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Pest management: the search for alternatives

In the 1950s synthetic pesticides often were the first choice of growers struggling to control pests in their fields. Broad spectrum chemical compounds offered powerful incentives in the form of excellent pest control, increased yields, better food quality, extended crop seasons and more reliable economic returns.

Today, however, successful farmers recognize that synthetic pesticides may also have significant limitations. Two of the production problems that growers confront are the increasing costs of synthetic pesticides and pest resistance. Both are strong incentives to reduce the pesticide load applied to crops.

"Harvest of Hope," a recent report by the Natural Resources Defense Council (NRDC), calls for change in farming practices to protect ground water from pesticide and fertilizer contamination. While calling for change, the NRDC report recognizes that the transition to alternative agriculture is already underway. It is notable that the council surveyed seven crops in California, and found that a diverse body of research has been generated on alternative methods of pest management, most of it by University of California scientists.

The research needed to give farmers pest control options is part of the ongoing agenda of agricultural scientists nationwide. At the University of California more than 150 scientists conduct research related to pest management. We estimate that 90% of the departmental pest management research focuses on basic biology, biological controls, cultural systems, genetics and toxicology. Additional research is carried on through several special programs, including the Low Input Sustainable Agriculture Program (LISA), the Sustainable Agriculture Research and Education Program (SAREP), and the Integrated Pest Management Project (IPM).

Last year UC scientists analyzed more than 600 crop-pest situations, seeking to identify possible alternatives to synthetic pesticides now in use. They found alternatives in 75% of the situations. But they also found that the practical potential and the economic feasibility of many alternatives is uncertain.

The challenge of developing viable alternative pest management techniques is continual, complex and sometimes frustrating.

Sometimes biological controls — insects, bacteria and viruses that eat or parasitize crop pests — are successful. For example, UC researchers have for many years studied the biology and mass-culture of the tiny *Trichogramma* wasp, and have shown that large-scale field releases could be effective for control of the tomato fruitworm and other species of Lepidoptera pests of agricultural importance. This work has permitted the rearing and application of *Trichogramma* by commercial insectaries. However, while some growers currently employ commercial releases of these parasites, the actual impact of these releases is difficult to assess and is often questioned. In another area of research, new applications of *Bacillus thuringiensis*, bacteria which cause disease and death in numerous pests, are being developed every year. New strains of this and other microbial control agents are also being identified.

Cultural methods are another method of pest management. For seven years UC researchers, sponsored by grants from the UC IPM Project, have been refining a system of removing leaves from grapevines to stop fruit rot. It involves costly hand labor, but often eliminates the need for fungicide sprays. Many farmers are adapting the system to their own conditions.

In some cases, however, alternatives to chemicals continue to elude science. For example, no alternative has been developed for some applications of the widely used fungicide benomyl. If tougher government regulations eliminate benomyl, farmers probably will incur much greater losses from fungi than they do at present.

Total reliance on non-chemical alternatives is not always economically feasible. Hand-pulling or hoeing of weeds — in preference to a combination of such cultural methods with judicious chemical use — may prove too labor intensive to be viable in many crops. Yet in other cases, notably with perennial crops, farmers can manage their orchard floor vegetation (including weeds) to provide benefits such as increases in beneficial insect populations.

While public concern about the undesirable aspects of synthetic chemical use remains high, such use has helped create an abundant agricultural system with benefits we all take for granted. We enjoy increased yields, longer production seasons, and greater crop reliability — resulting in diverse and abundant food at lower prices. Researchers and growers alike are now working to minimize the undesired effects of farm chemical use: residues on foods, impacts on the environment, and health effects on farm workers and farmers themselves.

Generally, growers hold the view that proper and judicious use of pesticides poses minimal risks when compared to other risks of everyday life. Yet in my experience, successful farmers are quick to adopt better methods of farming — when the technology is proven and economic incentives are present. As public discussion of agricultural chemicals grows, scientists and farmers are accelerating the pace of change. However, research funding in these areas has had no growth for more than a decade. As the public demands more change from agriculture it must also be prepared to support the research that can trigger these changes.