



# Biosecurity Issues Affecting Agricultural Crops and Communities: Genomics, Biotechnology, and Infrastructure

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## Editorial Note

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## American Phytopathological Society

Research on plant diseases and their control is and should be for peaceful purposes, to improve the lives of people through increases in the quality, supply and affordability of food and the sustainability of food and fiber production systems and natural resource management. With United States and global vulnerability to agricultural bioterrorism, the nation's research and education must now protect our gains, continue consumer confidence in the safety of our food, and assure sustainable growth in the production of food and fiber products produced from plants.

## Proposed Investments in Basic Research

Investments in basic research are needed to open new directions for applied research, including greater use of plant biotechnology and plant and microbial genomics for detection, forensics, prevention, or recovery from a bioterrorist attack on a U.S. crop or food produced from crops.

1. National Science Foundation (NSF) and Department of Energy (DOE). Expand investments in basic research on *microbial genomics* to include: a) sequencing of a wider representation of microbial pathogens that are potential threat agents, and b) functional genomics, proteomics, bioinformatics, and microarray technology applied to key virulence and survival genes and gene families in plant pathogens. This is needed to:

- Understand virulence mechanisms and basic biology regarding the spread and survival of plant pathogens with a potential to become threat agents and as a basis for new genetic approaches to their control; and
- Discover novel genes, molecules, or sequences as the basis for the development of new tools for accurate and rapid diagnosis of plant diseases and for determining global relationships of select plant pathogens.

As an example, just six genes revealed that, globally, there are seven groups of the notorious wheat scab fungus, *Fusarium graminearum* (O'Donnell et al. *Proceedings of the National Academy of Sciences U.S.A.*, 97, 7905-7910). In addition to deeper understanding of the evolution of a pathogen group, this kind of information can provide better trace-back capability as well as information on genotype(s) and phenotype(s) of the strains(s) that might unexpectedly need to be controlled.

2. DOE. Develop new tools for rapid detection and diagnosis of plant diseases, including by remote sens-

ing. The time between any introduction, deliberate or accidental/natural, and diagnosis is critical.

3. NSF, DOE, and United States Department of Agriculture (USDA). Expand research on genomics and plant biotechnology as the foundation for more rapid and effective development of crop plants with resistance to pathogens that are potential threat agents. Information on the genes and molecules in pathogens that make them virulent on plants, and the genes and molecules in plants that make them resistant to pathogens is needed to develop plants with resistance to all strains of any given pathogen or possibly to several related pathogens. As with vaccines for preemptive control of animal and human diseases, having varieties and hybrids of crop plants with resistance is both a deterrence and the best means for recovery from a plant disease used as a threat agent.

### **Proposed USDA Investments in Infrastructure**

United States agriculture is vulnerable to crop bioterrorism. Part of the vulnerability is due to missing pieces in the nation's infrastructure that are needed to detect, diagnose, and limit or recover from such an attack. Whether or not an attack should ever materialize, this infrastructure is still needed as part of the continuing improvements in this nation's ability to produce high quality food in competitive and sustainable production systems.

1. The United States needs a distributed system of diagnostic labs as first responders to a bioterrorist threat. The existing plant clinics maintained by land grant universities can serve as this distributed system of laboratories, but federal investments are needed to increase their capacity and technical infrastructure for rapid and accurate diagnoses of plant diseases. While most if not every state has one or more of these plant clinics, usually managed by Cooperative Extension, there is great variation in how well they are equipped and staffed. "Upgrading" of these clinics should include connecting them electronically for rapid sharing of new information, including

photographs, on new plant disease outbreaks.

2. The United States also needs a national disease laboratory, one that can provide many of the same services and national leadership currently provided for human diseases by the Centers for Disease Control and Prevention. Some of the functions that could be provided by a "Center for Plant Disease Control and Prevention" include:

- Ongoing risk assessment and updating of threat agents to crop plants.
- Development of a database and new or acquired collections of foreign and domestic pathogens and methods for their rapid diagnosis. Diagnostic systems require high-quality databases and well-characterized collections.
- Provide a mechanism for standardization of diagnostic techniques and certification of individuals or labs to make these diagnoses.

3. American Phytopathological Society (APS) is prepared to work under contract with USDA to develop lists of plant disease experts as a national resource for responding to any bioterrorist attack using a plant pathogen. This list would also include identities of labs available to detect and diagnose threat agents.

4. United States land grant universities need to increase the number of graduates trained in general plant pathology and plant health management for employment in seed companies, as consultants and field diagnosticians, and to staff plant clinics and regulatory agencies. These plant health professionals, equivalent to practicing veterinarians and general practitioners in medicine, are needed both as front-line responders in the event of a bioterrorist attack, and as a means to improve overall service in plant health management in the United States.

### **Actions and Activities of the American Phytopathological Society**

APS promotes the practice of plant pathology for the welfare of the environment, plants, animals and human kind. The APS Constitution and By-

laws, Article VII, Code of Professional Conduct, adopted in 1997, supports this position.

*The APS recommends increased efforts directed toward global surveillance of plant disease outbreaks as a deterrent against the use of plant pathogens as biological weapons. Of particular interest in regard to biological weapons, is the recognition of an unusual disease outbreak.*

As the professional scientific society representing the plant pathologists of America and as the world's largest professional society concerned with the diffusion of knowledge of plant diseases and their control, APS is prepared to be the first line of defense by taking the lead on behalf of plant pathologists worldwide to prevent the use of plant pathogens as agents of bioterrorism. Specific actions and activities planned or underway are listed below.

1. Establish an international electronic disease reporting system to garner information on global locations of new strains of pathogens and currently unknown pathogens (emerging diseases).
2. Monitor legislation and work with Congressional staff and elected officials to protect against unintended restrictions on research or the free flow of scientific information on plant pathogens and plant diseases, and the valuable assistance of foreign students and scientists to U.S. universities.
3. Continue to keep our members informed of existing and pending legislation with implications for research on plant pathogens. Plant pathologists will

be encouraged to take actions within their own labs to increase security.

4. Work with other scientific societies in areas of mutual interest related to crop biosecurity, including:
  - The U.S. National Academy of Sciences
  - The International Society for Plant Pathology
  - Other U.S. professional societies concerned with plant production and protection.

As an example, APS will work with the International Society for Plant Pathology and the Entomological Society of America to develop a web-based symposium for worldwide discussions on countering the use of pests as agents of bioterrorism.

5. Sponsor symposia and discussion sessions at annual and regional meetings. For 2002, a discussion session is planned on the findings and recommendations of a National Research Council committee report agricultural bioterrorism," that is due out in June 2002. Two APS members are serving on this committee.
6. Establish a permanent standing committee on Crop Biosecurity/Countering Agroterrorism to advise the profession and nation on threats and countering agroterrorism.
7. Develop a ranked list, to be updated as needed, of the five plant pathogens most threatening to U.S. food and fiber crops as potential agents of bioterrorism.