CAST
COUNCIL FOR AGRICULTURAL SCIENCE AND TECHNOLOGY

INTERPRETIVE SUMMARY

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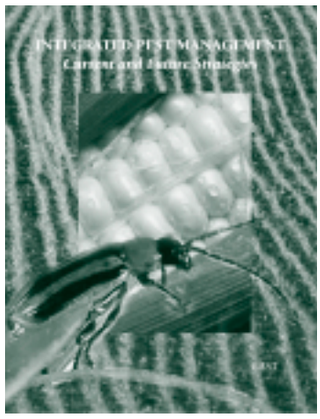
INTEGRATED PEST MANAGEMENT: CURRENT AND FUTURE STRATEGIES

In 1982, the Council for Agricultural Science and Technology (CAST) published *Integrated Pest Management*, a report that focused on the decreased use of pesticides. Now, new technologies and rigorous government policies are bringing much promise, as well as many challenges, to integrated pest management (IPM). The current report emphasizes the development and implementation of biointensive IPM strategies and tactics as well as the continuing challenges. Issues addressed include the rapidly evolving pests in natural and agroecosystems, the availability of innovative pest management tools, and the need to integrate those tools via a systems approach.



Deployment in Cropping Systems

The availability of both effective pest management strategies and the systems for their deployment is fundamental for successful IPM programs. Key strategies include

- prevention or avoidance of pests and/or pathogens,
- decrease of pest populations,
- decrease of crop or animal susceptibility,
- eradication of pests,
- a combination of strategies, or
- pursuing no action.

Primary tactics (tools) used in IPM encompass

- host resistance,
- use of natural enemies or biological controls,
- cultural practices, and
- pesticides.

Reliable identification, diagnosis, and monitoring of pest populations are essential for successful IPM implementation.

Diverse strategies and tactics that may be used to enhance the activities of soil- and foliage-inhabiting "beneficial" organisms include

- crop rotations,
- antagonistic plants or other organisms,
- trap crops,
- refugia, and
- cover crops.

With the pressure for decreased pesticide use and rapid growth of biointensive and organic food industries, divergent pest management practices are being adapted for certain production systems. Biointensive IPM production involves one or more management tools, including chemical inputs, when needed, to restrict pest populations below economic thresholds. In contrast, few or no synthetic pesticides or fertilizers or genetically modified organisms (GMOs) are permitted in organic production. Still, IPM must be central for sustainable organic farming.

Natural Ecosystems

Invasive pests are becoming an enormous problem in U.S. terrestrial and aquatic habitats. Natural areas and waterways are being invaded by both nonnative and native pests and weed species. Increasing international jet travel has made introductions of pests nearly limitless. Although prevention is the most cost-effective control method, other tactics—including herbicides, mechanical methods, and habitat manipulation—must be used for previously introduced pests. Biological controls also have promise.

Food Animals, Wildlife, and Companion Animals

Integrated pest management is recognized as the preferred best management practice to minimize pest problems on dairy and beef cattle and to protect farm workers, consumers, and the environment. In swine production, effective management of arthropod pests is important in minimizing the risk of diseases and preventing related poor growth and poor feed conversion. For poultry IPM, houseflies are key pests of dry-waste systems and other types of production that allow manure accumulation.

Because of increasing human population and intensified land-use practices, wildlife damage control is an increasingly important part of U.S. wildlife management. Control programs focus on problem-species ecology, control-method application, and control evaluation.

With approximately one-half of U.S. households owning pets, pests that affect companion animals are an important problem. In addition to insecticides, acaricides, and other available control tactics, future IPM options may include innate animal physiology to suppress the ectoparasites and to limit their deleterious effects on pet and pet-owner health.

Urban Areas

Attaining acceptable levels of pest control without exposing people or the environment to excessive risks from pesticides is the major goal of urban IPM; qualitative factors such as aesthetics and peace of mind usually substitute for the quantitative economics involved in decision making for agricultural IPM. The components of urban IPM are inspection, monitoring, situation-specific decision making, application of control techniques, and record keeping.

Economics

Economic analyses have been used to evaluate expected profitability, social welfare impacts, effect of IPM research on financial returns, and policies affecting pest management adoption. Most of these assessments have shown net benefits from IPM use, especially from pest-resistant or pest-tolerant crop varieties. Pioneering benefit-cost analyses have tackled the problems of multiple-season effects as well as the valuation of health and environmental effects for individual IPM methods and programs. The complexity of IPM methods and the difficulty of placing values on environmental and health attributes may account for the scarcity of comprehensive economic assessments.

Education and Delivery Systems

Pest management personnel need training in a variety of disciplines. Many universities have an IPM component within traditional departments such as entomology or plant pathology.

Striking changes in IPM delivery systems have occurred since the 1960s. Initially, IPM information was disseminated primarily through print media and verbal communications. Now, diverse IPM delivery systems are used, including many comprehensive Internet web sites. With so much information available, IPM resource personnel are needed to select the appropriate information for specific situations.

Assessments

Because of increasing public concern about pesticides, the approaches used to evaluate IPM are becoming increasingly important. The environmental and social parameters essential in assessing the consequences of pesticide use include

- health impacts on farm workers, consumers, and the general public;
- lethal, chronic effects on other nontarget biota;
- direct or indirect effects on natural and agroecosystems;
- calculation of air, soil, and water pollution; and
- costs versus benefits to producers and to society for decreasing pesticide use.

Enlisting producers' cooperation in compiling data on the parameters through surveys, sampling, and other means continues to be a challenge.

Future Challenges and Directions

This comprehensive report concludes with a consideration of seven key issues for the future of IPM.

- **Gene technology constraints**. Future crops may be modified for increased compatibility with IPM systems. Key unresolved issues include the extent to which genetically engineered crops will be used in production systems, the rate at which they will be adopted, their compatibility with IPM systems, their acceptance or lack thereof by the public, and their ultimate beneficiaries.
- **Genetic diversity and pest adaptability**. The ecological elasticity of many animal and crop pests allows them to adapt to almost limitless habitats. Genetic diversity within most crop pests often limits the utility of plant varieties developed with resistance to one or more pests.
- **Ecologically based IPM**. Interest is growing in shifting the focus of IPM from pesticide management to a biointensive systems approach based on biological knowledge of pests and their interactions with crops. Significant funding investments will be required to build the ecological knowledge base needed for the multitude of cropping systems, pets, environments, and pest complexes.
- **Systems approaches**. A major goal for maximizing the benefits of IPM and related cropping systems is to increase understanding of the interactions of microflora/fauna in natural and agricultural ecosystems. Effective collaborative research and extension programs as well as coordination with funding and support agencies are necessary; increased research on numerous field and vegetable crops and animals is warranted.
- **Evolving pool of trainers and speed of technology transfer**. Distance education programs may help expand students' access to college-level IPM courses. The increasing rate of development and the introduction of new technologies challenges the agricultural community's capacity to provide the necessary training and information to incorporate new tools into existing programs.
- **Government policy and regulations**. Implementation of IPM for urban pests likely will be the policy for most public properties at the federal, state, and local levels. Two future regulatory issues will have impacts on IPM: the international phase-out of methyl bromide, and the phasing in of the Food Quality Protection Act. The new National IPM Initiative, which focuses on economic and environmental risk reduction, soon will be introduced. The need will continue for additional funding to support research on an IPM systems approach.
- **Assessments of IPM**. Surveys suggest that the greatest shortcoming in most current IPM programs is the limited use of a systems approach. The ongoing national and international debates on the future of genetically modified organisms will affect policies related to production, marketing, and use of these new products.

The prospects for increased adoption of IPM and related cropping systems are excellent, despite challenges that include public perceptions of new technologies, limited financial resources, and an inadequate infrastructure. As the earth's carrying capacity for humankind is stretched, and as thousands of invasive pests are encountered worldwide, research, agriculture, industry, government, and communities must work together. Integrated pest management offers an effective option for production of the increasing amounts of food and fiber supplies needed to sustain the nation and the world.

Integrated Pest Management: Current and Future Strategies was written by a task force of 20 scientists, chaired by Dr. Kenneth R. Barker, North Carolina State University. The publication, Report 140, is available for $50.00 plus $3.00 shipping from CAST. Individual, retired, and student members of CAST may request a free copy; please include $3.00 shipping. Linda M. Chimenti, Managing Scientific Editor. World Wide Web: http://www.cast-science.org.

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