American Soybean Association

The American Soybean Association (ASA) welcomes the opportunity to provide comments for the development of the US Department of Agriculture (USDA) Research, Education and Economics Office (REEO) roadmap. Our ideas have not changed – they are compiled from earlier comments to USDA on research. What has changed is the economic and political environment that brings these ideas into focus and underscores the critical challenges that face American agriculture.

Among all of the compelling options, the Obama Administration has identified reducing the costs of health care and energy as critical to working our way out of the economic crisis and future debt burden.

Most Americans understand that food and its components are key to optimizing human and animal health. The need to understand how dietary components interact with genetic, physiological, sociological, and environmental factors is critical and arguably disease prevention is more effective and more efficient than curing diseases – yet $10 billion was provided to the National Institutes of Health (which has traditionally operated on a disease combating rather than a disease prevention paradigm) in the economic stimulus package and NO funding was provided to USDA for research on food.

Land can be used to produce energy or as a user of energy and American farmers and foresters own 75 percent of the nation's privately held land. Or, to restate – production agriculture can be a source or sink for carbon dioxide - part of the problem or part of the solution. The total energy stored each year in plants through photosynthesis is about 1000 times the global energy consumption.[1] While green technology innovators attempt to mimic photosynthesis, plants capture less than 3 percent of the sunlight that reaches Earth and that is enough to fuel demands of all living organisms – -and some technology. However, the Department of Energy not USDA received more than $5 billion for research on energy in the economic stimulus legislation. NO funding was provided to USDA for research on improving understanding of carbon sequestration on cropland or making photosynthesis even more efficient or on agronomic practices that minimize the use of inputs.

So these questions about how to identify priorities for agricultural research and focus resources are timely and crucial – and, perhaps, there is the political will to implement effective changes.

[1] "Energy Information Administration - International Total Primary Energy Consumption and Energy Intensity Data," http://www.eia.doe.gov/emeu/international/energyconsumption.html.

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1. What types of current and future critical issues (including those affecting citizens, communities and natural resources) does agriculture face that no USDA entity could address individually?

Over the past decade a wide net has been cast over the plant kingdom that has led to vast improvements in understanding of genes and pathways - and to vast amounts of data. The overarching research priority for the U.S. soybean industry is to translate the data generated from sequencing the soybean genome (as well as from model and other species) into even more efficient production of an even higher quality crop for the good of the environment, the U.S. economy, human health globally, animal production -- and for U.S. farmers.

The need to develop the tools to translate the knowledge gained from genomics research is a challenge that transcends crops, regions and disciplines. The tools needed to jump the translation gap – including diagnostics, statistical inference and decision support systems – are being developed to translate understanding of the human genome to treatments and therapies so the path is being paved.

In the United States, genomics research efforts have been led by the National Science Foundation (NSF). But, the mission of NSF is to support fundamental and basic science discoveries, not to translate basic research to the benefit of agriculture, consumers and the environment. So who will support translational research? While the USDA Agricultural Research Service (ARS) sees this as part of its mission, it is not clear that ARS programs can meet the immediate translational and applied research needs of production agriculture. Nor does such a solution take full advantage of the creativity and ingenuity of researchers outside the federal government. And the ARS solution leaves the training of the next generation of researchers out of the equation – which is clearly unacceptable when so many pressing issues depend on agricultural production.

Another issue that transcends USDA entities and indeed Federal technical agencies is measurement. Last year, the National Institute of Science and Technology (NIST/Department of Commerce) convened a conference that confirmed that current bioscience measurement capabilities are inadequate for dealing with complex biological systems. For example, although it is understood that dynamic changes in the expression and activity of proteins are at the root of most diseases that limit production efficiency, the capability to accurately measure and visualize the dynamic interactions of thousands of proteins involved in "disease signatures" is lacking.

The soybean industry's list of needs for advances in measurement runs the gamut from: inexpensive infrared spectroscopy to analyze protein at processing plants; to state-of the-art analytical equipment in metabolomics laboratories used to identify the small compounds that contribute to human and animal health; to the tools to readily distinguish natural environmental changes from those that are caused by human activities.

2. What criteria should USDA use to prioritize agricultural science (i.e., research, education, and extension) investments to address these issues?

The past successes of federally funded agricultural research and education have provided America and the world with abundant, safe, nutritious, low-cost food, but these past successes do not argue for the *status quo*. It is timely for USDA to rethink how agricultural research is prioritized in light of the importance of agriculture to the nation and the unprecedented scientific advances that have fundamentally revised our ability to understand how to grow food efficiently and responsibly.

Other technical agencies have approached the question of how to prioritize research in approximately the same way as USDA – by appointing advisory boards – but with different outcomes. The National Science Board at NSF establishes the Foundation's policies within the framework of relevant national policies identified by the President and Congress. The Board identifies critical issues, approves the strategic budget directions, the annual budget, new programs and major awards. It analyzes NSF's budget to ensure progress and consistency along the strategic direction set for NSF. The Board also serves as an independent body of advisors to the President and Congress on broad national policy issues related to science and engineering research and education. This is nothing like the function of the NAREEE Board at USDA.

At the National Institutes of Health, each of the 27 Institutes and Centers with its own mission and own advisory board determines how to allocate its own funds. The Office of the NIH Director is responsible for coordinating the programs and activities of all the NIH components.

Another example of a model for selecting priorities is the National Plant Genome Initiative described in question #4 below in which an inter-agency group came together under the auspices of the White House Office of Science and Technology Policy (OSTP) to coordinate research on an identified national priority.

Any of these models might serve to guide USDA.

Congress clearly has a role in identifying priorities, but neither the parochial interests of Members of Congress nor their constituents are serving farmers well by identifying the agricultural research problems and opportunities of highest national importance through earmarks.

3. How might USDA better coordinate agricultural sciences among its various agencies and with its partners?

Improved coordination is usually an outcome of a clear vision of the priorities and policies that focuses funding on problems rather than institutions, regions, or disciplines. Developing competitive programs around these big problems such as those identified in #1 is not picking one "entity" over another – it is a proven strategy for focusing interdisciplinary, integrated resources on a problem to solve it efficiently and effectively.

But the competitive programs for agriculture remain sorely under-funded. We are hopeful that the changes brought about by the 2008 Farm Bill in the agricultural research infrastructure will result in a more positive appreciation in the Administration and Congress for the agricultural research enterprise.

Certainly, the old model of distributing resources on a regional or institutional basis must be revisited. As long as decision making about funding for agricultural research is political, it will be poorly coordinated, less effective, less productive – and ironically – remain underfunded. The genetic basis of drought tolerance or carbohydrate metabolism in fish is not bound by region nor is the training of researchers to tackle these problems. Although it is appropriate to continue to provide some funding to support the research infrastructure, many studies, commissions and reports on the agricultural research system have urged USDA to increase the proportion of grants awarded on the basis of open competition judged for scientific merit.

4. What are some examples where agricultural sciences are successfully coordinated for maximum benefit? Why are they successful?

The National Plant Genome Initiative (NPGI) is an impressive example of coordination within USDA and across Federal research agencies. The result of that leadership led to coordination with industry and international stakeholders. The rationale for NPGI and expanded investments in *plant genome research* was described as "straightforward and urgent" and declared "Plant genomics provides a foundation for rapid, fundamental, and novel insights into the means by which plants grow and reproduce, produce organs and tissues essential to human nutrition and energy production, adapt to different and often difficult environments, and help stabilize ecosystems." This Initiative has lived up to its stated purpose and has provided data and tools to industry, education to new researchers and innovation for years to come to farmers.

It succeeded in large part because of the timeliness of the science and the inter-agency collaboration – but above all because it involved a group of strategic thinkers willing to set aside parochial interests for the benefit of the biological sciences and U.S. agriculture. In 1997, the Interagency Working Group on Plant Genomes (IWG) was established by OSTP. At the time, very little crop genomics was being pursued in the public sector. IWG members, which included representatives from NSF, USDA, the U.S. Department of Energy (DOE), NIH, Office of Management and Budget (OMB), and OSTP, were charged to: "(1) identify science-based priorities for a plant genome initiative; and (2) determine the best strategy for a coordinated Federal approach to supporting such an initiative, based on respective agency missions and capabilities." The total U.S. investment in competitive, peer-reviewed plant biology, including the flagship research programs, is less than $1 billion per year, roughly 30-fold less than comparable totals from NIH for programs focused on human health.

For its first 10 years, NPGI focused on: (1) studies of the organization of genomes and (2) studies that related genome structure and organization to plant function. The agencies involved in the NPGI insisted that researchers, in our case the soybean genomicists, organize themselves to develop priorities within the community if they were to participate. Regional, institutional and disciplinary “turf” was trumped by the availability of funding for high quality, focused research.

NPGI set an example for industry, too. The national soybean checkoff coordinated closely with USDA/ARS and CSREES and with NSF. Each institution funded strategic research projects. At the same time, our industry took a leadership role in working with USDA/ARS and NSF to organize the Legume Crops Genomics Initiative (LCGI) to work across legumes to leverage genomics information for the benefit of U.S. crop legumes. The result was a well-coordinated program at CSREES/NRI that encouraged researchers to work across species and with bioinformaticists to develop hypothesis driven proposals. In addition, as the result of this strategic planning and collaboration, the soybean genome was sequenced by the DOE/JGI.

Now, the focus on NPGI has moved to phase (3) - the “Application of the genomic information and knowledge for development of improved plants and novel plant-based products for human uses” which falls directly into the purview of USDA.

In part as a result of the encouragement of the agencies involved in the NPGI, the soybean research community has led the way with developing research roadmaps. Following the example and success of the Soybean Genomics Strategic Research Plan and the LCGI, the arrival of Asian soybean rust (ASR) in the fall of 2004 set in motion an unprecedented response – a coordinated effort between industry, USDA and academia on education, research, monitoring, and information distribution.

The Integrated Pest Management Pest Information Platform for Extension and Education (ipmPIPE) began shortly after ASR was found in the US. The dilemma the farmer faces is whether to spend thousands of dollars to apply fungicides to the crop as a preventative measure or withhold treatment and risk the loss of the entire crop. The web-based ipmPIPE system uses pest and crop data from strategically located plantings. Analysis of the data and information from predictive models is available to guide farmers’ decision making. The ipmPIPE is attributed with saving millions of dollars in unnecessary fungicide applications and with providing farmers with timely information on fungicide applications in cases where spraying was called for. Five USDA entities, other federal agencies, universities and the farmers themselves through the state and national soybean check-offs have contributed resources – funding, labor, and expertise.

ipm-PIPE is an excellent example of coordination not only across institutions, but across disciplines – research, education and extension. It is a good example of USDA’s listening to their constituents, as the pressing need for an early warning system for soybean rust came to USDA’s attention. Ongoing funding for this valuable tool remains uncertain.

5. What are some examples where agricultural sciences are not coordinated effectively? Why is coordination lacking? What are the barriers?

Aquaculture research may be the "poster child" for well-funded, poorly coordinated research attributable to entrenched factions. Given the role of Congress, state recipients of formula funds and the various USDA agencies in the allocation of funds, lack of coordination is not surprising.

Globally, aquaculture is the fastest growing animal food production system. Most of this growth is offshore and overseas. Seafood imports are the second biggest contributor to the U.S. trade deficit – more than $9 billion per year. But a sustainable, environmentally-friendly marine aquaculture industry, preferably in the U.S. (but at least for the next 10-20 years abroad) requires a renewable source of feed with minimal waste. And U.S. agriculture is uniquely positioned to provide those diets. But research is needed to understand why many marine species of economic interest have problems digesting plant protein.

Approximately $100 million is spent by federal agencies annually on "aquaculture research." Nevertheless, progress toward developing alternatives to fishmeal in aquaculture diets has been inefficient and expensive. Funding for aquaculture research is a patchwork of earmarks. There is little coordination among NOAA, USDA, NSF, DOE, DOI, EPA and USAID despite their participation in the Joint Sub-Committee on Aquaculture (JSA) under the National Science and Technology Council (NSTC) of OSTP.

As an unprecedented number of species are domesticated, there are opportunities to bring new knowledge and genomics tools to bear on issues surrounding domestication – including the tools of nutritional genomics to hone feed efficiency, minimize waste and optimize nutritional value of plant feedstocks. But this requires coordination across agencies, across disciplines, and, indeed, across nations.

To that end, the United Soybean Board has supported the development of the Plant Products in Aquafeed (PPA) Strategic Research Plan that identifies the research needed to optimize plant-based diets for marine finfish. International experts including USDA and NOAA program managers and researchers were involved in developing the plan. Recently, NOAA and USDA have formed the "Alternative Feeds Initiative" and are working closely with the aquaculture and feed industries under that umbrella. Nevertheless, despite the interest and cooperation of most of the program managers that fund aquaculture research, there is not yet a process for identifying how to coordinate research resources within USDA or across agency boundaries.

To overcome these institutional barriers and to fulfill the global demand for nutritional alternatives to fishmeal, the American Soybean Association continues to recommend that AFRI implement a $10 million competitive program with the goal of expediting the development of nutritious, sustainable diets for aquaculture production through the integration and translation of both fish and plant genomics.

Another example of an apparent lack of coordination of USDA research is in the area of biobased industrial products. ARS researchers interact regularly and have collaborated with the state and national soybean check-offs which also fund many projects at land grant universities. However, the coordination between CSREES and ARS is not readily apparent.

In addition, the joint research activities of USDA and DOE under the Biomass Research &Development Initiative (BRDI) appear not to be coordinated with either ARS or CSREES. While the USDA Office of Rural Development, the USDA lead on the BRDI, is not a research agency, it has provided funding to commercial entities to develop biopower and biobased products. Some may even be the result of research at ARS or CSREES labs. But coordination among USDA agencies is not evident.

6. What else might USDA do to improve coordination of science; enhance USDA's ability to identify issues and prioritize investments; and elevate its role in science implementation and coordination?

The challenges faced by USDA in revamping how research priorities are identified and how resources are allocated in a coordinated manner cannot be overstated. As a small, but potentially significant step toward improving how Americans perceive and understand food production and agricultural research, REEO might consider encouraging research projects to incorporate Research Experiences for Teachers (RET) type education programs. The NSF and the Department of Education fund RET programs. The idea is that K-12 teachers work alongside researchers doing real research as part of their ongoing continuing education. Unlike most other “education” programs, it has been proven that this one works - teachers doing research (learning to solve problems and to evaluate data) translates to student understanding.

The soybean industry through ASA will continue its leadership role in support of adequate funding for an agriculture research system that lives up to the needs of farmers and consumers. Thank you for the opportunity to provide these comments.

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