimal impact on populations of beneficials so they can continue to exert control pressure on the pest population.

“However, that may be difficult for southern growers, who often have only one or two chemicals available for use on a particular pest in one of their crops. This is in contrast with cotton growers who often have multiple chemical options with different impacts on populations of beneficial insects.



RIGHT: INSECT INTERCEPTION TRAPS LIKE THIS ONE BEING CHECKED BY DR JAMIE HOPKINSON, QUEENSLAND DAFF, ARE USED TO MONITOR THE MOVEMENT OF PESTS AND BENEFICIALS BETWEEN CROP AND NON-CROPPING AREAS.



ABOVE: ARMYWORM LARVA PARASITISED BY APANTELES. (PHOTO: J WESSELS)  
 RIGHT: PARASITISED APHIDS ON CANOLA. (PHOTO: M MILES)



“Good spray decisions, ranging from whether or not to spray to which chemical to use, have profound impacts on costs and pest populations.

“Repeated use of the same chemicals can result in pest populations developing resistance to them – there are already chemical-resistant mites, diamondback moth, aphids and *Helicoverpa* in Australia – and broad-spectrum insecticides reduce or wipe out populations of beneficials ranging from lacewings to predatory mites.

“And some chemicals increase pest attack and the risk of losses due to pest damage.

“A broad-spectrum pyrethroid with long-term residual effect, for example, may reduce numbers of the target pest when it is applied but can increase the risk of damage from subsequent pest build up because of its impact on the beneficials that would otherwise keep pest numbers down.

“An ‘Impacts Table’ developed by the cotton industry indicates that using a broad-spectrum insecticide can increase the risk of further damage from ‘secondary’ pests advantaged by the initial insecticide; a pattern that has also been observed in southern grain crops.”

According to the Impacts Table, which lists the target pests and persistence rating of 30 chemicals or chemical groups, their impact on 13 beneficial insects or groups

of invertebrates and whether or not they are likely to increase the chances of pests re-establishing at damaging levels, 12 of the chemicals listed increase the chances of at least one group of pests developing after use of one of those chemicals.

This highlights the importance of full and accurate risk assessment, Dr Miles said, although how to identify the level of pest risk is one of the issues for southern growers wanting to adopt an IPM approach.

“Identifying the risk of a pest causing economic damage is critical to making the right pest management decisions.

“If the risk of serious damage is low the grower may decide to take no preventative action but instead monitor the number of pests and beneficial insects in the paddock and apply an in-crop insecticide if the level of damage and the balance between pests and predators indicate chemical intervention is needed.

“With low initial pest numbers in a paddock where good pre-seeding decisions have been made a grower will have time to monitor, assess the situation

and take a reasoned decision because any build up of the pest population will be gradual.

“If the risk of pest damage is moderate a seed treatment to reduce the chance of early damage may be the starting point. An effective seed treatment will protect emerging seedlings but has little if any ‘off target’ impact on populations of beneficials that may help keep pest numbers down.

“With the seed dressing protecting the crop seedlings the grower can monitor to track the number of pests and beneficials in the crop as the season progresses and take action only if necessary.

“Where paddock history, paddock conditions or pest numbers indicate a high risk of pest damage a grower might decide to use pre-seeding control measures to reduce pest pressure, apply a seed dressing to protect the crop during the seedling stage and plan to apply a foliar insecticide if pest numbers reach a particular level.

“Or he could decide the risk is too high and decide to grow another crop.”