Outlook

Getting away from pesticides

Dr Douglas Waterhouse, Chief of CSIRO's Division of Entomology, doesn't believe that we can solve all our pest problems with pesticides. He and his Division's 109 scientists spend much of their $3- million yearly budget devising non-polluting methods of pest control. In the long run he doubts if it will be possible to defend our crops with a barrage of poisonous chemicals, and the effects these have on our environment make it undesirable anyway. Rather we should be learning to control insect and weed pests by a variety of means.

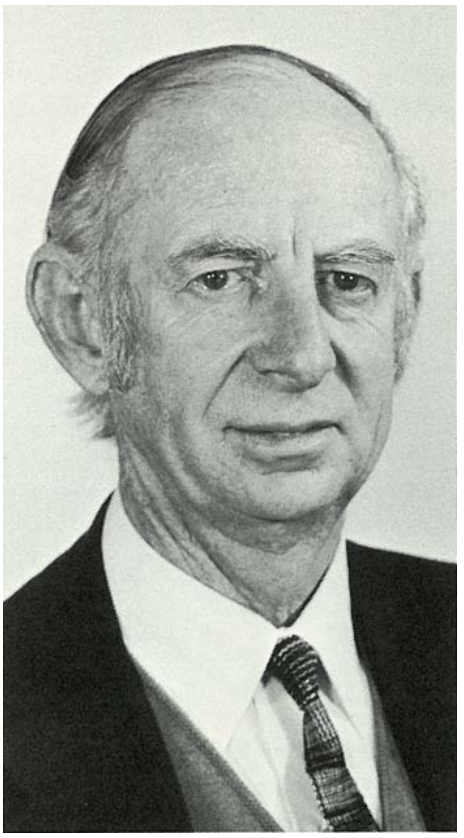
According to Dr Waterhouse we shouldn't stop using pesticides altogether, not yet anyway. Instead we should make judicious use of them as part of an array of weapons.

Entomologists call this approach pest management, and Dr Waterhouse defines it as 'manipulating pest populations by a combination of all available means so that they remain below the level at which they cause economic damage'.

Dr Waterhouse and his colleagues are investigating a number of techniques that don't use pesticides. Examples include:

- biological control—using pests' enemies and diseases against them
- using sex hormones to lure insects into traps
- altering pasture and forestry management to discourage pests from breeding
- manipulating the genetics of insect populations
- storing grain at temperatures too low for insect breeding

Quite a few ingrained attitudes will probably have to change before people adjust to the idea of pest management. For example, we may all have to learn to accept produce of slightly lower quality. Go to any greengrocer's shop, and there you will see rows of perfect apples displayed (in Dr Waterhouse's words) 'like wax models from a factory'. They're perfect because that's the way consumers have come to want them; but orchardists use a lot of sprays to make them that good. They wouldn't be quite so perfect if the pest management approach were used. But Dr Waterhouse considers the occasional mis-shapen or scabby apple a small price to pay for a cleaner and more stable environment.



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Not all insects are pests. The vast majority play an important, yet largely unnoticed, part in maintaining the balance of nature. Without bees and other plant pollinators, many crops would fail; without insects, many of our birds would die of starvation; without blowflies, carcasses would lie around and mummify.

Unexpected consequences

But most insecticides used today don't discriminate between the good and the bad. Consequently their use has produced unexpected results. Look what happened when Australian orchardists sprayed their apple trees against the codling moth. Another inhabitant of these same trees is the tiny two-spotted mite, which used not to do much harm. But spraying for codling moth also killed off the enemies of the two-spotted mite, so it too became a pest.

Using the pest management approach, the Division of Entomology appears to have the answer to this particular problem; from American orchards, it has introduced enemies of the two-spotted mite that are not affected by the codling moth sprays. Recent trials in a Canberra orchard were very successful—the new predators thrived and the mites diminished to a low level once more. The same approach is now being tried in the apple-growing States, and the early results have looked encouraging.

Our reliance on pesticides began with the debut of DDT during World War II. For the first time in history it became possible to kill insects by the million—to prevent them from eating crops and spreading disease. Other chemicals followed, and all seemed well until Rachel Carson's 'Silent Spring' alerted people to some disquieting consequences of their use. The appearance of dead birds and fish after spraying operations in a number of countries led to investigations that revealed that the pesticides were poisoning birds, fish, and possibly mammals—sometimes even Man—as well as the intended victims. In addition insects

A successful Sirex predator on a pine log — note its pin-like egg-laying tube.

were becoming resistant to them, and even much heavier doses were failing to control the pests.

Just this situation seems now to have arisen in the cotton-fields near Narrabri in northern New South Wales. Studies by the New South Wales Department of Agriculture and the CSIRO Division of Plant Industry have shown that the cotton bollworm in the area has become very resistant to DDT. Only extremely high doses of DDT now have much effect. This pest has also become resistant to two alternative insecticides.

Biological control

So research has swung back, slowly at first but with increasing momentum, to ideas of non-insecticidal pest control.

One of the major weapons of pest management is biological control. As Dr Waterhouse points out, this approach has the great advantage that once it has succeeded the pest should be controlled for a long time. So in the long run it's much cheaper than spraying with pesticides year after year.

Probably one of the best-known and most successful applications ever was against prickly pear in southern Queensland. During the late 1920s, *Cactoblastis cactorum* grubs brought in from Argentina literally ate their way through some 25 million hectares of prickly-pear-infested country. The Cactoblastis Memorial Hall near Chinchilla in central Queensland, on the Warrego Highway, commemorates the little grub's feat.

Another biological control project that bears all the earmarks of success is the now-famous CSIRO dung beetle program. Here the Division has set a beetle to work against two troublesome flies—the bushfly and the buffalo fly.

From the time they were introduced by the First Fleet, cattle have been upsetting the ecological balance with their dung, giving bushflies, and later blood-sucking buffalo flies, copious breeding places. Australia has native beetles that bury dung, but they evolved to cope with the pellet-like droppings of the native marsupials, not the massive and sloppy offerings of cattle.

Scientists from the Division went to Africa to look for beetles that would bury cattle dung; they chose Africa because that's where most of the world's largest plant-eating animals evolved. Six years after the first releases in Australia, several species are doing extremely well, especially in the tropics. But many more species will have to be introduced before beetles adapted to all of Australia's very varied climates can be let loose.

As well as removing breeding places for irritating flies, the dung-burying activities of the beetles will greatly assist in recycling nutrients back into the soil to maintain its fertility.

In Tasmania and Victoria another of the Division of Entomology's biological control projects appears to be paying off. Here, insects and a nematode worm released over the last few years are now preying on the Sirex wasp, which was once feared as a major pest of pine plantations in these two States.

Using viruses

As well as releasing insects to control pests, Dr Waterhouse and his colleagues are looking at using viruses to attack the pest species. CSIRO used this approach earlier against rabbits—myxomatosis is caused by a virus. Now entomologists are seeing whether they can control the potato moth in Western Australian crops with viruses. Early trials have been encouraging.

Perhaps the most spectacular recent achievement of the Division has been the use of a fungus to attack skeleton-weed. In the oration he gave last year when receiving the Farrer medal for outstanding contributions to agricultural research, Dr Waterhouse pointed out that this annoying weed of the wheat belts probably caused losses of more than $30 million each year.

It originally came from lands bordering the Mediterranean Sea, where it is uncommon and never regarded as a pest. Insects and fungi keep it in check there. Attempts to control this weed in Australia with the herbicide picloram have proved expensive and unreliable.

Within a year of the Division releasing a rust fungus from Mediterranean lands in 1971, practically every stand of skeleton-weed examined in Australia was infected—raising hopes that the $1 million research project was indeed a good investment.

In fact when embarking on any biological control project we take a gamble —but with the odds in our favour. We pay now in the hope of gaining big savings later.

More about the topic

Pest management in Australia. D. F. Waterhouse. *Nature*, 1973, **246**, 269–71.