Agriculture: NAS Panel Charges Inept Management, Poor Research

A candid and remarkably critical survey of agricultural research conducted at both the federal and state level has been prepared by a committee convened by the National Academy of Sciences. Administrators at the U.S. Department of Agriculture (USDA) appear to accept many of the criticisms but say that most of the necessary reforms are already in hand.

The survey faults the quality of agricultural research right across the board, ranging from poor administrative leadership in the USDA, to misallocation of resources for research, neglect of basic sciences, and the low quality of science and scientists both in the USDA and at state supported research institutes. It is the work of a 19-man committee chaired by Glenn S. Pound, dean of the College of Agriculture and Life Sciences at the University of Wisconsin. The committee, which consisted mostly of university scientists, included as members Nyle C. Brady, a former director of science and education at the USDA, and Nobel prize winner Robert W. Holley. It was set up in the summer of 1969 at the request of the then Secretary of Agriculture, Clifford M. Hardin, who wanted the quality of agricultural research to be assessed by an outside group. A report was submitted to the USDA in 1972 and will be published early this year by the National Technical Information Service.*

The study consists of a main section, comprising 20 specific recommendations for reform, and a number of appendices covering the topics investigated by special subcommittees. The appendices will be discussed in a later article. What follows is a résumé of the main report and the USDA's reaction to it.

The subject matter of the NAS study is a research enterprise that costs about half a billion dollars annually and commands the services of some 10,500 scientists in more than 500 laboratories. More than half of this is spent by the USDA on in-house research through its Agricultural Research Service, Forest Service, and other programs; the rest is supplied by states, the USDA, and other federal agencies to support research at the State Agricultural Experimental Stations (SAES). Although this research comprises a smallish fraction of national R & D expenditures, it amounts to nearly a quarter of the total budget of the National Institutes of Health and represents a substantial fraction of government funds available for biological research.

The NAS committee states in summary that it has found many excellent programs, well-trained scientists, and sensible research management in the USDA and SAES. But there is also reason to believe that "much of agricultural research is outmoded, pedestrian, and inefficient." The committee found evidence, the summary continues, "that, in the allocation of resources for agricultural research, grossly inadequate support was given to the basic sciences that underpin agriculture; that the agricultural research establishment seems to have an excessive number of field laboratories with an undesirably low level of coordination and integration of SAES-USDA efforts; that disproportionate commitment of funds to some areas has resulted in . . . weakening the vitality and balance of the total program.

"Evidence was also found that in the research itself there is an unwarranted duplication of effort . . .; that far too much of the research is of low scientific quality, indicating low ability of some researchers or poor administrative management of the researcher.

In the area of management of scientists, the committee found very disturbing evidence of ineptness with direct impact on research quality. Administrative structures and philosophies were found that reduce the decision-making power and freedom of movement of the scientists, with repressive effects on the vitality of science. Programs of staff improvement, throughout the system, are either grossly inadequate, or ineffectively used, resulting in stagnation and premature obsolescence of the scientists."

The NAS committee arrived at this blunt conclusion by addressing itself to several basic questions about the nature of agricultural research. The key question, "Does the research by agricultural scientists reflect the highest standards of the scientific community?" receives perhaps the directest answer of all: "Most of the specific disciplinary research studies made by the committee and its panels reveal a shocking amount of low quality research in agriculture. Admittedly, quality is a judgment factor, but the regularity with which the committee came up with judgments of low quality, including both USDA and SAES research, is significant and appalling."

The conclusion rests in part on an evaluation of USDA and SAES research projects in selected areas such as reproductive physiology, in which 42 percent were rated by panel scientists as "poor," and molecular biology, in which only 8 percent were judged good enough to receive support from the NIH or National Science Foundation. The committee reviewed 225 projects in reproductive physiology and found that 43 dealt with repetitive studies of hormone secretion. Members were convinced that there is "an inexcusable amount of mediocre and duplicative research and that the element of directed research is too great."

The underlying cause of this failing, the committee clearly believes, is the lack of proper review by competent scientists, such as the peer review system operated by agencies such as the NIH and NSF. A similar review procedure, drawing upon scientists in universities, industry, and other agencies, should be instituted by USDA and SAES, the committee recommends.

Management of Research

How did standards sink to such apparent depths? One factor identified by the NAS study is poor research management, including heavy-handed administration which has both overdirected research and stifled creativity with a welter of bureaucratic impediments. The agricultural research establishment has an undesirable burden of administrative and planning effort that, in effect, is removing the active researcher from decision-making. Agriculture has had a "plethora of planning" over the last decade—the burden of bureaucracy becoming increasingly burdensome with each succeeding reorganization—yet "little has resulted from much of the planning other than to create additional

* Report of the Committee on Research Advisory to the USDA. National Technical Information Service, Springfield, Va., 464 pp.

layers of administration at the expense of program." Specifically, the NAS committee "feels that the USDA has some problems in removing unsatisfactory administrators."

In this atmosphere, the research environment of USDA is losing its attractiveness. "Unless extreme care is exercised, there is great risk of suppressing the individual freedom of the scientist and of accepting objectives of lower scientific integrity." The remedies, as the committee sees it, are to give active researchers a larger say in decision-making, to weed out the bad administrators, and to recruit from outside the USDA as well as internally so as to get the best scientists available.

Another failure of agricultural research management, the NAS committee considers, springs from misallocation of funds. One source of misallocation is the earmarking of funds by Congress for research "that no one can define or for which no scientists are equipped or interested." Cotton, for example, which in terms of cash receipts is half as valuable a crop as wheat, receives twice the amount of research dollars. Some earmarking of funds is an appropriate form of political action but to do it to excess, as the NAS committee believes Congress has done, leads to gross imbalances and serious gaps in the national research effort. The USDA should seek "to communicate better to the U.S. Congress the harmful effects of disproportionate commodity earmarking of agricultural research funds."

A third major fault in agricultural research management is the proliferation of small branch stations. In fact there are two such networks, the state system (SAES) and that administered by the USDA. The SAES system comprises some 300 outlying branch stations and field laboratories, while the USDA system has several major national laboratories scattered throughout the United States and some 200 smaller locations. According to the NAS committee, too much money has been invested in developing small branch stations, whose scientists, as measured by their publications and frequency of citation, are less productive than those working in larger units. In the absence of any evidence that the USDA research is done better or more cheaply than SAES research, the committee suggests the USDA should close down many small branch stations or at least transfer them to the SAES.

Basic Sciences Ignored

Besides the failings in research management, another principal reason for the poor standard of agricultural research is its inadequate interaction with the basic disciplines that underlie it. Plant physiology, for example, is a discipline which might seem quite pertinent to agricultural research, yet a survey of 200 plant physiologists conducted in 1969 indicated that only some 6 percent of their support was derived from the USDA.

As for biochemistry, another presumably relevant discipline, the committee describes itself "appalled" by the low level of support given by the USDA. For example, all of agriculture is dependent on photosynthesis, yet there has been little support for it from agricultural administrators. Nitrogen fixation is another biochemical reaction of more than purely academic interest; the committee describes as "irresponsible" the failure of the scientific administration of the USDA to fund significant research in the subject.

To remedy these oversights, the USDA (the SAES are said to be not quite such bad offenders) should set up a competitive grants program for the support of basic research in all the sciences—biological, physical, and social—that underpin the USDA's mission. (The USDA's existing grants program is inadequately funded and does not allow for a free flow of ideas from the scientific community because the administrators define the program areas.) The new program should be evaluated by a peer review system and administered separately from USDA

Briefing

Congress May Investigate NAS

The threat of a congressional investigation of the National Academy of Sciences (NAS) looms, damping the spirits of the NAS brass whenever they think about it. As one of them quipped, "It is one of the cheerier things we have to look forward to in the new year." Whether the threat will actually materialize is strictly a matter of conjecture.

Earlier this fall, during Senate hearings on food and nutrition, Senator Charles Percy (R–Ill.) accused the academy of being "insensitive" to conflicts of interest among scientists who serve on its many advisory committees (*Science*, 29 September 1972). His allegation came after testimony regarding the composition of a committee reviewing the safety of monosodium glutamate (MSG), the food additive that apparently causes so-called Chinese Restaurant syndrome in susceptible diners.

Academy president Philip Handler, who is particularly sensitive to these charges of conflict of interest and who feels he has taken steps to keep persons with bias or even the appearance of bias off NAS committees, followed up Percy's public statement. For the record, he wrote to Senator Gaylord Nelson (D–Wis.), chairman of the committee that had been holding the hearings and explained the NAS's procedure for seeking out potential conflict of interest among candidates for its committees. Handler also got in touch with Percy on the subject and received a reply that said, in general, yes, he (Percy) was concerned about the situation and would be willing to talk to Handler about it personally after his return from a lengthy trip to Asia.

As things stand now, that meeting may take place sometime in January. A spokesman for Percy says that the issue of a review of the NAS is still quietly alive but was put to one side during the elections. He said that the senator had always thought highly of the academy and was surprised by the charges leveled against the committee reviewing MSG by James W. Olney, a neurophysiologist from the Washington University Medical School in St. Louis. Since then, congressional staffers have been doing legwork in case there is a hearing. Percy's spokesman says that so far the only substantive indication of "dirty dealing" involves the MSG review. No hearings are scheduled at this time and, he says, whether they will be is up in the air.

Clearly, the prospect of a congressional investigation does not appeal to the academy, which has just been submitted to intensive scrutiny by former *Science* writer Philip M. Boffey. Boffey has been probing the NAS for more than 2 years under the auspices of the Ralph Nader organization. His report is nearing completion.—B.J.C.

in-house research. The grants program should account for 20 percent of the USDA's research budget. It is "particularly important" that "recognition be given to the significance of social science research to the agricultural industry and rural people."

A third major failing in agricultural research, as perceived by the NAS committee, is the quality of scientific manpower. Agricultural research suffers from a "paucity of outstanding scientists." Several steps could be taken to improve the research atmosphere. One is to overhaul the way a scientist's performance is reviewed. Practices vary, but in the Agricultural Research Service the head of the scientist's division is often the chairman of the review committee. This is a "too tightly controlled in-house operation." For lack of competent peers, the scientist can be misled as to the quality of his own research and the administrator may not have the benefit of unbiased guidance. The USDA's evaluation system "has failed in many areas to produce top quality bench scientists." The SAES makes broader use of peer review, but both organizations should put outside scientists on their personnel review committees and eschew the practice of using department heads as chairmen.

Another way of improving the climate for research in the USDA would be to break the administrators' virtual monopoly of top jobs, the NAS study suggests. In the USDA's Plant Sciences Research Division only 6.4 percent of a staff of 755 scientists have ratings above the Civil Service GS-14 level, and only 0.5 percent have ratings above GS-15. The system "forces scientists to become administrators if they wish to reach the top grades," a condition that is bound to be repressive of good research. The USDA should allow active researchers to reach the top salary grades and in addition should recruit at all grades from the outside scientific community as well as internally.

The USDA reaction to the NAS study has been expressed by Ned D. Bayley, director of science and education and the official most directly concerned with the subject matter of the report. Bayley told *Science* that the committee had originally been asked to evaluate the state of agricultural science rather than the management of research. "The report was a little different from what we asked, but that was their prerogative," he says. Bayley does not agree with all the committee's conclusions but believes that many of its recommendations have already been met by a major reorganization initiated before the committee reported. Its study should be understood and interpreted in light of the great success of agricultural research. The committee makes too little allowance for the constraints imposed on the USDA by the shortage of research funds. But Bayley acknowledges that the "catharsis" experienced by the committee in the course of writing the report is evidence of how closed the USDA system has been to outside review.

Shake-Up of ARS

Many of the administrative criticisms raised by the committee have been addressed by a "real shake-up" of the Agricultural Research Service (ARS), the USDA's largest in-house research agency. In the reorganization, Bayley says, the ARS was decentralized, redesigned along regional rather than subject-matter lines, and a whole layer of administrators was cut out. The entire top staff of the ARS, amounting to some 130 people, was replaced or reassigned; also its former administrator, George W. Irving, retired in 1971. Asked if new people had been brought in by the changes, Bayley said it was more a question of "new faces in new positions." A large portion of the NAS committee's criticisms of poor administrators, he believes, referred to a single large laboratory, the problems of which are now being worked on.

As to the committee's suggestion that 20 percent of the USDA research budget should be devoted to basic research, Bayley says 35 percent is basic right now. Is it true that the agricultural research establishment has neglected such basic subjects as photosynthesis and nitrogen fixation? Bayley cannot say whether or not these have been underfunded in relation to other areas, but he notes that "every time I set a group of scientists to look at their own research they say that they want more money."

Replying to criticisms of the administrative treatment of scientists, Bayley says the ARS has long had a special promotion ladder for research scientists, but the recent government-wide restrictions on grade levels have curtailed its use. He intends to do more recruiting from outside but notes that one reason why the NAS committee pushed this suggestion was that "when Irving retired the committee members asked to be consulted on his successor—they were worried that a regulatory man would be put in charge of the ARS." (The committee was not consulted, but neither was a regulator appointed.)

Probably the most far-reaching of the committee's suggestions for reform is the institution of peer review systems. Bayley sees a "lot of merit" in the idea but harbors several reservations. "You don't launch something like that until you are sure there is going to be acceptance in the field, and there is some resistance there." The ARS supports some 20,000 projects with an annual turnover of about 5,000. To put all these through the peer review system would be a pretty massive undertaking. "If we undertake the peer review system, it will be on a pilot basis so as to learn how to work it." He feels that the peer review system works better for pure research, being less easily matched to mission research. Asked about the case of the NIH, which combines mission research with the peer review system, Bayley remarks that "the NIH has got a lot more money than we have and has been through a plush period." And knowing the business of grantsmanship, one also needs to have a feel for the extent to which a written proposal reflects the research which is actually done." He is not fully convinced of the implicit premise of the NAS committee's recommendation, that peer review leads automatically to higher caliber research. Bayley also evinces a certain distrust of the elitism implied in the peer review process. "I feel we sometimes give undue credit to the big shot. The progress of agricultural research is one of the big success stories of our times, but there are no big breakthroughs. It has been built up on the basis of a tremendous number of small advances. We have had four or five Nobel prize winners coming out of agricultural research, but that is just part of it—our success has been based on input from the whole agricultural community."

Is agricultural research a success story because or in spite of the way USDA and SAES research has been administered? Some members of the NAS committee believe that agricultural research is living off past laurels. One of the committee's special panels surveyed significant advances in understanding of nitrogen fixation and concluded none of them emanated from USDA laboratories or was supported significantly by USDA funds. Yet if the state of agricultural research is as debilitated as the NAS committee believes, how has U.S. agricultural production come to be the marvel of the world? This paradox, and further details of the NAS committee's unusual report, will be discussed in a later article.—NICHOLAS WADE