What Are the Best Policies to Promote Ag-Related R&D?

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Projected World Food Demand

- World food demand could double by 2050
  - 50% increase from world population growth from 6 to 9 billion – all in developing countries
  - 50% increase from broad-based economic growth in low income countries
- How many presently low income consumers are lifted out of poverty will be the *most important* determinant of the future global demand for food.
- The World Bank estimates that the number of people in developing countries living in households with incomes above $16,000 per year will rise from 352 million in 2000 to 2.1 billion by 2030.
Growing Demands on Forests, Too

• The same forces of population and income growth that increase demand for food also increase demand for things made out of wood, e.g. paper, furniture, building materials; poles.

• In rich countries, growing demand for environmental amenities and preservation of (especially old-growth) forested areas.

• Now biofuels production is claiming more and more land to grow feedstocks.
The Land Constraint

• There is at most 12% more arable land available that isn’t presently forested or subject to erosion or desertification – and degradation of many soils continues.

• The area of land in farm production could be doubled…

• But only by massive destruction of forests and loss of wildlife habitat, biodiversity and carbon sequestration capacity

• The only environmentally sustainable alternative is to at least double productivity on the fertile, non-erodible soils already in crop production.
Water A Growing Constraint

• Farmers use 70% of the fresh water used in the world. They are both the largest users and the largest wasters of water.
• Water is priced at zero to most farmers, signaling that it is much more abundant than in reality. Anything priced at zero will be wasted.
• With rapid urbanization, cities are likely to outbid agriculture for available water.
• The world’s farmers need to double food production using less water than today. Biofuels will add further to this challenge.
Research Investment Essential

- Since Malthus, prophets of doom have argued population growth will increase food demand faster than agricultural production can grow.
- Public and private sector investments in agricultural research have increased productivity faster than demand growth, with resulting 150 year downward trend in real price of grains.
- Need to more than double world ag production using less water and little more land than today.
- Future world market price trend will depend on whether research increases land and water productivity faster than world demand grows.
Larger Fraction of World Ag Production to Move Through Trade

• The world’s arable land and fresh water are not distributed around in the world in the same proportions as is population.
  – No way for Asia or Middle East to be self-sufficient in food

• With population growth, urbanization and broad-based economic development, many LDCs’ food consumption to outstrip their production capacity and they will become larger net importers.

• Efficient producers of animal products, grains and oilseeds, wherever they are, will benefit.
The World’s Arable Land (left) Is Distributed Very Differently than Its Population (right)

- **OECD Countries**: 26%
- **South Asia**: 15%
- **Middle East and North Africa**: 4%
- **Latin America and Caribbean**: 10%
- **Europe and Central Asia**: 20%
- **East Asia and the Pacific**: 14%
- **Africa**: 11%

- **OECD Countries**: 14%
- **South Asia**: 22%
- **Middle East and North Africa**: 5%
- **Latin America and Caribbean**: 9%
- **Europe and Central Asia**: 8%
- **East Asia and the Pacific**: 31%
- **Africa**: 11%
Exports Are Critical to Ag Profitability

- American agriculture exports the production of one out of three acres of cropland. These exports generate 1/4 of farm sales revenue.
- In 2006 U.S. ag exports totaled $68 billion:
  - Grains & oilseeds $28.4 billion
  - Horticultural products $16.7 billion
  - Animal protein $13.2 billion
  - Cotton $4.9 billion
- Most important markets:
  - Canada 18%
  - Mexico 16.5%
  - Japan 12%
  - China 11%
  - E.U. 10%
U.S. Ag Competitiveness

• Fertile soils and favorable climatic conditions are fundamental, but…

• Investments in productivity-enhancing ag research by the public and private sectors and in infrastructure that reduces cost of transport are at least as important.
<table>
<thead>
<tr>
<th>Commodity</th>
<th>% of World Production</th>
<th>% of World Trade</th>
<th>% of Prodn Exported</th>
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<tbody>
<tr>
<td>Cotton</td>
<td>20</td>
<td>40</td>
<td>70</td>
</tr>
<tr>
<td>Corn</td>
<td>40</td>
<td>60</td>
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<tr>
<td>Soybeans</td>
<td>38</td>
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<tr>
<td>Wheat</td>
<td>9</td>
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<td>50</td>
</tr>
<tr>
<td>Rice</td>
<td>2</td>
<td>13</td>
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</tr>
</tbody>
</table>

Source: Congressional Research Service
U.S. Farm Policy Is Much More than Price & Income Support

• U.S. farm policy is much more than commodity price & income support programs

• When Congress passes agricultural legislation (“farm bills”), it authorizes USDA programs, but nothing happens unless Congress annually appropriates funds for each program.

• 93% of farm program payments go to growers of 5 commodities, and 2/3 of U.S. agriculture receives no commodity support payments, but most is affected by some USDA program(s).
<table>
<thead>
<tr>
<th>Program</th>
<th>$ billions</th>
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<tbody>
<tr>
<td>Farm Commodity Programs</td>
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<tr>
<td>Foreign Programs</td>
<td>5.3</td>
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<tr>
<td>Rural Development</td>
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<tr>
<td>Food and Nutrition</td>
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<td>Food Safety</td>
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<td>Natural Resources &amp; Environment</td>
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<td>Marketing &amp; Regulation</td>
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<td>Research, Education &amp; Economics</td>
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<tr>
<td>USDA administrative overhead &amp; other</td>
<td>0.5</td>
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<tr>
<td>Total</td>
<td>124.9</td>
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</table>
The Current Farm Policy Landscape

• Many farm groups happy with 2002 Farm Bill.
• Rapid growth of ethanol industry with resulting increase in crop prices
  – There’s more interest today in ethanol than exports.
  – There’s little for corn, soybeans, or wheat in extending 2002 Farm Bill.
• Significant reduction in CBO’s budget baseline for ag commodity programs
  – Direct payments and research budget are seen by many farm organizations as place to raid to cover cost of increasing price and income supports
Current Policy Environment (continued)

- WTO trade negotiations and threat of more litigation in WTO continue.
- Unprecedented anti-farm program editorial comment in media across the country.
- Numerous groups have proposed alternatives to present farm programs, including Bush Administration.
Two Fundamental Philosophical Questions in Writing 2007 Farm Bill

• Of the Federal dollars allocated to agriculture and rural America, how much should go to farmers as individuals & how much should be invested for the greater good of agriculture and rural America?
  – E.g., agricultural research & rural infrastructure

• Of the fraction that goes to farmers as individuals, how much should be linked to the production of specific commodities & how much should be decoupled from what the farmer produces?
U.S. Ag Productivity Growth Success Story

- In 2002, U.S. farm output was 2.6 times larger than what it was in 1948.
- It was produced with fewer total inputs than were used in 1948!
- This was a much higher productivity growth rate than in the rest of the U.S. economy!
- The estimated annual real rate of return on public investments in agricultural research is in the range of 30-60 percent – one of the highest payoff investments in the American economy!
Public vs. Private Ag Research

- Historically public support of biological research key to agricultural development (“public good”)
- Private sector did most of the mechanical, pesticide & animal pharmaceutical research (could patent resulting intellectual property)
- Private sector role in biological ag research only took off after late 1970s when Congress reduced appropriations for research and encouraged the private sector to take on this role.
- Private investment in ag research is now more than twice as large as public investment.
Need Both Public & Private Agricultural Research

- There are many areas of research in which the private sector will invest less than the social optimum, such as:
  - Basic research: Payoff is too uncertain and too far in the future
  - Where hard to protect intellectual property, e.g. open-pollinated varieties
  - Where no market exists, e.g. conservation and public policy

- Universities must be involved to produce credible PhD researchers for the private sector to hire.
Public and private sector investments in R&D

Million 2000 $
U.S. Ag Research Issues

- Balance between public and private investments in agricultural research
  - Level of public funding more important than how we structure administration of the funds!
- Balance between formula funds and competitive grants
- USDA research grants inadequate relative to NSF & NIH (too few dollars & too short duration)
- Earmarking
- Indirect cost recovery (overhead) rate
Other U.S. Research Issues

• How efficient is our present Federal ag research system?
  – How many Land-Grant Universities and ARS labs are needed? ARS – Land-Grant balance?

• What role agricultural extension in the future for agricultural tech. transfer?

• How to attract more bright young Americans into ag sciences? Need immigration reform to allow more foreign Ph.D. students to stay in the U.S.
International Ag Research

• Under-funding by national governments, foreign aid programs and World Bank.
  – Agriculture has been off the international development agenda
  – Nutritional deficiency diseases have been off the international health agenda