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Integrating insect control for Ord soybean production

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Heliothis destroying soybean pods.

The Department of Agriculture has started three important biological control programmes which have greatly influenced the overall pest management system for grain legume production. The first of these projects was the deliberate build-up and encouragement of the very small January. Commercial crops planted in January have been virtually free from damage. Good crops are produced without the need for several expensive insecticide applications which would otherwise be required to exclude the stem borer.

Another example of reducing the significance of pests has been the concentration on growing fast-maturing varieties. This is particularly important in avoiding the pod-sucking bug pests. Clearly, the shorter the time the vulnerable soybean pods are on the plant, the less opportunity the bug pests have to damage the developing seeds.

Cultural practices

When the biology of an insect pest is well understood there is often a great deal to be gained by adapting cropping practices to avoid peak pest levels. An example of this approach is the avoidance strategy now used to limit the level of damage from the stem borer, Zygrita diva. Time of planting trials have indicated that crops planted early in November and December suffer extremely high levels of borer damage, but that the pest's activity declines rapidly in tunnels in the stems of soybeans. This has been considered the most damaging pest of all to soybeans, since it can totally destroy infested plants by chewing through the stem. Other important pests include several pod-sucking bugs (especially the green vegetable bug); leaf eating loopers caterpillars and pod-chewing pests (especially the budworm, Heliothis spp).

Below is a review of the methods entomologists have adopted to control these pests so that the control strategy for one does not induce the build-up of another.

Biological control

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Key pests

Some of the pests which attack soybeans are widespread and well known in Australia while others are unique to the non-temperate regions of the continent and require special consideration. An example of the latter is the beetle Zygrita diva which, when in the larval stage, is a pest that

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wasp, Trichogramma sp, which parasitises the eggs of many moth pests including some of the most devastating cotton pests, the budworms, Heliothis spp.

This wasp egg parasite is an integral part of a complex with other parasites and predators which exert a strong natural controlling force on moth pests. In fact it is wise pest management to allow a build-up of leaf-eating caterpillars since they in turn enable the beneficial species to increase in number during the non-crucial stages of crop growth. The consequence of this is that at the times when yield loss can occur quickly (i.e. between flowering and pod maturity) there exists already a complement of beneficial insects which will reduce, if not completely control, the population of potentially serious budworm caterpillars.

Entomologists have established two biological control programmes to control the pod-sucking bugs, in particular the green vegetable bug, Nezara viridula. The first of these was relatively simple and involved the introduction of an egg parasite, Trissolcus basalis, to the Ord. This parasite was already established in southern Australia where it had been extremely successful in controlling the green vegetable bug since its importation into Western Australia from the West Indies in the 1930s. The parasite was reared in large numbers at Kununurra and more than 40,000 wasps were released in the irrigation area, where they quickly established and drastically reduced the population of the green vegetable bug and other bug pests.

Although Trissolcus was effective at most times it was unable to cope quickly with the large invasive flights of bugs which were common at the end of the wet season. For this reason entomologists sought a more mobile parasite which could attack the adult bugs, rather than their eggs. This led to the importation from Hawaii of a well known adult bug parasite Trichopoda spp. Unlike the egg parasites, this parasitic fly has proved extremely difficult to rear and to establish at the Ord. This project is described elsewhere in this issue.

Insecticides
Insecticides remain the final weapon against insect pests. Basically they can be employed either to totally annihilate or to selectively remove or reduce a group of pests. Under the sub-tropical conditions of high pest densities it is most desirable to use selective insecticides which tend to minimise the destruction of natural beneficial insects and biological control agents.

Examples of selective pesticides include the bacterial preparation 'Dipel®', the virus 'Elcar®' and the ovicides chlordimeform, amitraz and methomyl. All these insecticides selectively control moth pests in either the egg or caterpillar stage without seriously affecting the range of parasites and predators.

Researchers are continuing to study the use of these chemicals, because of the considerable variation in results. However there is no doubt that they can be very valuable pesticides when used in well-timed situations.

Although there are no insecticides specifically selective for control of the pod-sucking bug pests, 'soft insecticides' are used when possible. The 'soft chemicals' are those which have a high level of activity in terms of pest species but which are 'softer' on beneficial insects. At the Ord, for example, endosulfan and trichlorfon have been found to be 'soft' on wasp and fly parasites of pests and are therefore used preferentially when broad spectrum insecticides are necessary.

Insect resistant varieties
Although disease resistant varieties of many crops have been used for many years, the value of insect resistant varieties has been recognised only recently. Projects of this nature are long term concepts which involve field assessments of potentially useful varieties and a great deal of plant breeding activity.

At the Ord, only preliminary results are to hand from screening trials for resistance to the stem borer Zygrita diva. However these results give an indication of the potential of such varieties.

Summary
Controlling insects on susceptible crops in the sub-tropics requires an integration of pest control techniques. It is extremely important that each component of the system complements the others. The natural and introduced biological control agents, rather than insecticides, are the most significant agents in the pest management system for soybeans at the Ord.