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The Potential Economic Impact of Terrorism In The Agri-Food System

Potential vulnerability of the agri-food system to terrorist actions

The agri-food system involves all aspects of the industry from farm input supply to retailing/food service. Aspects that make the system vulnerable to terrorist acts include:

- Geographical dispersion increases the cost of maintaining security at all points.
- Products intermingle from many sources and at many levels, increasing the possibility that contamination could spread from a single source.
- Because of levels of trade (both imports and exports) there is a need for international security of both U.S. exports and U.S. imports.

Potential costs of terrorist actions in the agri-food system

The costs of a terrorist action in the agri-food system would vary widely, depending upon the type and scale on which the action was taken. Possible costs include:

- Health care and income losses of consumers affected by contaminated food.
- Production losses, quarantine and eradication costs by the introduction of diseases.
- Income losses of farmers, food processors, and exporters affected by the loss of sales in domestic or international markets due to loss of consumer confidence in the safety of food products or international prohibitions on exports.
- De-contamination costs of farm, processing, or distribution facilities.
- Income losses of employees in food processing or distribution whose employment is affected by contamination of the food supply.
- Income losses of consumers affected by higher prices of food products.

Estimated costs of terrorist actions in the agri-food system

Though no studies of the economic impact of terrorist acts have been completed, existing studies of accidental food contamination or outbreaks of disease provide an indication of the potential costs of a terrorist attack (Table 1). This wide range of events demonstrates several aspects of the economic impact of a terrorist act in the agri-food system:

- Existing cost estimates may underestimate the impact of terrorist events, since such estimates often include only a portion of total economy-wide costs of the event.
- Existing cost estimates may also underestimate the impact of terrorist events because, unlike unintended accidents or outbreaks, a terrorist attack might be designed to maximize the cost of such an event.
- The cost of such an event is highly unlikely to be limited to one state. Consequently, an individual state is unlikely to provide a nationally adequate level of protection and detection services. Such state-level limitations suggest that a joint state-national of cost-sharing for such services is necessary to provide protection of the agri-food system.

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Maintaining a Safe, Economical and Readily Available Food Supply for the United States and the World

The Situation:

The United States is actively being targeted by state sponsored and proxy terrorist organizations. Agriculture is a critical infrastructure for our country, it is vital to the security and well being of the American people, the United States and world economy. Any comprehensive federal terrorism plan must include agriculture as a high probability, highly leveraged asymmetric target.

The Problem: Disruption of the food supply chain would have a profound effect on the economy, national security, political stability and national psyche of the country.

The Threat: A coordinated attack is most likely to occur simultaneously in multiple commodities, across multiple regions using multiple pathogens or chemical agents. In addition, a catastrophic disease outbreak (natural or man made) targeting one agricultural commodity can also damage other non-related agricultural commodities. Specific categories of animal diseases cause the implementation of quarantines, which stop all exportation of agricultural products

The United States is currently unprepared and ill equipped to deal with the consequences of a terrorist attack on the food production system. USDA-APHIS released a Draft *Communication Plan for an Animal-Specific Threat* (released 2-24-03), which does not articulate a strategy for dealing with multiple targeting scenarios. The fact is, the government currently lacks the necessary resource stockpiles of vaccines, emergency equipment, supplies and antibiotics required for an appropriate response, as well as a means of effective distribution of these products. In addition, the government currently lacks a coherent and comprehensive plan for integrating the efforts of federal, state and local response agencies, which presently have conflicting and competing regulatory authority and responsibilities. Therefore, if an attack did happen, senior leaders could not receive the information required for informed decisions.

Important Points to Consider Regarding Our Nation's Agriculture

- All emergencies begin as local emergencies
- Animal disease outbreaks are first responded to by local or company veterinarians
- Local or company veterinarians refer cases to State Veterinarian
- State Veterinarian refers issue to Department of Agriculture, Governor and notifies USDA- APHIS
- Delay in local diagnosis and referral increases the financial impact and the area affected
- Delay in federal response increases the financial impact and the area affected
- Federal resources may not be available at time of emergency

The Solutions: The United States food production system holds national security issues. The most pressing critical need is the rapid development of a comprehensive and coordinated plan and functioning system to address the needs for surveillance, detection, response, containment and remediation. For the plan to be successful, a new paradigm must be adopted where all stakeholders, including federal, state, local governmental agencies, qualified non-governmental organizations and private industry are considered equal partners in the planning and operation of a comprehensive system. In addition, adversarial relationships between regulatory agencies and private industry must end immediately and a new partnership fostering cooperation be initiated.

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“Securing Our Future Through Preparedness”

The Situation: The threat of agroterrorism is real. Foot and mouth disease, if introduced into the United States, would be an economic disaster throughout the agricultural sector, as well as a bureaucratic nightmare. There have been numerous unintentional introductions of plant pests, such as the Russian wheat aphid, cereal leaf beetle, and Karnal bunt that have caused considerable economic losses.

The Problem: Are we prepared in plant biology if a destructive organism is introduced – whether it is intentionally or unintentionally? The answer is - It depends on the crop, but generally no, we are not well prepared. After prevention, the newly formed National Plant Disease and Pest Diagnostic Network can help us identify a problem. Also, certified crop advisors (CCA) could be used to help identify problems. However, this program and the CCAs should be viewed as an early warning system. Once a disease or pest is identified, it does not help with alleviating the problem, unless existing pesticides can kill the disease or pest.

The Solutions: To better understand potential diseases and pests the following measures should be taken:

- All imported soil and plant materials (including horticultural plants) should be inspected to reduce the opportunities for intentional and unintentional introductions of diseases and pests and to determine the occurrence of pests being brought into this country.
- National crop nurseries should be established that include cultivars with well-known resistance genes. If previously resistant cultivars become susceptible, the nurseries will identify immediately what genes were defeated. The host-pathogen or pest interaction will identify if plausible, natural mutations that have occurred in the pathogen or pest, or if an agroterrorism event has occurred. This type of attack would take a relatively high level of sophistication for bioterrorists to accomplish, but could occur with state sponsorship.
- It is important that plant scientists and specialists prioritize potential threats to each economic plant that would include ease of pest movement, economic impact, and ease of development and introduction. For example, currently stem rust and stripe rust are particularly important diseases of wheat. If a cold-resistant stem rust or a heat-tolerant stripe rust were deployed it could cause considerable yield and economic loss to the Great Plains States.

- We need a strategy based on preparedness for the intentional and unintentional introduction of pests. For example, the sunn pest, a serious wheat pest of western Asia, is an example of an organism that could be introduced easily. Cultural practices, identification of beneficial organisms that control these pests, and germplasm should be developed that allow us to quickly deploy resistance strategies if a disease or pest is introduced. The control strategy is analogous to having adequate supplies of human vaccines ready for deployment should a human disease be introduced. Simply knowing the disease or pest is present is an inadequate response. The Russian wheat aphid (RWA) is an example of a pest that we should have anticipated would eventually come to the U.S, and we should have been ready for it. There are at least two RWA biotypes that are virulent on our resistant lines so we should be screening for resistance now. Soybean rust is another disease for which we should be preparing.

In Conclusion: Historically, germplasm development and screening has been a USDA/Agricultural Research Service responsibility often in cooperation with some state crop improvement programs. While these programs have been successful in the past, it appears that less effort is going into germplasm development and screening and the study of cultural practices that alleviate disease and pest losses. These resources need further coordination in light of the heightened potential for agroterrorism.

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Briefing On Crop Biosecurity—Are We Prepared?

Accounting for 16% of the GDP and 27% of our total export value, plants provide our food, feed, fiber and many of our medicines. Hence, growing plants in a sustainable and economically viable manner is required for the US to be secure. Maintaining plant health from naturally occurring or purposefully introduced disease agents is the role of research, instruction and outreach programs in plant pathology. While there is a readily available and generally affordable breadth of options for food, clothing, and shelter; there are many voids in the security and sustainability of our crop production systems.

The Situation: America's largest domestic and export economic sector is agriculture. Crops are produced on about 350 million acres in the United States and 12% of plant products we consume, such as fresh fruits, tree nuts, fresh vegetables, vegetable oils, and grains are imported. The security of this vast system has been under supported for a long time. Consequences include:

- Arrival of key pathogens in commodities, cargo and luggage, resulting in huge epidemics:
 - Examples: Chestnut blight, dutch elm disease, white pine blister rust.
- Unintended arrivals are occurring at an accelerating rate due to improved transportation systems, and poor ability to detect pathogens at ports of entry.
 - Examples and estimated cost: citrus canker (\$342 million annually), karnal bunt (\$160 million to date), plum pox virus (\$20 million to date), sudden oak death (\$1000 to remove a single tree; currently limited to West coast; potential impact is uncertain)

The Problem: Investment in research is needed to open new directions for application, including greater use of plant biotechnology and plant and microbial genomics for detection, forensics, prevention, or recovery from a naturally or purposely introduced malady on a U.S. crop or food produced from crops.

- Expand investment in microbial genomics to include sequencing and functional genomics of a microbial pathogens that are potential threats to plant health. This is essential to understand virulence and survival genes, and identify sequences for rapid diagnosis.
- Annualize support for the National Plant Disease and Pest Diagnostic Network and begin the development of a national center for plant health.
- Invest in research to develop sustainable agricultural production systems that have greater buffering capacity to mitigate an introduced disease.

The Threat: Currently, intentional or unintentional introduction of a threatening plant pathogen could go unheeded resulting in severe damage because of a:

- 1) Lack of modern or reliable detection technology to screen persons and cargo;
- 2) Lack of focused resources to recognize and respond to threats to plant health;
- 3) Lack of understanding of sustainable agrosystems to assure continued profitable plant production.

Table 1. The Solutions: The following steps should be taken to improve the quality of our response to both accidental and intentional releases:

| Activity | Outcome |
|---|---|
| <p>Expand investment in microbial sequencing. Few (~6%) of the microbial genomes that are sequenced are plant pathogens. Increased investments are needed for: a) sequencing 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.</p> | <ul style="list-style-type: none"> •Understand virulence mechanisms and basic biology regarding the spread and survival of plant pathogens, especially threat agents. This will be the basis for new approaches to control; •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 plant pathogens of concern. |
| <p>Annualize support for the National Plant Disease and Pest Diagnostic Network and begin the development of a national center for plant health. The support for the the National Plant Disease and Pest Diagnostic Network, initiated with approximately \$24 million in May 2002; needs to be annualized. The APS urges that a focused effort on plant health, such as a nation institute or center, be developed.</p> | <p>Provide support for the infrastructure for a coordinated and effective diagnostic network, and a center for plant health that would include:</p> <ul style="list-style-type: none"> •risk assessment and updating of threat agents •a database and collections of pathogens •provide for standardization of diagnostic techniques and certification of persons or labs to make diagnoses. |
| <p>Expand investment in research to understand components of sustainable agroecosystems. Sustainable agriculture is a widely embraced, but inadequately understood, umbrella under which the economic, biological and social aspects of the agricultural enterprise can be viewed at a systems level. To elucidate the dynamics and controls of the complex systems in a sustainable environment requires fundamental investigation into the components of the systems.</p> | <p>A better understanding of the plant environment, the development of new disease management chemistries, and improved methods for delivery, will lead to implementation of the best practices for a specific agricultural production system that are based upon sound scientific principles.</p> |

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Agroterrorism: Security Through Prevention and Preparedness

Situation: Agroterrorism is focused on humans, while the nation's food supply and natural resources are increasingly at risk to naturally recurring and manipulated organisms. Unfortunately, the scientists and institutions laboring on this issue are fragmented and lack many of the infrastructure improvements developed to combat human infectious agents (i.e., communication networks).

Threats: Modern life, including climate change, is increasing the rate of entry, dissemination and effects of plant and animal diseases. Devastating examples are West Nile virus, affecting birds, horses, and people; and plum pox, affecting peaches and plums. Widely feared intentional diseases include soybean rust (a fungus) and foot-and-mouth disease virus of animals.

Challenges: Prevention and preparedness are key.

- Prevention includes increased security, secrecy, and border protection, already occurring and poised to increase. Increases in these areas may paradoxically limit preparedness by restricting free and open conduct of science and information exchange.
- Preparedness includes early detection, rapid and accurate diagnosis and rapid recovery.
- Agriculture lags far behind the medical field in the development and use of new and emerging technology, such as nanotechnology, rapid and inexpensive diagnostic tools, availability of publicly funded reagents and robust databases.

Needs: Basic and applied research of disease agents. Developing model scenarios to better understand how pathogens cause disease in plants and animals (a fundamental need). Disease eradication methods must be improved beyond traditional means, namely killing the infected animal(s) or chopping down the tree(s).

- Education of scientists, public officials and the media is pivotal to intervention.
- Maintaining and enhancing the fledgling rapid response network for detection, identification and diagnosis for both plant and animal diseases, and equipment and personnel for database interoperability. These distributed and regionalized labs need to be supported by robust state systems.
- Establishing, refining, modifying and implementing categorical priority lists of threat agents for planning and allocating resources.
- Genomics data to understand and develop broad-based mechanisms of innate disease defenses within crop plants and immune system modulators for animals. These investments are high-payoff (i.e., resistant to both natural and intentional attack). Genomic pathogen data would allow improved understanding of disease agent spread and possible points of vulnerability. Conversely, maintaining and enhancing healthy plants and animals requires beneficial microorganisms, which we know little in comparison with human agents of disease.

National Response: CoFARM endorses the National Academies new report “Countering Agricultural Bioterrorism,” which addresses many of the points raised in this briefing. CoFARM also endorses the creation of a National Institute or Center for Food and Agricultural Sciences, which is being examined by the USDA. Such a center would be pivotal in addressing basic needs in communication, validation of detection and diagnostic tools, and standardizing disease intervention and control techniques for agriculture.

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