INTEGRATED PEST MANAGEMENT: SAFE, ECONOMICAL, SUSTAINABLE, AND EFFECTIVE

ESA Position Statement on Integrated Pest Management
Approved on September 10, 2020
Valid through September 10, 2024

For better *and* worse, insects have played an integral role in history. Control of pest species has been unreliable, often resulting in severe economic losses and public health emergencies. After World War II, agricultural and public health communities quickly embraced the use of DDT and other new synthetic insecticides. Like nothing before, these chemical tools controlled insects quickly and effectively. They helped dramatically reduce incidence of diseases like malaria and yellow fever, were an efficient way to control many household pests, and paved the way for increasing farmer's yields and profits.

However, by the end of the 1950s, insects began developing widespread resistance to these pesticides, posing a significant challenge to their sustainability. This led to recommendations to integrate chemical control with biological control.[1] Furthermore, in 1962, marine biologist Rachel Carson published a devastating critique of widespread chemical-pesticide use. Serialized in *The New Yorker*, the book *Silent Spring* was the first time many citizens became aware of the hidden health and environmental costs of synthetic pesticides when used indiscriminately. *Silent Spring* led to rethinking how insecticides should be used and helped spark global interest in environmentalism.

By the 1970s, scientists and farmers began widespread testing of a new pest management decision-making framework. **Called integrated pest management (IPM), this approach supplanted the goal of pest *eradication* with a more environment-friendly and realistic ecological goal of pest *management***. Based on ecological concepts, IPM replaced an "insecticides-only" approach to pest control with a philosophy that relies on both chemical and non-chemical tactics, including using beneficial insects, to suppress pests. The "integration" in the IPM approach is comprehensive and lies in the weaving together of biological, cultural, physical, and chemical tools to manage pests in a way that reduces overall economic, health, and environmental risks.[1]

BENEFITS OF IPM

Farms

- Save farmers money and reduce their exposure to pesticides
- Protect crop yields
- Delay pesticide resistance
- Maintain healthy water and soils

Pollinators & Beneficial Insects

- Maintain diversity to pollinate crops, gardens, and uncultivated plants
- Ensure adequate supply of nutritious fruits, vegetables, and nuts

Public Health

- Reduce spread of diseases caused by ticks, mosquitoes, and other insects
- Reduce public health threats through proper sanitation
- Lower pesticide residues on food

Schools

- Reduce childhood asthma
- Protect from structural pests
- Minimize pesticide exposure in children

[1] Peterson, R.K.D., L.G. Higley, and L.P. Pedigo. 2018. Whatever Happened to IPM? *American Entomologist*, 64: 146–150.

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Today, IPM forms the basis of most applied research on pest management, including the control of pest insects, plant pathogens, and weeds. Practical adoption of IPM has been rapid and successful in some crops and industries and slower in others. Meanwhile, **the financial and environmental benefits of IPM today are clear and well-documented**. Estimates of the cost of pesticide resistance in agriculture alone are more than $10 billion annually, but IPM helps slow or avoid the development of such resistance.[2,3] Reduction in insecticide use also protects pollinators and other beneficial insects that provide an estimated $57 billion in services including pollination and natural pest control.[4]

COMPONENTS OF IPM

Effective IPM programs draw on extensive laboratory and field research. This usually requires extensive cooperation among state research institutions, private industry, and government scientists. Examples of the components of IPM and expertise involved include:

- **Preventing pests**: Many pest problems can be prevented. Options include using resistant or tolerant plants, adjusting planting times, rotating crops, using barriers, improving sanitation, and pest-proofing buildings.

- **Identifying pests and their risks**: Pest identification is essential for accurately identifying risks caused by the pest and for selecting proper management methods. Knowing the pest allows assessment of its damage potential and when intervention is needed. This is often done using economic cost-benefit analyses.

- **Predictive modelling**: IPM uses biological and weather modeling to predict pest life stage and to pinpoint timing of management tactics. Knowing what life stage of an insect pest is present or whether certain weather events may lead to a pest outbreak are critical to pest management.

- **Considering economics**: Before agricultural producers will accept IPM, it is critical to show the economic benefits of the IPM approach. Economic analyses confirm whether profits can be enhanced and risks lowered with IPM.

- **Integrating management tactics**: Experience shows that use of multiple tactics is consistently safer and more effective for managing pests. This holds true for agricultural, public health, structural, and other pests.

- **Monitoring**: Detecting pests before they become a problem and monitoring changes in abundance or pest damage are critical components of IPM, both before and after a potential intervention. When pests are monitored, their numbers can inform decision makers when and at what level intervention is needed.

- **Training and education**: To be successful, IPM users must be trained in monitoring, decision making, and selection of the best control tactics. In addition, IPM often requires the cooperation of stakeholders, including the public.

IPM is based on science and ever-changing. We already successfully apply IPM approaches for a number of important pests in diverse systems, but **we need to expand the research base to develop IPM recommendations for dozens of other pests**. In our increasingly connected world, new pests land on our shores while existing pests constantly evolve and adapt. This makes it essential that we also evolve, adapt, and—most important—**communicate** to our stakeholders about IPM and the clear economic, environmental, and health benefits that it provides. This includes helping stakeholders and policymakers understand how IPM can be applied across many different settings:

[2] Pimentel, D. 2005. Environmental and economic costs of the application of pesticides primarily in the United States. Environ. Dev. Sustain. 7: 229-252.
[3] Gould, F., Z. S. Brown, and J. Kuzma. 2018. Wicked evolution: Can we address the sociobiological dilemma of pesticide resistance? Science 360: 728-732.
[4] Losey, J. E. and M. Vaughan. 2006. The economic values of ecological services provided by insects. BioSci. 56: 311-323.

- **Buildings and homes**: Inspect, identify pests, keep pests out, clean to deny pests food and water, vacuum, trap, or use low-risk pesticides.

- **Public health**: Monitor, assess, and reduce levels of disease vectors, and develop ways to reduce or eliminate our exposure to them

- **Agriculture**: Check for pests or pest damage regularly, identify accurately, choose pest-resistant plant varieties, encourage/introduce beneficial insects, time planting to avoid pests, and use low-risk pesticides.

- **Managed natural systems, including national forests, parks, and military bases**: Identify pests and use management options that have minimal risks to pollinators, humans, and pets, while reducing the threats posed by invasive species.

IPM is an essential service. It can be applied to everything from farms and landscapes to dwellings, hospitals and schools, as well as businesses, public health, restaurants, shops, and other public spaces. Individuals who manage pests directly are already familiar with this approach, but no matter who you are, or what you do, IPM touches your life. **However, there are several barriers to the use and dissemination of IPM**. These include consumer education and awareness, support for research funding that builds the economic case for IPM across a wide range of settings, and support for science-based, unbiased recommendations by state extension services and land-grant institutions to get the word out to specific constituencies.

RECOMMENDATIONS TO IMPROVE IPM TECHNOLOGY AND ADOPTION

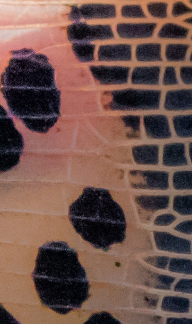
The Entomological Society of America believes that investing in IPM research and promoting IPM adoption should be a priority of the federal government. We believe the "National Roadmap for IPM" provides an authoritative and comprehensive outline of recommended approaches.[5] These efforts should continue to be supported by a diverse array of funding sources, including some that specifically target IPM research, education, and extension. While the societal benefits are well documented, a variety of barriers make widespread adoption of IPM a persistent challenge.

- **Consumer awareness and confidence**: Consumer choices have tremendous influence on behaviors of growers, vendors, and pest management providers. If consumers are aware of IPM benefits, they are more likely to choose "IPM-friendly" products and services and generate a positive-feedback loop that in turn promotes more IPM adoption and branding. An experiment by a grocery store chain two decades ago demonstrated a willingness on the part of consumers to share in costs of more costly practices that provide societal benefits, but this has not been extended or replicated more broadly.[6] A public-private campaign, with social scientists and marketing insights, could help the public understand the importance of their decisions in pest management professionals, the grocery store, home improvement retailers, etc.

- **Education**: Some established and existing IPM recommendations are undersold. We need more support for extension services and IPM centers that receive funding through U.S. Department of Agriculture (USDA) National Institute of Food and Agriculture (NIFA), which connect IPM with the clear economic benefits that can help farmers, homeowners, and consumers make informed decisions for protecting their land and properties and provide training and educational opportunities.

- **Research**: New pests are continually arriving, and established pests are constantly changing and evolving directly in response to existing management practices. Research supported by NIFA as well as USDA's Agricultural Research Service (ARS) and Forest Service is needed to keep pace, develop new technologies and tools, preserve the established approaches, and connect across disciplines to innovate new solutions.

[5] https://www.usda.gov/oce/opmp/IPM%20Road%20Map%20FINAL.pdf
[6] https://www.supermarketnews.com/archive/wegmans-add-private-label-ipm-grown-vegetables



- **Economic and environmental impact analysis**: Eliminating unwarranted or unnecessary pesticide applications, as well as introducing novel approaches to pest management, may present economic challenges that must be addressed. The judicious use of pesticides and other pest management strategies should result in economic benefits for the community as well as growers. Clean air, clean water, healthy soils, and community health costs must also be included in the calculation of economic costs and benefits. Quantifying and accounting for these benefits, however, requires special expertise and should be part of all significant IPM programs.

- **Developing and maintaining a competent workforce**: IPM requires technical expertise. This includes pest identifiers, knowledge of pest life cycles and ecology, economists to assess the relative costs and benefits of pest management, and skilled communicators to develop written, oral, and online resources to reach a range of stakeholders with clear, accessible language. We must invest in people as much as we do in tools.

The Entomological Society of America is the largest organization in the world serving the needs of entomologists and other insect scientists. ESA stands as a resource for policymakers and the general public who seek to understand the importance and diversity of earth's most diverse life form—insects. Learn more at www.entsoc.org.

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