

Public Agriculture Research: The United States Can't Catch Up by Slowing Down

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U.S. Public Agricultural Research and Development Funding: A Strong History, but a Growing Gap

The United States was long the leading innovator in agriculture. This was no accident. It was the result of a deliberate government policy to invest substantial amounts of money in agricultural research. In 1940, just before the outbreak of World War II, the United States spent 40 percent of its federal R&D budget on agricultural sciences (Fuglie 1996). That investment paid off in the post-war boom in agricultural production that enabled the country to feed its surging population as well as supply many war-devastated countries overseas.

This public investment also laid the foundation for the first Green Revolution in the late 1960s. It showed conclusively that along with best practices, advances in technology, fueled by publicly funded research, could make dramatic improvements in agricultural productivity. The high-yielding varieties of wheats and rices developed by Norman Borlaug, a world-renowned agronomist, and others are credited with saving a billion people from starvation, and Borlaug won the 1970 Nobel Peace Prize for this work.

Today, the research funding picture is far different. U.S. investment in agricultural research is only two percent of the federal total, and public investment in agricultural R&D has been falling for nearly

two decades. Congressional funding for the Agricultural and Food Research Initiative, launched a decade ago to address the problem, has never reached authorized levels, leaving unfunded three-quarters of worthy projects (Grumbly 2019). At the same time, other major food producing countries are stepping up their game and investing more and more public funds in agriculture research (Pardey 2016). More than a decade ago China passed the U.S. in public agricultural research spending in absolute dollars and now spends more than twice as much. India and Brazil have been raising their spending levels in recent years while U.S. spending has gone down (Nelson 2019).

This loss of American leadership could hardly come at a worse time. Experts say that with the world population headed toward 9.8 billion people by 2050, according to the United Nations, (United Nations: Department of Economic and Social Affairs 2017) and with global incomes steadily rising, the world's farmers will have to produce twice as much food as today on the same amount of land, and probably with less water. Climate change will make growing conditions more challenging. Globalization is hastening the spread of pests like the fall armyworm and diseases (The Lugar Center. 2019) including African swine fever across continents. American consumers are demanding food that is healthier and raised more sustainably; with the rise of social media, food-borne disease outbreaks can more quickly wreak market havoc. People in many poor regions will still need more biofortified foods to avoid chronic malnutrition and childhood stunting. In addition to costing lives, COVID-19 is straining agriculture systems and trade and has exposed weaknesses in food supply chains.

These challenges can only be met, and the U.S. regain its position as a leader in agricultural innovation, with a robust program of publicly funded research and development in the agricultural sciences.

Today's Funding Gap

Over the decades, the trajectory of American public investment in agriculture research has gone from one of slowing growth to an actual decline in real spending in recent years (Pardey 2017). This happened at the same time the rest of the world was stepping up its commitment to R&D, so that by around 2010, the U.S. share of global public spending on agriculture research had fallen by nearly half, to just 11 percent, compared to 20 percent in 1960, according to figures in an important Farm Journal Foundation paper by Philip G. Pardey and Jason M. Beddow at the University of Minnesota's International Science and Technology Practice and Policy (InSTePP) Center (Pardey 2017).

The other Big Three food producers---Brazil, China and India---collectively passed the United States in annual investment in agricultural R&D at the turn of the 21st century, and by the beginning of the 2010s were together spending more than twice as much (Nelson. 2019).

There has also been a shift in the balance between public and private, or commercial, spending on agriculture research. In the 1950s, public agencies outspent private companies by roughly a third. By the beginning of this decade, that ratio flipped strongly in the other direction: the private sector accounted for the lion's share of food and agriculture research spending, investing 73% more than the public sector. This reflects not only a rapid growth in private spending that initially outpaced the growth rate of public spending, but also a real-dollar decline in public investment beginning in the last decade (Pardey 2017).

Is a Shift from Public to Private Funding OK?

But much of this private research has gone into only a couple of specific, focused areas including genetic modification (GM) and gene editing (CRISPR) technologies applied to a handful of major crops and animals. This funding is typically aimed at short-term, commercial needs. Profit-oriented companies don't invest significantly in basic research, which usually has no immediate payoff but reliably leads to major, if sometimes unexpected, breakthroughs down the road. There is little incentive for them to invest in long-term applied research problems that may take many years to solve. In addition, so-called "orphan crops," such as

yams, millet, and cassava, eaten and grown locally by smallholder farmers in low income, developing countries, are vital for millions of people around the world. Yet they attract little interest from the major biotech companies.

In other words, it has not been a case that private dollars are simply substituting for public dollars. Instead, as the Farm Journal Foundation paper notes, “the private sector tends to conduct more developmental or nearer-market research that is readily commercialized, but which often relies on breakthroughs achieved by way of the upstream research.”(Pardey 2017). It is that upstream research, basic research aimed at making fundamental scientific breakthroughs, which is suffering because of insufficient public investment (Pardey 2017). Globally, the strong U.S. position in private research funding is also eroding. In 1980, the U.S. accounted for a third of all private sector ag R&D spending. By the beginning of this decade, that share had slipped by nearly a quarter (Pardey 2017).

Bringing Public and Private Funding Together for Impact

One of the bright spots in the research funding picture is where private funding and tax-payer dollars have come together in the Foundation for Food and Agriculture Research (FFAR) (Foundation for Food and Agriculture (FFAR)). Congress took a bold stand by creating FFAR in the 2014 Farm Bill and providing it with \$200 million in funding, to be matched dollar for dollar by private investment. This led to an increase of nearly \$400 million in agriculture R&D during the prior farm bill, and the program was continued in 2018 with the addition of \$185 million in public funds.

FFAR directly funds projects to address challenges in crop and animal health and productivity, as well as important environmental programs to protect soil and water resources. It also works in partnership with organizations in consortia to develop solutions through multiple areas of research. One such consortium is “Crops of the Future” which is working to “accelerate global efforts to develop crops needed to meet food system challenges 20-50 years from now.”(Foundation for Food and Agriculture (FFAR)).

What We Eat Determines Our Health: We Need to Know More

Research into food nutrition, which is becoming an increasing focus of policymakers, also depends heavily on public funding. It comes in two forms. One is primarily aimed at poor countries where people may rely mainly on one or two staple crops for their calories but suffer from malnutrition and related diseases because they don't get enough of the right vitamins and minerals. Research by government agriculture departments and universities has focused on such nutrients as iron, zinc, selenium and vitamin A. Today, HarvestPlus is working with 8.5 million small-holder farmers in 30 countries to deliver over 240 biofortified crop varieties including iron beans, zinc rice and wheat, and Vitamin A cassava, maize and plantain (HarvestPlus 2019).

In the U.S., consumers have had access to fortified food for nearly 100 years since iodine was added to salt in the 1920s to prevent goiter. Today U.S. supermarkets carry a number of fortified products, such as bread, milk and orange juice. But these nutrients are added during processing, which is not practical for most populations in developing countries.

The other form of nutrition research concerns populations who don't suffer from food insecurity but nonetheless have severe health problems because of poor food choices. Although primarily a developed country problem, increasingly this challenge is also beginning to exist among people in the developing world. In its recent report, *Challenge of Change*, the Association of Public and Land-Grant Universities (APLU) addresses seven major challenges to addressing food security by 2050, with Challenge 6 being "Address the dual burdens of undernutrition and obesity to ensure full human potential." (Association of Public and Land-Grant Universities (APLU) 2017)

In the U.S. alone, diet-related diseases like diabetes and hypertension cost hundreds of billions of dollars a year. Obesity is estimated to cost \$1.4 trillion per year in the U.S. and \$2.0 trillion globally (Waters 2016). Health and cosmetic concerns have fueled a \$72 billion weight-loss industry in the U.S., (Business Wire 2019) but commercial funding for scientific research on nutrition is

limited. Publicly funded nutrition research in this context is scattered throughout the government in what critics say is a fragmented way that has come under scrutiny by Congress and the Government Accountability Office. It is coordinated by the Interagency Committee on Human Nutrition Research, which has 18 members, from the National Institutes of Health (NIH) and the Agricultural Research Service to the Pentagon and the Environmental Protection Agency. Much of the basic research is carried out by several different institutes at NIH, which earlier this year published its first-ever NIH-wide 10-year strategic plan for nutrition research, (National Institutes of Health (NIH) 2020). With the many challenges of both over and undernutrition taxing both the health of people and the budgets of governments, it is positive that this deep and more strategic focus on nutrition research has now begun. A commitment to the resources that will be required to implement the plan over the next decade will be necessary in order to achieve positive results.

U.S. Public Funding with and for International Partners Provides Positive Results

Federal spending on international agricultural research is also far down from its heyday during the Green Revolution. Besides its obvious humanitarian benefits, such research also has important implications for U.S. international relations and national security and can benefit U.S. trade and American farmers directly. As Senator Richard Lugar said during the 2009 global food crisis, “The consequences of hunger are profound. Quality of life for affected families deteriorates as access to food decreases, affecting their productivity, and ultimately the economic growth of nations. Hungry children are unable to learn, and hungry adults are not productive. Hungry people are desperate people, and their hunger can breed instability...It is both a moral and national security imperative for the United States and other wealthy nations to address the root causes of hunger.” (Lugar 2009).

From a slow start in the 1950s, U.S. spending on international agriculture research and its related extension and education activities accelerated in the 1960s as global food shortages

loomed. (These figures are separate from the direct food aid the U.S. has provided through Food for Peace and other programs.) It skyrocketed in the 1970s after the oil shocks helped drive up food prices around the world. These investments peaked around 1985, at over \$300 million a year (in 2009 dollars), but then fell over the next 20 years nearly as fast as they had risen (Pardey 2017). There was a bit of a revival in spending after food shortages and price hikes in 2007-08 led to food riots in as many as 19 countries (Lugar 2009). But that growth also eventually stalled out.

As Sen. Lugar's comment suggests, severe food insecurity overseas can impoverish nations, making them poor trading partners for American products, including American farm products. In addition, supporting foreign agriculture research can help form a first line of defense against farm diseases and pests that originate overseas but may eventually reach our shores. For instance, in the late 1990s, a virulent new strain of wheat rust emerged in Africa. Known as Ug99, the Food and Agricultural Organization warned that the windborne disease "could damage all commercial wheat *globally*." (Food and Agriculture Organization (FAO) 2009). To combat the threat, Cornell University joined with several international agricultural research institutes which are a part of the CGIAR system (CGIAR. 2020) and the FAO to establish in 2008 the Borlaug Global Rust Initiative, an international consortium of more than 1,000 scientists. Funded in part by USDA and USAID, the BGRI fosters international cooperation to keep wheat rusts from spreading to major wheat producing countries—including the United States—and to "enhance world productivity to withstand global threats to wheat security." (Borlaug Global Rust Initiative 2020). The Ug99 example is just one among countless that demonstrate the impact of U.S. investment in CGIAR centers across the globe. Their work, conducted across 15 centers, includes research to improve crop yields, support plant resistance to pests and diseases, and improve plant tolerance to drought conditions.

In 2019 the Board for International Food and Agricultural Development released a report highlighting the benefits to the United States of agricultural and food security investments in developing countries. (Board for International Food and

Agricultural Development (BIFAD) 2019) These investments come in the form of partnerships between U.S. and international educational institutions with public funds to address threats of transmission of plant and animal diseases, as well as technology and seed improvements that strengthen growers in multiple countries. The benefits include increased exports and jobs and technology spillovers, as well as U.S. and global security.

A Commitment to Publicly Funded Agriculture Research Continues to be Vital for the United States and its Current and Future Global Trading Partners

The multi-trillion-dollar spending bills Congress passed in response to the pandemic crisis make it impossible to predict near-term budgets for agricultural research. But the current fiscal year's appropriations under which agriculture research and development is taking place demonstrates that policymakers still accord it a low priority. As policymakers assess the future needs of the U.S. in a post COVID-19 environment it will be vital to reverse the decades-long decline and instead increase public investments in agriculture research and development. The economic consequences of the pandemic are a stark reminder that pennies invested now in research on pests, diseases, climate-adapted crops, nutrition, and other key contributors to food security can save many dollars and prevent crises in the future. The countless demands on federal funds have been amplified by the COVID-19 pandemic, but continued cuts in agricultural research will do little to balance the budget. Rather, an increase in R&D funding is an investment in a stronger American farm economy, a healthier population, a decrease in global hunger and poverty, a more stable and prosperous world, and a more secure America.

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