Agriculture's Strategic Role: Feeding and Fueling a Growing World
At the Farm Foundation Conference

Gale A. Buchanan
Chief Scientist, USDA
and
Under Secretary for Research, Education, Economics

Westin City Center Hotel, Washington, D.C.
December 4, 2008

Good morning. It's a special pleasure for me to address this forum on Agriculture's Strategic Role: Feeding and Fueling a Growing World and to be able to discuss the role of publicly funded agricultural research.

First, however, I want to congratulate the Farm Foundation on their 75th Anniversary. The Farm Foundation has truly been a catalyst on behalf of agriculture and this forum's timely topic is certainly an example of the Foundation's relevancy today.

It's interesting to look back 75 years ago to see just how far agriculture has come.

In 1933, we were at the height of the Great Depression; the farm economy however, had been in crisis since the end of World War I when farm prices and income reached rock bottom. We also had the Dust Bowl after several years of drought and decades of poor farming practices. And in 1933, only 13% of farms had electricity.

Back then, one farmer fed, on average, 9.8 other people; and it took 15-20 labor-hours to produce 100 bushels (2 1/2 acres) of corn. Farmers accounted for 21% of the American labor force; and there were more than 6 million farms in the U.S. with and average of 157 acres each. Farms were also much more diverse; farmers grew many different crops and raised several different types of livestock.

I grew up on a small farm in North Florida. We grew corn, cotton, peanuts, watermelon, several vegetables, and had hogs, cows, and chickens. And it was a small farm.

Today farmers account for less than 2% of the labor force; there are less than 2 million farms and the average farm size is 441 acres. Farming today is also much more specialized and vertically integrated. In fact, some enterprises, particularly poultry, are almost totally integrated. Hogs are moving in that direction.

It's clear to see that a lot has changed in 75 years. Interestingly, a lot of today's farm programs have their origins in the 1930s.

Clearly, agricultural has undergone tremendous changes since 1932; although in fact, agriculture and our food system have been constantly evolving for more than 10,000 years.

The developments have been the most dramatic during the last Century, largely due to the application of science and technology to agriculture. We've had three major revolutions in agriculture in the last 100 years: mechanical, chemical, and biological.

At the turn of the last century a farmer of ancient Egypt would not have been lost in the barnyard of a Pennsylvania farm in 1900. The mechanical revolution actually started with the invention of the internal combustion engine. This was soon followed with the tractor in the early 1900s. The tractor allowed one farmer to do much more work and cover more acres and I might add with less physical labor.

The introduction of chemical fertilizers followed the work early research at Rothamsted experiment station in England. Fertilizers increased yields significantly. This idea quickly crossed the Atlantic and was an integral driver in the development of the experiment station system in the United States. Following World War II, we saw the emergence of pesticides. I'm dating myself, but I really grew up with the pesticide era.

In the 1960s the Green Revolution took advantage of the new chemicals and new, higher yielding varieties of crops developed by plant breeders to produce more food on less land.

These research investments and scientific advances—largely in the public sector—helped fuel the tremendous rate of productivity growth in the American agricultural sector. Since the middle of the 20th Century, the productivity of U.S. agriculture has steadily increased, by about 1.8% per year on average. That translates into lower costs of production of crop and livestock commodities, and lower food costs for consumers.

The evolution of farming continues today, where we are in the midst of the biotechnology revolution. Biotechnology has become the most rapidly adopted form of agricultural technology.

Over the years, one result of agricultural productivity has been the decline in the number of farmers as a percentage of the U.S. workforce, from 25 percent in 1930 to 1.9 percent today. This change allowed our workforce to move from the farm into industry, service, and science and created the world's greatest economy. Increased agricultural productivity has improved our standard of living and moved us from an agricultural-based economy to an industrial economy, and now to a technology-based economy.

Improvements in agricultural productivity are also important for the economy as a whole. A Harvard study recently estimated that between 1960 and 2005, production agriculture accounted for 6% of all of the productivity growth in the US economy – even though agricultural composes less than 2% of the national GDP.

Continued investment in agricultural research is vital to maintaining this growth rate particularly in light of the challenges we face today. These challenges include sustainable energy security; global climate change; water availability and quality; and food safety and security.

All four of these challenges are connected, and agricultural research has a critical role to play in addressing these challenges. I call these the Grand Challenges of Agriculture. One of my administrators recently said the super grand challenge is addressing all of these simultaneously. I agree.

Publicly funded agricultural research is particularly important in these challenges because finding solutions to these complex problems will require long-term, sustained research, and most involve “public good” benefits where there is not sufficient motivation for private sector investment. For example, research to improve food safety, water quality, or mitigate climate change cannot be easily packaged and sold on the market.

The global agricultural community and policy makers face an enormous challenge in ensuring the availability of a food supply that is safe, affordable and produced in an environmentally sound manner. Science and technology are essential for achieving the kind of productivity levels we need to feed the world’s growing population now over 6 billion people and anticipated to reach 9 billion by mid-century.

At the same time there is an increasing demand for energy, increased attention to the protection of natural resources and climate issues, including the reduction of greenhouse gas emissions and a troubled world economy. As emerging economies in Asia have grown exponentially, so have their energy demands…while supplies of non-renewable fossil fuels only continued to diminish.

There are a range of other critical issues facing the nation that require improved agricultural science and technology. In many of these situations return is insufficient to generate much support. These include new technologies that conserve and protect natural resources; address climate change; and conserve genetic resources.

For example, public institutions such as USDA maintain much of the germplasm used by plant breeders all over the world and manage essential animal and plant taxonomic collections. Public social science research also performs important public services that help us better understand changes in agricultural policies, market conditions, and rural life.

Federally-funded and supported research is also important because it provides the scientific basis for the regulatory functions of the USDA and other Federal agencies, to ensure environmental protection, food safety and nutrition, protection from invasive species and competition in commodity markets.

Public research provides high-quality, credible, objective science to policy makers and other stakeholders and plays a large and important role in providing the science base in trade policy negotiations and to regulatory agencies. For example, USDA research played a critical role in opening markets in Japan to American apple growers following a dispute with Japan over phytosanitary standards. The dispute was settled through the World Trade Organization based on USDA conducted and supported science. Japan then agreed to accept apple imports, worth more than $143.4 million dollars from Washington State apple growers alone.

Being able to respond to urgent and emerging needs is an essential public service. Our public research system, which consists of both USDA and USDA-funded research, education, and extension programs, primarily at the Nation’s Land Grant Universities contains vital physical infrastructure, essential human capital, and an important network that can rapidly mobilize resources to address threats to our food and agricultural system. Threats like avian influenza, citrus greening, soybean rust, wheat stem rust, emerald ash borers, Colony Collapse Disorder, and other emerging issues.

Public agricultural research also complements private research in strategic ways. Public research addresses issues in basic science, generating knowledge that is too general to be patented but that is essential for maintaining long-run progress in science and technology. Basic scientific research to improve our understanding of how plant, animal, and environmental systems operate is an important role of publicly-funded agricultural research, and one that the private sector cannot support on its own.

The private sector acts as the delivery mechanism for much of the knowledge generated by public sector research. Patent licenses and Cooperative Research and Development Agreements (CRADA) are just two examples of formal mechanisms used by the USDA and other public research institutions to strengthen collaboration between public and private research. Innovations such as these in public-private research cooperation have helped ensure that results of public research move quickly into commercial applications. The US agricultural R&D system remains the envy of the world. There are two additional roles of agricultural science.
The public agricultural support system section is almost exclusively responsible for ensuring the training of the agricultural workforce. Not only universities get their employees from our programs, they provide most of industries with scientist, sales personnel, and other workers. Another aspect is extension or outreach. Taking research based information to those who can use it is extension's role and on important ones at that. Another of the REE agencies also plays a vital role. NASS is our GPS. They tell us where we are and what's happening in agriculture. A very important role. This total system I call "America's Agricultural Blue Ribbon Support System." While many countries have excellent agricultural teaching and research systems, a few have extension or outreach. However, no other country has the unified teaching, research, and extension system that we have.

USDA research has been responsible for hundreds of new products and countless improvements to the safety, nutrition, and quality of our food and agricultural products. Many of these products and technologies have become multimillion-dollar, or even billion-dollar, industries.

For example, USDA scientists patented texturized whey protein and worked with a Cooperative Research and Development Agreement (CRADA) partner, to develop a line of high-protein snacks that includes cheese curls, tortilla chips, and corn chips.

The company subsequently licensed the technology and is spending $2 million dollars to introduce a new branded line of "Good-For-You" Snack Foods. The company has entered into distributorship and manufacturing agreements with other businesses to develop an array of nutritional products for the sports nutrition market, including gyms, fitness centers, and nutritional retail stores. Research with a Desert Shrub Guayule has led to a tremendously important product. Latex from Guayule does not react with the human body as does Latex from the natural rubber plant. A small but growing industry is evolving making surgical gloves, tubing, etc..

The public's investment in agricultural research has paid off handsomely. A number of academic studies have been conducted over the past several years examining the economic returns to public agricultural research. The studies have all been in agreement that agricultural research has yielded a return far higher than the cost of Federal funds. The estimate of the economic rate of return to public agricultural research from these studies is 53%. Some would argue that such a high rate of return is actually an indicator that we are under investing in agricultural science.

I still recall my dad talking about a neighbor who complained about the cost of fertilizer. My dad's response was fertilizer pays. He said "it if costs, just don't buy any!"

These studies also find that these economic benefits are shared widely in the economy, such as by lowering the cost of food. So far there is no evidence that the rate of return to agricultural research has diminished. But continued support for agricultural research is essential for maintaining long-run growth of the food and agricultural sector.

Closing

The unique role of our public agricultural research system is to ensure that challenges to our food and agricultural system are dealt with in a balanced way—that the public's needs are protected through wise investments to answer the critical questions that are beyond the private sector's capacity and interests. This approach does not compete with the goal of production for food, feed, fiber, flowers, or fuels, but helps to ensure the sustainability of our system considering the social, economic, and environmental impacts of our research.

While the tremendous success of American Agriculture after World War II was largely due to public investments in Research and Development, since the mid-1980's the private investments have exceeded public spending. These private investments by definition must accrue profit to the producers and processors of agricultural products, but they are also critical in advancing the science of productivity in ways that benefit both private and public interests. The public science must increasingly be focused on those inter-related issues which require sustained collaborative work from multiple disciplines which respond effectively to questions from the laboratory to the household.

Such public value science must include critical private and public partnerships in order to ensure that the best knowledge from discovery, education and application enhances the results.

Success will depend on critical cooperation between public and private interests and leveraging the findings of science to the greatest possible extent. It also means using all the tools available to science, including biotechnology.

Today, more than 800 million people in the world are facing chronic hunger. Norman Borlaug believes we will have to double the World Food Supply by 2050 just to keep up with the expected increase in world population. The expanding power of genetic information must be harnessed to improve the productivity and resilience of our crops and livestock if we are to have any hope of feeding the 9 billion people projected to inhabit the Earth by 2050.

Additionally, the world, with the exception of the Americas and Sub-Saharan Africa, has limited potential for expanding agricultural lands. So 85% of future growth in food production will have to come from lands already in production.

Water is also a critical issue worldwide. Irrigated agriculture accounts for 70% of global water withdrawals; 17% of cultivated land is irrigated; and 40% of the world food harvest is dependent on irrigation. Improving the efficiency of irrigation is imperative and developing plants that require fewer inputs, like water and fertilizers, is critical to our success in meeting these challenges.

In addition to improving the quality of lives, with recent science and technological advances agricultural science can also help solve our growing energy insecurity problems and help address climate change. It will take a concerted effort on all sectors of our research system, both public and private, to meet the challenges of feeding and fueling a growing world.

I have a question for each of you. No, we are not going to take a test. In fact, I don't want to hear your answer. But I want you to carefully think over the answer for your own benefit. Here is the question: Of all of the things both state and the Federal governments can do to support and enhance agriculture, what do you think would be most meaningful thing they could do over the next 50-100 years? In other words, what should be government's role in supporting or fostering the future of agriculture?

I'd like to leave you with one thought. I was at a meeting of the Biomass Research and Development Technical Advisory Board earlier in the week. The question came up referencing the oil embargo of the early 70s. How is the situation different today? A good question that you and other agricultural leaders should be thinking about.

Well, each of us can think of many ways in which there are differences between now and the 1970's. But the bottom line is, times have changed. The world, particularly the agricultural world, has changed dramatically. But it doesn't take a genius to see some trends.

- We are using up a finite resource, (fossil energy) at a rapid rate.
    - It doesn't take a genius to see we must become sustainable
- Agriculture will continue to have challenges
    - Citrus greening and other diseases of many of our major and minor crops
    - Desire to improve production with ever more costly inputs for example nitrogen, water, etc.
    - The Social science will become even more important in the future
- Rising expectations of people everywhere
    - United States
    - Rest of the world

All of these provide a real challenge for agricultural research. In my opinion the future is exceedingly bright for agriculture scientist. The real challenge is to provide them the resources to get the job done.