ENTOMOLOGY AND THE FUTURE OF SUSTAINABLE AGRICULTURE

ESA Transition Document

OVERVIEW

To ensure that our nation's needs for food, fiber, fuel, feed, and a viable climate are met, the agricultural sector must innovate and adopt modern technologies. The Entomological Society of America (ESA) proposes that the next administration guide the future of agriculture through investing in innovative monitoring and sensing technologies, supporting research to improve the resilience of alternative growing systems, and fostering greater incorporation of IPM and genetic modification. Doing so will help the U.S. achieve a more environmentally friendly and durable food supply system.

CHALLENGES

Agriculture in the U.S., and globally, is always subject to risk and uncertainties. The entomological sciences can make a significant and positive difference via **pest management**, a challenge that affects every aspect of agriculture. The impact of pests on crops is twofold: reduction overall yield and reduced market quality. The Food and Agriculture Organization of the United Nations estimates that 20-40 percent of crop production is lost to pests each year.[1]

Technological limitations and a lack of effective systems-level approaches currently hinder our ability to determine which pests are active where and when, making the protection of crops a challenging feat. Many tools exist to monitor pests, but there is little communication within and across regions. Data are scattered and there are no centralized monitoring and analysis systems, making it difficult to predict where and when preventative measures should be deployed and limiting collaboration across industries and agricultural systems.

Pest management is also essential to strengthening alternative growing mechanisms like indoor growing, hydroponics, aquaponics, and intercropping/multi-cropping. Despite their increasing importance in the agricultural sector, we still lack the comprehensive understanding of the pest management challenges these systems may face. To make these alternative growing practices scalable to the needs of the U.S. agriculture sector, additional research is needed to understand how key pest dynamics change in alternative (e.g., confined) growing environments, compared with established, open field plantings.

Last, global dietary trends show a divergence between developed and developing nations, with Americans increasingly interested in plant-based meat substitutes while demand for actual meat is surging in developing countries. Research is needed to identify what crops will increase in production as the U.S. moves increasingly toward plant-based diets and then proactively develop pest management systems. We also need to facilitate greater capacity for insects to be used as food and feed.

RECOMMENDATIONS

To help the U.S. agriculture sector adapt to the aforementioned challenges and improve its sustainability over the decades to come, ESA recommends the following.

Invest in Automation and Digital Technologies: U.S. agriculture would benefit greatly from creating a high-level integration of various technologies such as drones, sensors, and computing to "take the pulse" in real-time of agricultural systems.

[1] http://www.fao.org/news/story/en/item/1187738/icode/#:~:text=FAO%20estimates%20that%20annual-ly%20between,insects%20around%20US%2470%20billion.

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ESA recommends that the U.S. Department of Agriculture (USDA) engage with other relevant federal agencies, growers, and researchers in academia as well as the private sector to lay the foundations for a cross-national network that consistently reads the health of agroecosystems. This can be realized by strengthening identification and monitoring of pests and factors that affect pest outbreaks. It is critical to develop a centralized monitoring system that spans commodities and is accessible and searchable anytime and anywhere—analogous to how people currently check the weather. Furthermore, the code should be open source, so that programmers can easily create add-ons to append data or access it. Investing in better predictive modeling will ultimately reduce pest-driven loss, as will optimizing use of pesticides and other pest management approaches.

Expand Alternative Growing Practices: As the agricultural sector sees continued expansion of in indoor growing, hydroponics, aquaponics, and intercropping/multi-cropping, it is imperative that research keeps pace. The federal government, through USDA, should invest in research to develop an understanding of the scalability of these novel approaches to food and fiber production and how growing more plants in a smaller footprint may alter pest management approaches. This includes documenting how factors associated with these growing methods change pest dynamics. Having a greater knowledge of these systems will help guide investments in new technologies and infrastructure for monitoring and controlling insect pests in these agricultural systems.

Support Integrated Pest Management Strategies: Investing in IPM research and promoting IPM adoption should be a priority of the federal government. ESA believes the "National Roadmap for IPM" provides an authoritative and comprehensive outline of recommended approaches. These efforts should continue to be supported by a diverse array of funding sources through USDA, including those that specifically target IPM research, education, and extension.

Use Genetic Modification and Precision Breeding to Help Meet Food and Fiber Needs:

Dietary Trends: U.S. dietary trends show a shift toward plant-based meat substitutes while demanding the same levels of fiber and protein. Simultaneously, interest is growing in healthier sources of animal-based protein. This will require the agricultural sector and regulatory entities to meet demands in new ways, requiring more research on ways to modify existing plants and insects to produce more fiber, more protein, and greater nutritional value.

Environmental Benefits: Genetically modifying crops holds significant promise for improving breeding and creating agricultural products that are more hardy or competitive, fortifying them against climate change. One approach may be identifying and editing crop genes to enhance pest management strategies, which in turn may improve honey bee health and production through the reduced use of existing pesticides.

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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