CAST assembles, interprets, and communicates credible, science-based information regionally, nationally, and internationally to legislators, regulators, policymakers, the media, the private sector, and the public.

- CAST is an international consortium of scientific and professional societies, nonprofit organizations, and companies, as well as individual members.
- CAST uses volunteer key scientific authors and reviewers.
- CAST provides credible, understandable science-based information to your staff and to the public.
Primary Objective

• The primary work of CAST is the publication of Task Force Reports, Commentaries, and Issue Papers written by scientists from many disciplines

• The wide distribution of CAST publications to nonscientists enhances the education and understanding of the general public
Visit CAST Online

www.cast-science.org

The above map depicts 38,872 visits in 2010 from 173 countries.
Friday Notes

- Published 48 times each year
- Lead articles on current topics being discussed in agriculture
- More than 60 current agricultural news items selected from 100+ sources, including live links to the original articles
- New international section
- Washington, D.C., congressional updates from Meyers and Associates
We Reap What We Sow
Investing in a Better Future through Public Agricultural Research

CAST Commentary QTA2011-1
March 2011
George W. Norton, Department of Agricultural and Applied Economics
Virginia Tech, Blacksburg, VA
Commentary Authors

• Wallace E. Huffman (Chair)
  – Department of Economics
  – Iowa State University, Ames, IA

• George W. Norton
  – Department of Agricultural and Applied Economics
  – Virginia Tech, Blacksburg, VA

• Luther G. Tweeten
  – Department of Agricultural, Environmental, and Development Economics
  – The Ohio State University, Columbus, OH
Commentary Reviewers and CAST Liaison

**Reviewers**

- **Allen S. Levine**
  - College of Food, Agricultural, and Natural Resource Sciences
  - University of Minnesota, St. Paul, MN
- **Marty D. Matlock**
  - Center for Agricultural and Rural Sustainability; Biological and Agricultural Engineering
  - University of Arkansas, Fayetteville, AR
- **John C. Owens**
  - Office of the Vice President-Emeritus and Vice Chancellor-Emeritus
  - University of Nebraska, Lincoln, NE
- **John F. Soper**
  - Pioneer High-Bred, a DuPont business
  - Johnston, IA

**CAST Liaison**

- **Phillip Stahlman**
  - Agriculture Resource Center
  - Kansas State University, Hays, KS
Introduction

- Population and income growth, climate change, biofuel demand, environmental degradation, and loss of cropland place increased pressures on agriculture
- Agricultural pests continually evolve
- Sustained agricultural productivity growth is crucial in a competitive world
- Volatile and rising food prices—growth rate in food demand exceeds growth rate in food supply
- Meeting future demands on agriculture requires investment in research
Beneficiaries of agricultural research

- **Consumers** through lower food prices
- **Producers** through lower costs
- **Economy** through improved competitiveness
- **Food safety** and **environmental quality**
- **National security** through global food security
Agricultural output, inputs, and productivity

- Flow of farm outputs depends on flow of inputs controlled by farmers and on the productivity of those inputs.

- Annual output growth: 1.58%
- Annual input growth: 0.06%
- Annual productivity growth: 1.52%
- Consumers have saved $\text{trillions}$ in food costs

Average percentage change in agricultural productivity by state

- Differences by state in ag productivity growth due to differences in ag research investments

Change in agricultural productivity by State, 1960-2004

Average annual change (percent)

Source: ERS data product, Agricultural Productivity in the United States. Average annual growth for the U.S. was 1.76 percent for the period 1960-2004.
Research is an investment

• Increased agricultural productivity requires investment in scientists, technicians, research assistants, labs, computers, greenhouses, etc.

• Research occurs at universities, government institutions, private firms

• Later advances build on previous successes
...a long-term investment

- Research time
- Adoption time
- Depreciation

- Research takes time and resources
- Research knowledge pays off over a long period of time, depreciates, and requires maintenance
U.S. public agricultural research expenditures

• Research expenditures, adjusted for inflation:
  – Grew 3.2% per year on average from 1960 to 1979
  – Failed to grow from 1980 to 1989
  – Grew 0.6% per year from 1990 to 2009

• As a result, U.S. agricultural productivity growth has begun to slow despite private research investment (Alston et al. 2010)

• Private firms depend on public R&D for discoveries in basic and pre-invention sciences
U.S. agricultural R&D funding trends

Real agricultural R&D funding 1970-2008

Billion dollars (2001)

Note: Data for 2007-08 are preliminary.
Source: USDA, ERS based on data from National Science Foundation, USDA's Current Research Information Systems (CRIS), and various private sector data sources. Data are adjusted for inflation using an index for agricultural research spending developed by ERS. See the documentation for details.
High rates of return to public agricultural research investments

• Numerous studies find rates of return of 20 to 80%. Huffman and Evenson (2006) estimate a marginal rate of return of approximately 50%
• Alston et al. (2010) find that the last dollar spent on agricultural research returns $32 to society
• From 1948 to 2009, the share of U.S. household income spent on food declined from 22.3 to 9.5%
What about obesity?

• Lower food prices increase food consumption and change the mix of foods consumed
  – In developing countries this is good
  – In the United States, not so good given the obesity problem

• Many factors influence obesity, and food prices play a relatively small role

• Rather than foregoing the many benefits of agricultural research, the obesity problem calls for research on diet, food, and health
Technologies improve the environment

- No-till reduces erosion
- Plant resistance decreases number of pests
- GM weed control lowers herbicide risk
- Higher yields reduce use of fragile lands such as forests, highly erosive soils, and wildlife areas
- Energy savings and lower greenhouse gas emissions result from increased productivity (Burney, Davis, and Lobell 2010)
How best to fund public agricultural research?

• **Block grants** (federal grants to USDA and formula funds to state agricultural experiment stations) and **competitive grants** are used
  – Both types of funding needed
  – Program more locally determined with block grants—agriculture is sensitive to local conditions
  – Empirical evidence finds block grants as (or more) productive as competitive grants
Why not leave it all to the private sector?

- Many types of research are “public goods” and would be insufficiently supplied by private sector alone, such as:
  - Basic and pre-invention science
  - Innovations that improve the environment
  - Market outlook information and policy research

- Research output and trained doctoral students are a joint product, but doctoral training is not undertaken by private firms
Where is agricultural productivity headed?

• Analyses by Fuglie (2010) and Alston et al. (2010) point to a slowdown in the growth rate of U.S. agricultural productivity during the past decade.
• Slower growth in expenditures for agricultural productivity-related research is primarily to blame
• Concern for the future because research spending slowdown is relatively recent and research impacts occur with time lag
What will the future bring for U.S. and world agriculture?

• U.S. and world agriculture face higher real prices in the future, even if the United States continues to invest in agricultural research at historic rates.

• If U.S. ag research investment declines, expect slower economic growth in the United States and increased instability abroad with poor consumers facing higher food prices.

• Competitive position of U.S. agriculture is affected as agricultural productivity continues to grow in countries such as Brazil and China.
Questions/Discussion

For a free download of this Commentary, visit the CAST Website @ www.cast-science.org

CAST Commentary
07/2011

Investing in a Better Future through Public Agricultural Research

Authors:
- Wallace Hoffman (Chair)
  Iowa State University
- George Norton
  Virginia Tech
  Blacksburg
- Luther G. Tweeden
  The Ohio State University
  Columbus

Reviewers:
- Allen S. Levine
  University of Minnesota
  St. Paul
- Marty D. Melnik
  University of Arkansas
  Fayetteville
- John C. Owens
  University of Nebraska
  Lincoln
- John F. Supor
  Pioneer Hi-Bred
  Johnston, Iowa

CAST Liaison:
Phillip Stahlman
Kansas State University

Introduction

The U.S. and world populations are expected to grow by approximately 30% by the year 2050, and world real income per capita is expected to grow by 58% (United Nations et al. 2003). Population and income growth translates into rapid growth in the demand for high-valued food—e.g., meat, fish, fresh fruits, and vegetables—and for feed for livestock. These changes will place increasing demands on arable land and freshwater. Moreover, climate change threatens to shift the competitive advantage for crop and livestock production further away from the equator and toward more northern areas in the Northern Hemisphere as well as to increase the variability of local weather conditions. Although agricultural productivity growth during the last two decades of the twentieth century was notable in developed countries and in some developing countries, they built on past investments in agricultural research. Worldwide and in the United States, however, investments in public agricultural research have slowed since 1990 (Hoffman and Eversen 2006a; Parley et al. 2006). In the United States during the same period, private agricultural research and development (R&D) has been growing significantly faster than public agricultural research (Ashworth et al. 2006; Hoffman and Eversen 2006a). As in the case of other global public goods such as the mitigation of air and water pollution, the full social costs of dramatically reduced funding of public agricultural research are unaffordably high.