

The 50th anniversary of a great idea

Landmark *Hilgardia* article on “integrated control” considered “most important” pest control paper of 20th century

Fifty years ago in October, four pioneering University of California scientists outlined a new way of thinking about pest control, establishing a pest management framework that changed the way the world farms.

The scientists recognized — way ahead of their time — that imposing a harsh chemical on a natural system threw it off kilter, causing many more problems in the long run. They believed that combining an array of pest control methods would be more effective, safer for farmworkers and kinder to the environment. The scientists proposed:

- Recognition that agriculture is part of the larger ecosystem, comprised of all the living organisms of an area and their environment.
- Supervision of insect levels so that chemical applications take place only when and where they are absolutely necessary.
- Promotion of beneficial insects through conservation and augmentation.
- Use of products and application timing to target specific pests, minimizing the effect of treatment on pests’ natural enemies.

Vernon M. Stern, Ray F. Smith, Robert van den Bosch and Kenneth S. Hagen presented their ideas in a landmark and often-cited article published in the October 1959 agricultural science journal *Hilgardia*, published by the UC Division of Agriculture and Natural Resources. The 20-page paper clearly and concisely described the consequences of pesticide overuse and detailed their vision of a sustainable pest control system.

None of the paper’s four authors is alive today. All of them are probably best remembered for their role in inventing integrated pest management (IPM).

“In essence, they laid the foundation of all IPM methods that we use today,” says Peter B. Goodell, UC IPM advisor with the UC Kearney Agricultural Center near Parlier. “The concept is so fundamental, we haven’t added much to it. We’ve just nibbled around the edges and refined it for individual crops and pests.”

At the time the article was published, Stern, Smith, van den Bosch and Hagen could only have dreamed that their ideas would spread across the globe, prompt the development of a new scientific discipline, and be credited with substantially reducing the use of pesticides while making farming more efficient and sustainable.

They wrote their seminal treatise about agriculture’s unhealthy dependence on pesticides several years before Rachel Carson published *Silent Spring*.

Founders of IPM

Vernon M. Stern (1923–2006) served on the entomology faculty at UC Riverside for 35 years, until his retirement in 1991.



Throughout his career, he worked on developing the integrated control concept to improve management of lygus bugs in cotton. For example, he led work that showed strip cutting of alfalfa could dramatically reduce lygus migration into cotton and subsequent damage.

Ray F. Smith (1919–1999) was an entomology professor at UC Berkeley.



He worked with key international agencies to carry the new pest strategy around the world. In 1974, he organized the United Nations Food and Agriculture Organization’s Global Project for Integrated Pest Management for Major Crops, and soon thereafter initiated projects on cotton, rice and food crops in Africa, the Near East and Asia. The *Hilgardia* paper was hailed by the National Academy of Sciences as “the single most important paper published on crop protection in this century” when Smith was elected to the academy in 1981.

Robert van den Bosch (1922–1978) began his



career as an entomology professor in biological control at UC Riverside and transferred to UC Berkeley in 1963. His concern for the environment and other broad concerns of society were expressed in talks and writings to his colleagues and students, and to farmers, politicians, farmworkers, environmentalists, agribusiness employees and lay people all over the world. His strongly held convictions were brought together in his last book, *The Pesticide Conspiracy*, published in 1978 and still in print today. In his book, he calls integrated pest management a “technology.” “It is scientific pest control and, as such, the only way we can hope to gain the upper hand in our battle with insects.” The Robert van den Bosch Scholarship in Biological Control is awarded to doctoral students at UC Berkeley each year.

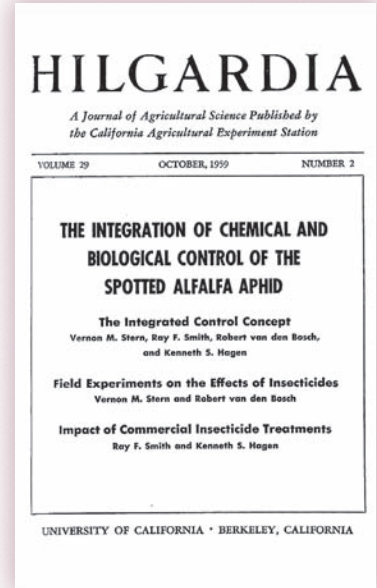
Kenneth S. Hagen’s (1919–1997) research career



covered some 50 years of service at UC Berkeley. Although he retired in 1990, he continued full-time research and teaching until the day of his death. Hagen’s accomplishments in research were widely recognized and respected internationally. He was a world authority in several areas of entomology and biological control. Perhaps his favorite research topic was the behavior and biology of ladybird beetles.



Effective integrated pest management (IPM) is based on regular monitoring and good record keeping. Above, an IPM scout inspects plants for disease. Right, "The Integrated Control Concept," a seminal article published in the October 1959 *Hilgardia*, provided the foundation for modern IPM.



In fact the four men are considered the fathers of IPM. They wrote their seminal treatise about agriculture's unhealthy dependence on pesticides several years before Rachel Carson published *Silent Spring*, the 1962 classic that some believe kick-started the environmental movement.

Both stories begin with the sudden availability of DDT after World War II. DDT's effectiveness at killing pests on contact lifted the heavy burden of pest management from the shoulders of farmers laboring to feed the nation. At first, the chemical seemed almost magical. But it didn't take long before farmers and scientists realized that it put U.S. agriculture on a fast-moving pesticide treadmill.

An example cited in the *Hilgardia* article is the 1947 explosion of cottony cushion scale in citrus. Widespread use of DDT to control other citrus pests in the San Joaquin Valley virtually eliminated the scale's natural enemy, the vedalia beetle. Another unintended consequence of DDT use was eggshell thinning in birds of prey, waterfowl and song birds, which put the populations of bald eagle, brown pelican, peregrine falcon and osprey into severe decline.

DDT was banned for all agricultural uses in 1972, but its initial success had spurred research in the chlorinated hydrocarbon chemistry and stimulated the development of other organic pesticides, the 1959 *Hilgardia* article said. The authors did not oppose chemical pest control in agriculture. "Without question, the rapid and widespread adoption of organic insecticides brought incalculable benefits to mankind, but it has now

become apparent that this was not an unmixed blessing," they wrote.

They advocated the for judicious use of chemical control measures in an integrated systems approach. "Integrated control," they wrote, "is most successful when sound economic thresholds have been established, rapid sampling methods have been devised and selective insecticides are available."

UC IPM entomologist Walt Bentley, who worked with Stern early in his career, says the four men's foresight was inspiring.

"I am just amazed that work done in the mid-1950s, and published in 1959, listed worker safety and the almost unheard-of potential for litigation," Bentley says. "I don't think at the time they knew DDT was causing the thinning of raptor egg shells, but they understood that you could over-use a product with broad toxicity and end up with no pest control at all over time."

The IPM techniques outlined in the *Hilgardia* paper are also applicable in home gardens and landscapes. Cheryl Wilen, UC IPM horticulturist based in San Diego County, advocates the use of the same concepts in landscapes and gardens that have proven so successful in agriculture.

"People will see an insect or weed problem and ask, 'What is it and what can I do to control it now?'" Wilen says. "IPM is really a long-term sustainable program. I tell them, 'This is what you have, this is what you can do, and this is what you can do prevent the problem from recurring.'"

— Jeannette Warnert