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## *Environmental laws elicit evolution in pest management*

The era of synthetic organic pesticides began in the 1940s and brought with it many benefits. The new pesticides enabled growers to produce abundant food and fiber, both economically and predictably. They enabled public health officials to control many serious insect-vectored diseases in the United States and throughout the world. However, the universal adoption of synthetic organic pesticides in the 1950s also brought risks. UC scientists soon noted adverse impacts from these broad-spectrum pesticides on natural biological control agents and developed the concept of “integrated control.” In addition to their adverse effect on biological control agents, it soon became apparent that pests could develop resistance to the new pesticides. This resistance required that increased rates of pesticides be applied to achieve acceptable control, exacerbating the problem.

The publication of Rachel Carson’s famous book, *Silent Spring*, in 1962, brought concerns about the environmental and health risks of pesticides to the forefront of public awareness, and began a national debate. The U.S. Department of Health, Education and Welfare established the Commission on Pesticides and Their Relationship to Environmental Health in 1969, chaired by UC Davis Chancellor Emil Mrak, to conduct the first assessment of pesticide risks. The Mrak Commission recommended the establishment of a governmental mechanism for assessing the environmental safety of pesticides.

In 1971, President Nixon created the Environmental Protection Agency (EPA) by executive order, transferring pesticide regulation from the U.S. Department of Agriculture (USDA) to the new agency. Congress soon mandated EPA’s charge to evaluate risks and benefits of pesticides by passing the Federal Insecticide, Fungicide and Rodenticide Act of 1972. Lawmakers had now established a mechanism for careful evaluation of any pesticide’s environmental and health risks, and for consideration of more environmentally benign pest-management alternatives. UC scientists, who were already leaders in the development of biological control, integrated pest management (IPM) and pesticide toxicology, became increasingly engaged in national programs to identify and develop alternative pest-management strategies to broad-spectrum pesticides. They formed alliances with their counterparts in federal and California agencies to develop and implement new pest-management systems and tactics, including both biological and chemical means to combat pests.

However, developing and implementing alternatives to organophosphate pesticides to meet the needs of California’s highly diverse agriculture, as well as its urban areas and natural resources, has been and will continue to be a challenge because of decreasing public funding for research and extension.

UC and USDA scientists released a task force report in 1992 entitled *Beyond Pesticides: Biological Approaches to Pest Management in California* (UC DANR Pub. 21512). This report provided an overview of possible alternative control tactics without the use of broad-spectrum pesticides, and was produced with an appreciation for the mounting political pressures on these products because of safety concerns. Two controversial National Research Council reports, *Regulating Pesticides in Food: The Delaney Paradox* in 1987, and *Pesticides in the Diets of Infants and Children* in 1993, focused attention on dietary risk from pesticides and on the differential effects of pesticides on vulnerable groups in the population. These reports questioned how the EPA established pesticide tolerances, and were drivers for passage of the Food Quality Protection Act of 1996 (FQPA). The FQPA is the most important regulatory reform yet enacted. Many broad-spectrum pesticide products and uses have been lost and more are anticipated in the future.

The elimination of the uses of many broad-spectrum pesticides has resulted in the development and registration of a number of reduced-risk and environmentally benign pesticides and control strategies. These new pesticides are more pest-specific and less robust in their control and will require increased vigilance on the part of pest control advisers. The new products are often slower-acting, will control only related pest species, and are more expensive. In addition, resistance to these new materials can occur in populations of many important pest species. Effective reduced-risk pesticides have not been developed for a number of important pests. Thus, there could be substantial economic impacts on California agriculture from implementation of the FQPA.

To address these concerns, the California Department of Food and Agriculture supported a study to measure the economic impact on the 13 top-valued economic agricultural crops in California if all organophosphate insecticides were eliminated from use. The study, *The Economic Impact of Organophosphates in California Agriculture* (<http://www.cdffa.ca.gov/publications.htm>), showed that the elimination of broad-spectrum pesticides would increase the cost of production, and the amount of increase was crop-specific. This report was the stimulus for the publication of this special issue of *California Agriculture*, in which UC scientists discuss alternative control measures that they have developed over decades of research.

The importance of UC maintaining its capacity to respond to future regulatory issues, introductions of invasive species, vector-related public health issues and economic challenges faced by California citizens has never been greater. To meet these challenges, a new era of cooperation and integration between UC’s Agricultural Experiment Station and Cooperation Extension must be implemented in the near future. This re-organization must be substantial and collegial, and foster the vertical integration of knowledge development and delivery. Through the closer integration of these two units, a leaner and more efficient organization will be positioned to lead California as it responds to the challenges ahead.