White Paper

Animal Agriculture's Vision to Feed the World: Merging Values & Technology

Information synthesized from April 16-17, 2013, Annual Conference in Louisville, Ky.: "Animal Agriculture's Vision to Feed the World: Merging Values & Technology"

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BACKGROUND

Animal Agriculture's Vision to Feed the World: Merging Values & Technology was the theme of the 2013 National Institute for Animal Agriculture's Annual Conference conducted April 16-17, in Louisville, Kentucky. The Opening and Closing General Sessions developed for the Annual Conference were a continuation of discussions and sharing of information that began at NIAA's 2012 Annual Conference that focused on the theme *Living in a World of Decreasing Resources & Increasing Regulation: How to Advance Animal Agriculture*.

The National Institute for Animal Agriculture (NIAA) is a non-profit, membership-driven organization that unites and advances animal agriculture: the aquaculture, beef, dairy, equine, goat, poultry, sheep and swine industries. NIAA is dedicated to furthering programs working toward the eradication of diseases that pose risk to the health of animals, aquaculture, wildlife and humans; promote the efficient production of a safe and wholesome food supply for our nation and abroad; and promote best practices in environmental stewardship, animal health and well-being.

NIAA membership encompasses producers, producer organization leaders, veterinarians, scientists, academicians, livestock and poultry extension personnel, Federal and State government representatives and allied industry professionals.

The Annual Conference was funded in part by Allflex USA Inc., Alltech, American Veterinary Medical Association, Brownfield, Dean Foods, Farm Credit, Fort Supply Technologies, GlobalVetLink, Illinois Farm Bureau, ITS Global, Kentucky Cattlemen's Association, Life Technologies, Livestock Marketing Association, Merck Animal Health, Merial, National Livestock Producers Association, Penton Media (BEEF magazine and National Hog Farmer), Pfizer Animal Health, the Pork Checkoff, Tetracore, The Ohio State University College of Veterinary Medicine, USDA/Veterinary Services, Vance Publishing Corporation (*Pork* magazine, *Drovers/CattleNetwork*, *Dairy Herd Management* and *Bovine Veterinarian*) and Where Food Comes From.

PURPOSE AND DESIGN OF THE SYMPOSIUM

The world's population is projected to exceed 9 billion by 2050. The responsibility of providing an abundant, affordable, safe food supply must be delivered while protecting the resources that sustain us: the land, water and air.

Scientific innovations—practices, products and genetics—have significantly enhanced the quality and quantity of food production. Today's farmers and ranchers can grow more food with greater efficiency, allowing them to feed more people while consuming fewer natural resources and generating less animal waste:

- Since 1944, annual production of milk per cow has quadrupled in the United States. Modern production of every gallon of milk requires 65 percent less water and 90 percent less land than it did in 1944 and 76 percent less manure is being produced for each gallon of milk sold. In addition, the carbon footprint for a gallon of milk in 2007 was 63 percent lower than it was in 1944.[1]
- Research also shows meeting demand for beef today takes one-third fewer cattle compared to 1977, with each pound of beef produced in the United States requiring 14 percent less water and 34 percent less land. Beef production today generates 20 percent less manure than in 1977, and the carbon footprint for each pound of beef purchased today is 18 percent lower than it was a generation ago.[2]
- Technologies used today allow an acre of wheat to feed nearly six people while an acre of wheat in 1961 fed about two people.[3]

Achievement of global food security and safety by 2050 is a mission that must be built on four pillars[4]:

1. <u>Science is universal, but solutions are local.</u>

   Although science provides universal answers, solutions must be local, due to wide variations in a number of environmental factors, including climate, soils and pests, as well as cultural traditions and issues surrounding transportation/distribution infrastructures.

2. <u>Collaboration unlocks answers.</u>

   Solutions must be collaborative—reached in concert with farmers, communities, local businesses, governments and non-government organizations (NGOs) who know the "facts on the ground," and with global corporations with specialized expertise to help solve specific problems.

3. <u>Science must become local wisdom.</u>

   Know-how must be brought to the people and places that need it most. Working side-by-side with the population in education and outreach efforts transfers knowledge to the communities who need it to secure their futures.

4. Solutions must be sustainable.
   The food supply must continually expand while also considering social, economic and ecological factors such as infrastructure, storage and waste and improving and preserving water quality.

With a majority of today's U.S. consumers three to four generations removed from agriculture, many do not have a good level of knowledge about agriculture and food production. Research shows that consumers know more about movies (40 percent), politics (45 percent), history (47 percent) and music (51 percent) than they do about food production (40 percent).[5] The same research indicates that only 22 percent of Americans trust that the agriculture industry is transparent about its food production practices.[6]

Findings by the U.S. Farmers and Ranchers Alliance show that anything deemed not "natural" by consumers is a threat: antibiotics, hormones, pesticides, herbicides, biotech/GMOs, chemicals, packaged food ingredients and what they term as "factory farms."[7]

NIAA's Annual Conference "Animal Agriculture's Vision to Feed the World: Merging Values and Technology" was developed so leading experts could share information regarding how to successfully merge technology and values for the benefit of consumers, animal agriculture and a growing hungry world. Conference attendees included producers, producer organization leaders, veterinarians, scientists, academicians, livestock and poultry extension personnel, Federal and State government representatives and allied industry professionals.

Annual Conference Planning Committee Chair:
Robert H. Fourdraine, PhD, AgSource Cooperative Services

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SYMPOSIUM TOPICS, SPEAKERS

"Grand Societal Changes and the Role of Animal Science" – Mr. Lowell Randel, Science Policy Director, *Federation of Animal Sciences Societies*

"What Role Will Animal Biotechnology Play in Feeding the World?"—Dr. Alison Van Eenennaam, Cooperative Extension Specialist, Animal Genomics & Biotechnology, Department of Animal Science, *University of California-Davis*

"Policy That Will Meet the Needs of the Growing Food Supply"—Mr. Bryan Dierlam, Director of Government Affairs, *Cargill*

"Financial Perspective: Impact of Tomorrow's Technology Trends and Developments on Animal Agriculture"—Ms. Deborah Perkins, Managing Director, *RaboBank International—Dallas Office*

"Getting to a Comprehensive Food Safety System"—Dr. John Ruby, Technical Services, *JBS USA*

PRESENTATION HIGHLIGHTS

The world population is growing at 1.1 percent per annum, and urbanization is leading to the Westernization of diets and a demand for higher value-added foods.[8] A result of population growth, income growth and urbanization is increased food demand—with food production needing to grow by more than 40 percent by 2030, and more than 70 percent by 2050.[9]

Agriculture in the 21st Century faces seven challenges that underscore the importance of technology and values merging:[10]

- Managing new pests, pathogens and invasive plants.
- Increasing the efficiency of water use.
- Reducing agriculture's environmental footprint.
- Growing food in a changing climate.
- Managing the production of bioenergy.
- Producing safe and nutritious food.
- Assisting with global food security and maintaining abundant yields.

Research Funding & Agriculture

The President's Council of Advisors on Science and Technology (PCAST) Report on Agricultural Preparedness lists six recommendations to addresses the seven key challenges. Among the recommendations are increasing the National Science Foundation for basic science relevant to agriculture from $120 million to $250 million per year, increasing the U.S. Department of Agriculture budget for competitive funding of extramural research from $265 million to $500 million per year and create six large, multi-disciplinary innovation institutes focused on emerging challenges, funding these at $25 million a year for five years.

The PCAST Report is resulting in "some movement favorable to agriculture."[11]

Farm Animal Integrated Research 2012 (FAIR 2012) brought together more than 160 representatives from academia, government and industry who identified research, extension and education priorities and strategies needed to support animal agriculture for the next five to seven years. Modeled after FAIR 95 and FAIR 2002, FAIR 2012 involved a year-long planning process and resulted in information that will be shared with policymakers in Congress and with Federal agencies.

Three major themes, or areas in which investments in the animal sciences should be focused to meet future needs, emerged from the FAIR 2012 process: food security, One Health and stewardship. The FAIR 2012 report states the following regarding food security, "In order to meet increasing demands in a sustainable way, food producers must continue to increase the efficiency with which they use limited natural resources, placing a premium on increased production efficiency in animal agriculture. Compounding the challenge of increased production with limited resources is the diversion of food and feed crops into bioenergy, effectively taking land and resources out of the food security equation. All of these factors point to the need for increased investments in science to increase production capacity and efficiency."[12]

Addressing stewardship, the FAIR 2012 report states: "Animal agriculture touches many aspects of our society: providing essential nutrition, balancing natural resources, and fostering animal well-being. In order to meet global food demands in a sustainable way, investments in science will be critical to increasing the efficiency with which limited natural resources are utilized. Water quality and quantity are major issues, as

competition for this precious resource intensifies. Society also continues to have concerns about climate change and the impacts that animal production may have on climate. These factors demonstrate the need for increased investments in science. Great successes in resource use efficiency have already been realized through technological innovations. . . "[13]

The FAIR process identified numerous crosscutting issues that apply to each of the three focus areas, including but not limited to, size and scope of needed projects, pipeline for new scientists and industry professionals, enhanced collaborations, increased public awareness, regulations, data mining and risk analysis.[14]

While animal agriculture has a significant impact on America's rural economy and is a major driver for rural America, federal investment in animal science is not proportionate with the economic contributions of animal agriculture.[15] The 2014 Agricultural Research Service's total research programs budget is $108 billion. Of the total 2014 ARS budget, livestock production has been appropriated $73 million, compared to $229 billion for crop production, $219 million for environmental stewardship, $119 million for food safety, $95 million for human nutrition, $85 million for new products/product quality/value-added and 4 percent for other. Funding trends have animal science at a disadvantage, as only two groups saw a decrease in budget from 2013: livestock production and new products/product quality/value-added.[16]

Leadership of the Federation of Animal Sciences Societies is working with the U.S. Department of Agriculture to communicate the role and contribution animal sciences can make toward the goal of feeding the growing world.[17]

Discussions between the USDA and National Academy of Sciences (NAS) in 2012 resulted in the development of a new study "Considerations for the Future of Animal Science Research" that has a six-month timeframe and could start as early as mid-2013. The study has five key purposes: 1) assess global demand for products of animal origin in 2050 within the framework of ensuring global food security; 2) evaluate how climate change and limited natural resources may impact the ability to meet global demands for animal products; 3) identify factors that may impact domestic ability to meet demand for animal products; 4) identify resources needed to develop and disseminate this knowledge and technology; and 5) describe the evolution of sustainable animal production systems relevant to production and production efficiency. The goal is to have results ready to impact FY 2015 government budget process.[18]

Technology, Biotechnology

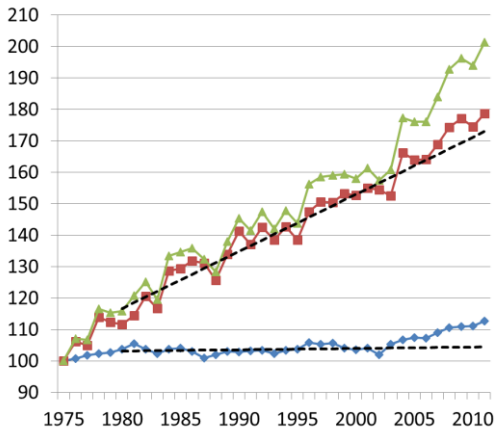
New technology, new production techniques and new ideas can increase efficiency and the sustainable, responsible use of resources and can take the form of biotechnology, energy efficiency, labor-saving devices, water reduction strategies, greenhouse gas (GHG) reduction and technology like Cogeneration.[19] Technologies with a positive impact on profitability will be attractive to players all along the food animal chain.[20]

Consumers, an important part of supply chain, are becoming less trusting and will have an impact on whether technology is taken up. Because consumers don't understand certain things, animal agriculture must help educate them if technologies such as genetically modified organisms (GMOs), antibiotics, etc., are to continue to be used.[21]

Certain capital expenditures will be needed to access certain technology, and farmers will need sufficient scale to access some technology. A challenge is to develop technology where consumers benefit and not

merely develop technology that increases production and potentially lower prices to agriculture. Another factor to have top of mind regarding technology development is that technology acceptable in U.S. may not be acceptable to other countries.[22]

Biotechnology available to U.S. farmers has advanced food production. Until somewhat recently, production increase has been a result of yield and not acreage expansion.[23]



Biotechnology—any technological application that uses biological systems, living organisms or derivatives thereof to make or modify products or processes for specific use—has been greeted with mixed acceptance. While certain biotechnology advances used in genetics and breeding are generally accepted—i.e. artificial insemination (AI), estrus synchronization, embryo transfer, etc., other biotechnology application have not received widespread acceptance, including cloning and transgenesis.[24]

Technology is available or advanced in the research pipeline to feed 10 billion people on a sustainable basis. The question is whether farmers and ranchers will be permitted to use the technology.[25] Theoretically, certain animal biotechnology applications, including genetically engineered animals, would appear to align with many sustainability goals. For example, producing disease-resistant genetically engineered (GE) animals would be associated with better animal health and welfare, and could result in the decreased use of antimicrobial products and improved food safety.[26]

All technology comes with risks and benefits, and there must be some practical considerations of what technology best suits a country and its production system. One technology that has the potential for generating significant impact in developing countries is artificial insemination of dairy cows focusing on increasing milk production in locally adapted breeds.[27]

Several genetically engineered animals have been developed, including chickens that don't transmit bird flu, are a breakthrough that could prevent future bird flu epidemics; pigs that produce omega-3 fatty acids which are known to improve heart function and help reduce the risks for heart disease; dairy cows that are resistant to mastitis; and salmon that result adult size in 16 to 18 months instead of 30 months.[28]

In addition to negative consumer perception pertaining to GE food-producing animals, another key challenge that GE animals face is the extensive length of the regulatory process. A case in point is the fast-growing salmon. The original GE salmon was produced by university researchers in Canada in 1989. FDA review of

their salmon started in 1995, with various FDA hurdles cleared in 2001, 2009 and 2010. In 2011, political efforts were at work to prevent the FDA from regulating GE salmon. To date, the company has expended more than $60 million to bring its fast-growing salmon through the regulatory process and to market, with the final regulatory decision still not announced.[29]

The first GE crops came to market in 1986, and, in 2012, 17.3 million farmers grew GE crop varieties. Humans and livestock have consumed billions of meals without a single case of harm attributable to the GE nature of the materials consumer. Regulatory policies add years and millions of dollars to the cost of developing GE crops and animals. Thus, arises a key question: Is this level of scrutiny aligned to science-based risks associated with the technology or is this level of precaution making the deployment of this technology beyond the means of all but the largest, multi-national corporations—to the detriment of food security globally?[30]

While a blanket approval of all uses of genetic engineering has no scientific case, a scientific case for certain safety testing is lacking.[31] The bulk of safety testing and expenses related to GE animals/fish is to detect "unintended" changes specifically resulting from genetic engineering. Many GE scientists agree that scientific uncertainty does not justify the GE process-based "equivalence" studies uniquely required for genetic engineered animals.[32]

A 2010 report on GMO foods and crops underscores unintended effects challenges: "Skeptics who remain fearful sometimes respond that 'absence of evidence is not the same thing as evidence of absence.' Yet, if you look for something for 15 years and fail to find it, that must surely be accepted as evidence of absence. It is not proof that risks are absent but proving that something is absent (proving a negative) is always logically impossible."[33]

It is argued that the genetically engineered regulatory framework should be connected to the best available science. While regulation to ensure the safety of new technologies is necessary, the trigger for regulatory review should be the novelty of the introduced trait—regardless of how it was derived—and not the process used to introduce the trait. The severity of regulatory control should be related to the actual, relative risk associated with the novel characteristic. Phenotypes with a history of safe use should be exempted from regulatory review regardless of the methods used to produce them. Regulatory frameworks should formally evaluate the reasonable and unique risks associated with the use of GE animals in agricultural systems and weigh them against those associated with existing conventional systems and those of inaction. In addition, the risk should be weighed against the benefits.[34]

Despite biotechnology's ability to increase yields and grow production and food supply, not all countries agree or move with the same sense of purpose or timing. Often product approved in one country may not be approved in another. When the non-approving country is small, this may be a minor issue. When it is a large importing country, however, it can create unacceptable risk for commercial companies—especially if it does not stay segregated from the approved product as it travel through the supply chain.[35]

Key Policy Areas[36]

Six key policy areas can help ensure sustainable, affordable, safe, responsible and secure food for the future:

- Honoring comparative advantage.
- Enable open markets.
- Investment infrastructure.

- Improving agricultural productivity.
- Harmonization of rules and regulations.
- Ensuring success of smallholder farms.

When laying out his arguments of comparative advantage in 1817, David Ricardo argued the world will always raise the most food the most economically if every farmer plants the right crop for the soil and climate and then trades with others. Countries benefit from growing what they are good at, export the surplus and buy what is deficient. Honoring comparative and trade is fundamental to ensuring abundant and secure food for the growing world's consumers.

During volatile times, challenges usually manifest themselves. Poor trade policy based upon snap political reactions to volatility can result in food insecurity. It is also important not to conflate food security with self-sufficiency. Unsustainable decisions could be made, scarce resources consumed and irreparable ecological damage done in the name of self-sufficiency when the right answer is to trade.

A trust-based system of trade where countries and companies deliver on their commitments is imperative. This means no export bans or trade restrictions post-contract. Without trust, countries may pursue policies they believe to be in their self-interest but may prove counterproductive to global food security.

Prices stimulate production, best allocate resources, and are driven by supply-and-demand fundamentals. Last year the world lost close to 80 million metric tons of overall crop production, solely the result of bad weather, and many countries restricted trade flows which forced prices up even higher than had those restrictions not been in place. On top of this crop volatility, there was turmoil in fiscal and monetary policy as both the United States and European Union worked through a debt-inspired policy debate. This volatility in global commodity, debt, interest rate and currency markets had to be managed.

Market volatility and the recent financial crisis led to policies, laws and regulations in the United States which are now under consideration in the European Union and elsewhere that address markets for risk management and price discovery. Rules that go too far by impeding price discovery and management of commercial risk do not change the weather and make risk go away—they make risk more difficult and more expensive to manage.

To move the bounty of U.S. crops requires a continued focus on infrastructure—or U.S. competitors will get the advantage and serve global consumers faster and more efficiently. With the United States in a difficult fiscal period, and as long as the mandatory side of the federal budget grows unabated without meaningful, significant and politically painful reform, significant increases in funding for infrastructure and virtually everything else will be difficult.

Harmonization of transparent, science-based standards should be a priority so food can be moved efficiently and predictably.

In developing countries, property rights are a daily concern. When citizens have property rights, they can take their property right and turn it into capital—which is important to foot security. Farmers in the developing world need their property rights clarified as this would lead to improving their land and their efficiency and farmers benefitting from many of the same legal rights, business arrangement, financing and property customs that U.S. citizens have.

Too often the agenda for animal agriculture is set by listening to, and reacting to, animal rights activists. Those involved in animal agriculture should keep focused on the majority—consumers who value farmers and their ability to provide the United States and other countries with food. Animal agriculture should develop a united message that resonates with the rank-and file and not get caught up in the hype stirred by animal rights activists and vegetarian advocates. After all, the bottom line may be that it's not a value question but a preference question.

Technology & A Comprehensive Food Safety System[37]

Approximately 300 million Americans purchase meat animal protein, and each person deserves the reassurance that the product purchased is safe. Food safety must start on the farm to go to the table, with no segment of the meat industries exempt when it comes to food safety responsibility. The question arises whether each segment is doing enough to control pathogens through the meat protein system.

Packers are extremely aware that certain organisms are inherent to their business and follow Food Safety and Inspection Service (FSIS) guidelines to lessen pathogen contamination.[38] Packers also have in-depth, multiple intervention systems and antimicrobial applications systems in place to eliminate pathogens. Yet, despite these systems, pathogens are still getting through the system. As such, new technologies and a comprehensive system are needed.

While a comprehensive food safety system will have a significant associated cost, the conversation around how to move forward needs to commence. Conversations must include the importance of pre-harvest practices and have those practices complement harvest plant practices.

Packing plant technologies under investigation include bromine technology, bacteriophage, and hide-on washes. Certain technologies have risks and benefits. For example, a technology might be effective enough to kill pathogens but the product is cost prohibitive as it is extremely hard on equipment.

Pre-harvest technologies that could lead to reduced pathogen-load are novel vaccines that reduce specific pathogens, direct-fed microbials, and sodium chlorate that kills certain bacteria.

Additional steps that help eliminate pathogens:

- Packers procure food animals from producers following certain criteria/technology.
- Video workers on the job and use the videos as a training tool so proper procedures are followed.
- Microbial samples are taken to pinpoint that each system is lessening microbials and to identify procedures that might need to adjust.

Packers are also interacting with, sharing best practices and learning from each other. That said, no one segment—feedyards, processors, packers—can do it alone.

COMMITTEE, COUNCIL CONSENSUS POINTS

Discussions at NIAA's six committee meetings and six council meetings—Aquatic Livestock Committee, Bovine Committee, Equine Committee, Poultry Committee, Small Ruminant Committee, Swine Committee, Animal Care Council, Animal Identification & Information Systems Council, Animal Health Emergency Management Council, Antibiotics Council, Emerging Diseases Council and Global Animal Health, Food Security and Trade Council—led to the following 18 consensus points:

1) Since regulations impacting food-animal agriculture will increase consumer costs and reduce demands, regulations should be based in science and involve stakeholder input—and not as a result of pressure from animal rights organizations.
2) With consumers wanting to believe farmers care for the environment and have a high level of care for their livestock, a dialogue between farmers and consumers needs to be cultivated.
3) Further communication and collaboration with the packing Industry regarding animal health and emergency management issues and outbreak response is encouraged.
4) Wildlife issues and knowledge gaps as related to Foreign Animal Disease (FAD) outbreak preparedness and response efforts should continue to be addressed.
5) Data integration and utilities that facilitate disease response should continue to be a focus of the industry.
6) Environmental pathogens play a role in antimicrobial resistance.
7) Dialogue regarding antimicrobial resistance should be expanded to include the public health and environmental sectors.
8) It is important to continue to communicate with stakeholders (e.g. producers, retailers, consumers) on the issues of antimicrobial use and resistance.
9) Genomics/biotechnology is here to stay and will change the way animal diseases are diagnosed and monitored.
10) Controversies in the use of genomics exist and must be addressed. An example of a controversy is public acceptance of use of genomics in microbes but not in disease management.
11) States should review their foot-and-mouth disease (FMD) response plan and provide such information to livestock producers and industry.
12) The swine industry's influenza surveillance program should be continued.
13) PRRS continues to be the major disease of concern in the swine industry and warrants continued research funding. Consideration should be given to how the industry addresses PRRS in the short- and long-term (control, elimination, eradication).
14) The swine industry needs to consider whether or not changes are necessary to the current PRV and Brucellosis surveillance programs and work with USDA and State Animal Health Officials to initiate any necessary changes.
15) Technology, such as genomics, will continue to ensure the livestock industry can supply a constant food supply for a growing world population with decreasing resources.

16) Achieving genetic potential through nutrition will play an important role in feeding the world as we meet future demands.

17) Diagnostic labs will play a varied role in the future of food animal production health programs.

18) Regulatory agencies and industry should partner to develop programs that safeguard food-animal production systems.

CONTACT INFORMATION

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FOOTNOTES

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