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# *Overview of NABC 24 Water Sustainability in Agriculture*

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Clean abundant water is both biologically and culturally essential to human life. Agriculture, as the major freshwater-consuming activity on earth, is a key player in managing water resources and in shaping future practices and water policies. As our population grows and greater demands are made for food, feed, fiber and biobased industrial products, it is essential that sustainable practices be employed to adapt to changing water needs and conditions. In 2010, the National Agricultural Biotechnology Council (NABC) issued a white paper detailing water-related agricultural issues along with approaches to address some of the related problems (NABC, 2010; Appendix). The 24<sup>th</sup> annual meeting of the NABC, *Water Sustainability in Agriculture*—held at the University of Arkansas at Fayetteville, June 11–13, 2012—further explored some of the complex issues facing agriculture and future water needs. Discussions were structured around four focal areas, summarized below, but encompassed multiple subjects directly tied to water sustainability in agriculture.

## AGRICULTURAL ADAPTATIONS TO WATER NEEDS

In the first session, on adaptations of agriculture to changing water needs, Hank Venema (International Institute for Sustainable Development) described a program with the dual purpose of managing water phosphate levels while providing economic benefit. Lake Winnipeg is the collection point for a huge watershed, encompassing vast agricultural lands in Canada and the northern United States. Much of the nutrient flow into the lake occurs through a large marshland that is populated with an invasive species of cattail. By harvesting the plant material, using it as a combustible biofuel and recovering the phosphorus for future use, benefits are seen at several levels. This system provides an excellent model for taking a serious environmental issue and attempting to manage it in an economically beneficial way. It was proposed that similar approaches will be applicable in other situations, and that this could serve as a model for a “watershed of the future.” This talk served as an excellent starter to the conference, and introduced a theme that

came up several times during the three-day meeting. Specifically, that the likelihood of adoption and success of sustainable water management practices will be greater when tied to a clear economic benefit.

Adopting plant genetics and cultural practices were also addressed in the first session. Improving plant drought resistance and water-use efficiency through conventional breeding techniques and via transgenic technologies were highlights of talks from both industry and academic researchers. The recent introduction of commercial crop varieties with enhanced drought performance illustrates the opportunity to minimize the negative impact of moisture deficiency on crop production through genetic modification.

As an alternative to conventional production of annual crops, scientists at The Land Institute are developing perennial crops. Obviously, large-scale adoption of a perennial grain system would require substantial changes in the way US agriculture functions. Although this is a long-term approach and major hurdles remain, the potential environmental and sustainability benefits are attractive. This presented an intriguing set of possibilities and provided the conference with an alternative to many of the conventional means of attacking the problems of water sustainability.

The keynote address, by Marc Andreini (Robert B. Daugherty Water for Food Institute, University of Nebraska), provided a powerful view of water usage in North America as contrasted with water use for drinking and agricultural needs in Africa. Based on his experiences working in Africa over many years, Dr. Andreini summarized the challenges faced by consumers in each system, and emphasized that collaborative approaches and consideration of the needs of end-users are crucial to developing sustainable water practices.

## DEVELOPMENTS IN WATER MANAGEMENT AND POLICY

The second session focused on water-management policies, and speakers discussed systems at local and national levels. A common theme for this session was the importance of managing point sources of water contamination, especially nitrogen and phosphorus, from agricultural, urban, and industrial runoff. For example, in the United States, the USDA-NIFA Conservation Effects Assessment Project (CEAP) is aimed at assessing the success of conservation practices implemented over a long time frame. At a state level, different models of water-quality trading policies and their relative successes in Ohio were described, with special emphasis on the Alpine Cheese Phosphorus Nutrient Trading Program, which is one of the few programs to have fully met the requirements of its National Pollutant Discharge Elimination System (NPDES) permit. Finally, the importance of identifying farm-based sources of nutrient runoff was highlighted, along with discussion of methods to control runoff. With all of the management practices that were discussed, it was clear that balancing the needs of producers and end-users with the environmental outcomes is essential. Likewise, the specifics of practices that are implemented, *e.g.*, the absolute allowable levels of nutrients in a waterway, might need to be varied depending on the individual watershed that is impacted. Finally, meeting participants were treated to the perspectives of Ray Vester, a fourth-generation rice farmer and a leader among US rice producers. His personal accounts of the changing needs and practices of farmers over a long period in Arkansas provided valuable insight into the

frontline problems faced by producers. In many parts of Arkansas, as in areas worldwide that have relied on groundwater-based irrigation, the depletion of aquifers is a primary concern. Coupled with enhanced regulatory and environmental concerns, farmers face many challenges concerning water usage.

## CHANGING ROLE OF AGRICULTURE IN ENVIRONMENTAL AND CONSUMER ISSUES

Session three focused on the role of agriculture and sustainability efforts in environmental and consumer issues. The discussions included academic, government agency, and industry perspectives. The Natural Resources Conservation Service (NRCS) focuses on issues of water use and soil quality, working directly with growers to improve sustainable practices such as decreasing water loss and soil erosion. Michael Sullivan of the NRCS described agency practices, and discussed the many benefits seen by growers who invest in these new approaches. Likewise, participants heard industry perspectives from speakers from Tyson Foods and the Sustainability Consortium, which includes academic, industry, and non-governmental organization members. Based on these talks, it is clear that major companies worldwide are working toward improving sustainable water usage. Industry and farmers alike will be drawn to many of the sustainable practices discussed, not only because it might be the environmentally responsible thing to do, but also because it most often makes good business sense.

## PREPARING FOR FUTURE CHALLENGES OF WATER ISSUES

The final session was centered on challenges to be faced by the agricultural sector concerning water use. As with other sessions, the economic benefits of adopting new practices, including use of transgenic crops, were discussed. Likewise, the value in having agricultural producers take a lead role in developing new policies was highlighted; in this way, growers can contribute to assessment of current practices and help shape new strategies. Reagan Waskom (Colorado State University) gave an excellent overview of many of the water-related challenges facing farmers, but also the interrelated impacts that these have on the environment and urban consumers. The overarching challenges were discussed, along with specific case studies and potential approaches to reduce consumption at multiple levels.

## SUMMARY

Based on the speaker presentations, breakout-session discussions and the poster session, it is clear that meeting participants saw that solutions to water-sustainability issues in agriculture will require cross-disciplinary approaches. This is a long-term challenge that will require continuity in terms of research methods and resource availability. Identifying the benefits of sustainable-practice adoption, whether they are economic, environmental or health-related, must play a role in educating end-users and in shaping water-use policies. In terms of biotechnology, an opinion that emerged, held by some at the meeting, was that the research community should show some caution about “over-promising” solutions based solely on improved crops. The water-related problems faced by growers and consumers are massive, and a single technological fix is not likely to solve these large-scale issues.

Water sustainability in agriculture is a complex issue, but it must be addressed because of the importance to worldwide food availability, economic development, human and environmental health, and political security. A recent review highlighting the need for integrative approaches to solving problems of this scale includes discussion of need for new evidence-based models that go beyond a food and farm focus in relief and rebuilding efforts. Attention must be given to broader livelihoods that manage risk while offering new entry points into activities that link vulnerable households to market opportunities (Dubé *et al.*, 2012). Furthermore, a report from the President's Council of Advisors on Science and Technology has identified seven high-priority challenges faced by agriculture, which include increasing the efficiency of water use (PCAST, 2012). This report recommends increasing federal government investment in agricultural research, with the creation of a network of public-private multidisciplinary innovation institutes. Clearly, solutions to water-related challenges will need to be addressed at levels ranging from small farms to regional, national, and multinational agencies.

## REFERENCES

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