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Office of the Secretary

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Perspectives on research and education for commercial agriculture

The status of agricultural research and the ultimate transfer of this technology into useful purposes has come into very sharp focus in recent years. As a farm manager, banker, and armchair economist, I have had to delve deeply into this special universe in an effort not only to better understand its mechanisms and orientation, but hopefully to find an approach which would result in more effective answers.

Simply stated, the issue for agricultural research and extension is how to find the means to sustain a high level of awareness and public support for this critically important component behind our food supply system. The problem is that when worldwide food stresses are surfacing in various alarming proportions, we are at the same time experiencing serious declines in scientific investment in food and fiber, both public and private. Further, we have invested substantial public funds in the development of technology which often remains on the shelf and thereby not transferred into useful application. Let's discuss the research side first.

The reasons why we are in difficulty are not hard to assess -- the answers to how we uncouple the needed financial resources are far more difficult. Nothing unusual in this comment, but what worries me is the lack of vigor with which we are facing up to the problem.

Remarks by Robert W. Long, Assistant Secretary of Agriculture, before the American Agricultural Economics Association, Texas A&M University, College Station, Texas - August 20, 1974

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No one seems to seriously challenge the proposition that research and its effective transfer into useful technology through education is the basis of most progress -- yet many are standing by like spectators and watching the slow but continuing decline of the greatest agricultural research and extension system ever assembled by one nation.

As stated earlier, the reasons are not too difficult to analyze:

1. Many people feel, have publically advertised, that public ag-research is redundant, over-mature, pedestrian, wasteful and inefficient. Among the critics are a significant number of scientists, including economists.

2. Other research and education disciplines have attracted wider support such as human health, space technology, social sciences, etc. Better salesmen with a highly visible product, I suppose.

3. High costs of specialized hardware and professional personnel are associated with the decline. ARS is currently operating in terms of real dollars at levels experienced fifteen years ago, and will probably go still lower. Similar patterns are true for most State Experiment Stations.

There are more reasons for the decline such as debilitating interdisciplinary squabbles, severe public budget constraints, and other priority issues, but the single factor of greatest significance lies in the lack of industry and public support. Some of the problems stem from their being unaware of the long-term consequences should agricultural research programs be allowed to erode further. One facet of the problem comes from a demand by management types that research produce clearly identifiable results within annual budget periods. The old accountability measurement has arrived for our bench scientist -- and he isn't prepared.

Probably the most serious charges are made by those who maintain there is excessive duplication of work caused by political considerations and poor communications. Congress is highly susceptible to individual and group pressures which often result in earmarked funds -- a process which tends to distort carefully planned research programs.

Other observers say three-quarters of a billion dollars annually in publically supported research should be enough to do the job - even with inflation.

The concerns coming from the private research sector (at least equal to the level of investment vis-a-vis public) are more understandable. Excessively high costs for transferring developed technology into merchantable product is destroying incentive.

If the investment in basic research, plus costs for registering under present regulatory controls exceed opportunity for return within a reasonable span of time, it is clear that development of new products will decline -- and they have, dramatically.

Pesticides are a good illustration. The chemical divisions of several oil companies are withdrawing from manufacture presently accepted products because they are no longer profitable (zectran).

Also, EPA bans and local court decisions on several of the more persistent pesticides have further reduced materials available to farmers,not to mention sales opportunities and incentives for manufacturers (most recently, Aldrin, Dieldrin, 2-4-5-T, etc.). USDA has contested most of these actions with only modest success so far. Local court decisions have gone both ways as scientific judgments give way to largely legal decisions. It all adds up to substantial indecision in the industry.

Somebody may have to pick up the tab for future development of alternatives to materials which are rapidly losing to environmental pressures. It looks like publicly supported research will have to bridge the gap. If true, we are back to the question of how we generate the public support needed to underwrite the need.

It is clear to some of us close to the scene that increased Federal and State funds for ag-research will be unlikely for the forseeable future. On the assumption that such an assessment is correct, a strategy must be developed at several levels to get the job accomplished.

First of all, we must start to use currently available resources at the optimum. This means stretching what we have over more workload. It may also mean better planning to divide up research commitments among the many facilities now accessible to agriculture. Inter-disciplinary teams are now a frequent method of problem solving in State and Federal programs. Specialization through research centers is another way to concentrate scientific tasks and avoid or reduce the probability of needless duplication.

The regional approach adopted by ARS two years ago is beginning to have the hoped for effect of improving communications between Federal and State research facilities -- a promising indicator.

The Current Research Information System is becoming more useful as the depth and versatility of the data bank increases. Scientists can now more readily determine the stage of development and location of work underway in their field. Another means of reducing unnecessary duplication of effort.

One of the most promising ways of stretching research dollars is in the area of better planning and administration. For example, the National Planning Committee of the Agricultural Research Policy Advisory Committee is composed of representatives of USDA and State Agricultural Experiment Stations who are charged with the broad responsibility of promoting coordinated and cooperative research among the University Land-Grant Institutions and the Federal Systems. With the aid of CRIS the planning body hopes to advise its members the extent of existing research programs and to suggest regional and national priorities in agricultural research needs.

No matter how extensive current and accumulated scientific knowledge may be, it is no more effective than the degree it is directed toward solving urgent (brush-fire) and long-term animal and plant production problems. In short, we greatly need a better system for transferring technology into useful results.

There is too often an unconscionable time lag between some scientific discoveries and public utilization.

Perhaps the difference can be traced to a misplacement -- or at least an imbalance -- of priorities. Perhaps we are simply putting too much emphasis on communication with potential users of the technology.

However it may be, let's look at this side.

A special report recently prepared for the National Science Foundation[1] addresses the problem of inadequate technology transfer and utilization of public research findings. The report recommends that "the Government, in collaboration with innovators, suppliers and users, adequately define the opportunities (for quickly transferring public research into public utilization) in terms of specific needs or ultimate uses, market characteristics, economic payoff and public benefits, and match these opportunities with the available technology."

While the report recommends such Federal involvement as the provision for incentives and tools such as adaptive engineering, seed financing and marketing assistance, it in no way implies that the Federal Government should become a competitor to the private entrepreneur.

I firmly concur. The Federal role in technology transfer and utilization should be one of stimulating and assisting, not one of inhibiting the nation's industrial sector.

In short, the Government can provide some of the important technology. And it is. But its role as a technology transfer and utilization catalyst needs considerable refinement.

Let's take a look at some of the things we might do to underscore our responsibility in the catalytic process.

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[1] Technology Transfer and Utilization: Recommendations for Redirecting the Emphasis and Correcting the Imbalance (Washington, D.C.: National Academy of Engineering, 1974). p.22.

We might be able to improve the quality and quantity of technology transfer by recognizing scientists who do a particularly good job of technology transfer and implementation. At present, most promotion evaluation systems recognize only so-called "scientific" contributions of researchers -- such as publications -- and not the time and effort expended in working with user groups.

Such a revamping of our evaluation and promotion systems might help offset professional jealousy and protection of personal domains that exist among some scientists. Both the scientists and the public would benefit.

The Department of Agriculture could also focus more attention on its licensing of inventions. USDA's current polity is to encourage the development of its inventions to the point of practical application, including the granting of licenses. Department inventions will normally be made available to responsible applicants with licenses granted on terms and conditions considered to be most favorable to the public interest. Either nonexclusive or exclusive licenses may be issued by the Administrator of the Agricultural Research Service to processors or manufacturers who meet certain requirements.

The current policy works like this: Exclusive licenses are considered appropriate when (a) the invention has not been developed substantially to the point of practical application,

(b) when it is not likely to be developed to such a point by the Government or by means of nonexclusive licensing, (c) when the granting of an exclusive license will substantially accelerate development of the invention, or (d) when the ARS Administrator determines that a previously granted nonexclusive license has not resulted in substantial development and that an exclusive license is necessary to bring the invention to the point of practical use by the public.

I see nothing inherently wrong with that policy. The trouble is, about the only way we've drawn attention to it is through the issuance of news releases. We must try new channels, and we will.

So far I've focused on the primary uses of technology, i.e. using public research in a narrowly-defined way to meet a specifically identified need. But let's not forget the limitless secondary uses we can get from our research -- items like Teflon and the micro-wave ovens that have emerged as by-products of our space program. Some of our most useful scientific achievements have come from chance discoveries. We need to avoid putting the scientist in too limiting a role.

I earlier said that one of our problems in technology transfer can be traced to a misplacement -- or at least an imbalance -- of priorities. Consider this:

Of the nation's total research and development budget for Fiscal Year 1973, only 0.25 percent was authorized to encourage technology utilization. This does not include funds for collecting and disseminating information.

This amount -- only one-forth of one percent of the R&D budget -- was all that was allocated to stimulate substantial and profitable secondary uses of publically-funded technology.

From these numbers the National Science Foundation[2] reaches a basic conclusion: That the Government should redirect the emphasis and correct the imbalance between merely reporting technology and actually doing something about its transfer to and utilization by the public.

One possible solution is to increase the funding for application, adaptation and utilization to at least the same level as that expended for the collection and dissemination of information. In Fiscal Year 1973 nearly $1 billion went to the collection, organization and dissemination of technical and descriptive information.

One billion dollars!

And that does not include the myriad of other services provided by the information personnel in the Federal Government.

It would seem to me that, if we cannot find the funds for more direct transfer of technology, a good place to start looking just might be in our information budgets. Perhaps we could re-direct the use of a portion of that billion dollar fund that we already have.

I suggest this because the techniques generally used by Federal and State agencies for transferring technology are based on passive methods: collecting, screening, indexing,

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[2]Ibid., p.18.

storing, and disseminating scientific and technical information on the specific request of a potential user. Such methods cannot be fully effective because they depend on the prospective user's ability to narrowly define the technology he seeks. Also, the procedures used to search out the information are often complex and overlapping, and the format in which the data are provided to the requester is frequently ripe with bureaucratic superfluity.

A summary point is this: We simply cannot measure the technology transfer and utilization output only in terms of the number of people contacted, the weight of our publications, the frequency of our public relations announcements or the thoroughness with which we complete our study contracts with universities.

These yardsticks bear little relationship to the real impact our research tax dollars have on the public good.

Along this very line, the same report prepared for the National Science Foundation[3] recommends that projects for transferring and using Federal technology should be funded on the basis of reasonable evidence that there will be widespread public benefit in terms of bolstering the economy and easing national problems.

This kind of approach would seem consistent with the suggestion that our information collection and dissemination budgets be re-evaluated.

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[3]Ibid., Summary, p.i.

Again, what are the dollars and sense of effective transfer and utilization of Federal technology? Consider this testimony from last year's hearings before the House Appropriations Subcommittee:

> "If the agricultural output we achieved in 1970 had been produced by the methods available to farmers in 1939, it would have cost our Nation about $29 billion more in land, labor, capital, and other resources than the actual cost in 1970. Using the 1939 methods today would mean higher costs for poorer quality food."

This estimate was derived from Economic Research Service data on total inputs and production in agriculture. Farm output increased by 59 percent from 1939 to 1970 -- during a time (like today) with much to be desired in the effectiveness of our technology transfer. If productivity had not increased during that period, total inputs required in 1970 would have been 50 percent higher. These additional inputs -- valued at 1970 costs -- would have totaled $29 billion.

Specifically, what is the agricultural economist's role in this?

It seems to me that that agricultural economist should be the impartial judge of critical commodity needs. He is the fulcrum. He is the focal point in the interdisciplinary activity that leads to effective transfer and utilization of our technology.

He is the one who can take a close -- and objective -- look at our total farm production systems and advise us on how best to adopt our orphans of technology.

And, as an additional role, the agricultural economist can interpret farm production costs for the consumer. He can be the mediator -- or buffer, if you will -- between the producer and the consumer. If the consumer is willing to pay, say, $1.50 -- but not $2 -- for a pound of beef, it's the agricultural economist who can bring this message back to the producer. That message would also be a challenge to the research scientist, whose job it is to transform public need into workable, practical technology. Then the economist's catalyst role takes over and we come full circle with technology utilization.

Indeed, the problems are large and imposing. And the possible solutions are complex and sometimes overlapping.

The hope is that more of our technological orphans will be adopted sooner so they can be useful now. So, too, must we build a system of research accomplishment which will continue to provide an anchor for a food industry unequaled in the world.

We can do it, and you can help.