The Economic Rationale for Public Agricultural Research in Canada

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Presentation Outline

- Background
- Objectives
- The Changing Sector and Emerging Challenges
- Our Framework
- Lessons Learned
- Discussion/Questions
Background

- Study funded by Agriculture and Agri-Food Canada
- Interested in clarifying the role of public agricultural research and identifying ways in which it can be improved for the benefit of the entire sector
- Why now?
  - The agricultural sector is undergoing a period of transition and Ag Canada recognizes the need to adapt to these changes

How is the Sector Changing?

- Globalization
  - Increased access to markets, increased trade, increased requirement for logistics
  - Greater transfers of capital, technology and the benefits of R & D
  - Increased competition and potentially lower prices
  - All of these can stimulate innovation and encourage R & D
Longer Supply Chains

- Increasingly complicated regulatory and security requirements
- Increased processing and traceability requirements
- More complicated relationships all the supply chain

Health and the Environment

- Aging baby boomers and increased obesity and communicable diseases
- Changes in diet will require more nutritional research and may lead to increased demand for functional food
- With respect to the environment, ag offers potential solutions to GHG emissions
  - Renewable fuels and carbon sequestration
A Rapidly Expanding Global Bioeconomy

- Has increased demand for grain and therefore prices received by grain farmers
- Has increased feed prices for livestock producers but has also provided a cheap source of protein
- These trends are likely to continue for the foreseeable future because of:
  - Economic growth in countries like China and India
  - The desire to reduce dependence on fossil fuels

Hubbert’s Peak - conventional oil production
Oil prices

East Asian Growth

- China, India and other economies growing at about 10% per year
- Growing demand for meat -- feed grains
- Growing demand for fossil fuel
- Very high savings rates 20-30%
- Large pollution issues
Biofuel policy

- Policies in US, Brazil, EU, Canada and many other countries
- Brazil (sugar) & US (corn) are the big players
- US is expected to use 85 million tonnes of corn this year & just expanded mandated use
- Many other players using corn, palm oil, soybeans, wheat
- High grain prices have halted expansion but with any period of low prices expansion will resume

US Ethanol Capacity*
(Million gallons per year)

Total Current Capacity at 136 ethanol biorefineries 7,525
Total Under Construction (63)/Expansions (8) 5,787
Total Capacity 13,312

This is about 120 million tonnes of Corn!
- Renewable Fuels Assn, Jan 4, 2008
US 2007 Energy Bill Renewable Fuel Targets

<table>
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<th>Calendar year</th>
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The US Biofuel industry is here to stay

- Economic desirability?
- Now biofuels are a major source of elastic demand for grains, sugar and oilseeds
- Grain is a residual supplier to a much larger fossil fuel market
- The price of oil will have a large impact on the price of grains
- Increased agricultural output will tend to increase biofuel production with less impact on price
- It also changes the relative demand for energy versus protein and location of livestock production
A US led global recession

- This could slow the demand growth if Asia gets dragged in
- But the weaker US dollar could maintain prices for commodities
- High commodity prices and low US$ are related

Integration of Scientific Capacity

- Private mergers and public reorganization
- Greater involvement of private sector accompanied by a diminishing role of the public sector
- An increased number of private-public partnerships
- These trends are caused by a greater enforceability of property rights, which allows firms to capture value for their research
Biotech and the Omics

- Lead to an increased understanding of how plants work and can lead to increases productivity
- Private research has exploded
- First generation input traits have been successful in corn, soybeans, cotton and canola
- The industry has become very concentrated owned by 5-6 life science companies
- Public institutions are pulling out of applied research

Research Spending in Canola
Role of Public Research
A restricted ability of some firms to access technology that is clearly beneficial to the sector as a whole (e.g.)
- Decreased sharing of research among researchers and research institutions
- Increased industry concentration
- Freedom to Operate Issues

What is Freedom to Operate?
- Obtaining the legal rights to commercialize a product
- FTO for research a product generally does not give FTO to commercialize
- An agreement with the owners of each process IP and each genetic IP is required for commercial use
Why is this an issue?

- New varieties can have many separate pieces of IP
- This will increase with trait stacking and patented gene sequences
- The firm wishing to commercialize needs a signature from each owner
- Each owner can hold up the process and will want a share of the profits
- Bargaining takes place after costs are sunk
- A hold up problem may exist

How can public research help overcome the challenges?

- Ideas and products of public research can be used over and over again - (non-rival)
- Very large potential spillovers between projects
- These characteristics can help in the sharing of ideas among researchers and research institutions
- Public research can potentially reduce freedom to operate issues
- Given limited available research funding, the key is determining where to focus our public research efforts
How do we determine where to focus public research?

1) First we should determine who is capable of providing research.

Research is typically provided by three sectors (Picciotto 1995):

- Gov’t sector – stakeholders are all of society and therefore pursue goals that are in the best interest of society.
- Participation Sector – stakeholders who have a common interest and voluntarily join to derive benefits from collective action (e.g. Western Grain Research Foundation).
- Private Sector – stakeholders are individuals or firms who own property rights and seek to maximize their own profit.

How do we determine where to focus public research?

2) Then we determine who has incentive to provide research.

In general:

- Private – when private companies have exclusive rights to benefits.
- Participation – where firms have incentive to conduct research collectively.
- Gov’t – when research is required but there are no incentives for the other two groups to provide it or when research by the private sector leads to market failure (e.g. freedom to operate).

Governments can also stimulate research by the other two sectors by creating a favourable regulatory environment.
How do we determine where to focus public research?

- By examining the incentives to provide certain kinds of research, we can then determine the appropriate government action on a case-by-case basis
  - Options include:
    - Do nothing – no need for research or it is already being provided successfully without market failure
    - Create or modify incentives for private or participation sector to provide research or overcome market failures
    - Provide research – the research improves welfare, there is no incentive for the other two sectors to provide it and/or there is a market failure

Areas Where Public Research Can Play a Role

1) The lack of private incentives for research related to:
   - § plant and animal health,
   - § food safety,
   - § bio-security,
   - § and the environment

Suggests the need to maintain a reservoir of reactive capacity, suggests that publicly funded research is vitally important in these areas.
2) The private incentive for investment in regional agronomic research is often very limited because farmers can easily mimic the best farming practices without paying royalties.

- This leaves the role of agronomic research to the participation sector (industry organizations), the government sector, or some combination of the two.

3) There are very large externalities associated with the market provision of goods for human health

- because the existence of public health services in conjunction with private insurance means that individuals bear only of small portion of the health care costs associated with their illness

- This reduces the private incentive for consumers to pursue wellness and to demand healthier foods, which reduces the private demand for this type of research
4) In crops where private IP is firmly established, the private and public research sector is constrained by issues of industry concentration and market power, freedom to operate, and downstream positive and negative externalities related to human health and the environment.

- In these crops there may be a need:
  - to stimulate research competition by reducing barriers to entry,
  - to address growing FTO issues through new institutional relationships, and to augment the private incentives to deal with health and environmental externalities.

Other General Lessons

1) Many economic studies have found high rates of return to research continuing to present day (Gray and Malla, 2007).

  § suggest a need to find mechanisms to fund more research in the sector
  § Public needs to invest in areas research where private industry and levy-funded research organizations will not invest.
  § Where the private sector is able to invest, more analysis is needed to determine what incentives, if any, are needed to create the maximum net benefit from research
2) Research by Veeman et al. (2007) found that the R&D expenditure stock for Canadian agricultural research has shown no growth since 1990 and that prairie crop sector TFP growth has fallen to an average of .51% per year for the 1990 to 2004 period, which is much lower than historic growth rates of close to 2% per year.

- This slowdown in productivity increase should be a concern for policy makers.
- If there is desire to increase productivity growth rates, greater and more effective research expenditure is required.

3) The introduction of intellectual property rights and biotechnology has recently led to significant private investment in crop research concentrated in Canola, Soybeans and Corn…. This illustrates that for some crops and some technologies IP can stimulate greater research investment.

However, a “one size fits all” approach to the provision and governance of research is unlikely to be optimal because there are many types of “agricultural” research, each addressing different issues, operating in different markets, with a different set of externalities and with different institutions.
4) Producer-controlled levy funded research has been introduced for many commodities and has been successful in driving innovation.

- these investment constrained by voluntary producer support, are limited to less than .5% of sales, with only a portion of the revenue being spent on research. - far less than other sectors
- Producers are concerned that their dollars will displace public investment
- The ongoing success of these organizations suggest that mechanisms, which might include easier rules for establishment and setting levy rates, and/or matching contributions by governments, are needed to encourage greater levy collection.

5) Genomics and related areas such as proteomics and metabolomics, are areas of research that would benefit from better integration of Canadian public research organizations.

- Not only does this type of basic research require scale and scope to be effective, it cuts across sectors and overlaps with animal and human health research.
- The optimal form of integration, the amount of integration and the institutions used to govern a more integrated approach, are very complex issues that deserve particular attention in a national science strategy.
Questions/ Discussion?