

Executive Summary

In early 1975 the Office of Technology Assessment (OTA) received requests from Senator Hubert Humphrey and Representative Olin Teague for an independent assessment of the current status of research and development in food and agriculture. At that time a number of other agencies and committees were engaged in reviewing and evaluating food, agriculture, and nutrition research,

OTA's Food Advisory Committee reviewed the scope and preliminary findings of the studies in progress and counseled OTA to focus its food and agriculture research and development activities on two areas: (1) Implications of Increased Support of Research on Major Food Crops in Developing Countries, and (2) the area addressed in this report, Organizing and Financing Basic Research to Increase Food Production.

In the past ten years, four different scientific groups have reviewed the agricultural research conducted by the U.S. Department of Agriculture (USDA) and the State Agricultural Experiment Stations. AH recommended an expansion in research programs, and three of the groups emphasized the need to accelerate basic research in the sciences which undergird food production,

The Need for Basic Research

Basic research for increasing food production includes areas possessing exceptional opportunity for discovery of knowledge vital to the understanding of biological processes in plants and animals. Food and agriculture research is the search for new technologies within the boundaries of existing scientific knowledge. If basic research remains static, food and agriculture research is subject to diminishing returns and eventual exhaustion.

Basic research to increase food production has primarily been carried on by scientists in the Agricultural Research Service of USDA and in State Agricultural Experiment Stations (SAES) who also adapt research and development. Increases in appropriations for these scientists in the past two decades have not

equaled the inflationary increases in research costs. Practical problems associated with increased food production have increased during this period rather than declined. As a consequence, the scientific talent available for this research has declined sharply.

Several recent reports issued by the National Academy of Sciences (NAS) and the National Science Foundation (NSF) listed the areas of basic research offering the greatest potential returns in the near future from accelerated programs. Three areas with outstanding potential returns are listed in all of these reports. They are photosynthesis, biological nitrogen fixation, and cell culture studies.

Achieving Return on Investment

Studies of U.S. agricultural research productivity show annual rates of return of 30 to 40 percent. On the basis of past studies and the potential payoff from accelerated basic research to increase food production, it is highly probable that an investment of \$300 million to \$500 million over a 10-year period would yield returns of \$1 billion to \$2 billion over the next 20 years.

Food and agricultural research funds are appropriated for specific USDA projects and

for major functional areas at State Agricultural Experiment Stations. Funds for these stations are allocated on a formula basis. No funds are appropriated specifically for basic research in the biological sciences.

Both university and Federal agency scientists agree that the creation of new Federal agencies to conduct basic research would not be cost effective. There is also substantial agreement that the use of a formula for the allocation of funds for high-priority basic

research would not be cost effective.

The most effective means of allocating additional funds for this high-priority research appears to be through a competitive grants program. These grants should be available to qualified scientists, on the basis of peer review, in USDA research agencies, State Agricultural Experiment Stations, public and private universities, and nonprofit research institutions. This approach broadens research opportunities beyond the traditional USDA/SAES complex.

Administering Basic Research Grants

The administration of high-priority basic research to increase food production could be assigned to either USDA or NSF,

Basic research, applied research, and developmental technology are inter-related. There is merit in supporting accelerated basic research through USDA, the Federal agency which has the responsibility for both applied research and technology development,

There are several alternative means within

USDA for administering a competitive grants program for high-priority basic research. It could be administered under Public Law 89-106, if amended to permit scientists in the Agricultural Research Service to participate in the grants. No other authorizing legislation would be required.

Congress, if it wished, could mandate a specific administrative structure within USDA or NSF for the administration of this high-priority basic research.

Funding Needs

The USDA's Agricultural Research Policy Advisory Committee and the State Agricultural Experiment Stations recommended expanded research on the 117 most important problems as identified at the 1975 Kansas City Conference on Research To Meet U.S. and World Food Needs. The committee did not distinguish between basic and applied research and recommended increases totaling \$215 million over a 4-year period.

The NAS world Food and Nutrition Study issued in June 1977 proposes a first-year appropriation of \$60 million in Federal funds for

a new high-priority basic and applied research competitive grants program. The report suggests that these funds be increased 10 percent each year for a 5-year period.

An OTA advisory panel found that about \$15.6 million annually is being spent on current research in the three high-priority areas of photosynthesis, biological nitrogen fixation, and cell culture studies. It estimated that in the first year of an expanded basic research program in these three areas, an additional funding of \$12.25 million plus \$200,000 additional administration expenses appeared cost beneficial,

The panel proposed that after starting at a minimum of \$12.45 million the first year the program should be increased \$4 to \$6 million a year for a 6-year period, as more scientists are attracted into research in these areas. The panel did not address the problem of desirable financial support for basic research in other high-priority areas, although it recognized that other areas should be included. Thus, their

conclusions should not be viewed as limiting the competitive grant program to \$12.45 million.

The merits of including other research areas as high-priority basic research areas should be evaluated by the administrator of the high-priority basic research program with the advice and counsel of an advisory committee.

Options for Congress

one option for Congress would be to continue funding food and agriculture research at the current level,

A second option for Congress would be to appropriate funds specifically for basic research to be administered by the Secretary of Agriculture under Public Law 89-106, with or without minor amendments,

A third option for Congress would be to mandate administrative changes in USDA, creating an office of competitive grants and authorizing a long-term program of high-

priority basic research to increase food production.

A fourth option for Congress would be to authorize and finance an NSF program for expanded basic research to increase food production.

An appendix, prepared by OTA's ad hoc advisory panel, provides supplementary technical analysis upon which the OTA report draws. Any reference to this material should cite the panel.