

Chapter 1

Summary

A new agenda is emerging for American agriculture in the 1990s, and there are serious questions as to whether the current agricultural research and extension system can respond effectively. Agriculture is changing in at least two distinct ways. First, agricultural research is broadening beyond its traditional focus on increasing production, and more recently on competitiveness, to also address issues of food safety and environmental quality. Technology to increase production in the future will be developed with increased attention to food safety and the environment.

Second, agriculture is entering a new technological era – the biotechnology and information technology era – that holds great promise for enhancing productivity, producing a safe food supply, and sustaining the environment.

Concern is growing that the traditional agricultural research and extension (AR&E) system, if unchanged, maybe bypassed by the broadening research base and emerging technologies. Already one-third or more of Federal funding of agricultural research is granted by Federal agencies outside the United States Department of Agriculture (USDA) and non-USDA funding for research is expected to increase significantly.

Ten of the 57 state agricultural experiment stations received 75 percent of the Federal funds for biotechnology research from agencies other than USDA. It is noteworthy that these 10 experiment stations are those that have basic science departments within the associated colleges of Agriculture. Unimportant prerequisite for researchers in biotechnology is training in basic fields that underpin this technology (e.g., cellular physiology, biochemistry, genetics). These disciplines are generally lacking in colleges of Agriculture. Approximately 40 per-

cent of the Ph.D. 's currently working in agricultural research did not graduate from a college of Agriculture.

All this implies that a broader base for agricultural research and its funding is evolving. But the research and technology transfer system is not well structured or coordinated and this could lead to serious problems. Without a close working relationship between basic and applied researchers on U.S. campuses and in Federal agencies, the lag time between the publication of basic scientific work and its adaptation into new technology will increase, damaging U.S. competitiveness.

There is the additional risk that without strong links between researchers and practitioners, basic researchers might focus on problems irrelevant to agriculture's needs or develop inappropriate approaches to perceived problems of agriculture. Faculty in fundamental sciences may not select problems meaningful to agriculture or design experiments that lead to readily adaptable solutions.

Ultimately, the private sector could surpass a weak AR&E system. A strong, mission-oriented AR&E system is needed to provide methods, products, and technologies to solve key agricultural problems. The United States cannot afford to have a public sector AR&E system falling behind the private sector and relegated to a role of simply reacting to, reviewing, or second guessing private sector research.

ISSUE AREAS FOR THE RESEARCH AND EXTENSION SYSTEM

The new agricultural agenda demands renewed and creative efforts to keep the AR&E system an effective and viable one for

American agriculture. A review of the system points to concern in the following areas:

1. **Mission:** USDA lacks a statement of goals, action to achieve stated goals, and systems to evaluate results against desired outcomes. As a result, no succinct written statement of the mission or policies of the AR&E system, or of Science and Education seems to exist within USDA. Without missions or policies, organizations can only express vague plans and priorities. It is very difficult to express commitment to clientele in terms of programs.
2. **Planning:** Effective planning directs resources to priority programs, problems, and issues in a well-thought, orderly manner. Within Science and Education at USDA, there are no short- or long-term plans for coordinating the activities of SAES, ES, ARS, or NAL. Nor are there plans for coordinating Science and Education activities with those of other USDA agencies such as ERS, FS, or its regulatory agencies.

A number of planning activities exist at state, multi-state, or regional levels, but they usually relate to program implementation. Sometimes plans are made by individual scientists or groups of scientists who have no authority over resources. Significant amounts of planning occur without necessary commitment of resources to set goals, implement plans, and measure progress.

3. **Priority Setting:** There is little specificity and clarity in stating priorities for the AR&E system. Within USDA no set Science and Education priorities exist. Individual S&E agencies have identified their own research and research-related priorities, and developed their own jus-

tifications without the benefit of close coordination among themselves.

A number of advisory groups independently set priorities for the AR&E system. These include the Joint Council on Food and Agricultural Sciences, the National Agricultural Research and Extension Users Advisory Board, the Experiment Station Committee on Policy, the Resident Instruction Committee on Policy, the International Committee on Policy, and the Extension Committee on Policy. However, there is no mechanism for reaching overall consensus. Stated needs for research and extension funding and for renovating facilities or replacing equipment are not prioritized.

4. **Structure:** Structure should facilitate the carrying out of mission, planning, and priority setting of the AR&E system. The present decentralized system is composed of Federal, state, and local partners. As research and extension budgets have declined, there has been increasing competition and division both within S&E at USDA and within universities. Little cooperation exists between many colleges of Agriculture and other colleges such as Arts and Sciences within the same university. In addition, new structures are evolving outside the traditional AR&E system as new technology is developed and transferred to the private sector for use. Extension's knowledge base, which has traditionally been drawn from the state experiment stations, has not kept pace with today's scientific advances. Extension runs the risk of being left out of the research and problem applications loop in the future.

5. **Funding:** There is evidence that the AR&E system is inadequately funded. Congress, however, will not increase fund-

ing as long as it considers the system's justification for additional funds to be inadequate. Until problems of mission, planning, priority setting, and structure are resolved, determining the adequacy of Federal funding will be difficult.

ALTERNATIVE POLICIES FOR RESEARCH AND TECHNOLOGY TRANSFER

OTA has identified a clear need for the AR&E system to have a well-articulated and coordinated research and technology transfer policy and proposes three alternatives:

- **Status Quo Alternative:** Continuation of the current policy as implemented under the 1985 farm bill.
- **National Research and Extension Policy Alternative:** Development of a larger Federal role in planning to align more closely research to end-user needs, without necessarily anticipating large increases in aggregate funding levels.
- **Competitive Grants Alternative:** Substantially increase the level of competitive grants research while continuing current levels of formula funding and/or appropriated funding for research and extension.

Status Quo Alternative

Based on the findings in this report and those of previous OTA reports dealing with the AR&E system, the likely consequences of the Status Quo Alternative are:

1. The new era of biotechnology and information technology will likely bypass the traditional AR&E system. A minority of the land-grant universities will compete effectively as technological advances are made in this new era.

2. Without a clearly enunciated mission-oriented policy, the AR&E system will continue to lack direction.
3. Planning and priority setting will continue to be ineffective, with no assurance of follow-through on initiatives and/or recommendations of the Joint Council and/or Users Advisory Board.
4. The AR&E system will continue to be rigidly structured and resistant to change.
5. Increased emphasis by land-grant universities and USDA on basic research, combined with accelerated technical change and continued neglect of applied research needs, will continue to widen the knowledge gap between research and extension.

National Research and Extension Policy Alternative

The National Research and Extension Policy Alternative is a mission-oriented approach designed to increase the AR&E system's responsiveness to the needs of the food and agriculture system. The major components of this system include:

- A clearly enunciated mission-oriented AR&E policy.
- A restructured, integrated and coordinated AR&E planning system.
- A combination of formula and competitive grant funds consistent with the conclusions of the planning system.

AR&E Policy

The first, and perhaps the most important component of the National Research and Extension Policy Alternative is a statement of clearly enunciated policy supported by the Secretary of Agriculture. It will emphasize that:

- Research and extension will be integral to carrying out all aspects of agricultural, food, trade and rural policy.
- The research and extension functions of USDA will be operated according to a comprehensive and coordinated plan.
- These functions will be mission-oriented with significant user influence on the planning process as well as on the resulting research and education programs.
- The research and technology transfer functions will be carried out by those scientists/institutions deemed to be the most competent, capable and efficient in achieving mission-oriented objectives.

Research and Extension Policy Planning System

The proposed policy statement implies a user-oriented research and extension system that places increased emphasis on competitive grants in research and extension programs. The key operating components include:

- . Users Advisory Council (UAC)
- . Agricultural Science and Education Policy Board (ASEPB)
- . Technical Panels
- . Existing research and extension agencies

Federal research and extension planning activities would be operationally centered in ASEPB, even though the planning process itself would begin in the UAC, in keeping with the user- and mission-oriented basis of the system. Research and extension agencies at the Federal, state, and local levels would also have planning functions.

Users Advisory Council. UAC would be independent of USDA and its role would be expanded considerably beyond that of the cur-

rent Users Advisory Board (UAB). Its primary functions would include:

- Identification of important research and technology transfer problems. (Same as UAB)
- Development of recommendations on goals and funding levels. (Expanded role)
- Coordination of industry support for agricultural research and extension at the Federal level. (Expanded role)
- Evaluation of results. (Expanded role)

UAC board members would be elected to represent, and would serve at the pleasure of: private agribusiness firms and associations; farmers and farm organizations; public interest groups; foundations; and government action agencies. Each major group could include specialized segments. For example, agribusiness might include a representative from suppliers of inputs, food processors, and exporters. The total membership on UAC probably should not exceed 25.

Agricultural Science and Education Policy Board. ASEPB would be the research and technology transfer planning center for USDA. It would be chaired by the Assistant Secretary for Science and Education and would include the following members who would be appointed by the Secretary of Agriculture, or other relevant agency head in the case of NIH and NSF:

- Administrator of each USDA research and technology transfer agency (ARS, CSRS, ERS, ES, FS, NAL)
- Assistant Secretary for Economics
- ESCOP chairman or designated representative (experiment station representative)
- ECOP chairman or designated representative (extension representative)

- RICOP chairman or designated representative (resident instruction representative)
- One 1890 university dean or designated representative
- AASCARR chairman or designated representative (nonland-grant representative)
- NIH director or designated representative
- NSF director or designated representative

ASEPB Functions. ASEPB would manage the Federal research and extension mission-oriented planning process, and oversee the allocation of grants for research and technology transfer functions. Specific functions include:

- Establishment of Goals
- Establishment of Priorities
- Maintenance of Intelligence System
- Creation of Technical Panels
- Assignment of Responsibility
- Evaluation of Results

AR&E Funding

Funding initiatives would come directly from ASEPB and from UAC. Since the Secretary would overtly adopt the ASEPB policy, he/she should be more inclined to support the recommendations of ASEPB within the Administration and the Congress.

Likely Consequences of the National Research and Extension Policy Alternative

- A basis would exist for effective AR&E planning in a mission-oriented context. In contrast to the present system, research funding would be allocated to programs, not agencies.

The argument that too much planning already exists stems largely from the ineffectiveness of current planning and follow-through.

- The USDA would have an internally consistent AR&E policy. The Secretary of Agriculture would be directly involved in establishing and endorsing AR&E policy.
- Multidisciplinary research would likely grow. Increased integration of biological (CSRS, FS and ARS) and economic (ERS) research would occur through ASEPB, UAC and the technical panels.
- The use of formula funds and competitive grants would be more balanced.
- Potential would exist for increased concentration of research and extension at specific locales within the system. This is occurring now, but the process would likely accelerate under this alternative.
- A mechanism would exist through the UAC for increased and more effective user input into AR&E decisions.
- Potential would exist for increased financial support for the AR&E system with improved planning, priority setting, and balance between research and extension.

Competitive Grants Alternative

The Competitive Grants Alternative was developed by the Board on Agriculture of the National Research Council, National Academy of Sciences. This proposal recommends:

Establishing a \$500 million agriculture, food, and environment competitive research grants program within USDA. It would en-

compass all science and technology relevant to research needs for agriculture, food, and environment, from basic biology to social sciences and public policy. Grants would be open to researchers in public and private universities and colleges, not-for-profit institutions, and research agencies of the state and Federal government. Major emphasis would be placed on fundamental and mission-linked multidisciplinary research. Mission-linked multidisciplinary funding would be designed to facilitate application of knowledge and the transfer of technology to the user through joint research-extension studies.

Other recommendations include:

- Provision of research strengthening grants to institutions and individuals.
- An increase in the duration and size of grants.
- Continuation of present levels of formula funds and USDA agency support for research or extension.
- Maintaining the Joint Council and UAB structure and the overall planning process now in place.

Differences Between the Competitive Grants Alternative and the National Research and Extension Policy Alternative

The Competitive Grants Alternative would place less emphasis on planning than the National Research and Extension Policy Alternative, which would make planning the driving force of the AR&E system. The primary emphasis and driving force in the Competitive Grants Alternative is more money for research; it assumes that a lack of adequate research funding is the major problem with the AR&E system. Structural problems in implementing a mission-oriented research and extension program are instead highlighted under the National Research and Extension Policy Alternative. The Competi-

tive Grants Alternative places virtually all of its emphasis on research. In short, it is a research proposal whereas the National Research and Extension Policy Alternative is a research and extension proposal.

Likely Consequences of the Competitive Grants Alternative

- More funds would be available to all public and private universities and government research agencies able to compete on a scientific basis. This would greatly accelerate agricultural research, rates of discovery and technological change without changing formula fund support.
- Potential for dealing with complex multidisciplinary problems would increase.
- While funds would be available for strengthening grants, this proposal would inevitably lead to increased concentration of research talent.
- The basic/applied research gap could be reduced. However, neglect of technology transfer as a target for grant funds would inevitably lead to a serious gap between research and extension.
- No changes would be made to improve the planning system or the linkage between planning and execution. Nothing assures that funds will be allocated to the UAB - and Joint Council-determined priorities.
- The drain of the best scientific talent away from extension would accelerate as more funds become available for research.

CONCLUSIONS

Three alternatives have been described and the likely consequences of instituting each identified. It will be difficult for the

current AR&E system to be effective in meeting the challenges facing American agriculture in the 1990s. In this regard, either of the other two alternatives represents an improvement over the Status Quo Alternative.

Questions remain as to whether a responsive mission-oriented system could be achieved by major structural change as implied by the National Research and Extension Policy Alternative, by increased research funding as implied by the Competitive Grants Alternative, or by a combination of the two. It is clear that without increased appropriations, structural change of the type contemplated by the National Research and Extension Policy

Alternative will be required to obtain a mission-oriented system.

Increased mission-orientation and responsiveness could be realized by combining structural change with more competitive grant money. Imbalances between research and extension could be remedied by opening up the competitive grants process to the development and implementation of innovative extension programs. And, it seems likely that these improvements could be accomplished with a less than \$500 million increase in appropriations for competitive grants.