

**Peer Assessment of 5-year Performance  
ARS National Program 304:  
Crop Protection and Quarantine**

Summary Comments and Recommendations

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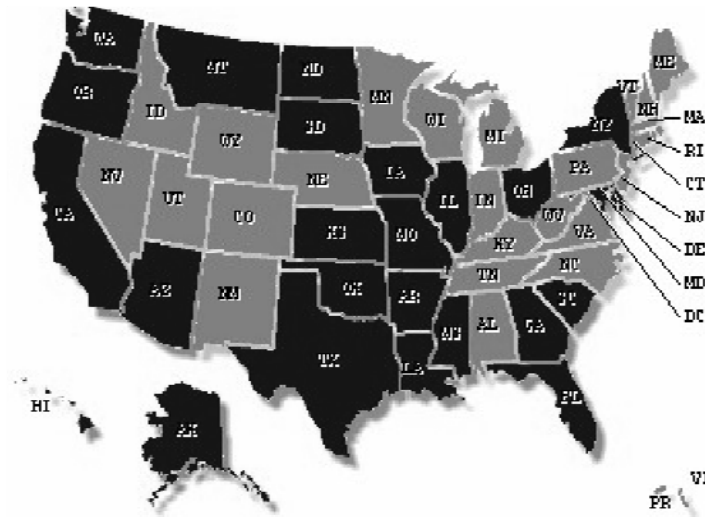
Panel Co-Chairs

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**Scope of National Program 304**

- 236 full-time scientists
- 140 projects
- 41 locations in 25 states, plus 4 overseas labs
- FY07 budget of \$102.8 million
- **Mission:** To provide technology to manage pest populations below economic damage thresholds by the integration of environmentally compatible strategies that are based on increased understanding of the biology and ecology of insect, mite, and weed pests.

## Distribution of NP 304 Projects



## National Program 304 Assessment Panel

- Thirteen accomplished scientists (entomology, botany, weed science, range science, horticulture)
- Two sub-panels: insects (7) and weeds (6)
- Diverse in expertise, employment, location -- research, extension, industry
- Panel met in Beltsville November 28-29, 2007

## **Charge to the Assessment Panel:**

- Retrospective review (5+ years) of performance and impact
- 10 components, 49 research problem areas
- Consider overall national program and problem areas, not individual projects
- Provide feedback to ARS leaders, stakeholders, and partners
- Guidance for focusing problem areas and planning goals for next five-year cycle

## **Criteria for Components and Problem Areas**

- Relevance to the Action Plan
- Results of the Science
- Communication of the Results
- Technology Transfer
- Impact on Production Practices
- Impact on Agriculture, Environment and Society

### **Criteria for Components and Problem Areas**

- Each component assessed, rated
- High, Medium, Low
- Quality, Relevance, Impact
- Overall Summary Rating per Component

### **Criteria for Components and Problem Areas**

- High: All or nearly all problem areas adequately addressed and presented
- Medium: Significant portions of components not addressed or presented
- Low: Insufficient attention to Problem Areas or low productivity reported
- Weak tech transfer lowered ratings

## **Documentation Used to Assess Goals and Determine Impact**

- NP304 Action Plan
- 2001-2006 Accomplishment Report and Appendices
- National Program Leader(s) Overview
- Publications and lab web sites
- Working knowledge of panelists

## **NP 304 Insects -- 6 Components**

1. Identification and Classification of Insects and Mites
2. Biology of Pests and Natural Enemies
3. Plant, Pest and Natural Enemy Interactions & Ecology
4. Post-harvest, Pest Exclusion, Quarantine
5. Pest Control Technology
6. IPM Systems and Area-Wide Suppression

## **NP 304 Weeds -- 4 Components**

7. Weed Biology and Ecology
8. Chemical Control of Weeds
9. Biological Control of Weeds
10. Weed Management Systems

## **Overarching comments**

- Significant role in US and world agriculture
- Key discoveries, significant impact
- Appropriate portfolio mix of near-term, problem-solving & long-term, high-risk research
- Several problem areas within NP 304 are the major national effort (especially high-risk areas) or research investment

# Research Component I

Identification and Classification of Insects & Mites

## Problem Areas:

Prediction & Analysis of Invasive Insects & Mites

Information Technology & Advanced ID Systems

Systematics of High-Priority Pests & Beneficials

Systematics of Emerging Pests & New Beneficials

Delivery of IDs to Customers & Stakeholders

## Component I – Summary

- Quality - High
- Relevance - Medium
- Impact - Medium-High
- Summary - Medium-High
- Essential component
- SEL collections are a national treasure
- Additional emphasis on molecular phylogenetics
- Expertise shortage and understaffed
- Need more expertise and IT support

## **Component I – Recommendations**

- Emphasize molecular phylogenetics for insight into invasive species and natural enemies
- Need systematists for leps, bees, bee pests
- Emphasize IT for non-experts, regulators
- Need more support staff to enable research and identification service
- Reduce # of Problem Areas and consolidate
- ID service is critical -- need more specialists; faster IDs and greater scientific progress

## **Research Component II**

Biology of Pests and Natural Enemies

Problem Areas:

Basic Biology

Rearing Insects and Mites



## **Component II – Summary**

- Quality - Medium-High
- Relevance - Medium
- Impact - Medium-High
- Summary - Medium-High
  
- Essential component
- Quality ranged from good to excellent
- Strong publication record in some areas
- Reporting uneven
- Biology -- good information
- Rearing -- poor documentation
- Great potential impact, but not yet seen

## **Component II – Recommendations**

- Balance basic and applied work on 'old' and 'new' pests
- Balance basic research on model pest species with that of invasive/exotic species, needing management info
- Coordinate work on model pests across labs by developing lists of gaps in knowledge
- Balance new technology with research on natural history
- Continue collaborations with Land-Grants and Industry to maintain mix of high-risk and ready-impact research
- Merge IIb (Rearing) with other Components -- rearing is relevant to other Components (e.g., exotic pests, biological control)

## **Research Component III**

Pest, Plant and Natural Enemy Interactions & Ecology

### Problem Areas:

Understanding Complex Interactions

Population Studies/Ecology

Effects of Various Types of Production Practices

Role of Transgenic Plants

## **Component III – Summary**

- Quality - Medium
- Relevance - Medium
- Impact - Medium
- Summary - Medium
- Developed new techniques and methods
- Discovered mechanisms of interactions
- Research on plant signaling, plant defenses, microbes and nematodes is top-tier
- Some tech transfer was evident (adoption of practices), but documentation was limited
- Research led to reduced pesticide use
- Risk assessments for Bt crops were beneficial

## **Component III – Recommendations**

- Assess health and environmental benefits from reduced pesticide usage
- Re-examine goals and projects -- some goals were significant, but nothing was reported
- Elaborate on tech transfer plans and outcomes
- Add field-based research to provide relevance and opportunities for technology transfer

## **Research Component IV**

Post-harvest, Pest Exclusion and Quarantine

Problem Areas:

Detection & Delimitation of Exotic Insect Pests  
Exclusion of Exotic Pests & Quarantine Treatments  
Control & Eradication of Exotic Insect Pests  
Biology & Ecology of Exotic Insect Pests  
Biology & Ecology of Stored-Product Insect Pests  
Detection & Monitoring of Store-Product Pests  
New & Improved Control Technologies  
IPM Programs for Stored Product Pests

## Component IV – Summary

- Quality - Medium-High
- Relevance - Medium-High
- Impact - Medium-High
- Summary - Medium-High
  
- Essential research will enhance competitiveness
- Top-tier research, excellent collaboration
- Publications and extramural support excellent
- Needed: pest detection and exclusion
- Needed: biology and ecology of exotic pests

## Component IV – Recommendations

- Develop and implement programs for commercial sector
- Incorporate population genetics into monitoring/trapping
- Develop sampling for very low densities related to risk assessment of newly arising exotic pests
- Implement IPM based on valid sampling to reduce the need for quarantine treatments
- Evaluate efficacy of eradication programs
- Research on fundamental biology of exotic pests to establish priorities and direct applied work
- Basic research (e.g., *Tribolium* genome) of broad utility may be better separated from stored-product Component
- Work on nutrigenomics to help understand impact of diet components on pest fitness
- Need IPM strategies for short-term and long-term storage; storage time will affect cost/benefit of management

## **Research Component V**

Pest Control Technology

### Problem Areas:

Traditional Biological Control

Breeding for Host Plant Resistance

Physical/Mechanical & Cultural Control

Other Biologically Based Control

Chemical Control

## **Component V – Summary**

- Quality - High
- Relevance - Medium
- Impact - Medium-High
- Summary - Medium-High
  
- Top-tier research
- Research has produced innovative practices
- Viable alternatives and implementation near
- Some work did not address goals
- Few measures of impact, pesticide reduction
- Work in progress, impacts will occur in future

## **Component V – Recommendations**

- Some research reported did not address goals
- Find ways to measure direct impact, pesticide reduction, profitability
- Document health benefits of reduced pesticides, and the resulting economic benefits
- Adjust goals in physical/mechanical control -- too specific and too modest; research has broader application and contribution
- Work on biologically based control accomplished only one goal -- reported work was good, but did not address the Action Plan

## **Research Component VI**

Integrated Pest Management Systems  
and Area-wide Suppression

Problem Areas:

Sampling Methods, Detection & Monitoring

Establishment of Economic Thresholds

Development of IPM Systems

Implementation of IPM Systems

Transition & Technology Transfer to Users

## **Component VI – Summary**

- Quality - High
- Relevance - High
- Impact - Medium-High
- Summary - Medium-High
  
- Comprehensive and deliverable IPM programs developed for several pests
- Expert IPM systems developed
- Both national and local scope of projects

## **Component VI – Recommendations**

- Need to reconsider priority areas, balance between national and regional issues
- Combine Problem Areas
- Need fundamental research for development of area-wide IPM programs

## **Research Component VII**

### Weed Biology & Ecology

#### Problem Areas:

Invasive Potential and Ecological Impact

Taxonomy and Systematics

Early Detection, Rapid Response and Monitoring

Reproductive Biology and Seed Dynamics

Growth, Development and Competition

Population Dynamics

## **Component VII – Summary**

- Quality - Medium
- Relevance - Medium-High
- Impact - Low-Medium
- Summary - Medium
  
- Much research was discovery-based -- long-term
- Advanced understanding and development of ecological approaches to weed management
- Excellent approach to modeling, quantifying reproduction from seeds, propagules
- Work on seedbank dynamics is excellent
- Good effort on weed competition in key crops



## **Component VII – Recommendations**

- Expand efforts on weed genomics
- Need further taxonomic work on weeds affecting crops
- Need biology & ecology of additional weed species
- Increase efforts or reporting of applied work
- Increase efforts on early detection/rapid response for additional weed species -- this should be a priority
- Continue long-term research in seedbank dynamics and population dynamics -- these should be priorities
- Work with others to assist tech transfer, such as in weed management systems

## **Research Component VIII**

### **Chemical Control of Weeds**

#### Problem Areas:

Herbicide Use in Minor Crops

Herbicide Resistance and Transgenics

Herbicide Efficacy and Application Technology

New Herbicides

Environmental Transformation and Movement

Risk Assessment

## **Component VIII – Summary**

- Quality - Low-Medium
- Relevance - Medium
- Impact - Low
- Summary - Low-Medium
  
- Land managers rely on ARS for unbiased results for management
- Research supports registration of herbicides in fruit, vegetable and ornamental crops
- IR-4 was strongest part reported
- Research on alternatives will help organic growers
- Study of modes of action for natural products will help development of new herbicides
- Study on movement of herbicides provides template for expanded research

## **Component VIII – Recommendations**

- Add research on herbicide resistance in weeds
- Balance effort (or reporting) among research in minor crops, herbicide resistance, new technology, invasive species in non-crop land
- Approach research from null hypothesis, to include both positive and negative results
- Expand research on organic methods (chemical and other) -- possibly as an independent Problem Area
- Use knowledge gained from research on herbicide-resistant crops to prevent resistance in weeds
- Expand research on detection or eradication of resistant weed species or mitigate their impacts
- Partner with engineers and industry on drift reduction

## **Component VIII – Recommendations**

- Insufficient resources devoted to this important area -- ARS needs to be the leader
- Partner with land managers on outreach on need for herbicides in certain situations, minimizing risks
- Added outreach on effects of control options (including taking no action), to aid land managers -- including information on properties of herbicides that will not impact health or environment

## **Research Component IX**

### **Biological Control of Weeds**

#### Problem Areas:

Agent Discovery, Selection and Risk Assessment

Efficacy and Mass Production of Augmentative Agents

Field Evaluation

Combining Biological Control Agents

## **Component IX – Summary**

- Quality - Medium
- Relevance - Medium
- Impact - Low-Medium
- Summary - Medium
  
- Weed biocontrol is a strength of ARS
- Medium score represents uneven progress or outputs, lack of reporting on some areas (weeds in crops)
- Many goals addressed
- Necessary for ARS to invest in long-term projects
- Field evaluation reported was limited, did not match goals
- Work on combining biocontrol agents was weak -- minimal results reported

## **Component IX – Recommendations**

- Strength is Agent Discovery and Selection -- need greater resources to deliver agents with impact
- Need increased emphasis on field evaluations (as stated in goal) -- effort is not commensurate with that devoted to agent discovery
- Carry through to tech transfer
- Add another focus on weeds of crop lands -- but not at the expense of wildland weeds
- Conduct manipulative research on combining agents
- Address site specificity related to abiotic factors (e.g., soil type) underlying success or failure

# **Research Component X**

## Weed Management Systems

### Problem Areas:

Cultural and Mechanical Control

Integrated Weed Management in Cropland

Integrated Weed Management in Non-cropland

Rehabilitation, Re-vegetation & Restoration

## **Component X – Summary**

- Quality - Medium-High
- Relevance - Medium-High
- Impact - Low-Medium
- Summary - Medium-High
  
- Some strong research; good contributions to science
- Significant effort placed on cover crops -- difficult to assess whether innovation or a reiteration
- Cover-crop research is facing limited adoption
- Accomplishments on mechanical weed control were weak compared to other methods
- Research on cover crop plus phytotoxins will impact both future research directions and crop production

## **Component X – Recommendations**

- Need some “umbrella” problems to assess interactions of biological, chemical and mechanical control
- Greatly enhance tech transfer
- ARS needs to be leader in understanding mechanisms of invasion onto rangelands and wildlands, and propose and test hypotheses
- Need greater emphasis on developing integrated weed management in non-cropland
- Devote greater resources to revegetation and rehabilitation -- federal and state land managers are clientele
- Research on revegetation needs to use native species

## **Overall Recommendations**

- Split NP-304 into entomology and weed science
- Create more inter-agency cooperation (e.g., CSREES, FS, ERS, APHIS)
- Need economic analysis of value of research
- Strengthen the role of scientists in tech transfer
- Re-evaluate and re-combine components to capture what ARS does and plans to do
- Activities and outcomes reported should align with OMB Report on IPM

## **Review Process – Recommendations**

- More-complete information in Accomplishment Report
- Information in Accomplishment Report better organized
- Resources in each Component and Problem Area
- List labs working in each Problem Area; links to other Components and Problem Areas
- Indicate major changes in staffing or funding
- Provide numbers of outputs per Problem Area
- Highlight ARS authors in publications and grants
- Quantitative measure of publication impacts
- Cross-list publications
- List sponsors, collaborators for each Problem Area
- Highlight tech transfer for each Component