USDA-ARS Agricultural System Competitiveness & Sustainability
Customer Workshop
February 22, 2012

<u>TOPIC QUESTION 1:</u> What knowledge or technology would improve our abilities to produce an agronomic crop in systems that are profitable and will ensure environmental stewardship?

Facilitator: Mark Burgess
Recorder: Bob Larkin

Please capture what you feel is important to share with the group in post-breakout report & discussion.

Summary of topics below:

Nutrient management – right mix of amount, timing, application for efficient production, reduce run-off, environmental impacts, etc. Manure issues. Programs that address these issues

In Organic systems, harder to determine adequate nutrition needs, applications. Also use of precision ag approaches to better determine management for organic production.

Water quality issues – similar to above. Water shortage aspects

Water quantity – water availability in crop producing areas. Systems that use water more efficiently. Alternative cropping systems that make better use of water resources. Developmnent of new crops that are more drought tolerant, use in cropping systems.

Converting rangeland to cropland – problems, issues. Bioenergy influence on grain production, prices. Growing grain biofuel crops on land not previously used for agronomic crops

Organic grain production, resource conservation. Organic growers need more info on nutrient management (NPK) in organic systems.

Developing effective cropping systems for production systems. Soil quality, management issues

Optimal crop rotations research

Challenges to getting multiple species of cover crops established, integrated into cropping systems

Cover crops - timing, establishment, multiple benefits (pest & disease suppression, nematodes, etc)

Soil temperature (cold, warm) issues magnified in organic production.

Fitting energy crops into existing cropping and production systems. How fit into systems – total contribution, benefits, limitations, etc. Same with cover crops – how fit into systems. Cost aspects, benefits

Benefits of no-till – maintain no-till in improved cropping systems

Environmental stewardship – Fate and transport of agricultural inputs. Research at all scales, from field to watershed. Technology – improved ability (remote or nano-sensing, enhanced technologoies) to measure fate and transport of materials

Conversion of land from agriculture to non-agriculture uses. Factors influencing the removal of agricultural land

Farm as lab. Use farms as research units through technology. Use whole farm data to understand systems through utilization of advanced technologies. Precision science

Herbicide Resistance issues. Relation to and role in cropping and farming systems. Research Opportunities in this NP? Ecological approach to weed management, relationship to herbicide resistance.

Integration of agronomic and specialty crops, as well as integration with crop and livestock issues. Improving crop residue issues, pest problems through integration of crops and systems. Mixing traditional crops with specialty.

USDA-ARS Agricultural System Competitiveness & Sustainability
Customer Workshop
February 22, 2012

<u>TOPIC QUESTION 2:</u> What knowledge or technology would improve our abilities to produce specialty crops in systems that are profitable and will ensure environmental stewardship?

Facilitator:
Recorder: Bob Larkin

Please capture what you feel is important to share with the group in post-breakout report & discussion.

Summary of topics below:

Same issues as #1, but also these:

Research focused on food-borne pathogens in Ag systems, specialty crops. Origin, fate, transport, movement. Effects of changes in crops, production systems, and conservation practices on pathogens.

Residue issues in continuous specialty crop production. Leading to soil quality, productivity problems.

Improving soil quality through improved cropping systems. Increased research on perennial crops in this aspect. And Agroforestry. Weed control, water management in perennial crops.

Mechanization, Ag engineering aspects in specialty crop production systems. Specialized equipment issues for specialty crops. Resources, opportunities.

Management system effects on carbon sequestration. Temporary vs. permanence of C sequestration. Implications for future C trading, limits, economics, etc.

Improved crop varieties that are publicly available, locally adapted, and have desirable qualities for organic and specialty crop programs. Integration of crop variety research with sustainable production systems. Integration on-farm for improved production systems.

Adoption of organic agriculture in regions it is not well-developed. Limitations, obstacles to organic production in these regions (i.e., south). Regional food production for local markets.

USDA-ARS Agricultural System Competitiveness & Sustainability
Customer Workshop
February 22, 2012

<u>TOPIC QUESTION 3:</u> What knowledge or technology would improve our abilities to produce crops and livestock from integrated systems that are profitable and will ensure environmental stewardship?

Facilitator:
Recorder:

Please capture what you feel is important to share with the group in post-breakout report & discussion.

Summary of topics below:

More animals and manure production than land can handle. Nutrient management and distribution issues.

Historically (in past), most Ag was integrated. Need to incorporate old, existing knowledge of these systems with modern research and technology for improved systems. Specifically, with regards to current human pathogen research.

How does the future of food livestock production fit into current ag production systems? New technologies (molecular genetics, genomics, etc.) - what we expect to see in the next several years– how to incorporate or accommodate into ag systems now?

Gaps between what the market wants and what the systems currently provide.

Grass-fed beef and small ruminants is an option and should be incorporated into production systems.

Seasonality aspects of livestock production and relation to processing facilities. Processing available, but season needs to be expanded or broadened for optimal production.

Integrated plant-animal model that incorporates all the aspects of both animal and crop production systems.

What needs to be done to ensure and maintain animal welfare with changing production and management systems? Sustainability issues.

USDA-ARS Agricultural System Competitiveness & Sustainability
Customer Workshop
February 22, 2012

<u>TOPIC QUESTION 1:</u> What knowledge or technology would improve our abilities to produce an agronomic crop in systems that are profitable and will ensure environmental stewardship?

<u>TOPIC QUESTION 2:</u> What knowledge or technology would improve our abilities to produce specialty crops in systems that are profitable and will ensure environmental stewardship?

<u>TOPIC QUESTION 3:</u> What knowledge or technology would improve our abilities to produce crops and livestock from integrated systems that are profitable and will ensure environmental stewardship?

Facilitator: Gail Wisler
Recorder: Betty Marose/Noel Gurwick

Please capture what you feel is important to share with the group in post-breakout report & discussion.

Summary of topics below:

We considered what NP216 should do now in service of achieving a sustainable agricultural landscape in the U.S. on a 100-year time frame.
We first discussed what sustainability means and our points echoed many of those in the NRC 2010 report that had also come up in the morning's remarks. Characteristics of the agricultural landscape we hope will cover the U.S. in 100 years include:

- Lose no nutrients from the system.
- Less Haber-Bosch nitrogen inputs.
- NO petroleum inputs.
- Resilient to climate change, including tolerant to drought.
- Profitable. And not only profitable for the landowner but also for land managers, laborers, and all others who contribute to the enterprise of growing crops throughout the value chain. (We noted that in the past a single person held all these roles, but that's no longer the case.)

To achieve this objective, we need to start working now, and research in the NP216 needs to address the following features:

- Diversity. Diversity includes both spatial and temporal diversity – a wide variety of cropping systems across the landscape and a diversity of crops grown on the same piece of land at different times.
- More 'roots in the ground.' It is understood that having more plant roots in the ground more of the time helps build soil organic matter, keep nutrients on the land, and achieve the other attributes associated with sustainability.
- Cover crops (both breeding and agronomy). The benefits of cover crops are generally well-accepted. There is a strong need to breed cover crops so that growers have a wider diversity from which to choose given particular cropping systems, climates (now and in the future), soil types, and so forth. There is also a strong need to understand the agronomic factors that support growers' abilities to incorporate different cover crops into their farm systems. Knowledge and associated guidance for using a mix of cover crops on a field (vs. a cover crop monoculture), for a wide variety of agricultural systems, is also badly lacking.
- Perennial grains. Both alone and mixed with annuals, perennial grains could be a dominant part of way the world feeds itself in the future. But research on their breeding and agronomy is in its infancy. There is a strong need to investigate and develop the potential of this approach.
- Longer, alternative rotations. It is well-known that crop rotations confer many benefits in terms of breaking pest cycles, building soil organic matter, and closing nutrient cycles. There is a strong need to identify historically-valuable rotations and develop new ones that decrease financial reliance on a small number of crops, are regionally-appropriate, provide flexibility in a changing climate, and can support integrated crop-animal agriculture.
- Organic production systems. The NRC called out organic agriculture as a sustainable system for which a market already exists. But organic systems themselves are highly diverse, with enormous room for development and optimization. NP216 needs to take on the challenge of filling that space so that we can all reap the benefits of organic systems.
- Sustainability research for small growers. NP216 ought to support and develop approaches to sustainable agriculture that work at small scales or that are scale-neutral, not favoring homogenous, large acreages and/or growers with access to large amounts of capital, and that benefit what we call specialty crops (which include almost all the crops that we need for a balanced diet).

Approaches to agriculture exist that some consider sustainable and that fall more within the model of incremental improvements to the dominant model of row crop agriculture in the U.S. today. In general, our discussion concluded that there is ample support for incremental approaches from the private sector and from other pots of public sector research support. It is, after all, much easier to make small improvements on an existing system than it is to develop significantly different systems. Therefore, although one NRCS representative noted the frequent requests for NRCS assistance to increase nutrient use efficiency and the associated need for research to support that part of NRCS' mission, our discussion strongly favored using NP216 funds to support and promote transformative approaches to sustainable agriculture. We took the view that other aspects of agricultural research related to sustainability – like precision agriculture – receive ample support from elsewhere, and that transformative approaches that can reach commercial scale in 50-100 years can only come to fruition if we make a deliberate and concerted effort to develop them now.

All of the features we identified as needing attention can be articulated as researchable questions with testable hypotheses. For example:

- What kinds of rotations will deliver all these benefits in different places?
- How much diversity is needed, spatially and temporally, to confer attributes like resilience to climate change to the agricultural landscape?
- To what extent are different ecosystem services influenced by different mixtures of cover crop species in different soil-climate zones?

The ARS has a unique capacity to fill the needs we identified. It has broad geographic coverage (enabling region-specific research and comparative studies that can leverage research findings), land for experiments and demonstration plots, structural capital like laboratory facilities and field equipment, highly-trained staff, and the ability to engage in long-term, high-risk research. All these attributes leave ARS uniquely and strongly-positioned to carry out the kind of research agenda we articulated above.