

NABC

news

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*Providing an open forum
for exploring issues in
agricultural biotechnology*



NABC'S PRINCIPAL OBJECTIVES ARE TO:

- *provide an open forum for persons with different interests and concerns to come together to speak, to listen, to learn, and to participate in meaningful dialog and evaluation of the potential impacts of agricultural biotechnology*
- *define issues and public policy options related to biotechnology in the food, agricultural, biobased industrial product, and environmental areas*
- *promote increased understanding of the scientific, economic, legislative, and social issues associated with agricultural biotechnology by compiling and disseminating information to interested people*
- *facilitate active communication among researchers, administrators, policymakers, practitioners, and other concerned people to ensure that all viewpoints contribute to the safe efficacious and equitable development of biotechnology for the benefit of society*
- *sponsor meetings and workshops and publish and distribute reports that provide a foundation for addressing issues.*

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Letter from the Chair....

This past Halloween was notable for a milestone. It was estimated that the 7 billionth human was born on that day. Somewhere in Asia or Africa. Likely, in a poor family that was hungry on that night.

Estimates are that, of those seven billion humans, at least one billion will go to bed hungry tonight! Ironically, at the same time, over one billion people in the world are either overweight or obese and are popping statins, aspirin, and other drugs to control cholesterol levels, cardiovascular disease, blood pressure, obesity, or type-2 diabetes.

One billion, food-insecure people live on less than one dollar per day, while the developed world spends one billion dollars per day on farm subsidies. Yet another conundrum is that more than 50 percent of the food in the developing world is lost on farm or post harvest, and in the developed world almost 50 percent is wasted at or after the dinner table.

The above is the situation today, with a global population of seven billion.

Imagine the challenges humanity will face in just another 40 years, when the population is projected to be almost 10 billion humans on earth, in the face of diminishing arable land and water, exacerbated by climate change or the ever-increasing demand for protein in the diet owing to increasing wealth in a number of countries or the food-versus-fuel debate or the need to protect our environment.

The situation sounds daunting. It almost makes one want to bury one's head in the sand or run away and hide. Or, one can seek solutions based on science and technology, particularly the opportunities



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afforded by discoveries enabled by the New Biology, as articulated by the National Academies. What we need is a Green Revolution for the 21st Century—a genetics and biotechnology-empowered revolution! No, I'm not talking about transgenic technologies only, but the power of New Biology and agricultural biotechnologies applied to addressing the grand challenges humanity faces.

The National Agricultural Biotechnology Council (NABC) has convened conversations and produced white papers over the last couple of decades about the power of molecular biology and agricultural biotechnology to address global challenges, such as food and hunger, the environment, energy, water, climate change, disease and health, to name a few.

The most recent conference—NABC 23—hosted this past summer by the University of Minnesota, continued NABC's tradition of facilitating conversations on the pressing issues and central questions of the day. It had the theme of

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NABC 24 — Mark Your Calendars

Water Sustainability in Agriculture

Fayetteville, AR
June 15–17, 2012

Ken Korth & A. Rick Bennett
University of Arkansas

Agriculture—by far the largest consumer of fresh water on the planet—is fully dependent on a sustainable supply of quality water. Therefore, it is critical that agricultural researchers, food and fiber producers, and those involved in agriculture-related industries are fully aware of the many facets of their activities that impact water sustainability. Water-related issues are central to many themes within agriculture, including efficient use of water, coping with drought, water rights, and environmental impacts. These and other issues will be explored at NABC’s twenty-fourth annual conference, *Water Sustainability in Agriculture*, hosted in Fayetteville, Arkansas, by the University of Arkansas, June 11–13, 2012.

Because they directly reflect agricultural strengths of the state and region, research programs at the University of Arkansas focus on a variety of water-related topics, including impacts of poultry and livestock production, water-intensive crops such as rice, water-related governmental policy and legal issues, and agricultural economics.

Speakers at NABC 24 will include leading experts in areas of sustainability, water use in major crops, and other water-agriculture issues. The program will be centered on active discussion among participants, and will include focused consideration of future challenges. In addition, NABC 24 will have poster sessions, providing meeting attendees an organized opportunity to present and discuss their research findings. Likely topics for the program major sessions will include:

- Adaptation and mitigation of water needs in food and fiber production (including biotechnological approaches, water delivery and distribution, and plant/animal physiological approaches)
- Water management, policy and regulatory issues (covering flood and drought management, field methodology, economic considerations, and sustainable practices)
- Impacts of agriculture on “downstream” events (including watershed protection, environmental impacts and stress factors, and consumer needs)

- Responding to future challenges of water issues in agriculture (with consideration of worldwide needs, changing climates and consumption and global change patterns)

Details regarding meeting registration, travel, and accommodations will be forthcoming via a conference website. The location in northwest Arkansas is easily accessible by air travel, and offers a wealth of activities beyond the meeting. The newly opened Crystal Bridges Museum of American Art is located in nearby Bentonville, and houses a world-class collection covering colonial to contemporary artworks in an architecturally stunning setting. The vacation and arts destination of Eureka Springs is less than a one-hour drive away, and outdoor activities abound in the nearby Ozark Mountains. We look forward to seeing you in Fayetteville.

Please direct questions, comments and suggestions on NABC 24 to:

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Visit the NABC 24 Website at
<http://nabc24.uark.edu>
for details on the program, registration, accommodations
and travel planning.



Overview of NABC 23

Food Security: The intersection of Sustainability, Safety and Defense

F. Abel Ponce de León
University of Minnesota

The National Agricultural Biotechnology Council's twenty-third annual conference took place in St. Paul, Minnesota, hosted by the University of Minnesota. Delegates were formally welcomed by the author [NABC-23 program chair and senior associate dean of the College of Food, Agricultural and Natural Resource Sciences (CFANS)], Allen Levine (dean, CFANS), Mathew Wohlman representing David Frederickson (commissioner of the Minnesota Department of Agriculture), Bill McCutchen (NABC chair, 2010–2011) and Ralph Hardy (NABC president).

The conference was structured in four plenary sessions, each followed by a panel discussion and Q&A with the audience. Plenary sessions were held on the afternoon of June 15, the morning and afternoon of June 16 and the morning of June 17. Two breakout workshop sessions¹ were scheduled for the mornings of June 16 and 17, when delegates were assigned to one of four groups to create more opportunities for discussion of the theme of the conference and issues raised by the plenary speakers and during Q&A. Participating undergraduate and graduate students formed one of the breakout-session groups.

Reports of the breakout workshops were presented by the facilitators to the conference delegates on June 17. Likewise, the Student Voice group presented a report on their discussion on

¹ The workshop discussions were facilitated by Frank Busta, Deborah Hamernick, Michael Kahn, Jozef Kokini, Steven Slack and Graham Scoles.

June 17. Two keynote addresses were presented. *Food Safety: The Minnesota Model* was presented by Gene Hugoson (senior fellow, University of Minnesota and former Minnesota commissioner of agriculture), and *Agricultural Science, the First Best Hope for the Future* was delivered by Cathie Woteki (under secretary for Research, Education, and Economics, US Department of Agriculture).

The first plenary session **Sustainability and Needs of 2050 Agriculture** was designed to address global challenges and issues relating to food production needs to support human population growth in the next 40 years. This session was opened by Daniel Gustafson (Food and Agriculture Organization) with *The Importance of Convergence of Sustainability, Food Safety and Defense for Food Security*. Three other speakers provided academic and industry perspectives: John Foley (University of Minnesota) presented a talk titled *Simultaneously Addressing Food Security and Global Sustainability Challenges*; Deborah Swackhamer (University of Minnesota) addressed water issues with *The Minnesota Water-Sustainability Framework: A Plan for Clean, Abundant Water for Today and Generations to Come*; and Terry Stone (Syngenta Corporation) presented the industry perspective with *Sustainability and the Needs of 2050 Agriculture: Developed and Developing World Perspectives*.

The second plenary session, **Systems-Based Approaches to Food Protection and Security**, was aimed at understanding how prepared or not are societies to protect the food supply from contamination. June Medford (Colorado State University) opened with *Detector Plants for Agriculture, Food and Environmental Monitoring*. Her work is based on applying biotechnology to engineer plants as sentinels for detection of contaminants. This is a very clever approach, albeit limited to detection of small molecules at this time. David Andow (University of Minnesota) and Detloff von Winterfeldt (International Institute for Applied Systems Analysis) both discussed the state of the art in risk analysis and vulnerability with their presentations, *Risk and Vulnerability* and *Systems and Risk Analyses for Food Protection and Security*, respectively. Martin Duplessis (Health Canada) talked about advances in *Detection and Prevention*, addressing research methods needed for rapid detection of food contamination.

The third plenary session, **Preparing for Emerging and Unknown Threats**, focused on the interactions of humans, animals and plants, potential threats to their health, and technological needs. Robert Buchanan (University of Maryland) opened with *Preparing for Emerging and Unknown Threats in Public Health*, which blended well with the remarks of Jeff Bender (University of

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Summary of the Discussions at the NABC-23 Breakout Workshops

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Breakout sessions were held on days 2 and 3 of the conference, each comprising four parallel workshops. Oral reports on the first workshop were delivered on day 3 prior to the second breakout session, and written reports on the second workshop were prepared soon after the conference by the oral reporters. The objective of the workshops was to provide all participants the opportunity to contribute verbally on the aspects of food security that had been discussed during the formal presentations and Q&A sessions.

To help initiate dialog during the breakout sessions, the facilitators posed the following questions and then encouraged free-flowing discussions:

Breakout session 1: Given what we have heard at the conference and the nature of food security, what would you propose should be the set of research actions necessary to start addressing food security at the local, regional and global scales?

Breakout session 2: What research and policies do you think are required to overcome the challenges of water and land availability in our quest to double food production while minimizing environmental impact in the next 39 years?

Below are some of the key points¹ that emerged, under ten headings. A fuller synthesis will be presented in the conference-proceedings volume, *NABC Report 23—Food Security: The Intersection of Sustainability, Safety and Defense*.

¹ Recorder.

² Discussion facilitator.

³ Oral reporter.

⁴ As judged by AE.

FOOD SECURITY

- A primary definition of food security is freedom from hunger. A broader definition is that food security comprises food safety, which is a consumer-level issue, and food supply, which is a crop-production/distribution issue. Food safety is relatively more important in developed countries and food supply is relatively more important in developing countries in which significant fractions of the population are concerned with where their next meal will come from. The global population is expected to increase by ~2.5 billion to ~9.5 billion by 2050, requiring a doubling of food availability in developing countries. In most of the world, food security is viewed chiefly as freedom from hunger.
- On the other hand, in developing countries, agricultural exports can be a source of cash that can lift people out of poverty, which then increases their food security.
- Food security is multidisciplinary in scope. The disciplines involved need to be defined to understand the social factors involved in policymaking that affects food security. Accordingly national and international initiatives require taking local priorities into account. Each country has unique strengths and weaknesses; optimization of national strengths will be needed to feed 9.5 billion people by 2050.

FOOD SAFETY

- As stated above, food security comprises food safety, which is a consumer-level issue, and food supply which is a crop-production/distribution issue. Food safety is relatively more important in developed countries where food is plentiful and relatively inexpensive, but

where several outbreaks of food-borne illness, affecting thousands of people, have occurred in recent years.

- Research is needed to develop new ways of treating foods to prevent or eliminate contamination by pathogenic organisms and/or chemicals.
- Crop breeding focuses mainly on pre-harvest characteristics, *e.g.* susceptibility to insects and disease and to abiotic stresses. Post-harvest issues are often neglected. The only example where a pre-harvest trait created a post-harvest impact is *Bt* corn, *i.e.* in reducing mycotoxin production. More research is needed on preventing adverse changes during storage of harvested entities.

FOOD SUPPLY

- What fraction of national resources is the United States willing to expend to produce food for other countries? Under some circumstances, when we export it is counterproductive to the long-term viability of agriculture in the importing countries. Doubling production may be possible for the United States and Canada, but the challenge is to get other countries, where the needs are greatest, to produce more food. Most countries have enough land and water and can produce sufficient food if it is priced right. An essential aspect is to get fertilizers to farmers who can't afford them, and can benefit most from them.
- Developing countries need to invest in food-production research with particular emphasis on addressing biotic and abiotic factors. To partner with developing countries to improve food production, the United States should provide more financial and logistical support via the international agricultural institutes. US public buy-in obviously will be needed here, particularly in these difficult financial times.
- The reason many developing countries are resisting genetically engineered crops is because they can't sell them in Europe, and often not in Asia, whether or not they are safe. Cultural barriers can preclude acceptance of data produced by good science. Research is needed on how to close gaps between cultural concepts and science.

ANIMAL PRODUCTION

- Single-cell protein—produced on non-arable land—represents a viable substitute for feed for animals that currently feed on wheat and corn.
- Further research is needed in the utilization of animal waste (*e.g.* for energy production).

- The minimization of loss of nutrients from animals is important, *e.g.* similar to the Enviropig® which digests phosphorus more efficiently.

SUSTAINABILITY

- A broadly accepted definition of “sustainability” is needed. It still means different things to different people. In general, it is used effectively from a marketing standpoint. But it is important that we have a common basis to help make progress on an issue that is fundamentally important.
- There is a pressing need to gain better understanding of sustainability of water usage.
- To assess the sustainability of a food-production system requires 10+ years of experiments. Yet funding for such long-term research is seldom available. Funding longevity is usually no more than a third of this time-span.

WATER

- Is there a water shortage, or is water just not priced right? How well do we understand the cost of water? Research is needed to help producers make decisions on how much water is needed to maintain crop yields and to increase them. When we export grain and meat produced from that grain, we are, essentially, also exporting the water required to produce that grain, yet the cost of that water is not figured in.
- For water, the priority should be keeping chemicals out rather than developing means of detecting them once they are in. Processing procedures are available to decrease toxin levels, but more research is needed in this regard.
- Hydrological mapping, as in Minnesota, should be done in all states as an important priority.

REGULATORY/POLICY ASPECTS

- Providing testimony to Congress and/or to regulatory agencies can have greater impact than talking to the media. However, both are important.
- How the general public reacts to measures taken to improve food security and safety is influenced by whether they perceive direct benefit.
- Increasing food production is most pressingly important for Africa yet only a handful of African countries have biosafety laws. Assistance should be given to those countries to develop infrastructure and expertise to achieve appropriate regulatory oversight.

COMMUNICATION/EDUCATION

- As scientists, when we talk of the benefits of genetic engineering and other new technologies, the concepts can

be difficult for the lay person to understand. Overuse of technical jargon often evokes an adverse cultural response. We need to learn to lay out benefits in understandable terms to help consumers make informed judgments.

- Food security is a multidisciplinary entity. The disciplines involved need to be defined to understand the social factors involved in decision-making. Accordingly national and international initiatives will require taking local priorities into account. Education and training clearly are important and improving scientific literacy of the population as a whole will be necessary to ensure accurate risk assessment of genetically engineered crops and animals, food irradiation, *etc.*
- As climate change occurs, education can help farmers make good decisions with regard to planting patterns (what to plant, how much to plant, when, *etc.*).

Risk

- How is risk assessment to be taught, particularly environmental risk assessment? Multidisciplinary input will be needed including a strong social-science component. Inevitably, risk assessments will be underpinned by cultural values yet must be based on scientific data.
- Formal protocols are needed for analysis of risk from new technologies, which includes input from diverse experts. We usually cope well with engineered systems, but less so with ecosystems, and with terrorism we are just inching our way in. Some say risk analysis will not help to prevent terrorism; on the other hand, we need to take what we know as far as possible. The weakest-link issue is still a concern.
- Risk-analysis protocols must be expanded to encompass terrorism, including behavioral analyses of adaptable adversaries.

BIOFUEL AND ENERGY

- Research is needed to provide better understanding of the role of biofuels in recent increases in food prices globally.
- Although second-generation biofuels hold much promise, environmental implications of exploitation of marginal lands—from large-scale planting of switchgrass for example—needs thorough examination. The consequences of stover removal and energy-crop production—for soil fertility, water budgets, soil-nutrient content, and herbicide and insecticide needs—are largely unknown; research is needed for construction of sound economic models and to inform policy.
- Using algae as biomass for biofuel production requires more research. ■

continued from page 1 “Letter...”

Food Security: The Intersection of Sustainability, Safety and Defense (page 3). The presentations and panel discussions addressed the realities of a food-insecure world in the 21st century, and the possibilities and potential pitfalls involved in the use of agricultural biotechnology. The speakers considered the role of changing climate, soaring food prices, emerging pathogens, and concerns over environmental integrity and food safety and the promise and risks of agricultural biotechnology in the development of technologies that will help feed the burgeoning global population.

The tradition will continue in 2012 when the theme of NABC 24—hosted by the University of Arkansas—will be Water Sustainability in Agriculture (page 2). I hope you will join me in supporting this and NABC’s other endeavors. ■



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Are you a graduate student at an NABC member institution and would like to participate in *The Student Voice at NABC 24* in June, 2012, in Fayetteville, AR?

Please visit the Student Voice webpage at

<http://nabc.cals.cornell.edu/studentvoice/index.cfm>

for application details and deadlines.

The Student Voice at NABC 23

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We thank NABC for sponsoring the Student Voice program, allowing us to share in the lively discussion. Also we thank our member institutions for participating in the program and, for some of us, for providing matching funds. We leave with many issues in mind and are excited to continue the discussions

We offer the following comments and suggestions:

- The breakout sessions promoted interaction in a more intimate setting and enabled us to hear views of attendees while also sharing our views. Many conferences lack this special feature, and even more breakout sessions or workshops would be beneficial for future conferences.
- Including farmers in the breakout sessions facilitated our understanding of some of the issues addressed in the presentations. For this reason, inviting farmers and/or extension agents as speakers would increase the interdisciplinary nature of the conference.
- We would like to see more publicity of the event in advance to the public and throughout the various universities involved (press releases; updated, detailed webpage).
- Poster sessions at future events should be considered.
- It would be helpful to have presentation materials available at or shortly following the conference.
- There was good insight on the issues of food safety and security, but there could have been more information on the issues of food sustainability and self-sufficiency (e.g. water/nutrient-use efficiency, crop-yield increases).
- Increasing involvement of students after the conference (e.g. Student Voice ambassadors, a mailing list of previous participants) would facilitate discussion beyond the conference.
- As for future conferences, we feel that the following points need emphasis.
 - Water availability is becoming critical in certain areas of the world. In order to meet the future demands for water, technologies that facilitate sustainable water use should be discussed.
 - The solutions presented should take account of local, socio-economic and cultural characteristics of every agricultural region. Something that proves to be effective in one place, might not work in another.
 - More research is needed into alternative sources of raw materials for biofuel production that can substitute for food and feed material. For example, oil-rich microalgae could be an alternative model because of its ability to grow on non-arable land and use non-potable water.
 - Food security is a multidisciplinary problem. We need to address it at multiple levels by including all stakeholders, including policymakers, scientists and farmers.
 - Prevention is key. We need to be proactive rather than reactive when it comes to food security and sustainability.
 - Education is fundamental to raise public awareness of problems such as food availability, food safety, population growth, water scarcity and pollution. The general public can motivate the policymakers to make changes. Targeting young generations is essential to ensure the long-term effectiveness of implemented solutions.■

^{1,2} Verbal reporter at the conference and co-author with contributions from the other students

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Minnesota), on *Recent Animal Disease Outbreaks and their Impact on Human Populations*, and of Jacqueline Fletcher (Oklahoma State University) on *Preparing for Emerging and Unknown Threats in Crops*. The latter presentations provided insights into institutional responses to food contamination and disease threats at the national level.

Opening the fourth plenary session, **Emerging Biotechnologies to**

Promote Safety, Enable Defense, and Discourage Fraud, John Besser (CDC) discussed *Emerging Biotechnologies to Promote Food Safety*, focusing on DNA-fingerprinting technologies that contributed to the development of the national PulseNet system to rapidly respond to outbreaks of food contamination by bacteria. Shaun Kennedy (University of Minnesota) presented *Emerging Food System Defense Risks and Technology Needs*, expanding on the complexity of food

systems, the inherent difficulty in identifying the origins of human-disease outbreaks and technology needs for traceability and vulnerability assessments. With *Food Fraud: Public Health Threats and the Need for New Analytical Detection Approaches*, Jeffrey Moore (US Pharmacopeia) highlighted the challenges of economically motivated adulteration of foods, the inherent difficulty in keeping ahead of fraudsters and technology needs to support the latter. ■

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