National Program 304
Crop Protection and Quarantine

Retrospective Review

Executive Summary
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The retrospective review of National Program 304 consisted of one panel of experts, who operated as two largely independent sub-panels: one reviewed the "insect" portion of the Program (Components I – VI of the Plan), and the other reviewed the "weed" portion of Program (Components VII – X of the plan). Although each sub-panel operated mostly independently, the report combines all aspects of the review, with overarching comments and suggestions, as well as review comments, ratings and recommendations for individual Components. All sub-panelists read and reviewed all Components and Problem Areas of their respective part of the document; responsibility for reviewing and discussing each Component was assigned to primary, secondary and tertiary reviewers. The Panel met November 27-28, 2007.

ARS scientists in NP304 have both discovery-based research programs and responsibility to transfer the developed science and technology to end-users. Often the research directions are high-risk, meaning the likelihood of success may be low. The Panel members recognized the importance of ARS scientists serving the role of carrying a large portion of high-risk research in the overall portfolio, particularly as Land-Grant and Industry partners are less able to invest in long-term, high-risk research.

Overall, the Panel was impressed with both the breadth and depth of the research portfolio in NP304. ARS scientists are clearly among the leaders in their discipline and subdisciplines in many of the research areas in NP304. With a Program as broad as NP304, it is not simple to organize the research directions and accomplishments into discrete Components; overlap among Components is healthy to demonstrate collaborations and multi-disciplinary approaches, but it also resulted in some difficulty in assigning credit for achievements in appropriate places in the review. It is clear that many Problem Areas within individual Components receive adequate attention, direction and support. Activity and productivity among Components and Problem Areas varied, as would be expected. Some Problem Areas within Components were either not well developed or reporting of accomplishments was too incomplete to assess adequately. Many of the Problem Areas consist of long-term research investments, which are less likely to yield significant accomplishments within a five-year time frame. Most of the Components and Problem Areas had an appropriate mix of discovery-base research and development of near-term solutions to problems affecting agriculture and stakeholders. In general, one criticism was that technology transfer was either not developed fully or was not reported sufficiently to be able to assess its effectiveness and impact.

Panelists had high expectations of the scientific accomplishments and delivery of results for all the Problem Areas and Components. Our ratings reflected careful review of the information presented in the Accomplishment Report, but we also viewed the accomplishments reported with a critical eye, and have noted in details below where we believed the work reported needed more attention or resources dedicated.

In Table 1 (below), we summarize the ratings of each Component; ratings were divided into Research Quality, Relevance and Impact, plus an overall rating. Reducing vast and varied programs to ratings consisting of single or few words does not give ample credit to the effort and resources directed toward Components or individual Problem Areas. Some summary comments are provided for each Component, with the details in the full report.

Table 1. Ratings of Research Quality, Relevance, Impact and Summary for Ten Components of NP304

Component	Quality	Relevance	Impact	Summary
I	High	Medium	Medium-High	Medium-High
II	Medium-High	Medium	Medium-High	Medium-High
III	Medium	Medium	Medium	Medium
IV	Medium-High	Medium-High	Medium-High	Medium-High
V	High	Medium	Medium-High	Medium-High
VI	High	High	Medium-High	Medium-High
VII	Medium	Medium-High	Low-Medium	Medium
VIII	Low-Medium	Medium	Low	Low-Medium
IX	Medium	Medium	Low-Medium	Medium
X	Medium-High	Medium-High	Medium	Medium-High

Some description of the Summary Ratings is warranted. If the Panel felt that all or nearly all Problem Areas were adequately addressed or presented, the rating was labeled "High." A rating of "Medium" usually was due to significant portions of the Component that were not addressed or for which the information presented was incomplete or presented in the wrong Component. A rating of "Low" reflected insufficient attention to the Problem Areas or low productivity in the Problem Areas. In numerous instances, panelists were aware of work by ARS scientists that was not reported. Ratings in Quality, Relevance or Impact were subjective. Although all of the Components in NP304 are relevant to agriculture and the Program, not all the work reported was relevant to the Component or the Problem Area. Impacts were rated lower if the evidence of technology transfer was weak or lacking. Nearly all the research we assessed was of very good quality. Our ratings were based on our expectation of effective use of resources and productivity for those areas. We had high expectations of the scientists and their productivity. Ratings of medium and medium-high reflected our very high expectations.

Overall, we were impressed by the performance and outcomes in the Components and Problem Areas. Further attention will need to be paid to Problem Areas for which little was accomplished or reported.

Summary Comments

The scope of NP304 is broad enough that the program should be separated into two National Programs –weed science and entomology. Although there are some labs and programs that cut across both aspects, there are also overlaps with other National Programs. The portfolios in each of the two primary areas are diverse already and separating into two National Programs would allow highlighting – and reviewing – each Program more effectively. The separate National Program on plant pathogens might be used as a model for the advantages and disadvantages of separate National Programs for entomology and weed science.

There are opportunities for more inter-agency cooperation (e.g., CSREES, CES, APHIS, FS). The Panel suggests that a portion of each agency budget be used for cooperative activities. The Panel recognizes that there already are coordinated programs within USDA (e.g., area-wide suppression, invasive species, research to support regulatory activities). We urge continued support and encouragement of collaborations throughout the USDA system.

Because much of the scope of NP304 has at its heart an underlying philosophy of integrated pest management, the Panel suggests that the NP 304 review document directly address and report activities and outcomes that align with recommendations of the Office of Management and Budget report on IPM, thus giving credibility to the activities within the NP304 portfolio.

We found numerous overlaps in Component areas – sometimes it was not clear why research was included in a particular Component. Although some overlap is to be expected and encouraged, we suggest that the Stakeholder Workshops and development of new plans include re-evaluating and re-combining some of the Components. An important question to keep at the forefront of new plans is whether the Components capture and convey what ARS is doing and what is planned for Crop Protection and Quarantine. It will be critical to involve ARS scientists in the discussions of major Component areas to be developed, both at the level of stakeholder workshops and in developing detailed goals and objectives.

ARS administrators need to clarify the role and responsibilities of scientists to encourage – when possible – technology transfer. The Panel felt strongly that technology transfer is a critical aspect of the research process that needed to be strengthened and highlighted, and scientists rewarded for completing the process.

One missing aspect was economic analysis of the benefits of NP304 programs. The research of NP304 has produced numerous benefits to agriculture and science. Economic analyses must demonstrate the return on the research investment; this will be crucial to ensure future funding and to highlight the value of the long-term, high-risk research investments. Such analyses will also help direct future Problem Areas and Components. However, it will be equally crucial to recognize that not all research will fit a five-year time frame and will not produce near-term economic returns. Some high-risk research must be included in the NP304 portfolio, regardless of returns, because the research will not be conducted elsewhere. We suggest collaborative studies (e.g., with Economic Research Service) be pursued at the National Program level to document economic benefits of NP 304 programs, and that the appropriate analyses should be included in the next review.

Components I to X (Insects and Mites) Summary Comments

Component I: Identification and Classification of Insects and Mites

This Component is essential for US agriculture. The SEL collections are a national treasure – they integrate historical data collections with molecular studies of field populations. The research is of very high quality, easily in the top 10-20 % nationally and internationally. Additional emphasis on molecular phylogenetics and character evolution will be needed to remain at the forefront of the larger systematics community.

However, there appear to be major scientific expertise shortages in SEL, and our assessment is that they are understaffed for what they are asked to do. There is a need for more systematic expertise and more IT support for the systematists. It will be critical to decide whether ARS priorities for SEL scientists are to conduct research, create web-sites, or provide identification service to the entire scientific and regulatory communities.

Component II: Biology of Pests and Natural Enemies (Microbes)

Fundamental knowledge of the biology of pests and natural enemies is essential in the development of novel and sustainable pest management. Research quality ranged from good to excellent, with a strong publication record in some areas. However, the reporting for this Component was very uneven. Based upon the information provided to the Panel, the biology aspect was considered to be medium to high; however, the rearing aspect was assessed as low to medium because research accomplishments for rearing were poorly documented. The impact of this research is not yet seen, but is potentially very great.

Component III: Plant, Pest, and Natural Enemy Interactions and Ecology

ARS researchers developed new techniques or methods that will influence research in many areas. Scientists made significant discoveries of mechanisms of plant-pest-natural enemy interactions. Together, these investigations have influenced and will influence other researchers and open new research directions. Research on plant signaling, plant defenses, and on microbial and nematode pathogens, is in the top 10-20%. The area of molecular ecology has the potential to be in top 10-20% of all related research. However, the review team could not determine what technology transfer was accomplished – elaborate on the plans and outcomes of tech transfer. In addition, more field-based research needs to be added to provide opportunities for tech transfer to end-users.

Component IV - Postharvest, Pest Exclusion, and Quarantine Treatment

The research on stored product pests and its impact will enhance the competitiveness of American agriculture, and yield health and economic benefits to consumers. However, only about 50 % of the goals were addressed. It was not possible to assess the goal of reduction in pesticide use while maintaining or improving yields and/or profitability. The research contributes directly to the sustainability of agricultural production and the maintenance of ecosystem services. Most research is top third nationally and

internationally, as shown by collaborations, number and quality of publications, and extramural support. More research is needed on pest detection and exclusion for stored product pests, and on fundamental biology and ecology of exotic insect pests, to help establish priorities and direct the applied work.

Component V - Pest Control Technologies

This Component has been a strength of ARS, with a long history of top-tier research. Research quality, productivity and impact are impressive, and in the top 10-20% of similar research. Several new innovative practices for pest and pesticide resistance management have resulted from research in this Component, and ARS research has significantly influenced other research in similar and related fields, and results that will provide viable alternatives or commercialization are near implementation. However, the research reported only partly addressed or accomplished the goals stated in Plan. Some research on pesticide reduction and profitability was excellent, but did not directly address stated goals. Few direct measurements of impact, pesticide reduction or profitability were provided. The rating of this Component reflected work in progress, but many of the rewards will be apparent in the next retrospective review.

Component VI - Integrated Pest Management Systems and Area-wide Suppression

Comprehensive and deliverable IPM programs were developed for several important insect pests, as were systems-based, expert IPM systems. Some research had a large national scope -- other projects were limited in scope. As a new plan is developed, it will be important to re-examine the balance among Problem Areas, as well as national versus regional problems, and reconsider priority areas and goals.

Component VII – Chemical Control of Weeds

Most of the research in this component was discovery-based, which, by definition, will not always result directly in problem solving. It is difficult to fit long-term research programs that are essential for advancing weed science into the required five-year plans and goals. As a result, many projects did not match well with the goals. The projects focused on important problems, and outcomes were presented in terms of problem solving. However, few reports on applied work were listed, so it was unclear how much direct impact the research in this component had on agricultural practices or their adoption. Nevertheless, it was clear that the research advanced the understanding and development of ecological approaches for weed management, particularly in modeling and quantifying reproduction.

Component VIII – Chemical Control of Weeds

ARS should be the leader in this area. The public and land managers rely on ARS as an unbiased source of information on the benefits and risks of synthetic and natural herbicides. Land managers interested in an integrated control program need unbiased results to justify their decisions on management approaches. There was an unbalanced

effort reported between minor crop herbicide research, new herbicide technology, and resistance issues. Herbicide application is the primary way weeds are managed in most cropping systems. However, there was limited research reported on herbicide resistance in weeds, application technology, herbicide movement, or the use of herbicides for controlling invasive species in non-cropland

Component IX – Biological Control of Weeds

Of the four weed components, this was one of the two strongest. Biological control of weeds is one of the strengths of the NP304 program. Research reported addressed most goals, some better than others. It was not clear whether the weakest goals were not addressed, were not as far along, or were not carried out to an endpoint. ARS can and should invest in long-term projects like this. This Component had high or medium quality and relevance overall. The section on "integrating biocontrol with other weed management areas" was not addressed here, though may have been elsewhere.

Component X – Weed Management Systems

This Component had some strong research directions under which ARS has made good contributions to science and management in agriculture. There is a greater need for approaches that integrate biological, chemical and mechanical control techniques, and for studies that evaluate them together, both in crop and non-crop situations. This is one of the Components in which ARS needs to greatly enhance the technology transfer of the research results, so that end-users can put the results to work.