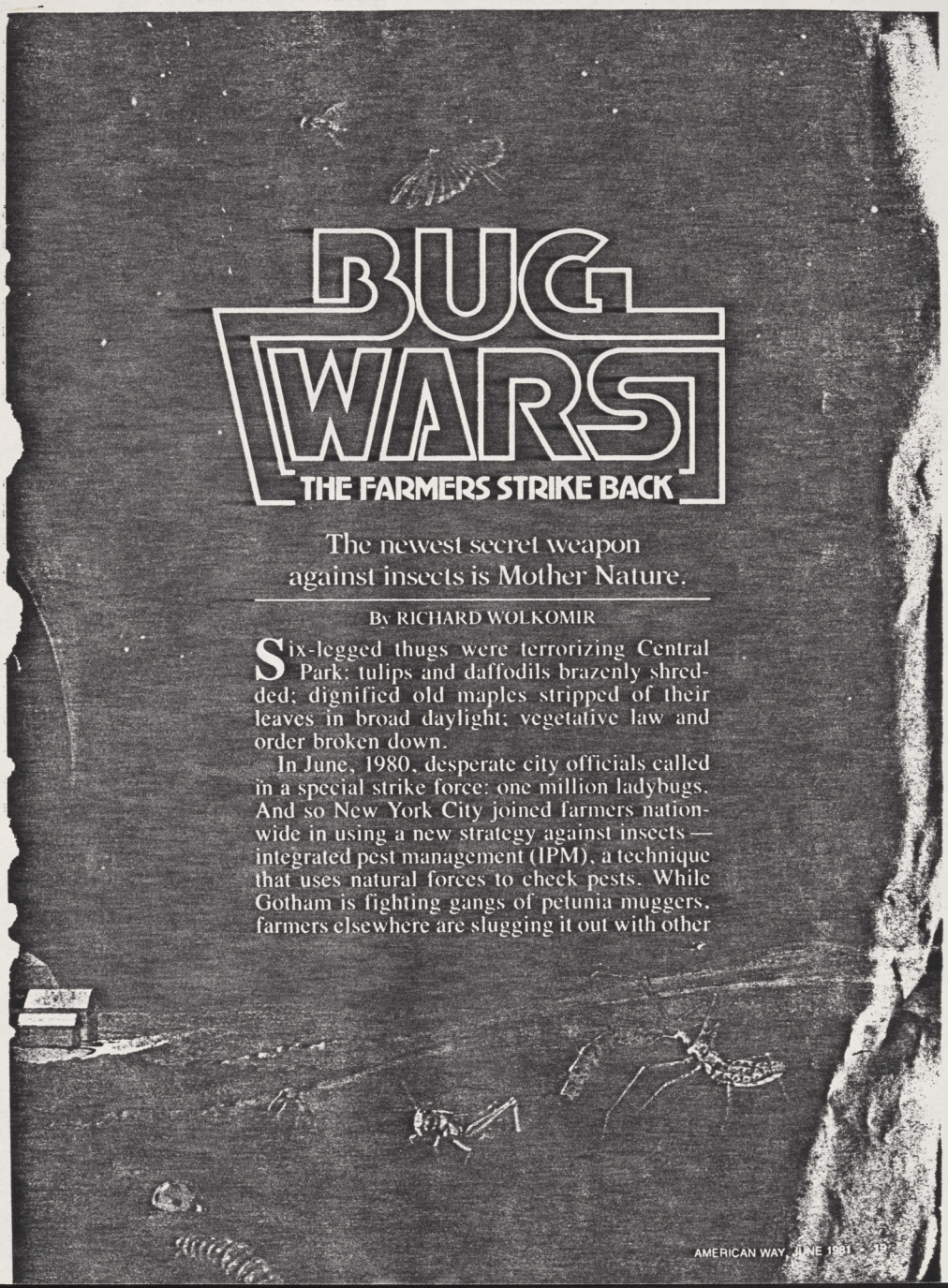


BUG WARS

THE FARMERS STRIKE BACK

The newest secret weapon against insects is Mother Nature.

By RICHARD WOLKOMIR

Six-legged thugs were terrorizing Central Park; tulips and daffodils brazenly shredded; dignified old maples stripped of their leaves in broad daylight; vegetative law and order broken down.

In June, 1980, desperate city officials called in a special strike force: one million ladybugs. And so New York City joined farmers nationwide in using a new strategy against insects — integrated pest management (IPM), a technique that uses natural forces to check pests. While Gotham is fighting gangs of petunia muggers, farmers elsewhere are slugging it out with other



COURTESY OF TEXAS AGRICULTURE EXTENSION SERVICE

Researchers at Texas A&M University monitor infestation outbreaks by the striped blister beetle, feeding here on soybeans.

insects that attack us where we eat.

IPM can be as simple as deploying predatory ladybugs against insects chewing up Central Park. Or it can be as complex as computerized programing to bash bugs with viruses, plant extracts, hormones, timed plantings, and precisely measured chemicals in a well-orchestrated and lethal onslaught.

The stakes are high in the bug war: Every bug-nibbled bushel of wheat or corn is that much less to be sold abroad. Agricultural exports now run around $35 billion a year, the country's biggest export. Even more important, as world population rises, every bit of food that can be produced will be needed. Yet we now lose approximately 33 percent of our crops each year to pests.

Pesticides, once thought to be the answer, are losing their punch — the environment is becoming polluted by them, and insects are developing immunities to the poisons. But just in time, like the U.S. cavalry, IPM is coming to the rescue:

- In Texas, where approximately 75 percent of the cotton crop now is protected by IPM techniques, insecticide use in the cotton fields has dropped from about 20 million pounds a year in 1965 to approximately 2 million pounds.
- By exploiting weed-eating insects such as the white moth, California now saves $1 million a year in herbicides for tumbleweed control alone (IPM is used to combat weeds, as well as insects).
- An IPM experiment in Arkansas cut insecticide applications on 50 square miles of farms from 10 a year to 2.
- Apple growers in central Washington State have reduced pesticide spraying by nearly 50 percent.

Recently, after a careful study of IPM, the U.S. Office of Technology Assessment announced that the country can cut its huge before-harvest losses to pests by 50 percent if the shift to the new techniques is speeded up. And the office said that a rapid shift to IPM could cut pesticide use for major U.S. food crops by 75 percent.

> A computer tells the farmer when to spray and how much.

Pesticides, of course, will continue to be an important agricultural tool. Farmers have relied on them since the World War II debut of a heavyweight bug fighter called dichlorodiphenyltrichloroethane — DDT to its friends. Today farmers choose from approximately 35,000 different pest-killing concoctions, using more than twice as much pesticide as they did as recently as 1966.

John H. Berry, a U.S. Department of Agriculture economist, says: "Pesticides have been a major factor in improving the efficiency of agriculture. Some estimates indicate that pesticides were responsible for 20 percent of the gain in agricultural productivity since 1940."

But there are snakes in this chemical paradise. Rachel Carson sounded the public alarm in 1962 in her book *Silent Spring*, pointing out that DDT was poisoning song birds and other beneficial species as well as obnoxious insects. Many biologists were already worried and have since supported their claims with studies.

Entomologist Stanley Hoyt of Washington State University scrutinized DDT's effects on apple orchards: "DDT had been used so much to kill codling moths that it was killing off beneficial insects, too," he noted in the 1978 issue of the National Science Foundation journal *Mosaic*. "Most noticeably, it was killing the natural predators of the mites that attack fruit trees here. Suddenly we had a plague of mites."

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Even more alarming, many bugs were giving pesticides the Bronx cheer. In 1965 the United Nations Food and Agriculture Organization listed 182 insect species that had developed a resistance to insecticides. By 1968 the list included 228 species. By 1977 it was up to 364 species. The writing is on the wall.

Cornell University's David Pimentel has pointed out that we have increased our use of pesticides tenfold since the 1940s. Yet during the same period, crop losses to insects have nearly doubled. Meanwhile, the cost of the petroleum-based chemicals in pesticides has soared.

In 1972 the National Science Foundation and the Environmental Protection Agency funded a six-year search for alternatives to pesticides. When the study was concluded in 1978, the new strategy —

> IPM can be as simple as deploying predatory ladybugs against insects in Central Park.

IPM — already was a winner. Entomologist and project-director Carl B. Huffaker said: "Certainly the knowledge is there now to reduce the use of the most polluting chemical insecticides by 50 percent within a few years."

For example?

Consider the wretched boll weevil. An ill wind blew this voracious cotton eater up from Mexico in 1892. With no natural predators to check it, the weevil marched through the cotton belt like General Sherman. Desperate farmers fought back with poisons, gas, mechanical contraptions, fire, water, and fervent prayer. But the weevil just snickered and continued chewing.

Finally, in the 1940s, scientists brewed chlorinated-hydrocarbon insecticides — and farmers gleefully massacred weevils. But by the mid-1950s the weevils were immune. Today only organophosphates control weevils, and the bugs could become immune at any time. Meanwhile, the weevil sprayings also kill off insect predators, enabling other cotton pests that are immune to insecticides — such as the bud worm and the bollworm — to swarm into cotton fields.

"A lot of growers had ruinously heavy losses, and some of them quit growing altogether," remembers Perry L. Adkisson, a Texas A&M entomologist.

IPM came to the rescue: The project's scientists developed a new type of cotton that matures so fast it outruns early pest infestations. Farmers can now skip mid- and late-season weevil sprayings, which used to kill off the insect predators that control bud worms and bollworms. And they can harvest early, before the weevils begin their late-season proliferation.

Early harvest has another bonus: Cleaning the fields before autumn robs the weevils of winter hideouts. That means fewer weevils to infest crops in the spring.

Results? Entomologist Adkisson reports: "We made some comparisons that show the short-season producer netting almost four times as much in dollars per acre as the typical grower."

IPM scientists have all sorts of tricks:

- Agriculture Department biologists have found they can control the green peach aphid, a nasty customer, simply by replacing weeds that grow around the peach trees with grass. The world's No. 1 destroyer of vegetables, including sugar-beet crops as well as peaches, the green peach aphid requires weeds for survival at one stage in its life cycle. Because the aphids have developed a resistance to pesticides, substituting grass for weeds should save hundreds of millions of dollars in crop losses each year.
- A few years ago citrus farmers near Los Angeles stymied an invasion of Mediterranean fruit flies by importing 150 million irradiated fruit flies from Hawaii. The sterile Hawaiian flies mated with the Los Angeles flies, producing infertile eggs. Within weeks, wild fruit flies were nearly extinct in the area.
- Beware, Mexican bean beetles: An entomologist has discovered that bean beetles in El Salvador are infested with tiny, spiderlike mites. They live under the beetles' wings, sucking their hosts' blood and weakening them so they can't reproduce. Now U.S. Department of Agriculture scientists expect to have mites ready for farm use in about two years. They attack only bean beetles, the country's No. 1 enemy of bean crops.
- Other tricks? Entomologists are using growth hormones to prevent juvenile insects from maturing into full-fledged pests. They also use germ warfare; since 1974 the Environmental Protection Agency has registered three viruses for use against the cotton bollworm, the Douglas fir tussock moth, and the gypsy moth. The EPA also has approved a bacteria for use on grain. Toxic to bugs, it is said to be harmless to humans.
- Grasshoppers have been known to form swarms 100 miles long, 3 miles high, and 15 miles wide. Containing billions of insects, the swarms chew through everything from crops and fences to shovel

handles. Now Agriculture Department researchers have found a way to infect grasshoppers with a deadly, naturally occurring disease called nosema locustae (grasshopper sickness). One application can keep hoppers in check for up to a decade, yet researchers say the disease is harmless to all other animals, plants, and beneficial insects.

Scientists are combing the world for plants containing natural bug zappers. Emory University scientists now are working on a chemical from a plant native to Africa that blocks insects' appetites, putting them on a permanent hunger strike. Other researchers have found that crops ranging from wheat to tomatoes are impervious to pests for 10 weeks if the surrounding soil is mixed with ground-up seeds from the subtropical neem tree. And it turns out that natural oils in the peels of oranges, grapefruits, and lemons are highly toxic to the eggs and larvae of the Caribbean fruit fly.

Meanwhile, insecticides are not obsolete. But instead of spraying indiscriminately, IPM requires only a well-timed squirt here and there.

For instance, the codling moth has no known natural enemies. And so researchers have developed a system for spraying the apple pests at just the time in their life cycles when they are most vulnerable and when the least spray is needed. But the insects may be at one stage in one orchard and at a slightly different stage in the orchard over the hill. Michigan has solved that problem with a computer.

The Agricultural Extension Service in Michigan feeds data from 37 weather stations into a computer, adding details on the status of codling moths in individual orchards. Farmers check up on their unwanted tenants by setting traps baited with the insects' sex pheromones, secretions that have a fatal fascination for the male of the species. The computer ponders it all, then tells each farmer in the program precisely when to spray and how much.

The result? Better apples and much less pesticide going into the environment.

IPM appeals to just about everyone — except the bugs. Even the National Agricultural Chemicals Association has endorsed it. And now farmers, wary at first, are beginning to accept the new strategy.

Explains one entomologist: "When you tell a farmer that IPM can increase his return 25 dollars to 100 dollars an acre, as has been done in many instances, his resistance goes down in a hurry."

Free-lance Richard Wolkomir reports he is losing the bug war in his garden in Montpelier, Vermont.

