

**Standing Committee on Agriculture and Agri-Food**

# **STUDY: Biotechnology**

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## **Speaking notes**

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**VALGEN** 

## **1. Introductory comments**

Thank you for inviting me today to comment on the role of biotechnology in the Canadian and global agri-food industries.

Let me start by saying I think this is an important study, as Canada now has the opportunity to renew and revitalize its national agri-food innovation policy.

I firmly believe there is both a strong case and significant opportunity to renew and accelerate agri-food innovation by intelligently and aggressively developing, adapting, adopting and using advanced technologies, including biotechnology, to enhance Canada's globally competitive agri-food sector.

## **2. Background and experience**

I should preface my remarks with my background and expertise. I am an international political economist with the Johnson Shoyama Graduate School of Policy at the University of Saskatchewan in Saskatoon. I teach, do scholarly research and consult on the role of technology in economic development, markets and trade, with a particular focus on agricultural biotechnology. I also am the Co-Lead and Principal Investigator of VALGEN (Value Addition through Genomics and GE<sup>3</sup>LS), a Genome Canada funded project that is investigating the deep governance issues related to science led agri-food development and trade.

In the interests of full disclosure, I should report that I have past employment experience in industry (banking) and government (Saskatchewan) and have held a number of academic appointments in Canada and abroad that have allowed me to investigate matters of technological change and innovation policy. I have been applicant and senior research collaborator on more than 20 national and international grants and contracts that have generated more than C\$150 million to support research and scholarly investigation of new technologies in the global agri-food system. I have held peer-reviewed grants from SSHRC, NSERC, the NCE program and Genome Canada, contracts with Saskatchewan Department of Agriculture and Food, Agriculture and Agri-Food Canada, the Canadian Food Inspection Agency, Western Economic Diversification, the Canola Council of Canada, the Saskatchewan Seed Growers Association, Monsanto, Ag West Bio, the State of Victoria, the OECD, and a number of law firms in Canada and the US litigating market effects of innovation. I was a member of the Canadian Biotechnology Advisory Committee for 7 years (I served as co-chair of the review of Canada's regulatory regime for biotechnology) and was a Canadian member of the NAFTA Chapter 13 expert panel investigating GM corn in Mexico. I currently am a member of the boards of directors of both the Estey Centre for the Study of Law and Economics in International Trade and Ag West Bio Inc. and was a founding director of the Canadian Agri-food Policy Institute (CAPI). I

am also co-editor of *AgBioForum*, the preeminent on-line peer-reviewed journal that concentrates on the economics and politics of the global agricultural biotechnology industry.

### **3. The innovation imperative**

Two pressures—one domestic and one international—provide the context for your important deliberations.

First, domestically, the Canadian agri-food sector faces a daunting challenge. When I look at the value added per employed person in the agri-food sector I find that the agri-food sector is returning about 50% less value added per employee than the other sectors in Canada (but about 70% in Western Canada), and that is deteriorating over the past two decades (overall GDP per employed person in the total economy jumped 70% in the same period that crops and livestock output per person rose only 40% —more depressing yet, Canada’s numbers for the overall economy are lower than in the rest of the OECD). If this continues, it won’t be the Americans, it won’t be the Mexicans and it won’t be the Chinese that ultimately overwhelm the Canadian agri-food sector—it will be the other sectors within Canada. They will draw away the high quality land, labour and capital that are so important to a growing and prosperous sector. What will be left is a poor and declining industry.

Second, internationally, destructive trade and market policies, compounded by inadequate investment in agri-food research and development, have dampened supply, just at the point when demand is accelerating (due to a combination of a larger world population and rising demand from per capita income growth). The result is spiking world food prices and increasing unease in food-insecure countries where more than 850 million malnourished people live.

Canada has an economic and moral imperative to respond, if for no other reason than we are relatively big. . The Canadian agriculture and agri-food system accounted for 8% of total Canadian GDP in 2005 and employed one in eight or nearly 2.1 million people.<sup>1</sup> In 2008, Canada was the fourth-largest exporter of agriculture and agri-food products in the world, with exports valued at \$38.8 billion.<sup>2</sup>

Canada has more than 100 years of world-class agri-food innovation, leading to world-first innovations for wheat, barley, oats, canola, pulses, cattle and hogs, which now underpin the world's capacity to feed itself.

Agri-food innovation, which can and should include more intelligent and aggressive use of all advanced technologies, including biotechnology, will address both our national economic interest and our global public interest.

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<sup>1</sup> <http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1205769582306&lang=eng>

<sup>2</sup> <http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1261159658146&lang=eng>

#### **4. Innovation**

Innovation is not just investment in the next hog plant or in the next crop variety or the next grain elevator—innovation is a continual process. It requires that we change a whole lot of things continually.

Peter Drucker has observed that the key resource in a knowledge-based economy is neither land nor labour as we traditionally view it; it's not even capital.<sup>3</sup> It's knowledge. Schumpeter said it best. Ultimately it's the development and use of new ideas in the context of new products, new processes, new markets and new organizations.<sup>4</sup>

#### **5. Pressures for change:**

In the past generation there has been a sea change in the global economy. In the context of the agri-food sector, the science, research and markets that drive innovation have globalized. While small, largely autonomous government and university research labs were the key actors in developing and introducing new agri-food technologies until the Second World War in most countries, since then there has been a major shift—global science is mobilized by global research programs in pursuit of globally relevant innovations that can serve global markets. This creates real coordination challenges, as multiple levels of government (e.g. local, provincial, federal and international) need to

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<sup>3</sup> Peter Drucker. 1994. *Post Capitalist Society*. Harper Paperbacks.

<sup>4</sup> Schumpeter, J. (1934), *The theory of economic development*, Cambridge, MA: Harvard University Press. Schumpeter, J. (1939), *Business cycles: a theoretical, historical and statistical analysis of the capitalist process*, New York: McGraw-Hill. Schumpeter, J. (1954), *Capitalism, socialism, and democracy*, London: George Allen and Unwin.

collaborate with an array of universities, multinationals and producer groups, often in the context of public private partnerships.<sup>5</sup>

Biotechnology is at the core of this global effort.<sup>6</sup> It is both now and is likely to remain an important tool that will underpin, accelerate or precipitate innovation in Canada's agri-food sector.

Canada should be proud that it was a leader in the development, application and use of agricultural biotechnology. Without Canada's aggressive development, adaptation and adoption of biotechnology methods, herbicide tolerant canola would not have been such a success—and might not have happened at all. HT Canola, developed and commercialized largely in Canada, was one of the first and arguably most rapidly adopted technologies ever introduced in global agriculture.<sup>7</sup> This was the result of a real P3, with universities contributing the science and skilled technician, industry providing much of the capital and many critical proprietary technologies, with governments providing much of the translational science (in AAFC and NRC) and with farmers contributing to research design and market adoption strategies.

This technology alone is estimated to have generated more than \$1.2 billion of net benefit to Canadian farmers in the past 15 years, to have netted the seed developers more than \$1.5 billion in revenues

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<sup>5</sup> Phillips, P. 2007. *Governing transformative technological innovation: Who's in charge?* Oxford: Edward Elgar, pp. 306.

<sup>6</sup> Phillips, P. 2002. Biotechnology in the global agri-food system. *Trends in Biotechnology*, 20(9), September, pp. 376-381.

<sup>7</sup> Phillips, P. and G.G. Khachatourians. 2001. *The Biotechnology Revolution in Global Agriculture: Invention, Innovation and Investment in the Canola Sector*. CABI, pp. 360

(which has been reinvested, taxed or disbursed to shareholders in Canada and around the world) and to have enhanced the welfare of consumers (many of whom are low-income families in developing nations) by about \$600 million. All in all, the canola-based innovative effort has enhanced economic and social welfare in Canada and around the world by as much as \$3.3 billion.<sup>8</sup>

Meanwhile, the technology has improved the environmental footprint of canola production. A recent survey<sup>9</sup> revealed that more than 94% of respondents reported that weed control was the same or had improved and only 8% indicated that they viewed volunteer GM canola to be one of the top five weeds they need to control. Meanwhile, producers reported that the introduction of HT canola, in conjunction with air seeders and other min-till technologies, allowed farmers to largely remove summerfallow as part of their crop rotation. Tillage use has dropped from 89% of canola acres in 1999 to 11% in 2006.

The commercialization and wide spread adoption of HT canola has also changed weed management practices in Western Canada. Prior to the introduction of HT canola, weed control was largely done through the use of tillage. Much of the tillage associated with HT canola production has been eliminated as 64% of producers now use zero or

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<sup>8</sup> Phillips, P. 2003. The economic impact of herbicide tolerant canola in Canada. In N. Kalaitzandonakes (ed) The economic and environmental impacts of agbiotech: A global perspective. Kluwer, pp. 119-140. Gusta, M, S. Smyth, K Belcher, P. Phillips, and D. Castle. Forthcoming 2011. Economic Benefits of Genetically Modified Herbicide Tolerant Canola for Producers. AgBioForum.

<sup>9</sup> Smyth, S. M Gusta, K Belcher, P Phillips and D Castle. Forthcoming 2011. Changes in Herbicide Use Following the Adoption of HT Canola in Western Canada. Weed Technology.

minimum tillage as their preferred form of weed control. Additionally, there have been significant changes regarding the use and application of herbicides for weed control in canola. Research shows that when comparing canola production in 1995 and 2006 the toxicity of agro-herbicides applied to canola has decreased by nearly 60%, there has been a 61% decrease in producer exposure to chemicals and a decrease in chemical active ingredient application of 3.6 million kg.<sup>10</sup>

Moreover, the introduction of HT canola provides one valuable model for the responsible introduction of new technologies. When the new traits were approved in Canada in 1995, our key market in Japan had yet to approve the trait. In response, the seed developers worked with the Canola Council of Canada, grain handlers, commodity groups and the regulators to contain the traits in an identity preserved production and marketing system in order to differentiate supply and serve all core markets. This system was largely industry led and arguably set the gold standard, generating accelerated benefits for the industry, farmers and global consumers.<sup>11</sup>

## **6. The opportunities**

The average annual growth in yield for crops that have adopted biotechnology have accelerated while those crops without active

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<sup>10</sup> Smyth, S., M. Gusta, K. Belcher, P. Phillips and D. Castle. Forthcoming 2011. Environmental Impacts from Herbicide Tolerant Canola Production in Western Canada. *Agricultural Systems*.

<sup>11</sup> Smyth, S. and P. Phillips. 2002. Competitors co-operating: Establishing a supply chain to manage genetically modified canola. *International Food and Agribusiness Management Review* 4(1), pp. 51-66.

research using biotechnology are lagging. Yields for wheat, barley, oats, pulses and even canola are all lagging productivity gains in corn, soybeans and cotton, the top three GM crops in the world today. The combination of greater private investment for biotechnology crops and the accelerated capacity to deliver targeted results using biotechnology make it difficult to compete. There is every reason to believe that similar application in our crops could yield comparable gains. At the same time, there is significant opportunity for new genomics-based tools to develop vaccines and drugs to treat the most economically destructive animal diseases.

There are significant opportunities that could be pursued. Research can and should be directed at improving yields on our core crops: biotic and abiotic stresses and the lack of competitive and accessible elite germplasm holds back many crops. Higher quality and more differentiations are possible—most of the current value from our agri-food sector is realized from quality differentiation. Biofuels and other industrial uses, including enhanced environmental services from land management, are possible but little organized effort is underway to tap the value in our agri-food feedstocks and lands. Many of our plants and animals could become platforms or biofactories for valuable proteins and enzymes. Ultimately, differentiation of products, technologies and environmental services will need new and more effective regulatory and management systems, which will inevitably require new and better

science to measure, monitor and control the adventitious presence and detect low-level presence of comingling.

The good news is that Canada may be uniquely endowed with the research infrastructure, human capacity and institutional mechanisms to ramp up agri-food innovation. Canada has a world class research system, anchored by AAFC Research Branch and its research centres, NRC and its institutes (esp. the Plant Biotechnology Institute in Saskatoon), world class universities, innovative P3s like the Crop Development Centre, which increasingly are partnering with check-off funded commodity groups, and an array of almost unique facilities (e.g. the CLSI and InterVAC-VIDO which are at the cutting edge of applying science to agriculture).<sup>12</sup>

## **7. The choices**

Ultimately, accelerating innovation in the Canadian agri-food system will require new policies, programs and partnerships that will mobilize capacity from industry, government, universities and farmers—the trick to mobilizing those resources will be to create a sense of purpose and commitment. Conflict and lack of focus create uncertainty, which simply signals to others to avoid engaging.

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<sup>12</sup> Phillips, P., C. Ryan, J. Karwandy, T. Procyshyn and J. Parchewski. 2008. “The Saskatoon agricultural biotechnology cluster,” in C. Karlsson ed., *Handbook of Research on Clusters: Theories, Policies and Case Studies*, Edward Elgar, 233-52. Boland, W., P. Phillips and C. Ryan. 2010. *Centerless Governance and the Management of Global R&D: Public-Private Partnerships and Plant-Genetic Resource Management*. VIII Triple Helix Conference, Madrid, October 20-22.

At a minimum, the federal government, in partnership with other stakeholders and partners, needs to work on three priority policy areas.

### **7.1 Federal research needs to refocus on agri-food opportunity**

To the dismay of many in the industry, the federal government has sent some troubling signals that agri-food research is not on the A-list of priorities. In 2007 the federal government released its strategic statement on Mobilizing Science and Technology to Canada's Advantage. The strategy targets to invest in Canada's entrepreneurial, knowledge and people advantages in four priority areas: environmental science and technologies; natural resources and energy; health and related sciences and technologies; and information and communications technologies. While parts of the agri-food sector (e.g. healthy foods, nutraceuticals and biofuels) might be shoehorned into the various priority areas, the strategy and its proponents show a detectable bias against national S&T investments in the agri-food area. One effect is that existing and new S&T programs are no longer open to the Canadian agri-food sector. Already the National Centres of Excellence, NSERC and the Canada Excellence Research Chairs programs have explicitly rejected proposals to invest in the agri-food sector.

More effort needs to put on aligning federal funding towards the areas of greatest opportunity. Two points come out of theory and practice. First, while macroeconomic and sector wide-policies are

perhaps necessary conditions for innovation, successful and sustainable innovation occurs most often in special places, using special processes and engaging special people.<sup>13</sup> Federal policy too often has sought to work against the agglomeration of innovative activity:

- federal research efforts are often disconnected from each other (e.g. federal labs cannot participate as full partners in Industry Canada funded programming) and from industrial or sectoral opportunities (e.g. federal investments too often follow political priorities rather than industrial needs or regional capacity);
- federal funds are increasingly provided on extremely short-terms that ignore the long gestational periods for innovation; most successful research investment efforts tend to last 5-15 years while federal programming now focuses on the 1-3 year horizon; and
- federal administrative rules are so restrictive that the cost of doing business with government programs and agencies is becoming prohibitively expensive in terms of time and money.

## **7.2 Intellectual property policy needs to be clarified**

If and when the research system generates an invention, inventors and investors seek to lock in their ownership and control as a precondition to justifying the frequently expensive costs of gestating the invention. Reducing any invention to practice, scaling up, gaining

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<sup>13</sup> P. Phillips, G. Webb, B. Boland and C. Ryan. 2010. Research and Innovation Delivery Models in Agri-based Innovation Systems. Contract 01B68-10-0121 for Innovation Policy Analysis, Research Branch, AAFC.

regulatory and market acceptance and positioning an invention in the market usually costs more than the research effort, and is largely unrecoverable without effective property rights.<sup>14</sup> Hence, intellectual property rights policy and practice is important. As discussed a few weeks ago by my colleague, Dr. Richard Gold, there are a range of policies and practices the federal government could adopt that would go a long way to removing some major uncertainties in this area.

### **7.3 Canada needs to complete its regulatory system**

If Canada is serious about being a major agri-food innovator, the federal government will need to revitalize its regulatory capacity.<sup>15</sup>

While Canada arguably has one of the best and most respected regulatory systems for biotechnology derived foods and crops, it lacks the authority and capacity to deal with the new products that will come from accelerated innovation. Our regulators need to be vested with the authority to develop rules and procedures for efficiently and effectively evaluating and judging new crops and animals. Canada was among the first to develop regulations for plants with novel traits, but it has lagged in developing rules and procedures for dealing with new product

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<sup>14</sup> Smyth, S. P. Phillips, W. Kerr and G. Khachatourians. 2004. *Regulating the Liabilities of Agricultural Biotechnology*. Wallingford, UK: CABI Publishing, pp. 210.

<sup>15</sup> Phillips, P., S. Smyth and W. Kerr (eds). 2006. *Governing Risk in the 21st Century: Lessons from the World of Biotechnology*. Nova Science Publishers, pp. 112. Smyth, S., W. Kerr and P. Phillips. Forthcoming 2011. *Recent Trends in the Scientific Basis of Sanitary and Phytosanitary Trade Rules and Their Potential Impact on Investment*. World Investment. Smyth, Stuart, Peter W.B. Phillips & William A. Kerr. 2009. 'Global Governance Quandaries Regarding Transformative Technologies for Bioproducts, Crops, and Foods'. *Journal of World Trade* 43(6), 1299–1323.

candidates. For more than a decade the system has languished. I was co-chair of the CBAC review of the system in 2001<sup>16</sup> and have participated at times in efforts to develop rules for evaluating GM animals (including fish), industrial plants, plant-made pharmaceuticals (PMPs) and a range of other technologies and applications, including rules to govern post-market monitoring and quality management<sup>17</sup>—but virtually no new rules have emerged. The system has ground to a halt. This is not the fault of our regulators—it is the lack of leadership by our government and the industry.

## **8 Conclusion**

In conclusion, let me say you have a golden opportunity to start a debate that may change the direction of the Canadian agri-food sector and contribute to global welfare.

All of these policy prescriptions are eminently doable. The simple need federal will. The choice is simple--the Canadian government needs to lead, follow or get out of the way.

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<sup>16</sup> CBAC. 2002. Improving the Regulation of Genetically Modified Foods and Other Novel Foods in Canada: A Report to the Government of Canada Biotechnology Ministerial Coordinating Committee (Final report).

<sup>17</sup> Smyth, S. and P. W. B. Phillips. 2004. Identity Preservation, Segregation and Traceability: Marketplace Features and Uses. In R. E. Evenson and V. Santaniello (eds.), *The Regulation of Agricultural Biotechnology*. CAB International, pp. 191-200.