Funding Agricultural Research

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My introduction to agriculture began with my life on the farm. Among my first farm related tasks was harvesting tobacco, shucking and shelling corn for a "large" flock of chickens and hoeing weeds in peanuts. These were all very common tasks on the typical southern farm in the 40's and 50's. Today, tobacco is mechanically harvested, corn is a component of chicken feed that is mechanically harvested, processed and fed to chickens automatically. Weeds are quite effectively controlled in peanuts with selective herbicides.

Here are a few other changes that have occurred in recent decades.
Banking – In years past, one usually got to know his favorite bank teller who handled transactions quite quickly and efficiently and at times, provided comments on the weather and depending on the season, on the results of the local high school football game. Today, banking is almost exclusively done by machines located on street corners in New York, Bangkok, Tokyo, or Beijing. Personally, I resisted ATMs for 3 or 4 years, but eventually even I came around.

Gasoline
Once upon a time gasoline was so cheap and competitive, different distributors gave away tea glasses and other trinkets just to get you to buy their brand. They also often offered exceptional service such as pumping your gas, washing windshields, sweeping out the floor of the car, and smiling while wishing you a good day and safe driving. Today, you unceremoniously stick your credit card in a machine and it turns the pump on for you so you can pump your own gas and automatically debits your account that absolutely always includes the fill up on your bill at the end of the month. I resisted this system for at least 3 years. I'm still hoping for at least a smile and a windshield cleaning, but don't hold your breath.

Airlines
When I first started flying commercial airlines, I was a student here at Iowa State. To go home, I had to drive to Des Moines, board a DC 3 (dubbed the gooney bird by the US Army Air Force) for the 2-hour flight to Chicago. Then, I boarded a DC 7 or later, the souped-up DC 7 (called a DC 7B) for a flight to Jacksonville, Florida. It took most of the night. In addition to personal attention, there was coffee, chewing gum, and a meal. Some airlines even gave out cigarettes. Of course, we all complained about airline food. Well the airline's solution is to just not serve meals anymore. One problem solved.

Today, flying is a bit different. Airlines have gotten us pretty well trained to check ourselves in, print our own ticket, and handle our own luggage.
Nowadays the airlines manage to put the fear in us by losing just enough of our luggage, for us to keep our bags in sight, thus saving on their labor bill.

Of course the oldies, Pan AM, Eastern, Southern, and your regional airline whose official name I can't remember, you will recall its unofficial name the "Sick Duck," are no longer flying. But in their place you still have Delta, American, Northwest, soon to merge with Delta, and United. In addition, there are a dozen new "start-up" airlines that manage to be around for a couple of years.

The stewardesses were all quite young and appeared to be college girls looking for a more exciting life than Friday night Frat dances. Stewardesses have now become Flight Attendants to accommodate men among their ranks of course, age discrimination is not acceptable today. However, I'm becoming more and more appreciative of older flight attendants as I add a few more years.

Checking in at the airline counter requires a substantial level of computer skills, and we just won't talk about undressing for the security check. After this experience, who wants food? Even a $7.00 beer sounds good.

And these are not all the changes progress has brought. Just recall your first cell phone (early versions were called bag phones), laptop computer, or digital camera. And a wrist watch for my birthday came with a 40-page manual in 5 languages.

With these kinds of changes in our society, is it any wonder the funding mechanism for agricultural research has and is continuing to evolve?

Publicly funded agricultural research is a relatively modern phenomenon. Prior to the modern era, most research was conducted by those who had an interest and was supported either privately, by the church, or some institution. You will recall Gregor Mendel, who did his classical breeding work with peas was an Austrian monk.
Formal agricultural research has its roots in Europe in the early 19th century. Among the early agricultural experiment stations was Rothamsted in England. During this period, agricultural research emerged throughout much of Europe.

Many of the early results from those research efforts, particularly in plant nutrition, were so exciting the concept of agricultural research quickly crossed the Atlantic to this country.

The Connecticut Station has the distinction of being the first agricultural experiment station in the United States. The Connecticut Station dates back to 1875. Soon other states followed with their version of an agricultural experiment station.

One of the great stimuli for agricultural research was the creation of the Land Grant Universities, by the Morrill Act of 1862. It soon became evident in those new institutions, that if they were to be centers of learning about agriculture, then there must be a reliable means of developing new information about agriculture that could be taught.

Building on the European model for agricultural research and the success of the Connecticut Station, several states began some form of agricultural research. Each state took a unique approach. Unfortunately, there was little coordination among the states. Consequently, they evolved along different lines.

Fortunately, it was soon envisioned that agricultural research was so important it must have some type of national focus—yet not overlook the specific needs by each state and their communities regarding their unique problems in agriculture.

In this environment, William Henry Hatch of Missouri had a vision. William Henry Hatch was born in Scott County, Kentucky, on September 11, 1833, the son of a pioneering protestant (Campbellite) minister. Hatch was called to the bar in Hannibal, Missouri, where he became a noted lawyer. Later he joined the Democrats, and was elected circuit attorney (1858-1862).

After a tour in the confederate army, he became the Democratic congressman for the solidly agricultural First District of Missouri in 1878, thereafter winning eight consecutive 2-year terms. Hatch's influence in Congress was exerted mainly through his chairmanship of the Committee on Agriculture. He never achieved his ambition of becoming Secretary of Agriculture, though he successfully led the movement to raise that post to Cabinet level in 1889.

Hatch made his greatest contribution to American agriculture with the Hatch Act of 1887. This gave direct Federal support to each state and territory for the agricultural experiment stations closely associated with the Morrill land-grant colleges. This was the first systematic Federal support provided for research conducted at academic institutions.

The Hatch Act brought immediate improvement. More than 50 research stations were eventually created, and their discoveries helped revolutionize American agriculture and the life of the farmer.

These experiment stations grew rapidly after 1887, and it was soon taken for granted that Federal and state governments should work together in a national system of agricultural research, as well as teaching, and (later) extension education. The U.S. Office of Experimental Stations was created in the U.S. Department of Agriculture in 1888.
The first serious funding for agricultural research can be attributed to the "Hatch Act of 1887." This funding truly made possible the State Agricultural Experiment Station (SAES) we know today. Indeed, this was rather clever legislation in as much as it provided resources to the respective states to address important local needs, which given the distributed nature of agriculture, created national impact. It also cleverly leveraged the Federal dollars with state dollars.

The Hatch Act enabled the director of the state agricultural experiment stations to focus on specific problems impacting their state that could be addressed through research. The money was allocated to the respective states according to a formula that considered several aspects of the agricultural and rural portfolios of the respective states. The Hatch Formula took into account a number of factors including number of farms and the relative size of the state's rural and agricultural population. I might add that, today, the Hatch Formula does not even come close to relating to each states agricultural portfolio.

In the early development of the SAES, it was quite logical to ensure a steady stream of money to these new experiment stations. They were in their infancy and needed sustained funding to ensure their survival. The Federal Hatch formula money was a critical resource that helped institutionalize the SAES.

Probably more than any other factor, the formula is responsible for state agriculture experiment stations that exist today. The "Hatch monies" were allocated to each state to address

researchable problems unique to that particular state as determined by the state agricultural experiment station director.

Unfortunately, over the years few experiment stations directors exhibited sufficient discipline to allocate their Hatch money for special, local needs, or to address specific problems as called for in the legislation. Most directors simply used the Hatch money to pay salaries or a portion thereof of scientists associated with the stations. As this process evolved over the years, there were few dollars available to respond to new or emerging special local needs. The solution was obvious. This development gave rise to the congressional earmarks to address those special local needs.

Earmarks are not necessarily bad. In fact, many, if not most congressional earmarks address existing high priority local and state research needs in agriculture. The success of earmarks reflects the power and willingness of congressional delegations to use such power.

The argument used often to discredit formula or Hatch funds for agriculture research are for the most part, not true. Research supported by Formula funds is equal to research funded by state, private or competitive funds. In addition, Hatch funds leverage funds in many states where the non-Federal match for Formula funds for research is as high as 8 to 10 to 1.

State funds are, in most situations, are about the same as Federal formula funds. Consequently, in the typical experiment station, the sources of funding for specific research projects are widely dispersed, except research supported by competitive grants or contracts. Consequently, it is difficult to demonstrate the specific impacts attributed primarily or exclusively to formula funds.

It should be noted that formula-type funding could probably be better defended if such funds were maintained for maximum flexibility and used for rapid response to address new, emerging local problems.

An argument often made is that some types of research can't be conducted without formula funds. This argument has always seemed fallacious to me. It does, however, require research managers (experiment station directors) to be far more innovative and creative in how they manage their total research portfolio. The 2008 Farm Bill now authorizes USDA to make grants for up to 10 years.

A more logical argument that may be made is that as scientists become more entrepreneurial through the competitive grant process, the administrators lose some direct control. Some have argued that formula funds, even distributed in small parcels or unseen in salaries, have hampered innovation and entrepreneurship among faculty.

If a scientist supports herself (himself), then the need for support by the administrator is minimized. This can sometimes be a problem for field days and tenure panels, as well as other academic duties.
Here again, innovative administrative leadership can still bridge the gap between the grant supported scientist and his (her) colleagues who are supported by the administrator through Federal Formula or state appropriated funds.

The bottom line is, just as a scientist must have a different skill set to be successful through the competitive process, the research administrator must possess a different skill set to be effective managing grant supported programs.

Alas, my experience reflects that scientists are usually more receptive to change and accepting of new funding approaches than are experiment station directors or research managers.

Having served as an experiment station director in two states, I clearly see the merit in receiving money according to a formula that is constant and so sufficiently assured it can be added to the base support of the experiment station.

In many land-grant universities during much of the first half of the 20th century, agricultural research was a major component of the Universities' total research portfolio. During these years, the formula approach was a very satisfactory model, but times and situations have changed.

With the advent of WWII, research became much more specialized and the total university research portfolio rapidly expanded. There became no clearly defined means to fund research in many program areas or disciplines in the typical university.

The agricultural formula model was simply not a viable option for the many, many disciplines of the typical university. Hence, a new model for funding research evolved—the competitive research model where funds were awarded for specific projects on a competitive peer-reviewed basis became the norm.

After World War II, and Vannevar Bush's landmark report, entitled *Science - The Endless Frontier*, science became a strategic national investment. Bush advocated for a "National Research Foundation" which in 1950 resulted in the establishment of the National Science Foundation and the exponential growth in publicly-funded research.

These developments, and the Cold War, provided the impetus for federal funding through the National Institutes of Health, National Science Foundation, National Aeronautics and Space Administration, etc.

The Competitive Research Model

Congress first authorized competitive merit-based peer-reviewed grants at USDA in 1977. However before discussing the competitive research model for agricultural research, I'd like to start with a statement from the managers report for the Food, Conservation and Energy Act of 2008.

> "The managers of the conference committee recognize the numerous benefits of competitive research programs and have supported the expansion of funding for these programs. They encourage the Department to make every effort to increase support for competitive programs while maintaining the needs of capacity and infrastructure programs when making budgetary decisions."

The competitive research model begins with a carefully crafted request for applications (RFA), Request for Proposals (RFP), funding opportunities announcement (FOA), or some similar type of request. This initial step must be very carefully crafted to ensure that it clearly articulates the range of issues the research should address and also be worded such that it encourages scientist to submit proposals and can satisfactorily address the problem that is identified.

Stakeholder input, both from scientists who know where the opportunities for discovery are and citizens who need the scientific output, is critical to RFA development.

For more that fifty years, Federal support for research has focused on Federal laboratories, both federally-owned and operated, such as those of the Agricultural Research Service, and federally-owned and contractor operated, such as the labs managed by the Department of Energy; and on peer-reviewed, competitively-awarded extramural grants often focused on fundamental science.

The intramural programs support science for government needs such as regulation, high-risk and high-security development, and program implementation. Grants tend to focus on science deemed in the broad public good, often removed by time or concentration of commercial interests to make the work economically viable for the private sector, but necessary for advancing science or laying the groundwork for solving dispersed, public problems.

This emphasis and approach to both extramural and intramural science support have been repeated in agency guidance on research programs promulgated annually as part of the Federal budget development process through the President's Office on Science and Technology Policy and the Office of Management and Budget. Science priorities are set through a continuing stakeholder and interagency process, then targeted for funding through either the federal laboratory system or competitive grants programs.

Recent decades, regardless of political leadership, have seen strongest growth in support for competitively awarded grant programs through the National Science Foundation, National Institutes of Health, National Institute of Standards and Technology, and the Department of Energy. At the same time, many programs operating outside the peer-review system have languished, such as Hatch formula funding for the agricultural experiment stations.

This first step is the most critical, most important, and most difficult. It describes what research we should do, what research we can do, and what research some important constituency cares about. Done well, it will yield positive outcomes; however, done poorly, results will be disappointing.

From a national perspective, I think that the approach of first defining the problem to be researched then using an open, competitive process to select the best scientists to address the problem is quite obviously an elegant and important concept for funding research. (This process frees up the incredible innovation of creative minds.)

This past week, I was at the University of California-Riverside to present the Discovery Award to Dr. Julia Bailey-Serres and her colleagues. The Discovery Award recognizes exceptional scientific and economic impact of NRI funded projects. Their research identified a gene locus, Sub 1, that enables rice to survive flooding. This was a most exciting, elegant and impressive research accomplishment for one of the most important grain crops in the world. Of course, their discovery has implication for other crops.

This competitive approach provides an effective mechanism for indentifying, addressing, and solving truly national problems, while the Hatch (formula) funds, along with the state match, complete the picture by addressing special local needs as identified by each state experiment station director.

Under the provisions of the new Farm Bill, the National Institute for Food and Agriculture (National Institute) will build on the success of the Cooperative State, Research, Education, and

Extension Service (CSREES), and will assume all of the authorities currently assigned to CSREES.
I anticipate the National Institute will be much more than just the old CSREES with a new name. The National Institute will be operational by October 1, 2009.

Also included in the Farm Bill is a reincarnation of the National Research Initiative (NRI), coupled with the old IFAFS (Initiative for Future Ag and Food Systems) into the Agriculture and Food Research Initiative (AFRI).

AFRI will accommodate both basic and applied research, as well as related efforts to support education, securing our research capacity, and technology transfer, including extension, to assure the usefulness of science to solving real world problems.

The 2008 Farm Bill also designates that the Under Secretary for Research, Education, and Extension shall also be the Chief Scientist of USDA. One of the important tasks of the Chief Scientist, USDA and Under Secretary, Research Education, and Economics is to be a champion and "lift up" agricultural science within the Department and across the entire National science community. The entire agricultural research, education, and extension community must help in this process.
Here are a few ideas to strengthen agricultural research:

I. Embrace the competitive funding mechanism for agricultural research.

A. This will require some adjustments, but there is no reason to believe that any administration is going to support increasing the Hatch formula. A key question is, is it the means of funding or the amount that really matters most? You will recall the Clinton Administration supported the competitive process. The science community today is driven by the peer reviewed competitive process. We are a part of the science community. Therefore, you see the inescapable conclusions.

B. That means we support the formula at current levels to address special local needs as envisioned in the 1887 Hatch legislation. We have supported a multi-mechanism funding approach or a "balanced portfolio."

C. You will note in the current Farm Bill, funding for research increased by over $100m per year, or almost 10%. This growth came in four program areas:

1. Specialty crops
2. Biomass
3. Organic agriculture
4. Beginning Farmers and Ranchers

D. All of the money in each of these categories will be allocated on a competitive basis.

II. Disdain earmarks. Yes, I know the argument. Sorry, I'm guilty of soliciting earmarks when at Auburn University and at University of Georgia. I know how the system operates. But truly, this is not a concept we should promote or be proud of. It diminishes the perceived value of our science, by funding it outside the peer reviewed competitive process.

A worst case scenario is, what about the situation where 4 or 5 states have Federal earmarks to do the very same type of project? – pretty hard to defend this as the best use of taxpayers money.

I'd like to wrap up my comments by addressing, "how do we move to the competitive era?"

Accepting the peer reviewed, competitive approach for funding agricultural research programs is clearly our future. Whether or not we wish to move in this direction is irrelevant. We don't control the situation. However, if we want to be successful, it is imperative we change.

Change is seldom easy. Embracing a new method for funding agricultural research is no exception. This is especially true when the formula method has been so successful and quite frankly, highly effective over the years. I know that these funds have been woven into the core of many experiment station's programs and it is hard to envision getting to the same destination by taking a different road.

To respond to this question, I'd like to address this matter from two perspectives─ Administrators and Scientists.

Here are a few ideas that might facilitate the transition.

For Scientists

1. Visualize the competitive process as an opportunity to put your ideas up against everyone else's ideas. If you don't succeed the first time, this is a great way to improve your proposal, and succeed the next time. There is a great sense of accomplishment when you have been deemed to have the best ideas to solve a problem.
2. Learn the ropes of the competitive process. Become an expert at writing proposals. Throughout my administrative career, I was often encouraged to hire a grant writer. I never gave it a second thought. I don't think you can hire anyone that can be as effective as a scientist in writing grant proposals. The scientist knows the literature, knows what to do, and, of course, knows the approach to take to addressing the problem.
3. Keep in contact with colleagues from other institutions and organizations. Today, many issues need to be addressed from a broad, multidisciplinary perspective. Consequently, having a team approach often enhances opportunities for success.
4. Use your management skills. Throughout my career, I've seen many problems when scientists overlook management of their research enterprise. Many project leaders manage research projects that involve ½ to 2 million dollars. It starts by ensuring you have resources to do the job. Be a tough bargainer. If there is less money, then make the proposal more narrow in scope. Don't ever agree to do more research than you have resources to support.
5. Include graduate students in the competitive process. They will learn and improve their skills as well as provide a continuous renewal of new and sometimes innovative ideas.
6. Train students in the art (science) of grantsmanship. While here at Iowa State, I took a course in electron microscopy. As part of the course we had to develop a full blown research proposal – I believe it had to follow the NIH format. Well, it was not sent to NIH, but it was turned in and graded for course credit. What a great experience. On my first assignment at Auburn University, I applied for and received two competitive grants. Each grant was for over $50,000. This was a pretty good grant for 1965. My preparation and submission of research proposals were directly related to the class experience at Iowa State University.

For Administrators

1. Create opportunity for success. The first task for the experiment station director or research manager is to support the competitive process by preparing faculty for success. In fact, some experiment directors already compete their formula money. They carefully identify the research needed, develop an RFA, RFP, or FOA, and then determine who on their staff can get the job done best through a competitive peer review process.
2. Hire only scientists who are comfortable in being a part of the competitive approach. This requires leadership skill on the part of the director. During the probationary period (before tenure) you can ascertain whether or not a scientist can compete. If he (she) can't be competitive, do that person (and your program) a great favor and help them get a job where they can be competitive.
3. Accept responsibility for identifying areas where extramural funding is not readily available. The director must consider other means of funding needed research in such areas.
4. Recognize effort in being competitive but don't reward grant writing or even receiving grants. Researchers should be rewarded for research accomplishments.
5. One of the most important things a director can do is provide money to bridge programs between grants. The director seldom loses because invariably you are betting on your best scientists. It really is not a gamble to bet on your best scientist. It's an investment.
6. Develop workshops or training programs for scientists to improve their grantsmanship skills.
7. Ensure that scientists understand they are expected to be successful at grantsmanship. If you don't tell people what you expect, you should be satisfied with whatever you get.
8. Provide assistance where applicable. One of the most critical areas is in developing the budget especially in addressing the match and help in processing. A staff person who can be helpful when working "under the gun," and won't become "unglued" when a scientist comes in at 4:45 p.m. on Friday and says he (she) needs to get the proposal through the budget office, the Dean's signature, and a grants.gov date stamp by midnight. When you find this kind of budget person, keep him or her at whatever costs.

In closing, I've long understood that having adequate funding for agricultural research is important. The mechanism as to how the money is allocated is far less important. I've long held the position that if money is available, scientists will figure out how to get their fair share.

I'm confident that a multi-faceted approach (balanced portfolio) that this Administration has supported with new growth in competitive money is the most logical approach for funding agriculture programs in the future.

I'd like to leave you with a statement from the 2000 National Research Council report, "*A Vital Competitive Grants Program in Food, Fiber, and National Resource Research:"*

> "If implemented, the recommendations growing out of this third National Research Council review of the NRI (the other two were in 1989 and 1994) will re-energize the NRI and the nation's food, fiber, and natural-resources research complex and will give USDA the opportunity to rediscover its fundamental research roots—where it began 120 years ago. In the committee's opinion, the nation needs USDA to re-emerge as the research engine of the food, fiber, and natural-resources complex that has served the nation so successfully in the 20th century. There is no acceptable alternative. The food, fiber, and natural-resource system is too important and too fundamental to future national security and stability not to have its own research program that focuses explicitly on high-risk problems with potential long-term payoffs. The committee believes that an

> expanded and refocused NRI is the proper platform. Without a dramatically enhanced commitment to merit-based peer-reviewed food, fiber, and natural-resources research, the nation places itself at risk."

Like so many life endeavors, the future will belong to those who can successfully compete. The world is a competitive place. Research is no different. I challenge you to be a competitor.

Thank you, good luck, and best wishes