Environmental Concern Sparks Renewed Interest in IPM

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Environmental movements during the 1960's inspired a system to control crop pests with fewer synthetic pesticides, and the recent revival of concern for the environment has renewed interest in this approach.

The system of pest control called Integrated Pest Management (IPM), partially funded by the Federal Government, is saving participating farmers significant pesticide expense. A national evaluation team has estimated that in the 1980's, total annual benefits to farmers in 15 States using IPM exceeded $500 million.

IPM evolved as entomologists and other agricultural scientists became concerned about the unintended effects of pesticides, such as killing nontarget species, or causing pests to build immunity or create mutations. Today's concerns are about the potential risks from pesticide residues on food and in groundwater supplies, and about the sustainability of heavy pesticide use in agriculture. IPM offers farmers a variety of pesticide-reducing techniques which allow them to produce high quality, abundant food supplies while minimizing environmental impacts.

Although few farmers in the United States use no pesticides, the conventional practice of applying pesticides by the calendar is becoming uncommon for cotton, canning tomatoes, and other crops where IPM is having success. Instead, pesticides are applied only when pests reach economically damaging levels, and pest-resistant varieties, biological control, and other non-chemical techniques are often used as well.

The Federal Government began funding IPM research through several large, nationally coordinated projects in 1972. Funding gradually increased to approximately $7 million annually during the early 1980's, and has remained at that level. State and private funding of IPM research has also been growing. Today, the Federal Government funds IPM research projects for over 100 major and minor crops grown in the United States.

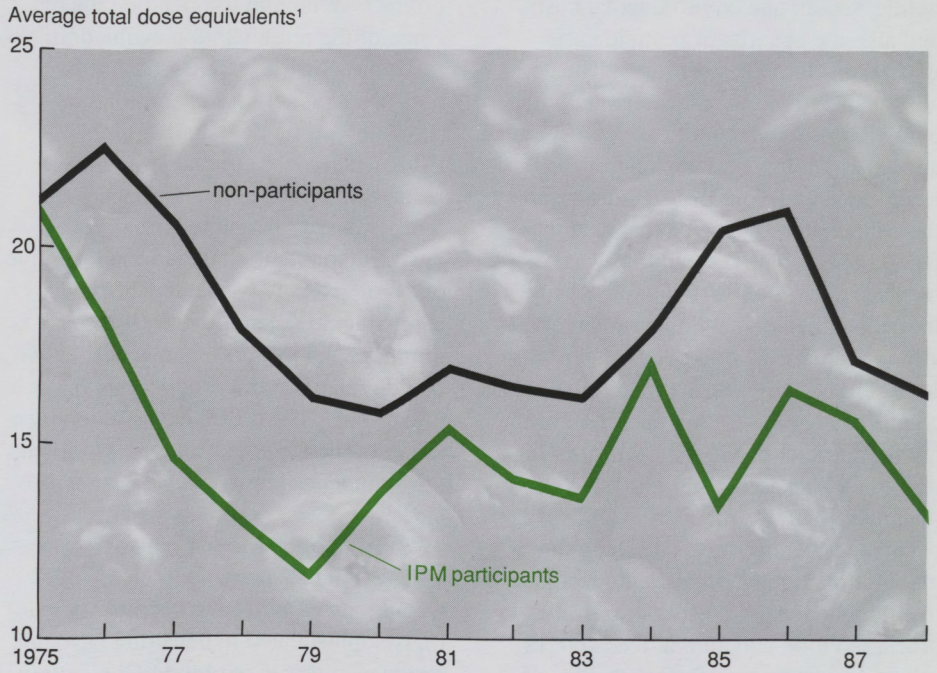
IPM practices have reduced pesticide use, especially insecticides, on some of the major crops such as cotton and soybeans. Although less data are generally available for minor crops, the IPM program for apples in New York, documented since 1975, shows consistently fewer applications of pesticides *(figure 1)*.

A national evaluation of Federal Extension IPM programs conducted during the mid-1980's found that 3,500 farmers of 9 major crops in 15 States earned $54 million more annually in net revenues from decreased chemical costs and increased crop yields than those not using IPM. And the evaluation team found that total benefits to all IPM-using farmers in the 15 States exceeded $500 million.

Scouting is the Cornerstone

IPM uses both efficiency and substitution approaches to control pests. Making better use of synthetic pesticides is the

Figure 1. IPM Permits New York Apple Growers To Use Fewer Pesticides



[1]Is a measure of pesticide use calculated by dividing the actual rate of product applied per acre by the Cornell University recommended rate.
Source: New York State IPM Program, 1989 Annual Report, Cornell University.

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focus of the efficiency approach. Pest populations are monitored and pesticides are applied only when the population exceeds an economically damaging level. This approach, called scouting, has been the cornerstone of IPM for several decades.

The economic threshold, or level, at which pests are damaging depends on crop prices, pesticide costs, the types of pests, pest population densities, and other factors. Because economic thresholds must be developed separately for each crop and each crop pest, researchers have many thresholds yet to develop.

With the substitution approach, a variety of biological, cultural, and other nonchemical techniques and management practices are used to control pests. Biological control uses parasites, predators, and pathogens to lower the population of crop pests. For example, seven parasitic wasps, predators, viruses, and bacteria have been developed to control tomato pests in California, although only two, *Trichogramma* and *Bacillus thuringiensis,* are commercially produced and used by growers.

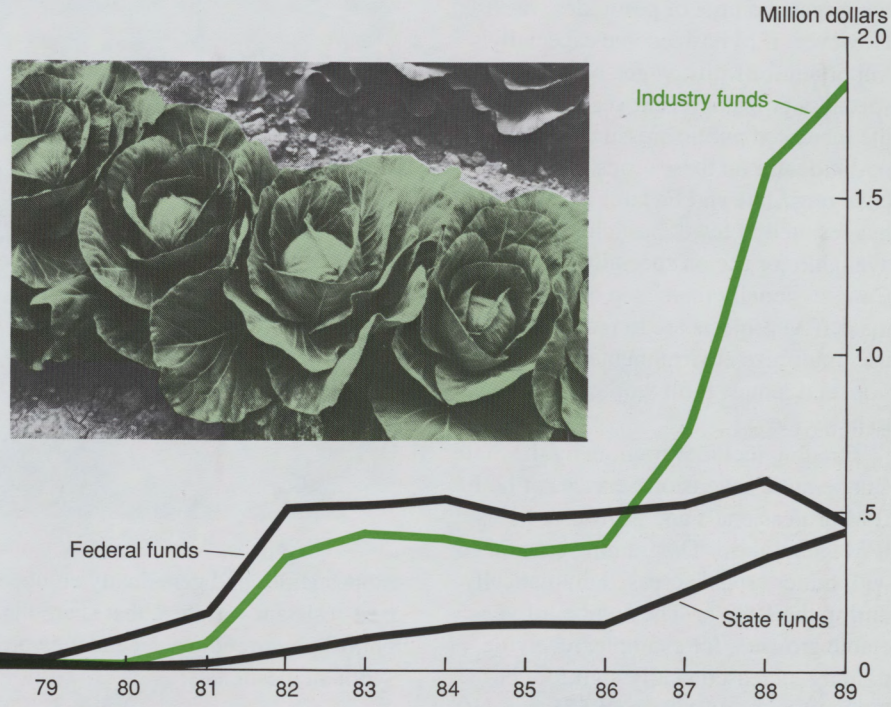
Cultural controls include crop rotation, field sanitation, mechanical cultivation, irrigation, pruning, and other beneficial management practices that reduce or prevent pest problems. Other IPM techniques include the use of pest-resistant varieties, natural chemicals such as pheromones (substances secreted by pests that influence specific behavior patterns by others of the same species) and botanical pesticides (derived from plant sources as opposed to synthetic pesticides made from petro-chemicals). Botanical pesticides, such as rotenone and sabadilla, are generally recognized as breaking down more quickly in the environment than synthetic pesticides.

IPM Funding Expands to Specialty Crops

Annual reports indicate a dramatic increase in the funding and use of IPM for specialty crops during the 1980's. The number of States with Extension IPM programs for vegetable crops increased to 22 by 1989. Combined funding from governments and industry for vegetable IPM projects rose from approximately $64,000 in 1978 to almost $3 million in 1989 *(figure 2)*. During this time, State funding for vegetable projects tripled to almost $500,000 and industry funding quadrupled to almost $2 million.

Federal IPM funding of vegetable projects was fairly constant during the 1980's at approximately $500,000 annually, which represents approximately 8 percent of total Federal IPM expenditures.

Figure 2. Vegetable IPM Funding Increases



Source: Extension Service, USDA.

The conventional practice of spraying pesticides by the calendar has become uncommon for canning-tomato growers who use the integrated pest management systems.

Federal and State funds are used to conduct basic scientific research on cropping systems and pests, to develop IPM techniques (including additional economic thresholds, sampling and monitoring methods, pest-resistant crop varieties, and biological controls), and to implement commercial use. IPM research originally focused on field crops where the largest volume of pesticides was used. However, IPM has become especially important for fruits, vegetables, and other specialty crops in recent years because of the increased public pressure to reduce pesticide use on these crops. Also, changing State and Federal legislation has resulted in fewer pesticides being available for use on specialty crops. Congressionally mandated objectives of these IPM projects are to reduce pesticide use, minimize environmental contamination, and reduce farm workers' exposure to pesticides.

Funding includes training by the State Cooperative Extension Services of both IPM professionals and growers who use IPM techniques. The training associated with minor crops increased dramatically during the 1980's. The number of vegetable growers, for example, receiving training increased nearly eightfold between 1984 and 1989, from 555 to 4,419, and the number of vegetable scouts trained more than doubled to 665.

Industry is the predominant funding source for IPM programs in most of the top vegetable States, especially in California and Florida. Industry funding of Extension projects generally represents grower payments for IPM services such as scouting. However, grower payments to Cooperative Extension Services are frequently pooled with Government funds to cover both research and implementation. Although industry funds mainly reflect payment for services, private industry also conducts IPM research. IPM consultants sometimes develop their own economic thresholds and other techniques. U.S. vegetable processors conduct research on pest-resistant varieties, cultural practices, and other products and management practices to reduce chemical dependence in the production process. Also, U.S. corporations are developing a wide array of new products and technologies, including biopesticides and genetically engineered pest-resistant varieties, that share the IPM philosophy to reduce dependency on synthetic pesticides.

Cotton farmers in Texas use integrated pest management systems extensively.

Vegetable IPM Acreage Increases

Vegetable acreage under IPM increased from 742,000 in 1984 to nearly 2 million in 1989 (33 percent of total vegetable acreage in 1989), according to USDA Extension Service reports. Management of IPM acreage ranges from minimal (monitoring a single pest) to intensive, where multiple insects, diseases, and weeds are monitored and resistant varieties, natural predators, crop rotations, and other nonchemical strategies are used.

IPM acreage for some of the larger vegetable crops illustrates the differences in IPM adoption among States. New York, for example, had 59 percent of its onion acreage under IPM in 1989, while Georgia had only 1 percent. California had 80 percent of its 1989 tomato acreage under IPM, while total U.S. tomato IPM acreage was only 55 percent. These differences are partly a result of different priorities within States.

Growers themselves managed the biggest portion of vegetable IPM acreage (39 percent) in 1989. They were followed by industry representatives, including advisors for contracted processing acreage as well as chemical companies' advisors, who handled 37 percent. IPM acreage was also managed by private IPM consultants and firms, 11 percent; Cooperative Extension Services, 9 percent; and cooperatives and other grower organizations, 3 percent.

The primary group handling IPM acreage differs significantly between different types of vegetable crops and States. Some States have a highly developed private consulting industry or good Extension IPM programs. Others have well-established grower organizations providing IPM services for particular crops. Sometimes advisors or neighboring growers are the most important sources of IPM services.

For example, all of the Wisconsin potato IPM acreage is handled by private consultants, while 83 percent of the Idaho acreage is handled by grower organizations. Most sweet corn acreage in Ohio (80 percent) and half of Oregon's is under Extension-sponsored IPM programs. Industry representatives are the primary

source (84 percent) for New York's onion IPM acreage, while growers manage their own in Georgia.

The intensity of IPM use varies among these different groups handling vegetable acreage. IPM acreage handled by growers may not be as intensively managed as that handled by Extension programs, consultants, grower organizations, and industry advisors.

According to a 1984-85 survey of Florida vegetable growers, those using commercial IPM scouting recommendations applied 80 percent fewer insecticides after adopting IPM, while growers who did their own scouting used only 50 percent less. Fungicide use was reduced by 31 percent for growers using commercial scouts and 17 percent for those doing their own scouting.

Current IPM issues

There is growing public concern about the environmental impacts of production agriculture. In response to this environmental concern, low-input (chemicals) sustainable agriculture (LISA) production systems are being developed. LISA integrates pest control, plant nutrient and water requirements, and livestock feeding into production systems that minimize the need for synthetic pesticides and fertilizers. IPM is the component of LISA that addresses pest control. IPM focuses on reducing pesticide inputs while maintaining crop yield and quality.

Other growers have responded to consumer environmental concerns by going organic. In organic agriculture, it's the process—the nonuse of synthetic pesticides and fertilizers—that's most important. Organic growers are willing to sacrifice yield or quality to ensure that no synthetic chemicals are used in the production process. Today, less than 1 percent of our food is produced organically. To help facilitate organic food sales, Congress approved legislation last year to create national standards and a consumer label for organic food. *(For more details about organic legislation see "Congress Mandates National Organic Food Standards" in the January-March 1991 issue of the Food Review.)* However, there is concern that widespread adoption of organic production techniques may not be sustainable because it could generate a different set of problems. Potential problems include a damaged marine ecology due to excess harvest of kelp for organic fertilizer. Increased acreage needed to maintain production levels would increase soil erosion because of cultivation practices such as tillage for weed control.

Because consumers are concerned about both food safety and the effects of agriculture on the environment, several States have become interested in promoting the environmental benefits of IPM-grown food in the marketplace. A preliminary study in California, however, indicated that consumers would be confused by an "IPM-grown" label. Other surveys showed that consumers wanted assurances of no pesticide residues. Instead of promoting IPM-grown food, States could promote low or no pesticide residue foods in which IPM is used.

The California study also suggested that consumers would be interested in more general educational materials explaining the efforts of growers, processors, and retailers to ensure food safety and reduce environmental pollution. The New York IPM program recently experimented with one approach for educating consumers about IPM. A poster explaining the goals and techniques of IPM, provided to growers for display at farm stands and U-pick operations, received favorable responses.

Although IPM adoption has been good in some States and for certain crops (for example, cotton in Texas and tomatoes in California), other growers have lagged in adopting IPM. Some growers perceive that IPM involves more production risk. Not all crops have IPM programs, due in part to stagnant Federal funding for IPM research. Also, in some States and in some crops there is a smaller advantage for its use. For example, hot, humid Southeastern States generally have heavier pest problems, and some crops, like fresh-market tomatoes, have more insects and diseases.

IPM is both an approach to pest control and a developing set of techniques. While synthetic pesticides are still a critical component in most IPM systems, new strategies for preventing pest damage to crops are still being developed. The suppression of pest populations below economically damaging levels, and the development of alternative pest control techniques are goals of both sustainable agriculture and IPM.

Development of gene-transfer procedures, systems management techniques, and other new technologies are allowing more rapid advances in pest management. However, although revolutionary pest control solutions may become available during the next century, State and Federal regulations on pesticide use are already tightening, and IPM programs that reduce pesticide use will continue to be important during the coming decades. ■

References

Adkisson, P. L. "Integrated Pest Management." *Bulletin of the Entomological Society of America,* Fall 1986, pp. 136-141.

C. A. Francis, C. B. Flora, and L. D. King, editors. *Sustainable Agriculture in Temperate Zones.* New York, NY, John Wiley & Sons, Inc., 1990.

Greene, C. R. and G. W. Cuperus. *Integrated Pest Management (IPM) in the Vegetable Industry During the 1980's.* ERS Staff Report No. AGES 9107, Economic Research Service, USDA, February 1991.

Pohronezny, K., ed. *The Impact of Integrated Pest Management on Selected Vegetable Crops in Florida.* Bulletin 875, Agricultural Experiment Station, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL, September 1989.

Stephens, C. T. "Minimizing Pesticide Use in a Vegetable Management System." *HortScience* 25(2), February 1990.

Tette, J. P. and C. Koplinka-Loehr. "New York State Integrated Pest Management Program: 1989 Annual Report." Cornell University and New York State Department of Agriculture and Markets, IPM Program Office, New York State Agricultural Experiment Station, Geneva, NY, 1988.

Virginia Cooperative Extension Service and USDA. "The National Evaluation of Extension's Integrated Pest Management (IPM) Programs." Cooperative Agreement No. 12-05-300-659, VCES Publication 491-016, July 1987.