Integrated pest management in wheat

The Ute Guide – July 2010

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This Ute Guide is an excellent resource for all farmers considering using, or already using, IPM on their farm. The guide has been developed using the experience and knowledge generated from IPM research and extension programmes funded by MAF SFF and FAR. The programmes have developed sustainable, long-term approaches to managing key pests of wheat in New Zealand.

The guide has key sections on the beneficial insects, cultural and chemical control and, of course, the pests and how to monitor for them. It will prove to be an excellent and enduring extension booklet for all farmers and I congratulate the authors for having the vision to develop and deliver the booklet in a complete and informative but simple format to benefit all arable farmers.

Nick Pyke
CEO, Foundation for Arable Research

Purpose of the guide:
These guidelines outline the basic steps involved in implementing IPM in arable crops.
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Introduction

Routine use of broad spectrum insecticides can result in the loss of beneficial insects, which can lead to pest outbreaks and increased dependence on insecticides. This in turn can lead to pests developing insecticide resistance. Integrated pest management (IPM) offers an opportunity to move away from a routine broad spectrum insecticide-based approach to pest management.

IPM is:
An approach to pest control that aims to maximise the use of beneficial insects whilst minimising unnecessary insecticide use. IPM combines biological (natural predators and parasites), chemical (selective molluscicides and insecticides) and cultural controls in a compatible way.

IPM is not:
a) Integrated pesticide management. Monitoring for pests and using insecticides according to pest levels is a legitimate approach to pest control but is not IPM if it does not incorporate biological and/or cultural controls.

b) Insecticide resistance management. Such strategies provide a legitimate approach to prolonging insecticide efficacy but are not IPM strategies.

c) Stopping the use of insecticides. Although the aim of any IPM strategy is to minimise the use of insecticides, simply stopping the use of insecticides (conventional or organic) does not mean that IPM is being practised.
Getting started

If you have not used an IPM approach before it may seem daunting. A good place to start is with just a few paddocks. This will give you a chance to:

a) Gain experience in identifying beneficial predators
b) Become familiar with the full range of pests to anticipate when broad spectrum insecticides are withdrawn
c) Become comfortable with how best to monitor to suit your schedule and crops
d) Gain confidence in using the results of monitoring to guide decisions
e) Observe differences between IPM-managed paddocks and the rest of the farm.

Getting started involves recognising the role of biological and cultural controls, not just alternative pesticides.
A wide variety of beneficial predators and parasites contribute to pest control in arable cropping systems. Some are resident predators that live in the crop all year and play an important role in helping to control establishment pests (pests that inflict the most damage while the crop is getting established). Others are transient and only arrive in a crop if there is a pest present to eat.

When broad spectrum chemicals are withdrawn from a farming operation, it may take a while for the resident beneficial populations to build up enough to contribute to pest control, whereas transient beneficial insects may fly into a paddock and maintain a presence if no broad spectrum chemicals are being used.

IPM aims to increase populations of resident beneficial species and make the best use of transient beneficial species.
Resident beneficial predators

Native carabid beetles (Carabidae)

a) Some common carabid species in Canterbury are (L to R) *Megadromus antarcticus* (metallic green beetle), *Metaglymma monoliferum* and *Holcaspis angustula*.

b) *Megadromus antarcticus* (metallic green beetle).
Native carabid beetles (Carabidae) are generalist feeders that predate on pests such as slugs, aphids and caterpillars.

The relatively long generation times of these beetles (1–2 years) means that a single synthetic pyrethroid application can reduce populations for many years.

Carabid beetles are active throughout the year with peak activity in summer. They are nocturnal predators so just because you don’t see them, it doesn’t mean they’re not there.
Resident beneficial predators

Rove beetles (Staphylinidae)

a) Rove beetle (photo supplied by Denis Crawford of Graphic Science).
Rove beetles (Staphylinidae)

Both adults and larvae are active predators that attack eggs, larvae, pupae and adults of most soft-bodied soil insects and aphids.

Adults are usually black and differ from other beetles by having short wing covers. They vary in size and resemble earwigs, but can be distinguished by their lack of forceps at the tip of the abdomen.

Adults are found throughout the year, but larvae are most abundant in summer.
Other resident beneficial predators

a) Harvestman.
b) Wolf spider.
Predatory earwigs, predatory mites, harvestmen and spiders are also resident beneficial predators. **Spiders and harvestmen** are common generalist predators of insects in wheat crops. Some are soil- or foliage-dwelling whereas others spin webs in the vegetation. Spiders and harvestmen can be active throughout the year with highest numbers occurring in spring.
Transient beneficial predators

Brown lacewing (*Micromus tasmaniae*)

- a) Lacewing egg.
- b) Lacewing larva and aphids.
- c) Adult lacewing.
The **brown lacewing** (*Micromus tasmaniae*) is a common predator in many crop systems in New Zealand. Both adults and larvae are highly active predators of aphids and other soft-bodied insects.

The adult lacewing is 7–10 mm long with brown lacy wings. The larvae are up to 9 mm long with a brown alligator-like appearance and move around a lot searching for prey. Eggs are less than 1 mm, smooth, white and oval and single eggs are often placed on the plant surface close to aphid colonies or other suitable prey.

Brown lacewings can be present all year, but abundant numbers are usually not found until spring.
Transient beneficial predators

Hoverflies

a) Hoverfly egg.
b) Hoverfly larva.
c) Adult hoverfly and pupae.
Hoverflies

The adult stage of hoverflies is recognisable as the insects hover in one place in the air and have yellow markings on a black body, similar to bees and wasps. They feed on nectar and pollen. The larvae of hoverflies climb around in the foliage of plants and are predators of aphids and other soft-bodied insects.

Hoverfly eggs are white and oval, and adults lay eggs near aphid colonies so that there is food for the juveniles that hatch.

Adult hoverflies appear early in spring, but larval numbers may not build up until later in the season.
Transient beneficial predators

Ladybird beetles (*Coccinella* spp.)

a) Ladybird eggs.
b) Ladybird larva.
c) Ladybird adult eating aphid.
Ladybird beetles (*Coccinella spp.*)

Most adults and larvae of ladybird beetles are highly active predators, aphids being their main prey.

Ladybird larvae look very different from adults. They can be up to 10 mm long, are highly mobile and have a greyish-black alligator-like appearance with yellow or orange bands or spots. Ladybird eggs are yellow and oval and placed in batches on the underside of leaves or in the soil.

Ladybirds overwinter as adults along hedgerows and in other protected places. In spring they migrate to find prey and suitable egg-laying sites. Most ladybird species are active from late spring to late autumn if food is available.
a) The female *Aphidius* bends her abdomen under her legs and injects an egg into the aphid with her ovipositor (next to hoverfly larva).

b) *Aphidius*.

c) Mummified aphid.

d) After the adult parasitic wasp emerges, an aphid shell with a circular hole is left behind.
Parasitic wasps/parasitoids

Some parasitic wasps are species-specific and many actively search for aphids. The main parasitoid of aphids in cereal crops in New Zealand is *Aphidius rhopalosiphi*. The female lays an egg inside the aphid. When the egg hatches, the emerging larva consumes the aphid and eventually an adult parasitic wasp emerges, leaving behind an aphid shell with a circular hole.

Adult wasps are up to 3 mm long, black and can easily be mistaken for other flying insects. The most obvious sign of parasitoids is parasitised aphids, which become swollen and turn a dull brown colour. They are referred to as aphid ‘mummies’.

Parasitoids are active in early spring through to late autumn, with numbers peaking in early summer.
Cultural controls include all management activities that can contribute to better pest control.

A key cultural control for cereal aphids is to avoid planting at high risk times by sowing later in the autumn (i.e. after May) to avoid aphid flights. This option is becoming less common due to concerns about yield loss with current cultivars. If the decision is made to sow later, monitoring is still essential until the crop is past GS31 as some winters are mild enough for secondary spread of BYDV and selective chemical applications may still be necessary (see BYDV and aphid control sections).

Soil preparation and good quality seed and weed management are also important cultural controls. If the crop can be established quickly and the plants are growing well, problems with establishment pests will reduce.
Chemical control

IPM involves using pesticides only after monitoring indicates that they are needed and, where possible, only selective chemicals are used. Avoid synthetic pyrethroids such as lambda cyhalothrin or organophosphates because their broad spectrum effect means they will kill beneficial predators as well as target pests.

When choosing chemicals:

a) Make sure the pest is correctly identified

b) Avoid broad spectrum insecticides

c) Avoid routine use of insecticides, there must be a pest in sufficient numbers at a critical time

d) Consider the effect of selected pesticides on beneficial predators (resident and transient).
Identification of key pests and diseases

Aphids

a) *Metopilophium dirhodum* aphid colony.
b) *Rhopalosiphum padi* aphid colony.
Aphids

Aphids are small soft-bodied insects, typically yellow-green, dark green, dusky brown or blackish. Winged aphids fly into cereal crops from pasture grasses or other crops, and start colonies of wingless aphids. When plants become unsuitable or overcrowded, winged aphids reproduce and migrate to other plants or crops.

Aphids are a key food source for a large number of insects. Hoverflies and ladybirds tend to lay eggs only where there are aphids present as their larvae depend largely on aphids.

Aphids can damage the crop directly by feeding or indirectly through their ability to vector *Barley yellow Dwarf Virus* (BYDV). In Canterbury, cereal aphid flights usually peak in autumn from mid-March to mid-June and in spring from September to November.
Identification of key pests and diseases

**Barley Yellow Dwarf Virus (BYDV)**

a) and b) Symptoms of *Barley Yellow Dwarf Virus* on flag leaves in wheat.
Barley Yellow Dwarf Virus (BYDV)

*Barley Yellow Dwarf Virus* is a plant disease in cereals and grasses caused by a virus. The virus is transmitted by aphids that fly into the crop (primary infection) and by their offspring within the crop (secondary infection). BYDV can be a big problem in mild autumns and winters due to prolonged aphid presence in crops.

Symptoms of infection are yellowing and/or reddening of leaves and stunted plant growth. Damage is most serious in plants infected at an early growth stage. The highest risk of BYDV occurs in mid-March to mid-June for autumn-sown cereals and in September to November for spring-sown cereals.
Identification of key pests and diseases

Slugs

a) Grey field slug (*Deroceras reticulatum*).
b) Brown field slug (*Deroceras panormitanum*).
c) Keeled field slug (*Milax gagates*).
Slugs

The most common slugs likely to cause damage to arable crops are the grey field slug (*Deroceras reticulatum*) and the brown field slug (*Deroceras panormitanum*). The grey field slug causes twice the damage of the brown field slug (per individual). The keeled slug (*Milax gagates*), though less common, is also very damaging.

The grey field slug can easily be identified as it is the only species that produces a milky white mucus when disturbed. The brown field slug is a uniform brown colour with no distinctive markings. The keeled slug is usually very dark with a sharp ridge, or keel, running along its back.

Slugs are active at night and depend on moisture for activity, survival and reproduction. They are at their most damaging in wet weather.
Aphid control

If crops are sown in April or May, use an imidacloprid seed dressing, to minimise BYDV spread until the start of tillering (GS21). Plants are at risk until GS31 so this window must be closely monitored for aphids. Where a seed treatment is used, aphid tolerance falls into two categories.

**Low tolerance (GS21-31).** If aphids are found in the crop over this period (start of tillering until stem extension) they are assumed to be vectors of BYDV so selective aphicides are recommended, i.e. pymetrozine or pirimicarb (apply pirimicarb on the morning of a sunny day; if weather is cold and cloudy higher rates are required).

**High tolerance (>GS31).** Once the crop has reached GS31 it is no longer susceptible to BYDV infection so is more tolerant of aphids. Take note of the presence of beneficial predators before deciding to spray.
Slug control

During autumn and spring, conditions are most conducive to slugs. Hot and dry or cold weather conditions reduce slug reproduction and feeding activity.

Crops are most vulnerable to slug damage during establishment because slugs attack and hollow out seeds and bite off young seedling plants at ground level. Slugs must be monitored until the wheat crop has established, especially in moist conditions.

Avoid broad spectrum molluscicides such as those with methiocarb as the active ingredient. These baits will kill beetles through secondary poisoning (beetles are poisoned after eating a slug that has ingested bait). EDTA or metaldehyde baits are recommended instead.
1. Know which crops and areas on your farm are more susceptible to pest damage.
2. Be able to recognise conditions that lead to rapid increases in pest numbers.

Yellow sticky traps can be used to monitor small flying insects such as aphids or brown lacewings. These traps can help detect sudden increases in a particular type of insect, which can lead to more timely decision making.

Pitfall traps (any container dug into the ground flush with the surface and half-filled with diluted antifreeze as a preservative) will collect insects and other invertebrates that are active on the soil surface. They are a good way to see if there are any carabid beetles in the paddock (aphids can also be found on the surface).

Following establishment of the crop, direct searching for colonies of aphids or leaf damage is simple and quick.

Slug activity can be monitored using anything that provides shelter, such as wooden tiles or sacks.
a) Yellow sticky trap.
b) Pitfall trap.
c) Wooden tile used to monitor slug activity.
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