AAIC Annual Meeting

Industrial Crops: Developing Sustainable Solutions

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"How agricultural research helps build the bioeconomy and a sustainable future"

Good morning. Thank you for that kind introduction and thank you to the Association for the Advancement of Industrial Crops for inviting me here to speak. USDA scientists have long worked on industrial uses of crops and industrial crops themselves. I'm proud to see researchers from the Agricultural Research Service in leadership roles in this organization, on its board, as well as many National Program Leaders from the National Institute of Food and Agriculture involved in AAIC too.

My role at USDA is to serve as the Chief Scientist and Under Secretary for Research, Education, and Economics, which includes both of those agencies. In that position, I coordinate our work in those areas across the Department. Today I'd like to talk about the importance of two kinds of innovation – scientific

innovation and policy innovation – that help build a biobased economy and a sustainable future. We'll need both kinds of innovation to meet the food and ag challenges before us.

Among those challenges is the ambitious goal Congress has laid before us regarding biofuels. The Renewable Fuel Standard mandates that by 2022, our nation must produce 36 billion gallons of renewable fuels per year, which will help the United States be energy independent and help address climate change. Achieving that level of biofuels production can be both a guiding star for our research and policy, as well as the foundation for stronger rural communities with good jobs that a biobased economy brings with it. Industrial crops like switchgrass, oilseeds and dedicated woody biomass will be a large part of that equation are one the best solutions for fueling a domestic, renewable bioeconomy – a marketplace built on the necessary transition our society will need to make from traditional fossil fuels to fuels that come from renewable biomass and sustainable agricultural stocks.

Industrial crops and biotechnology has an important role to play in the *scientific* innovation of agriculture. Despite its name, "biotechnology" is as old as

agriculture itself – in many ways they are one and the same. Directed selection and later, hybridization have been foundational principles of world agriculture since its inception roughly ten thousand years ago. While the techniques are new, the principles and the fundamental goals – the intelligent cultivation of nature to meet human needs –are longstanding.

Today's science allows us to do a lot more than with what we sometimes call 'conventional' breeding. In some ways this science has progressed so quickly over the past few decades that it has outpaced policymaking.

With a major food crisis looming on the horizon, we need to make sure our *policy* keeps pace with our science. This can't wait – the world needs to intensify agricultural production by 70-100% by mid-century to meet the projected demand for food, and do so in the face of even greater environmental challenges.

A sustainable future requires that we produce enough food and energy to keep our population fed and our world running. The question is, how do we do both? How can we produce more food as well as more feedstocks, *and* do it sustainably? The solution is research – only scientific innovation can enable us to

sustainably intensify ag production to meet our future needs. And only a forward-thinking ag science policy can establish the right environment to help this research blossom.

When I was appointed, one of the first projects I undertook was to talk to reach out to stakeholders, to experts within USDA and across our wide range of university, industry, and farm and commodity groups to create an Action Plan that would guide our work so that we could answer the call of science policy in the most efficient and effective way. As budgets became more constrained, the Action Plan really became a touchstone for our work, as it became clear that collaboration and coordination were going to be necessary to support our core mission. Partnerships are key to this method of working – especially our long-standing partnerships with universities.

To a large degree, the core of that mission is to do the fundamental research – genomics and genetics in particular – that private industry can't afford to, or won't, do. This is vital in agriculture, which relies more heavily on improvements in technology for growth than almost any other sector of the economy.

Fortunately, as the productivity achievements of the past century demonstrate, there is still much to be learned, and gained, from agriculture. The global chemical industry is projected to expand by 6 percent per year by 2025. USDA estimates biobased chemicals can comprise over 20 percent of that growth. Our genetic and biochemical research is working to unlock some of the most promising fundamentals of plant life to exploit their vast potential. The applications are wide-ranging, from new sources of food and nutrition to making use of byproducts to the generation of renewable bioproducts and biofuels.

USDA bioenergy research focuses on developing the best feedstocks for biofuels; producing feedstock crops sustainably; and converting feedstocks to fuels and other products that are profitable for everyone in the chain from producer to consumer.

Recently the National Institute of Food and Agriculture announced the sixth Coordinated Agricultural Project that has brought together academia and industry to develop a regional sustainable biofuels and biobased products system. Combined with the five joint Agricultural Research Service-US Forest Service Regional Bioenergy Research Centers, the REE Mission Area has invested over

$200 Million to support research along the bioeconomy supply chain while also serving as incubators for small businesses. Our programs, such as the Biomass Research and Development Initiative, support public-private partnerships to bridge the commercial “valley of death” and bring biobased products to market.

Because many materials needed for the bioeconomy are produced in rural areas and transferred to more urban areas, the bioeconomy offers great benefits across a spectrum of communities that are currently in need of an economic boost. Strong regional bioeconomies are built on local farmers and landowners who provide the essential feedstocks for bioproducts.

USDA has been working on these challenges for decades and is a world leader in building the foundation of the global bioeconomy. At the core of this shift is the continued sustainable production of food and fiber to support a growing population, protecting an environment that provides clean and abundant water and air, and maintaining human health and well-being. So this work isn’t without its challenges. But the costs of not doing it are just too great. And we know from past experience that the solutions are within reach.

So, what does it take to ensure a growing bioeconomy?

- Scientists must have access to a wide range of genetic diversity to design varieties and systems that are resilient to unfamiliar pests, diseases, and environmental stresses;
- Scientific research and the policies it supports must enable fiscally sound biorefineries to produce a variety of low cost, high-performance bioproducts that compete effectively against petrochemical materials; and
- We must develop and cultivate a new generation of scientists, farmers, and ranchers who have the technical skills to support these emerging industries.

So we need the right leadership – leadership firmly rooted in science, leadership willing and able to exploit the full range of resources we have, and most of all, leadership that's not afraid of change.

We also know we can't achieve these goals with science that is constrained by borders. The food and ag challenges we face are global in nature, and the solutions must be too. We live in a time when technology makes the prospect of a globalized "open science" a reality.

Today, only open science can get us where we need to go. Open science means collaboration. Open science means coordination. Open science means sharing resources to maximize research productivity. And it means sharing the tools to help people help themselves. Because public ag research occurs in a precompetitive space, reflecting our continued commitment to the protection of intellectual property protection in the marketplace – we know that expanding access to it only enhances productivity and innovation.

There is a lot that can and should be done to make global food and ag R&D better coordinated, more efficient and more effective. Fortunately, the world's attention is beginning to turn towards these issues. Greater direction on priorities and targets and increased transparency in global agricultural research and investment can *catalyze* growth and support the long-term sustainability of ag systems and natural resources.

So far, there are promising *pockets* of international collaboration for specific initiatives – like wheat – or for select regions or countries – an example here is the Global Conference on Agricultural Research for Development (GCARD) for developing country needs. But we can do much more to coordinate *all* global ag

research to strengthen research planning, encourage knowledge sharing, and foster necessary productivity gains. This is all the more critical given that the economic situation in the E.U. and the U.S. has led to reductions in government funding of ag research.

In 2011, both the G-20 Ag Ministers Group and the G-20 Development Working Group recognized the need for increased cooperation on international agricultural research and development as critical to achieving increased and sustainable global ag productivity. This year both G20 and G8 undertook additional action on these initiatives, with ag research as an important item on their agenda.

Through initiatives that the G8 and G20 leaders committed to, we're working to develop what we see as **six strategic platforms** to achieve sustainable food security. These platforms, once established, will be the fundamental building blocks for fostering the research to reinvent global agriculture, as it's been reinvented over and over again in the past, this time using all the tools in our toolbox to meet the needs of a changing world.

The six platforms are:

1. Open access to scholarly publications – this means maximizing the impact of federally-supported research by making the results of unclassified research, in the form of peer-reviewed scholarly publications, accessible and permanently stored so they may be searched, retrieved and analyzed by the public.

USDA is currently developing a digital repository for scholarly publications. Going forward, this initiative would extend beyond USDA to all government agencies that conduct or support research. Linked with similar archives abroad, these digital resources have great potential to increase global collaboration and research productivity.

2. Open access to germplasm collections - Crop diversity underpins all agriculture throughout the globe. But irreplaceable crop diversity is threatened by extinction in nature and in farmers' fields. Plant breeders turn to genebanks for this diversity, including sources of pest resistance or climatic adaptation. Sharing germplasm resources is a core principle in the United States, but not observed by every country, and so we're working to promote international cooperation.

3. Open access to genomic and genetic data - The U.S., E.U., and many other countries including China have made large investments sequencing crop and animal genomes. This work has transformed and accelerated modern breeding. But the benefits of rich datasets are increasingly going to a select minority of scientists and institutions with access to high performance computing resources and software designed to handle extremely large genetic datasets.

Open access to this data would enable scientists worldwide to fully exploit new genomic information and associated germplasm, including plant and animal breeders from developing countries, including those without sophisticated molecular laboratories. The results could be up to a 50 percent reduction in the time it takes to breed better producing animals and plants, which will help address the urgent need to increase crop and animal yields.

4. Accelerated technology transfer - to bring improvements from lab to field, we rely on tech transfer. A key goal is to establish a global culture of tech transfer and an infrastructure that can make it happen effectively.

An important part of this is global ag extension. We need to reinvent extension for the 21st century, to effectively communicate to farmers how best to use new seeds and other technology. Information communication technologies today have the potential to drive higher adoption of improved ag technology and in turn, improve agriculture globally. This year the G8 negotiated ways to reinvent ag extension for the 21st century, to better address global extension for smallholder farmers, farmer organizations and agribusinesses.

We also want to change the way research advances are brought to market. USDA's Agricultural Technology Innovation Partnership program is a network of geographically-based partnerships between USDA and well-established economic development organizations around the country that work to encourage adoption of USDA intramural research outcomes by U.S. private sector businesses for commercialization. We hope ATIP can serve as a model abroad.

5. Improved global agricultural statistics – In order to know if we are meeting our goals, we must set an accurate baseline for measuring progress on the sustainable intensification of agriculture, and key indicators to measure improvements on top of that baseline as we go along.

6. Finally, we need to establish regular coordination of the world's **chief agricultural scientists on ag research and development.** Currently no forum addresses agricultural research and development from a global perspective, and we risk having duplicative goals or countries investing in research already accomplished elsewhere.

Through the G20, the U.S. proposed a biannual "Meeting of Agricultural Chief Scientists on Research and Development" to coordinate a set of priorities, set targets, and align resources to sustainably increase productivity. We held the meeting in September of this year in Guadalajara, Mexico, and it was an important first step in what has to be the 21st century way of advancing science.

For the first time, the people in charge of their countries' food and natural resources science agencies sat together and forged agreements on how to determine the most crucial priorities for our nations, working together, in the coming years so that we can meet this global food challenge.

We discussed “blue sky” ideas – the wish list ag researchers think may have the greatest potential to transform our ability to meet food needs while conserving precious natural resources: finding ways for plants to fix nitrogen from the air into their tissues, thus decreasing harmful run-off of fertilizers into watersheds; discovering methods to turn annual crops into perennials that don’t need replanting, to reduce soil erosion, labor costs and fossil fuel inputs; and determining solutions to preserve our precious water supply. We agreed upon the urgency of this fundamental research as well as coordinating our research to make the best use of limited government funds.

Perhaps the most important development from the meeting, though, was our agreement to break down the walls between our scientific communities, and use online global platforms to share genomic and genetic data, improve agricultural innovation systems, and open access to scholarly publications and other technical documentation.

Open science and open data will ultimately help decision-makers, companies, researchers and – most importantly – farmers, access and effectively use new forms of critical agricultural knowledge, information and technology. These new

resources are essential for achieving the sustainable intensification needed to ensure future food security and help the bioeconomy grow.

Between now and 2050, today's ag science *students* will be doing the research, producing new products, and making the policy decisions that will determine whether the world will surmount the challenge. We need the leadership *today* to set the stage for this work to begin. These six platforms can be a big part of this.

People are *thinking* more about both food and energy these days. This interest is a great opportunity, one we in the scientific community can't afford to pass up. We need to nurture this interest with a clear and focused vision of where we need to get to, and how we can get there. With a plan for open, collaborative science, we can turn this interest into the action the world desperately needs.

Thank you for the invitation to be part of this meeting, and for the leadership role that AAIC plays.