PRESENTATION
to
AMERICAN SOCIETY
OF SUGAR BEET TECHNOLOGISTS
March 8, 1995

Robert D. Heil [1]

Good morning. I want to thank Tom for the invitation to participate on this panel to discuss a topic that is very much on the mind of administrators and research scientists on our campuses.

To address the role of the land-grant research programs now and in the future, I would like to first identify some of the factors impacting the research agenda of the land-grant system, then review the evolution of the land-grant research system, and then discuss several issues in terms of what changes have, or are occurring, or need to occur as the State Agricultural Experiment Station System positions itself for meeting its mandated mission.

A major factor influencing research programs at our state land-grants is the changing social agenda related to environmental, food safety, quality of life, international competitiveness, etc. In addition, questions related to intellectual property rights, new technologies – particularly biotechnology and computer technologies, impact of regulation on new technology implementation and acceptance, social and economic risks of new technologies, society's right to be informed about safety, health and environmental impact of agriculture, privatization of research in the public sector, bioethics, meeting research needs with a shrinking resource base, the challenge of doubling the worlds food supply by the year 2030, increasing multidisciplinary research and applying a more systems approach to research, and a much more diverse audience influencing the research agenda, represent the plethora of things influencing our research agenda and how we go about conducting research.

By creating the State Agricultural Experiment Station System, the Hatch Act passed by Congress in 1887 initiated a federal-state partnership which was perhaps one of the most unique pieces of legislation in our nation's history. This legislation formalized a social contract for maintaining and enhancing a strong agricultural industry through the generation of new knowledge and technology that takes advantage of the diversity in climate, soils, geographic location, etc., of this nation. Creating a scientific infrastructure across the entire nation to capitalize on this diverse natural resource base is unique and a major strength of agriculture in this country. Independent studies have shown that the return on R&D investment in this system is higher than for any industry – averaging about 40 percent per year.

In the initial phase, the greatest demands on the state agricultural experiment stations (SAES) were for innovative methods to improve productivity and guarantee that yields were adequate for providing adequate food and fiber. The next phase evolved to add an emphasis on improving the economic efficiency of production systems. During this period we also saw a large increase in the food processing sector. As we approach the end of the twentieth century, new opportunities and challenges face the agricultural research system as described earlier. In summary, the future evolution of the SAES System is requiring a clarification of our mission to emphasize the total food and fiber system from production through consumption, and the ability to link issues of science/technology with productivity and environmental stewardship, socio-political change and

---

[1] Executive Director, Western Association of Agricultural Experiment Station Directors

concerns, economic changes, while at the same time maintaining the quality of our natural resource base, and, also addressing the preferences and practices of diverse cultures and consumer health.

This broadened mission of the SAES System is clearly reflected in the 1990 Farm Bill when Congress expanded the priorities of the SAES and Cooperative Extension to incorporate explicit statements about satisfying human food and fiber needs; enhancing long-term viability and competitiveness of agriculture; expanding economic opportunities in rural America; and enhancing quality of life for farmers, ranchers, rural citizens and society as a whole. The 1990 Act further broadened the research agenda by focusing on the enhancement of human health, which depends on food quality, food safety and nutrition.

It is interesting to note that in the 1930's and 40's, perhaps not more than a dozen groups were involved in developing farm bill legislation – compare this with more than 260 groups in 1990.

This is perhaps an appropriate place to mention several other activities that will shape the research programs at our land-grant institutions. The National Research Council's Board on Agriculture has undertaken a three-year study of colleges of agriculture to evaluate teaching, research and delivery of services to the U.S. agricultural system and its clientele. Included in this study no doubt will be the question of how colleges of agriculture are or should be more fully integrated into the larger university to bring the larger university to bear on the needs of agriculture. They will be looking at structures, organization and programs of the colleges. In addition the Kellogg Foundation has provided funding to 22 states to catalyze transformation and assist colleges of agriculture at land-grant universities to visualize their future as programs responsible for preparing food system professionals for the 21st century. Although the focus of this project is on the teaching component of the colleges, there will be an impact on the research or SAES System.

Having spoken to the environment that is shaping the future research agenda of the SAES System, I would like to now shift for a few minutes to some of the things the System has done to address these issues. The System, I am pleased to report, has not remained indifferent to the changing social climate and has taken a number of initiatives to plan and prepare. For the last decade the SAES System nationwide has been involved in a strategic planning effort to develop priorities. In addition the System was primarily responsible for the creation of the federally funded National Research Initiative (NRI) that began in 1991. Current funding is at approximately $110 million which is far short of the original authorization of $500 million. But it has supported research for more than three thousand grants that have been awarded on a competitive basis. This initiative has represented the most significant increase in funding for agricultural research in over a decade.

The strategic planning effort has resulted in the following set of priorities. I share these because you will find they do reflect current and future needs and opportunities of agriculture. These priorities represent input from more than 200 commodity groups, farm and environmental groups, institutes and foundations, and 100 scientists from within as well as outside of the SAES System.

These priorities, not in ranked order, are:

- conserve and enhance air, soil, and water resources.
-increase use of integrated and sustainable agricultural systems.
-enhance food safety.
-protect plants for sustained productivity
-enhance agriculture and rural economies

-manage ecosystems to conserve and enhance biodiversity
-enhance animal genetic diversity and biological performance
-develop alternative plant management systems
-understand fundamental plant processes
-waste management in agriculture and forestry systems
-use genetics to improve plants for the 21st Century
-convert processing by-products to beneficial uses
-enhance food quality and value
-develop resource management decision systems
-increase the quality of animal -food products
-enhance the health and well-being of food animals
-target optimal nutrition for individual human health
-develop new or improved non food products
-strengthen rural communities
-empower people for economic and social viability
-promote healthy food choices
-enhance agricultural markets and competitiveness

This is a lengthy and ambitious set of priorities, and the System will not be able to address all of these issues given resources currently available.

To put the resource issue into perspective, I would like to share the following information which addresses the investment in agricultural R&D in the U.S. As a nation we invest in R&D at a rate of 2.7 percent of the GNP. We rate second in the world in this regard. Japan invests at a slightly higher percentage as a function of GNP and Germany invests just slightly less. But when you look at agriculture, this nation invests 0.16 percent as a function of the total value of the agricultural sector. As you can see, the investment in agricultural R&D is several orders of magnitude less than for other industries. One of the major gaps in agricultural R&D is in federal investment. The federal investment in agricultural R&D is less than 1.0 percent of the total of federal investment in R&D. Yet, agriculture makes up approximately 17 percent of the total GNP. It would appear that with the implementation of GATT and NAFTA, which is forcing U.S. agriculture to be in a more and more competitive position in the global marketplace, the issue of R&D investment needs to be addressed. As stated earlier, the priorities of the SAES System identified through our strategic planning effort cannot be adequately addressed within the framework of existing resources.

I would like to now shift gears a little and visit about multidisciplinary research and the need to utilize a more integrated systems approach to research. This approach to research will perhaps become the mode of operation in the future. This is perhaps where the land-grant system can make its greatest future contribution. The land-grant system does have the capability to draw from a large number of disciplines germane to studying the physical biological, social, economic and institutional components of what I will call "agroecosystems." And there is a great need to apply this approach at the field, farm, ecosystem and even higher hierarchial levels. Much progress has been made in this regard but we still face the issue of reward for researchers involved in multidisciplinary research. This issue must be addressed by the land-grants, disciplinary societies and professional organizations.

Another important element associated with the ability of the SAES System to respond to a number of the issues which have been previously described will be SAES linkage with agribusiness. My sense is that the success of the research programs of the land-grant system is in large part due to the

linkages that have been developed between the land-grants and the private sector over time. Over the past several decades as agricultural corporations have grown, they have developed the scientific capability to deal effectively with research needs of the corporation. For example, the number of major agricultural chemical companies has decreased from about 30 to seven over the past two decades, and each of these has developed an extensive research capability. We see the same happening in the area of bioengineering or biotechnology. Likewise, the farm machinery industry has come to consist of five corporations meeting the nation's and much of the world's needs in farm machinery, and much of the new technology has been developed by the companies themselves. But costs and complexity are barriers to new, as well as for existing, small companies. In addition, in many countries, a publicly supported agricultural research and extension system does not exist and global corporations have established their own research and technology transfer system to provide direct technical assistance to the farmers.

The challenge and the opportunity for publicly supported research are not in duplicating the private sector's research agenda but in building unique public/private partnerships or perhaps even jointly sponsored consortia for research. Links need to be forged between SAES's and the private sector to provide efficiency and effectiveness to the overall research agenda for agriculture. The question perhaps is – will the land-grant universities and the private sector find new and creative ways of working together? As I pointed out earlier it seems to me that the land-grant universities can play a major role in developing the methodology and conducting research using a systems approach. Decision making based on individual disciplines alone is proving to be insufficient for assessing the total impact of a given decision on the system.

The SAES System recognizes we have a joint challenge between the public and private sector in clarification and collaboration in the future of the agricultural research agenda.

Another question of importance to the public and private sector to ensure the responsiveness of the SAES System to the many challenges relates to technology transfer. The continued development and transfer of technology will be instrumental in the definition and conduct of research. Historically, through licensing of protected intellectual property, the SAES has played a major role in delivering technology to corporations, which then were able to transfer that technology to producers. Certain industries probably in large part owe their development to the results of SAES research. The hybrid corn industry is a classical example. The technology of corn variety development, initiated in both the SAES and ARS/USDA systems, now is primarily in the hands of major seed companies. This flow of responsibility for technological development from the public to the private sector needs to continue, but the recent strengthening of intellectual property rights may require development of new relationships. Associated with this is how do we ensure continued opportunities for noncompetitive dialogue and interchange between private-public sector scientists? Also, changes have been made in patent law, and universities now are allowed to retain title rights on public-funded inventions that they develop. New laws also were passed recently to facilitate technology transfer between federal laboratories and industries. One challenge is simply keeping up with these changes and fitting them into the SAES's research environment. A more critical problem is the degree of proprietorship that is emerging in contemporary research. It is caused by a number of factors: changes in laws and regulation; increasing interest in exclusive licensing by the private sector entities; increasing vertical integration of the agricultural input's industry; closer relationships in ownerships and the exceptional commercial and scientific power of biotechnology. These issues raise many questions relative to the future role of SAES's research, namely, for some technologies, can it best be transferred in limited partnerships such as foundations or seed associations? Can the public and private sector work together in forming public/private corporations needed to transfer

technology that cannot be transferred by either alone? Can we work together to enhance the overall social welfare? Should the SAES system play an augmented role in evaluating new technologies and providing an assessment of the impact on society? Has the recent strengthening of intellectual property right dramatically changed the course of the SAES's research agenda. These sets of questions will continue to require close attention and need to be resolved in the years ahead.

From my earlier discussion, it becomes apparent that the broadened agenda for agricultural research is the direct result of dealing with a broadened constituency.

The SAES System will need to build coalitions with the traditional customers as well as with consumer groups, regulatory groups, environmental groups and others. Most SAES's are now establishing broad based advisory committees to build these coalitions and there are numerous examples around the country where effective coalitions have been established. It is through the building of these coalitions and a strengthening of the ties between the land-grant university and the entire agricultural industry, including the production and processing sectors, that the future role of the land-grant research programs will be determined and carried out.

Finally, a discussion of this topic would not be complete without acknowledging the impact of new technologies. Advanced computer technologies as well as biotechnology are influencing the research agenda in agriculture. Applications of advanced computer technologies in agricultural management, the development of information data bases and ability of people to communicate worldwide electronically are already having, and will continue to have, a dramatic impact on how research is conducted and knowledge transferred.

With this presentation I have attempted to identify what the SAES System has been, is doing and will need to do in meeting its mandated mission. I have made the assumption that there is a role for us and have attempted to clarify the role. Again, thank you for this opportunity to share some thoughts along with the other members of this panel and I look forward to the discussion session.

Resource Information Used:

- A New Technological Era for American Agriculture. U.S. Congress, Office of Technology Assessment. OTA-F-474, August, 1992
- Selected Data on Research and Development in Industry: 1992, National Science Foundation. NSF 94-327
- Challenges Confronting Agricultural Research at Land-Grant Universities. CAST Issue Paper No. 5. Nov. 1994