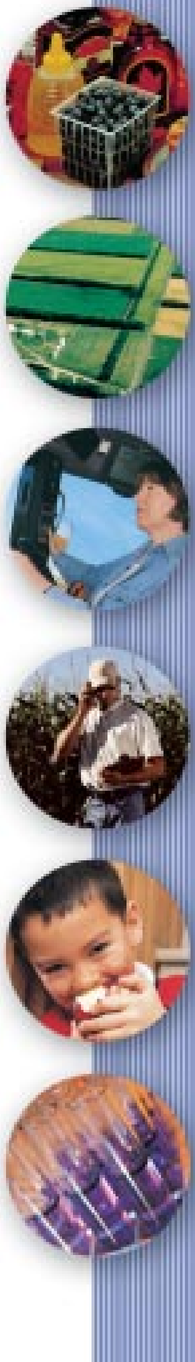
Next Generation
of Agriculture and
Agri-Food Policy

Economic Backgrounder:
Opportunities for Canadian Farmers:
Innovation and the Bioeconomy



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The Next Generation of Agriculture and Agri-Food Policy – A Federal, Provincial, and Territorial Initiative

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Opportunities for Canadian Farmers:

Innovation and the Bioeconomy

Introduction

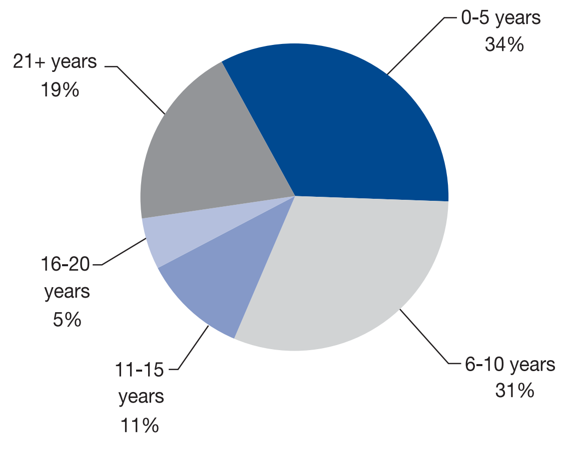
The bioeconomy has the potential to provide growing opportunities for Canadian agricultural producers and the agri-food sector in the 21st century. Given the importance of science and innovation for the development of the bioeconomy, the recent surge in knowledge and technical competencies related to genomics, biotechnology and proteomics have made the expansion of the bioeconomy possible, and will continue to contribute to its continued growth in the future. However, access to capital and regulatory regimes also play a key role in ensuring that the new products can be developed and delivered to market efficiently.

The bioeconomy represents economic activity that uses renewable bioresources, efficient bioprocesses and eco-industrial clusters to produce sustainable bioproducts, jobs and income (OECD, 2004). The bioeconomy can lead to opportunities for agriculture and food product markets through productivity gains, enhanced attributes (health and nutrition) and the development of substitutes for fossil-based products which make use of agricultural products as feed-stock. With agricultural commodity prices facing downward pressure and increasing competition from emerging low cost competitors, agricultural producers can benefit from the increased demand for traditional commodities for use in developing bioproducts (non-food, non-feed products), as well as from new markets for new products derived from agricultural products.

Bioproduct development and production in Canada

A recent Statistics Canada survey of firms developing and producing bioproducts in Canada in 2003 showed that the majority of sample firms (65%) had been engaged in bioproduct-related activities for less than ten years, indicating that this is a relatively new industry with great potential (Figure 1). Most of these firms were small (67%) and centered in Ontario and Quebec (54%). Over 1000 different bioproducts were developed or produced by these firms in 2003, with most of these in the chemical or fuel/energy category. Agricultural biomass was by far the prime source of feedstock for bioproduct firms. While most firms (77%) cited increasesd sales/market share as the main motivation behind developing bioproducts, developing new market niche/new products was also cited as important. In terms of impediments to bioproduct development, the top three barriers were stated as the high cost and timeliness of regulatory approval, a lack of financial capital and unreliable supply of raw materials (AAFC, The Canadian Bioproducts Development Survey, 2006).

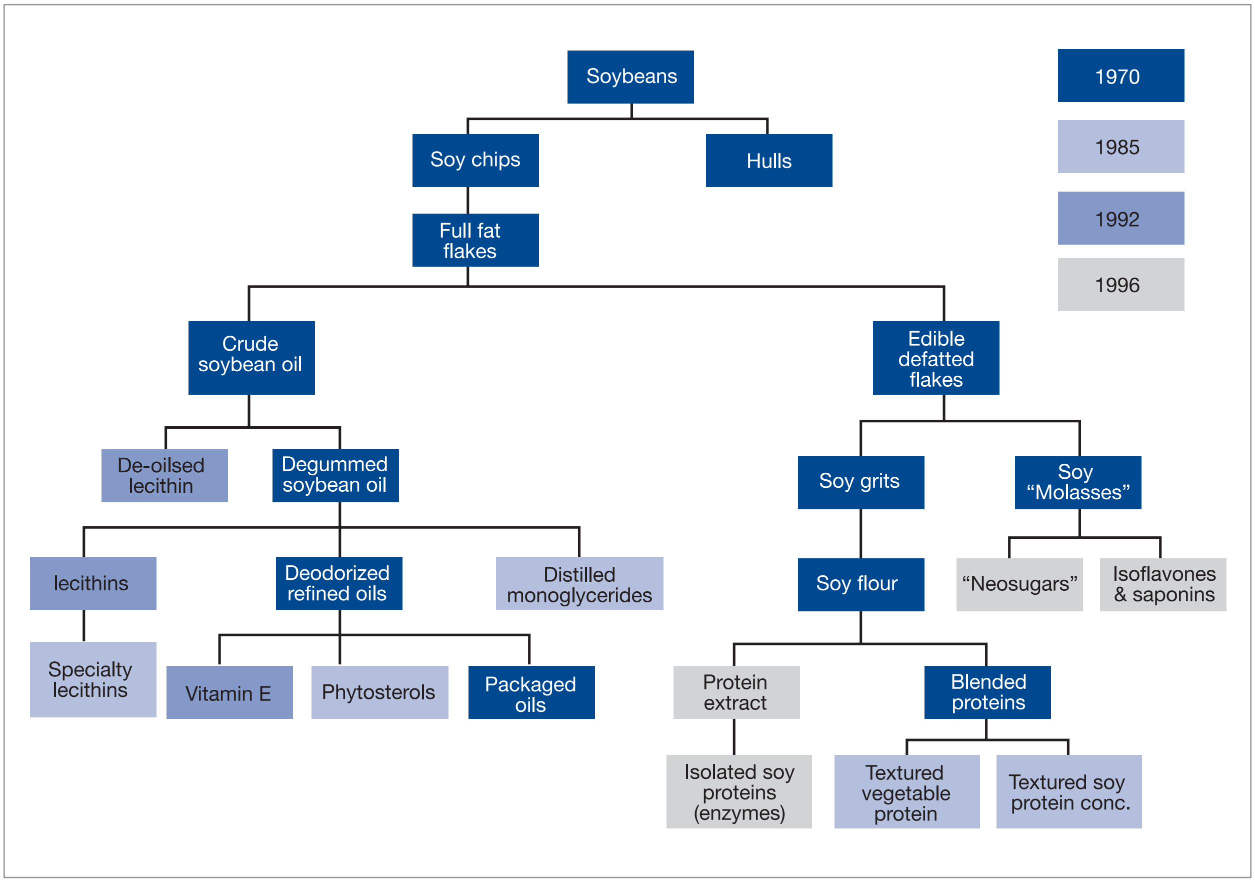
Figure 1: Share of bioproduct firms by years producing bioproducts



Source: AAFC, The Canadian Bioproduct Development Survey

Several important sources of feedstock or platform crops have been used to develop a variety of bioproducts and food and feed items over the past thirty years in Canada.[1] Research by AAFC and other public and private institutions into soybeans, for example, has led to products that go beyond the traditional oil and meal products (Figure 2). Soy flour, various oils, proteins and other products are now produced from soybeans for use in industrial and food applications.

Figure 2: Soy product breakdown



Source: AAFC Research Branch

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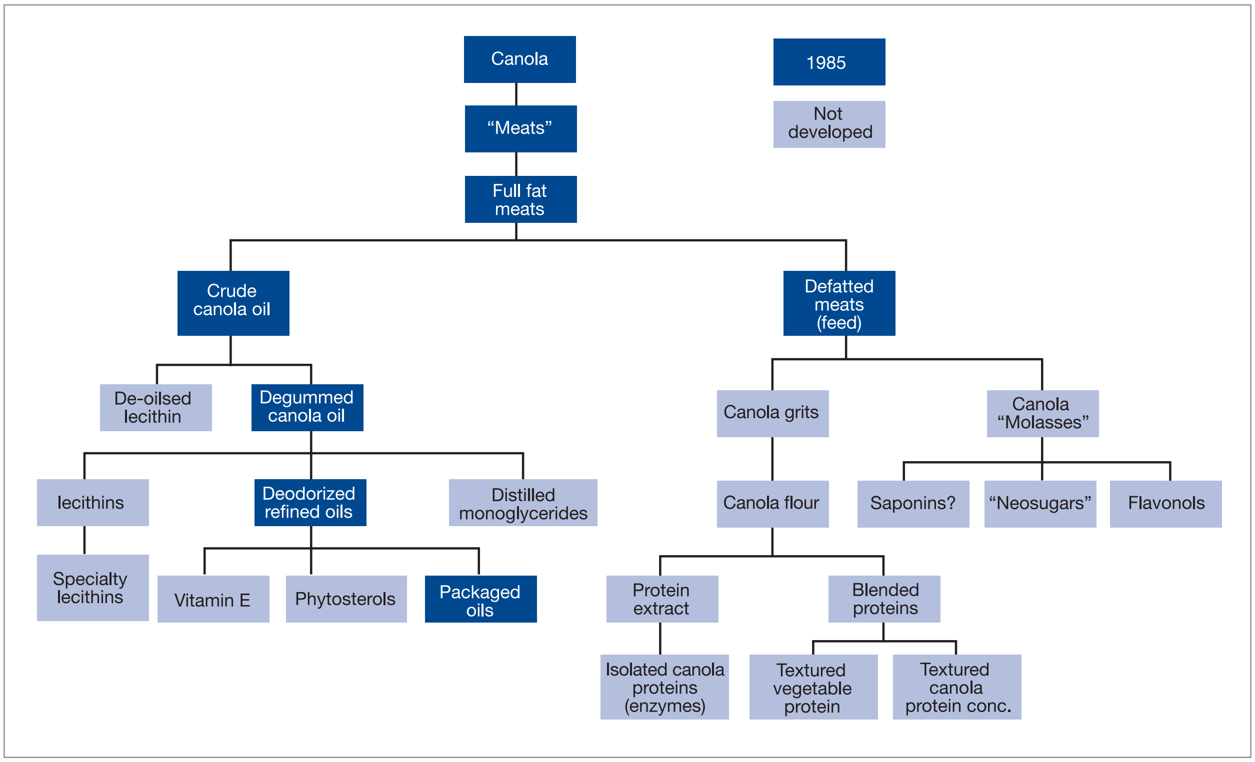
[1] Platform crops are crops that can serve as feedstocks for a variety of bioproducts, for example soy can be considered a platform crop and its associated bioproducts are described in Figure 2

Flax, triticale and canola have also been identified as important platform crops, that can be broken down into a multitude of products for food, non-food and non-feed purposes. These platforms are not as well developed as soybeans, but are in the process. Canola is an example (Figure 3). Additional R&D and commercialization efforts are needed for these products before their commercial production leads to increased demand.

The economic feasibility of many of these platform crops is expected to be enhanced by their being processed in biorefineries, where various components of the crop are used to produce a wide variety of products, allowing the value of some of the higher-valued co-products to offset the lower-valued ones.

Figure 3: Canola product breakdown



Source: AAFC Research Branch

Biofuels in Canada and in global markets

Biofuels produced from agricultural products are one of the many bioproducts that has attracted renewed interest of late due to the recent rise in world oil prices and the environmental benefits associated with renewable fuels. Most countries have introduced biofuel policies and identified targets for biofuel use in an effort to promote its development and expansion. The corn-based ethanol industry in the U.S. and the sugarcane-based industry in Brazil are two examples. The EU has also made efforts to develop biodiesel, encouraged by sector-specific policies and ample supplies of oilseed feedstock. Growth in international biofuel demand has in fact recently created upward price movements in commodity markets, particularly for corn and sugar.

Canada too, is making efforts to encourage its biofuel production. Canadian governments are among those that have set targets for biofuel use (Table 1). Through its Ethanol Expansion Program, Canada is expected to increase ethanol production from 200 million litres in 2005 to approximately 1200 million litres by 2007. This will increase Canadian domestic demand for grains by approximately 3.1 million tonnes. Given that Canada is a relatively small player in world markets, this incremental increase in demand will not have a significant impact on world grain prices. However, the domestic industry may be affected if Canada becomes a net importer of feedgrains.

Table 1: Renewable Fuel Blending Targets by Region

Region	Target	Date to achieve
Canada	Proposed 5%	2010
Ontario	5%	2007
Manitoba	8.50%	To be determined
Saskatchewan	7.50%	2006

Source: Various provincial sources

Internationally, the combination of many countries' biofuel policies could potentially lead to a significant increase in world demand for certain feedstocks, such as sugar, coarse grains and vegetable oil and may result in a rise in prices of these commodities. Over the medium-term, the price impacts would dissipate due to increased supply through substitution to other feedstocks, such as cellulose, and increased production in response to price movements. Long-term sustainability of biofuel production in a free market will depend on its cost competitiveness with other fuels. According to the OECD (2005), ethanol produced in Brazil from sugar is cost competitive when the price of oil is at US$29 per barrel, whereas ethanol produced in the U.S. from corn is cost competitive only if the price of oil is US$44 per barrel. Given Brazil's low cost of production for ethanol, it is likely that it will continue to dominate the world ethanol market. However, Canadian agriculture may benefit from increased exports of oilseeds, such as canola, as the EU mandates the increased use of biodiesel.

The path forward

The development of the bioeconomy hinges on many factors, including R&D, collaboration across the supply chain, and a regulatory environment which facilitates the development and marketing of new products and processes. Evidence from the Canadian Bioproducts Development Survey (AAFC, 2006) shows that R&D by Canadian bioproduct firms only accounted for 3% of bioproduct revenues, compared to the 10% of revenues that emerging science-based industries devote to R&D (Statistics Canada, Biotechnology Survey 2003). Access to capital to undertake R&D has been cited as one of the obstacles. However, many Canadian bioproduct firms used contracting or collaboration to undertake R&D activities so as to access skills and capabilities in other organizations for R&D activities while reducing costs and risk exposure. Most bioproduct-related contracts were with private research labs and universities, 40% and 37% respectively. Collaborations to access external scientific expertise were important for 51% of bioproduct firms.

Similarly, in the Canadian food processing industry where investment in R&D and innovation are closely linked, innovation was made possible through collaboration and partnering with upstream and downstream members of the supply chain, including primary producers, ingredient suppliers, packaging companies and retailers, (AAFC, Innovation Survey, 2004) (Table 2). Given the importance of collaboration for R&D and innovation, opportunities from the development and marketing of bioproducts and novel foods from platform crops will require collaboration among the members of the supply chain.

Table 2: Innovating Food Processing Firms and Their Collaborators

Partner Group	Product Innovation	Process Innovation
	% of innovating establishments	
Food ingredient suppliers	40	14
Packaging suppliers	27	23
Raw agricultural product suppliers/organizations	22	9
Food retailers/wholesalers	22	5
Equipment suppliers	20	37
Consultants	17	18
Commercial laboratories or R&D enterprises	15	7
Foodservice operators	14	3
Universities and colleges	12	6
Federal/provincial government research facilities	8	5
Competitors	5	3
Private research institutions	4	2

Source: AAFC, The Nature and Extent of Innovation in the Canadian Food Processing Industry, 2006

Other challenges for the bioeconomy will come from the impediments to R&D and innovation and the approval process for new products, such as the lack of access to cash flow, regulatory impediments and shortages of skilled workers (Table 3). By addressing these challenges will opportunities translate into improved profitability for agriculture producers and for food and non-food processors.

Table 3: Impediments to Innovation in the Canadian Food Processing Industry

Factor	% of innovating establishments indicating medium or high importance
Lack of internally generated cash flow	42.2
Long gestation period of innovation	37.4
Insufficient flexibility in regulations or standards	37.3
Shortages of skilled workers	37.1
Lack of marketing capability	36.3
Lack of retail acceptance or access to distribution channels	29.1
Lack of external equity funding	26.0
Lack of debt financing	25.2
Lack of idea champions	24.1
Corporate/management resistance to innovation	15.8
Difficulty in negotiating clear intellectual property (IP)	9.3

Source: AAFC, The Nature and Extent of Innovation in the Canadian Food Processing Industry, 2006

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