Final Report of the
APS/USDA Meeting on the
National Plant Disease Recovery System
Memphis TN, April 13-14, 2006

Homeland Security Presidential Directive No. 9 (HSPD-9) directed the Secretary of Agriculture to establish a National Plant Disease Recovery System (NPDRS) that assures resiliency in our crop production systems in the face of accidentally- or intentionally-introduced diseases of high consequence. Responsibility for working with the relevant agencies in USDA and developing the plans was assigned to the Office of Pest Management Policy (OPMP). The purpose of this meeting was to bring together representatives of the various agencies of USDA, scientists from land grant universities, and representatives of industry to (1) review completed drafts of three plant disease recovery plans, (2) discuss the essential elements that would comprise a "template" recovery plan, and (3) identify additional high consequence diseases for which plans should be developed.

The meeting was convened at 8:00 AM on April 13, and adjourned at noon on April 14. There also was an evening session held after dinner on the 13th to discuss emerging disease threats. The meeting was attended by approximately 40 people. Following is a summary of the meeting highlights:

April 13, AM.

Al Jennings, Director of OPMP, kicked off the meeting by explaining the charge imbedded in HSPD-9 and the NPDRS: To develop a response and recovery system that would enable agriculture to recover from a high-consequence disease event in one growing season. That is seen as a significant challenge, and requires a "system" of infrastructure, communications, disease management tools, resistant germplasm, research priorities, and planning. It can be summarized as assuring that all the right people are on the same page at the right time.

Rick Bennett, ARS, described some of the research efforts that ARS scientists are conducting in support of the NPDRS. These include:

- Stem rust of wheat. ARS scientists are carrying out research on the new race of stem rust, Ug99. US breeding lines are being sent to Kenya Africa for evaluation against a natural epidemic (being done in collaboration with CIMMYT). USDA researchers are also working in Ethiopia and Kenya to strengthen their capacity to develop and deploy resistant cultivars.
- Soybean rust. ARS scientists are developing methods for sampling from rain to assess spore deposition and risk. They also are looking at fungicides and improved application technologies, as well as using marker-assisted selection to develop genetic resistance.
- Citrus Greening. ARS scientists are developing methods for rapid detection. Also working on vector relations and methods to culture the causal agent.
- Stripe rust of wheat. ARS scientists are monitoring emerging biotypes of rust on a national basis and screening advanced breeding lines of wheat and barley.

Matt Royer, APHIS/PPQ, described his unit's role in prevention, preparedness, response, and recovery (what was described as "science-based early detection, rapid response, and practical recovery systems to safeguard agricultural and natural resources).

- Prevention: Involves offshore inspections, quarantines, permits, diagnostics, mitigations, and surveillance.
- Preparedness: Involves Offshore Pest information system (OPIS), risk assessments, vulnerability assessments, new pest responses, science panels, diagnostics networks, survey (CAPS/NAPIS), treatments (sec 18 labels), and training (for surveys, diagnostics, data management)
- Response: Involves implementation plans (generic and specific), incident command system (ICS), Fed and state unified command, resource allocation and tracking, human, fiscal, and physical resources, survey and detection (timely), accurate diagnostics and timely, timely mitigations.
- Recovery: Involves the National Plant Disease Recovery System, prevention elements, survey and detection, diagnostics, long-term pest control.

They work with states (the National Association of State Departments of Agriculture, NASDA), the National Plant Board, EPA, DHS, DoD, and the North American Plant Protection Organization (NAPPO), which involves the US, Canada and Mexico.

Kitty Cardwell, CSREES, sought to remind people of the importance of extension and education in the recovery system. She stated that the system revolves around "detection, diagnosis, mitigation, management and recovery" (D2M2R), and that research, extension and education are central to each of these elements. She went on to note that Land Grant Universities (LGUs) are presently hampered in the extension and education components, having funds mostly for research.

She also described the developing National Plant Protection Laboratory Accreditation Program (NPPLAP) that is seeking to accredit labs across the country for diagnostic equipment and protocols. Phil Burger (APHIS-CPHST) is leading the accreditation effort to build quality assurance into the system and reduce the incidence of false positives and negatives. Raised a question as to whether funding will be provided to make this a sustainable effort.

Kitty indicated that the National Plant Diagnostic Network (NPDN) has been active in developing fairly detailed SOPs for diagnosticians. Over its short life, NPDN has made great progress in linking diagnostic labs and LGUs with state departments of agriculture. She also described the importance of the Pest Information Platform for Education and Extension (PIPE) for web-based management of information related to disease mitigation, control and recovery.

Greg Pompelli, ERS, indicated that ERS does not have people dedicated to the NPDRS effort, but that ERS moves people around as needed for projects. ERS supports research on the economic impacts of diseases, the economics of control and mitigation techniques, the economics of invasive species, the effects on global trade, and regulatory and quarantine issues.

He described the current research priorities under the "Program of Research on the Economics of Invasive Species Management (PREISM)" grants program. These include:

- Institutions and Incentives for Efficient Invasive Species Prevention and Management
- Practical Decision Analysis for Invasive Species Management
- International Dimensions of Invasive Species Management

Some programs are carried out jointly, such as those with APHIS-PPQ's Cooperative Agricultural Pest Survey (CAPS) program, which has led to the economic analysis of 73 potentially invasive species. However, using economic approaches to the prioritization of diseases of consequence is problematic due to uncertainties introduced by lack of critical information.

They also have done a lot of work with Soybean Rust, such as the evaluation of alternative treatment regimes. In seeking to put a value on the SBR early-warning system, they found that the cost savings to growers far exceeded the cost of the NPDN.

Kent Smith, OPMP, then spoke about the recovery plans. He indicated that the focus of the plans is to be on diseases of high-consequence that could be introduced through intentional, unintentional, or natural means. The first focus of the planning effort has been diseases on the Select Agent list, but we need discussion about what should be done next.

The plans have specific purposes that are based on HSPD-9 and its call for a recovery system. For this reason, the plans are not comprehensive academic reviews of the diseases. They are intended to be concise (20 pg) summaries intended to inform USDA decision-makers, USDA research proposal panels, and even lay audiences (through educational web sites). It is envisioned that the plans could be used to identify what research is needed and what extension/education is needed, and to help drive funds to support those efforts. The plans will likely never be considered "done," but always subject to revision as more is learned.

Each plan is intended to cover some biology of the disease, responses to it, and what is needed for recovery. The plans developed to date were prepared by volunteers (largely APS members) that have been organized into working groups consisting of state (LGU) and Federal scientists who communicated through conference calls and e-mail.

Prior to the meeting, participants were provided with copies of draft recovery plans for

- Huanglongbing (citrus greening)
- Wheat rusts
- Corn downy mildews

A brief overview of each of the recovery plans was presented to assure full understanding by the group, and there also was discussion of the generic elements of a "template" plan.

There was considerable discussion of the definition of the term "Recovery" Some participants felt recovery begins at the early phases of detection, while others thought it came well after the fact.

First Breakout Session:

With this background, the participants then separated in three breakout groups, with each group assigned to discuss one of the draft plans, addressing each of the following questions:

- What specific corrections or recommendations are suggested for the recovery plan?
- What research is needed to more fully complete the current plans? Are the stated research priorities acceptable?
- What should be the elements of a "template" recovery plan? (include subject categories and suggested content)

- What research and information would be required to streamline the development of effective recovery plans for threatening and emerging pathogens?

Recommendations regarding draft plans:

1. Specific recommendations relating to Huanglongbing (**see Appendix 1**)

2. Specific recommendations relating to Wheat Rusts (**see Appendix 2**)

3. Specific recommendations relating to Corn Downy Mildews (**see Appendix 3**)

4. Specific recommendations relating to the elements of a generalized "template" plan (**see Appendix 4**)

5. Other, general recommendations.
   - In the discussion that followed oral reports, there was consensus that the recovery plans should only deal with single diseases. The attempt to include multiple diseases (i.e., Leaf Rust, Stem Rust and Stripe rust in the wheat rust plan, or Philippine Downy Mildew plus Brown Stripe Downy Mildew in the corn downy mildew plan) leads to some confusion. The individual diseases differ in terms of epidemiology, symptoms, germplasm resources, etc. The plans will be easier to write and easier for policy-makers to understand if they are more concise and targeted.
   - Need to make education and outreach an important part of every plan
   - Need to look into the resources that already have been prepared (e.g., Information relevant to the recovery plans was prepared for APHIS through an APHIS-funded project carried out by Purdue, Texas A&M and Kansas State University. Each treated disease covers symptoms, biology, control, list of experts, executive summaries, risk factors, whether the disease is likely to be established, etc.

April 13, PM.

The prioritization of emerging or high-consequence plant diseases: An overview, history and expectations.

It was noted that APS has two committees involved in these issues: The Committee on Biosecurity (chaired by Jim Stack), and the Committee on Emerging Pathogens and Diseases (chaired by Doug Luster). Jim Stack noted that CAST published a report in 2004 that identified 2,000 pathogens and 600 insects that need to be kept out of the country…a nearly impossible task.

Doug Luster, ARS, spoke of the APS committee he chairs, and the work it has done to prioritize pathogens and diseases. He noted that this has been a challenge, since different groups need different lists of pathogens for different purposes. For example:
- Lists of pathogens prone to accidental introductions - Sue Tolin (VPI)
- Lists of bioterrroism agents (that might be used by individuals or small groups)– Anne Vidaver (U. Nebraska)
- List of bio-warfare pathogens (that might be used by terrorist states, countries) – Don Huber (Purdue)

- Lists of mycotoxin-producing microbes, molds, mushrooms – Gretchen Kuldau (Penn State)

Pathogens have definable biological characteristics that make them more or less amenable to exploitation as weapons. His committee has sought to use these characteristics to establish an analytical hierarchy. It is possible to weight various categories and criteria, and then model risk using Expert choice software. Need to use numerical ratings in evaluations for this to work. Currently using a 5-point scale.

The "Master Criteria" (from the Vidaver subcommittee) include:

- Potential for pathogen establishment, reproduction and spread
- Pathogen is amenable to production and delivery
- Pathway for entry
- Pathogen has significant social or psychological shock value
- Establishment in US would have significant direct economic effects to producers or trade
- Public costs associated with monitoring, eradicating or managing the pathogen.

Jim Stack, Kansas State University, then spoke about NPDN. He indicated that the network supports national issues, but also focuses on state issues. Each state has been asked to assess their critical concerns.

His assessment is that NPDN has been very successful. It accomplished what it set out to do, and is coming up for its 5-year review.

Kim Schwartzburg, CPHST-CAPS, discussed the Cooperative Agricultural Pest Survey (CAPS). She noted that CAPS deals with a range of exotic pests. Prioritization needs to incorporate objective and subjective data, be scientifically defensible, and transparent.

Her group has been using an "Analytic Hierarchy Process." They identified their "pest universe" as being 139 pests of importance using lists from APS, APHIS, NAFC exotic forest pest database, etc. Criteria involve:

- Entry potential
- Establishment potential
- Spread potential
- Economic impact
- Non-economic impacts

They have developed a list of "top ten" pests as targets for the national survey.

Russ Bulluck, CPHST, indicated that CPHST was asked to look at risk assessment. They have done that through "Bioterrorism-based Organism Pest Risk Assessments" (BOPRAs). This is a conventional pathway risk analysis that addresses the consequences of introduction and the likelihood of introduction.

They also are developing a "Combined Bioterrorism Index" (CBTI) for each pathogen. This is based on the ease of access, ease of culturing, ease of spread, ease of infection, etc. The intention is to develop an index number that will allow the direct comparison of select agents. This effort is directed primarily toward pathogens that cause disease and yield loss, not necessarily to pathogens that would cause a bigger economic loss because of trade disruptions (quarantines, etc).

Larry McDaniel, PPQ, spoke about the Select Agent Program (SAP). He indicated that the detection of citrus greening in Florida has opened discussion as to whether the agent should be removed from the Select Agent List (i.e., "delisted"). He stated his belief that it would not be delisted, because it still poses a significant threat to Texas, Arizona and California.

He noted that the select agent list gets reviewed every two years to see if pathogens should be added or removed.

April 13, Evening Session.

The evening session was a chance for people to inform their colleagues of emerging or threatening diseases that might warrant consideration as security risks. The individuals, and diseases mentioned, included:

Sue Tolin (VPI&SU): A new whitefly transmitted virus of soybean. Present in Brazil. May also be seed-borne. May be a carlavirus. May be a strain of cowpea mild mottle virus.

Judy Brown (U. Arizona): Tomato yellow leaf curl virus. Begomovirus (Geminiviridae). Present in central Africa, Middle East, Caribbean, and FL / GA in US. Also in northern Mexico, just south of CA/AZ/TX.

Gail Wisler (U. Florida): Citrus greening, citrus canker, soybean rust, sudden oak death, citrus leprosies virus, citrus variegated chlorosis, black spot of citrus, sweet orange scab, sudden death syndrome of citrus (cause unknown).

Bob Martin (USDA-ARS, Corvallis OR) Sudden oak death, blackberry rust, hop powdery mildew (OR/WA), Iris yellow spot of onion (thrips transmitted), strawberry decline (CA), complex of several aphid and whitefly transmitted viruses, black raspberry decline virus, blueberry scorch disease (aphid transmitted carlavirus).

Kim Schwartzburg (CPHST-CAPS): Phtophthora alni (Phytophthora disease of alders), Heterodera latipons, Mediterranean cereal cyst nematode. Infects wheat, barley, oats & rye. Occurs in Mediterranean and eastern and northern Europe. Probably would survive in wheat growing areas of US.

Anne Vidaver (U. Nebraska): Gumming disease of grasses-slime disease (ryegrass). Pathogen of plants and disease. (This is one of the 12 diseases in the KSU/PU/TAMU report). Apple proliferation, Phytoplasma mali (apple witches broom); canker of grapevine, Xylophilus ampelinus; marginal chlorosis of strawberry (phytoplasma-Candidatus Phlomobacter fragariae).

Russ Bulluck, (APHIS,CPHST). Phytophthora kernoviae sp. nov - magnolias, beach, oaks, rhododendrons. Found in 2002 in New Zealand.

Doug Luster (USDA-ARS)– soybean red leaf blotch, Phoma glycines. Found in Zimbabwe.

April 14, AM.

Second Breakout Session:

With this background, the participants then separated in four breakout groups, with each group assigned to discuss one question:

Group 1: Selection of crops and diseases to consider – State vs. National issues (led by Don Huber)
Group 2: Development of quantitative criteria and associated rating scales (led by Sue Tolin)
Group 3: Pathogen introduction pathways and scenarios and selection of criteria subsets (led by Gretchen Kuldau)
Group 4: Refinement of short list of obvious high consequence emerging pathogens (led by Kim Schwartzburg)

Summary reports of breakout group discussions:

Group 1, see Appendices 5, 5.1, and 5.2
Group 2, see Appendix 6.
Group 3, see Appendix 7.
Group 4, see Appendix 8.

Wrap-up.

At the end of the meeting, there was a brief, open discussion in which the following points were made:

HSPD-9 mandates a “recovery system.” Therefore, we need to be sure that plans address system-level issues in order to realize a recovery (and “recovery” within the mandated 12 month period is probably unrealistic).

Doug Luster led a group discussion regarding two pathogens of considerable concern at present - Sudden Oak Death and citrus canker- and whether it was appropriate to consider them at the stage where "recovery" was still appropriate (i.e. are recovery plans appropriate, or are we beyond recovery at this point?). This discussion again raised the issue of what “recovery” means. Clearly the view differed by region. In Florida, there is now little interest in “recovery” from citrus canker, but there is remains strong interest in California and other citrus regions. There was discussion about whether we should consider recommending a top ranking pathogen from the rating exercise spreadsheet (Appendix 5.2), such as *Phytophthora ramorum*, *P. kernoviae* or *P. alni*- which should probably be split into separate but largely parallel plans. Again, regional interests differed; those from California, where *P. ramorum* is firmly entrenched were less interested in recommending a plan than those from parts of the country where it is not established. The general concept of treating *Phytophthora* spp. in future plans did have support from the group.

While there is benefit to a “generic” plan, there still is a need to look at specific diseases and general preparedness (such as fast-tracking registrations of fungicides so they are available for use).

The APS member directory needs continual updating and effective keyword searching to facilitate locating experts in certain areas.

The PowerPoint presentations from the workshop should be posted to APSnet so that they are all available to conference participants. The report itself, when completed, should also be placed onto APSnet for the benefit of participants.

The meeting adjourned at noon.