



Current

Agriculture, Food
& Resource Issues

A Journal of the Canadian Agricultural Economics Society

Using Biotechnology to Lower Production Costs of Biofuels in Canada: Will it Hinder the Growth of an Export Industry?

Laura J. Loppacher

Research Associate, Estey Centre for Law and Economics
in International Trade, Saskatoon, Canada

This paper was presented at the Canadian Agricultural Economics Society's workshop, Sustainable Development and Globalization of Agri-food Markets (Quebec City, August 2004). Papers presented at CAES workshops are not subject to the journal's standard refereeing process.

The Issue

Bio-based fuels represent one of the most viable alternatives to petroleum-based fuel to meet transportation needs in the 21st century. The biofuel industry is in its infancy in Canada but shows considerable growth opportunity. The international interest in biofuels due to environmental and energy security concerns could result in a large and profitable export market for Canadian biofuel producers. Many industry participants are beginning to use biotechnology in their production processes to lower costs. Such use means they will be forced to contend with the unclear international regulation of trade in the products of biotechnology. Substantially different rules have been created by the Cartagena Protocol on Biosafety to the Convention on Biological Diversity, which governs only trade in biotechnology products, and the World Trade Organization, which governs trade in all goods. The inconsistencies of the regulatory situation create significant risks for biofuel producers, as their products may be blocked from important export markets.



Implications and Conclusions

The Canadian biofuel industry shows considerable export potential due to its agricultural and technological resources. Due to the unclear regulatory situation for trade in products of biotechnology, if the Canadian industry adopts biotechnology in order to lower production costs, there is a significant chance its products will face import bans in a number of important foreign markets. Investors must be aware of this risk before making additional investments in biotechnology applications and production facilities. Further, it is important that industry participants work to have regulatory issues addressed before they impede trade.

The Biofuel Industry and Biotechnology

Biofuels, such as ethanol and biodiesel, are produced from renewable biomass and are more environmentally friendly to use than are fossil fuels. They can be directly substituted for petroleum-based fuels in gasoline and diesel engines. The use of biofuels for transportation has attracted considerable attention in recent years, but their use actually pre-dates the use of petroleum-based fuels. When Rudolf Diesel first demonstrated his compression engine in 1898, he used peanut oil for fuel. In the 20th century, however, petroleum fuels quickly replaced bio-based fuels due to their low cost, availability, efficiency and consistency (Werner, 2003). Biofuels have become increasingly attractive because of their renewability and availability, and the environmental benefits they offer. It is widely recognised that eventually the world's petroleum reserves will be exhausted and new sources of energy will be needed. Biofuels are made from renewable sources such as sunflower seeds, corn, soybean, rapeseed and wheat. By substituting consumption away from petroleum fuel and onto biofuels, countries could reduce their dependency on imported oil – a particularly important point for the United States. Governments also see biofuels as a way to better utilize agricultural resources, thereby increasing prices of commodities and therefore their farmers' income. However, the primary motivation for the increased interest in bio-based fuels outside the United States is concern for the environment, especially with regard to urban air pollution and global warming – both of which are contributed to significantly by the burning of fossil fuels for transportation. When total lifecycle emissions are considered, depending on the production methods utilized, biofuels can reduce greenhouse gas emissions by up to 90 percent compared to petroleum fuels. In addition, toxic substances in emissions are also reduced (Walsh, 2000)

Thus far, governments have played a very large role in the development of the biofuel industry. Canada has followed in the footsteps of the European Union, the United States, Brazil and others, providing large subsidies to encourage development and growth of the industry. Under the Climate Change Plan, the Government of Canada has implemented a variety of programs to encourage increased biofuel adoption. Some of these programs include eliminating the excise tax on ethanol, providing grants and loan guarantees to

encourage construction of ethanol and biodiesel facilities, undertaking research projects and creating public awareness campaigns to encourage biofuel adoption (Climate Change Canada, 2004).

The major justification for this subsidization in Canada and the majority of other countries that follow similar policies is the desire to correct the market failure pertaining to the environmental damage caused by the externalities associated with using petroleum fuels. It is also viewed by some, especially in the EU, as a good way to diversify the agricultural sector. In addition to subsidization, some countries are beginning to enact regulations mandating minimum levels of biofuel adoption. The most prominent example of this is the European Union, which has put in place the EC Directive for the Promotion of Liquid Biofuels, requiring that 5.75 percent of the fuel market must be supplied by biofuels by 2010 (Koerbitz, 2004). Although individual countries in the EU are adopting a wide range of measures to achieve this goal, one commonality is that, given their rural economic development goals, imports are not a desirable option.

One of the most significant impediments to the development of a sustainable biofuel industry is the high cost of production of biofuels when compared to petroleum-based fuels. Although there are benefits to using biofuels, such as lower emissions and in some cases better vehicle performance, consumers are not willing to pay a large price premium for these fuels. The most recent estimates state that U.S. corn-based ethanol is economically viable at oil prices of \$60/barrel and biodiesel is economically viable at \$80/barrel (*The Economist*, April 20, 2006). It is only recently, during a period of record-breaking high oil prices, that biofuel production has become economically viable without large subsidies. The long-term persistence of these prices is uncertain, and the powerful biofuel lobby will fiercely resist any reduction in subsidies that have been in place since the inception of the industry.

Many people involved in the Canadian biofuel industry, including scientists, investors and government officials, believe that biotechnology could be a vital tool in reducing the cost of producing biofuels (OECD, 2001). The successful development of a biofuels industry based on biotechnology would require, however, that the industry contend with the differing regulatory approaches to biotechnology around the world and an international trade law system that, thus far, has been unable to reconcile these approaches (Kerr and Loppacher, 2005). Inconsistencies in the regulatory environment could severely restrict the growth of an export industry.

The ability of a firm to export its product could be a central factor in profitability calculations when considering a new investment. Evidence has shown that exploiting economies of scale could be another significant factor that will help reduce production costs. However, expansion may result in more production than can be absorbed by the Canadian market; hence the need to find international markets.

Biotechnology could be used in a number of ways to lower the production costs of biofuels. The first approach could be to genetically modify the biomass to be converted

into the biofuel. The objective would be either to increase yields or to produce biomass that has characteristics that make it easier and less costly to convert to biofuel. The second approach would be to use biotechnology to create enzymes/fungi/bacteria to be used in the conversion process. The objective would be to increase the efficiency of the conversion process, primarily by lowering the amount of energy required in the process, decreasing the time required or increasing the yield. For example, a Canadian company, Iogen, has pioneered a process that uses biotechnology to convert waste cellulose (such as straw) into ethanol in an energy efficient manner. As the materials used are waste products from agricultural production, input costs can decrease significantly as they have a much lower opportunity cost (*The Economist*, May 12, 2005).

Regardless of the approach taken to utilize biotechnology, after the conversion is complete, the amount of GM material remaining in the biofuel would be extremely small. Even given this small amount, however, countries may attempt to regulate biofuels produced using biotechnology differently from the way they regulate biofuels produced without using biotechnology. The director of the Austrian Biofuel Institute, Werner Koerbitz (2004), has stated that in the event that even a fraction of the Canadian industry began to try to export biodiesel produced using GM canola, countries in the European Union would do everything in their power to stop entry into their market. While this position is likely a guise for providing protection to their domestic industry, the problems it will create for North American exporters could be substantial.

International Trade Law and Biotechnology

International trade law is a vital component of an efficient international trading system. Individuals and firms around the world have benefited from the effectiveness of this system. In many cases, it quickly and easily accommodates new products into the mix of internationally traded goods. Biotechnology, however, has presented problems for this system due to its novel characteristics, which result in unknown long-term risk factors. In the face of this uncertainty, countries around the world have taken significantly different regulatory approaches to biotechnology and this has resulted in the evolution of divergent trade regimes. The EU has taken an extremely cautious approach and from 1998 to 2003 had a moratorium on the approval of genetically modified organisms (GMOs) and their importation. Even after the removal of the moratorium in July 2003, their regulations remained far more restrictive than those of, for example, the United States and Canada.

The World Trade Organization is the primary organization for creating and enforcing international trade law. The WTO is primarily concerned with limiting the ability of governments to respond to requests for protection from domestic firms; it has been unable to deal effectively with the issue of calls for protection from environmentalists and domestic consumers (Isaac and Kerr, 2003b). As a result of these perceived deficiencies in the WTO, many countries began considering the creation of a new system that was directed towards the protection of the environment. In the case of biotechnology, the

result was a multilateral environmental agreement (MEA), the Cartagena Protocol on Biosafety to the Convention on Biological Diversity, more commonly known as the Biosafety Protocol (BSP). The BSP entered into force on September 11, 2003 after 50 countries, including the EU, ratified it. As of February 2006, 132 countries had ratified the protocol. Notably, the world's major users of agricultural biotechnology have not ratified it. The United States was never part of the BSP process because it has not ratified the overarching Rio Declaration on Environment and Development, and Canada and Argentina, both signatories to the convention, have not ratified it. The BSP could have a deleterious effect on how products using biotechnology are regulated and traded.

WTO Rules

The WTO and its predecessor the General Agreement on Tariffs and Trade (GATT) were created with the very narrow mandate of removing barriers to international trade through the creation, monitoring and enforcement of market access rules (Isaac and Kerr, 2003a). The WTO has recognized that, in certain circumstances, safety regulations to protect consumers may be needed that may impede international trade. It has also recognized that the ability of governments to enact these safety regulations must be constrained to ensure that they are not being used as illegitimate barriers to trade. WTO rule-making now extends to issues related to food safety and protection of the environment.

One of the most important underlying principles of the WTO is non-discrimination. An important concept that is an integral part of the principle of non-discrimination is that of "like products" or "like goods", which states that goods are to be grouped according to their end-use and product characteristics, not according to their production and processing methods (PPMs). This concept applies with regard to not only biotechnology but also labour standards, cultivation practices, pollution emissions or other factors that do not physically alter the end product. The underlying, trade-enhancing rationale of the concept of "like goods" is that it prevents a more developed nation – whose domestic standards will almost always be higher – from using these standards as an excuse to erect a trade barrier to protect its producers from imports from developing countries (Isaac and Kerr, 2003a).

The WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) and the Agreement on Technical Barriers to Trade (TBT Agreement) allow member countries to adopt trade-restricting measures to protect human, animal and plant health and the environment, but place limitations on when and how these measures can be applied. The SPS Agreement outlines when and how WTO members can deny market access to particular exporters to reduce risks arising from:

- the entry, establishment or spread of pests, diseases, disease-carrying organisms or disease-causing organisms;

- additives, contaminants, toxins or disease-causing organisms in food, beverages or feedstuffs;
- diseases carried by animals, plants or products thereof (WTO, 1994).

The TBT Agreement addresses technical regulations and standards, as well as testing and certification procedures that countries enact to protect their citizens. Two key principles of both the TBT and SPS agreements are that safety measures must be applied in a manner that does not unnecessarily obstruct trade and that the standards adopted by member states should be based on international measures established by international standard-setting bodies. In addition, both agreements require that, where applicable, national measures should be scientifically justifiable. However, because the TBT Agreement deals with topics such as labelling due to consumers' right to know, the scientific justification principle is considerably weaker in the TBT Agreement than the SPS Agreement. The SPS Agreement allows countries to not follow the principle of non-discrimination and to place restrictions on specifically targeted countries.¹ The TBT Agreement, however, requires that countries follow the principle of non-discrimination when dealing with "like goods". If an end product is to have different technical regulations, testing procedures or labelling requirements than are required for a similar product, it must have some characteristic that differentiates it. The role of these two agreements is clear: to ensure countries can still erect barriers to trade when needed to protect their citizens but also to ensure there is a legitimate justification for doing so.

In the case of biofuels, there appears to be no legitimate justification for a ban on the basis that biotechnology has been used in their production. Traditional claims against products of biotechnology relate to one of two concerns.² The first is that there is insufficient information available to determine the long-run health risks associated with consumption of GM material. The second concern relates to the protection of the environment. Some groups believe that GM plants could pose an unacceptable risk to biological diversity by creating super-weeds, cross-mingling with non-GM plants or causing mutations in organisms that eat the plants (such as insects). These arguments are not applicable to biofuels. With regard to the first concern, biofuels are not intended for human or animal consumption so there is no risk to human or animal health. It also cannot reasonably be argued that biofuels pose a risk to the environment. As mentioned above, biofuels are highly processed products that would contain only minute amounts of GM material. As such, they pose no risk of harming plants, organisms that feed on plants or biological diversity. Furthermore, due to the very small amount of GM material remaining in the biofuel, there would be no evidence to support a claim that biofuels produced using biotechnology are significantly different from biofuels produced without using biotechnology; therefore, they could not be treated differently under trade regulations – they would be considered "like products". Under these agreements and the risk analysis framework that underlies them, there is only a very small chance that a ban on biofuel

imports would found to be WTO-compliant (Kerr and Loppacher, 2004). A trade ban of this nature is precisely what the WTO rules were designed to prevent.

Biofuels, Biotechnology and the Cartagena Protocol on Biosafety

The international law created in the Biosafety Protocol regarding permissible regulation of biotechnology is very different from that in the WTO. The BSP “seeks to protect biological diversity from the potential risk posed by living modified organisms resulting from modern biotechnology” (Secretariat of the Convention on Biological Diversity, 2004a, p. 1). The BSP specifically embraces the use of the “precautionary principle”. The precautionary principle states that lack of evidence proving a product is unsafe does not indicate that the product is safe. It is a reversal of the traditional approach of “innocent until proven guilty”. Hathcock (2000) argues that the precautionary principle requires an impossible burden of proof for new products. He also suggests that “[i]n effect, the application of the precautionary principle would negate the input of science and allow ... decisions to be made by risk managers on an arbitrary basis that would overrule risk assessment, regardless of the data supporting a conclusion of safety” (p. 256). The precautionary principle is reflected in Article 10.6 of the BSP, which states:

Lack of scientific certainty due to insufficient relevant scientific information and knowledge regarding the extent of the potential adverse effects of a living modified organism ... shall not prevent that Party from taking a decision, as appropriate, with regard to the import of the living modified organism (Article 10.6, Cartagena Protocol on Biosafety, 2001)

The BSP also very specifically bases its rules on processes – modification of genetic material. As a result, characteristics of the final product are not the only deciding factor, unlike the rules under the WTO. In addition, due to the acceptance of the precautionary principle, the BSP allows countries to adopt a provisional measure with no obligation to review it after a certain amount of time (Isaac, Phillipson and Kerr, 2002).

Although a ban on biofuels produced using biotechnology would almost certainly not be justifiable under the WTO rules, under the BSP rules, it may. Although there is no evidence that these products would pose a danger to human, animal or plant health or the environment, the BSP specifically states that lack of evidence shall not prevent a party from taking actions to avoid or minimize potential adverse effects. The BSP principle that allows a country’s import restrictions on a product to be based on its PPMs rather than its end characteristics will allow parties to restrict or block the import of biofuels produced using biotechnology, regardless of the risk those products present. This creates the potential for countries to put protectionist-motivated trade barriers in place under the guise of sanitary barriers.

Which Laws Will Rule?

The BSP and the WTO obviously have provisions that contravene one another. Which system will take precedence in international law is an extremely complicated matter. For a more detailed discussion, see Loppacher (2005). The WTO created the Committee on Trade and the Environment to help clarify the relationship between the WTO and MEAs. Despite frequent meetings, the committee has not reached a consensus on how this could or should be done. A major factor in the settlement of disputes will be the strength of the dispute-settlement mechanisms enshrined in these agreements. A significant weakness of the BSP is its lack of a binding dispute-settlement procedure. The protocol “envisages procedures and mechanisms to *promote* compliance of Parties with their obligations and address the cases of non-compliance” (emphasis added) (Secretariat of the Convention on Biological Diversity, 2004b, p. 23). The protocol uses compulsory arbitration or conciliation to promote compliance, but compliance is voluntary and there are no punishment mechanisms for cases where countries choose not to comply. As the WTO does have a binding dispute-settlement procedure, the WTO will likely be the forum for meaningful dispute resolution.

If the BSP is challenged at the WTO, the case will be extremely complex, take a long time to be decided and involve many members of the WTO. For example, in a case that could serve as a primer to a direct challenge to the BSP, the United States, Canada and Argentina have brought a case against the European Communities regarding their moratorium on the approval of genetically modified organisms. In their defence, the European Union will surely contend that they are acting within their rights as a party of the BSP. This case has already proved that it will be very complex, with Australia, Brazil, Chile, Columbia, India, Mexico, New Zealand and Peru all requesting to participate (WTO, 2004). Although the panel is given a general timeframe of six months to issue their report, timeframes set by the panel have been repeatedly delayed, and as of March 2006 a final report had still not been issued but was expected no later than the end of September 2006 – over two years after the panel’s formation (WTO, 2006). An interim report was issued in February of 2006; this report is confidential and released only to the parties involved. While the findings may change before the final ruling is released, available information suggests the interim report generally supported the complainants’ position.

A direct challenge to the BSP will likely be even more complex. It is not unreasonable to assume every major agricultural trader that was not part of the complaint, including exporters and importers, would request involvement as third parties in the panel. The severity of the issue would not be lost on any of the players. A decision in favour of the BSP could radically change the WTO, allowing decisions to be based on premises other than sound science and a rules-based approach. However, a decision against the BSP could very negatively affect the image of, and support for, the WTO. Input on the issue is

likely to come from the Committee on Trade and the Environment, officials from the BSP and officials from the international experts committees recognized by the SPS. The panel's task will be enormous: determining if and how a MEA that contravenes the WTO principles and text can be accommodated. In addition, due to the implications of the decision, it will almost surely be appealed by the losing members. There is no precedent set as to how this issue will play out but the dispute will be long, costly, involve many players, be highly contentious and drastically affect the relationships among trade, the environment and consumer calls for protection (Isaac and Kerr, 2003b).

Implications for the Canadian Biofuel Industry

Like many industries in Canada, if the biofuel industry is to exploit the comparative advantage it holds in biofuel production, it will have to exploit economies of scale that could result in more production than the local market can absorb. Canada has significant potential in this market both due to high capacity in biomass production that can be used as an input to biofuels and due to the Canadian industry's technological capabilities. For example, Canada is one of the world's largest producers of canola oil and wheat – both of which can be transformed into biofuels. In addition, Canada is producing some of the major innovative breakthroughs in the international industry, such as Iogen's production process that efficiently converts waste cellulose into biofuel (*The Economist*, May 12, 2005).

Part of Canada's comparative advantage will be derived from using biotechnology in the production of biofuels. The Canadian industry will be forced to contend with conflicting international rules regulating trade in products of biotechnology. The WTO, which requires legitimate justification for trade bans made to protect consumers' right to know and human, animal or plant health, would likely find a ban on biofuels produced with biotechnology to be incompliant with its rules. The BSP, however, allows decisions to be made based on the PPM of a product and allows countries to apply the precautionary principle. Given these provisions, a ban on biofuels would likely be found to be in compliance with the BSP. As the European Union works to deny importers access to their market in order to assist their farmers, they will likely invoke their rights under the BSP to keep products from Canada (and most likely also the United States) out of their market. A challenge to this ban at the WTO would likely take many years and there is no guarantee of a favourable outcome or that the EU would comply with a WTO ruling.

The Canadian industry faces a difficult trade-off. If they chose to adopt biotechnology, they may be able to lower their costs of production sufficiently to reduce their dependence on subsidies and make their industry competitive with petroleum fuels. If they do this, however, they would be subject to considerable uncertainty regarding access to important markets such as the EU. Coordination with the U.S. industry will be important, as it is likely they too will adopt biotechnology. At present, it is unlikely the Canadian industry will turn away from using biotechnology in their production process.

Consequently, they must be proactive in finding a way to resolve this trade issue before they look to export their products and find that they cannot.

References

- Climate Change Canada. 2004. Backgrounder: Ethanol Expansion Program. Government of Canada. Available online at http://climatechange.gc.ca/english/newsroom/2003/bg_ethanol.asp
- The Economist*. Steady as she goes. 20 April, 2006.
- Gaisford, J. D., J. E. Hobbs, W. A. Kerr, N. Perdikis, and M. D. Plunkett. 2001. *The Economics of Biotechnology*. Cheltenham: Edward Elgar.
- Hathcock, J. N. 2000. The precautionary principle – An impossible burden of proof for new products. *AgBioForum* 3(4): 255-258.
- Isaac, G. E., and W. A. Kerr. 2003a. Genetically modified organisms and trade rules: Identifying important challenges for the WTO. *The World Economy* 26(1): 29-42.
- Isaac, G. E., and W. A. Kerr. 2003b. Genetically modified organisms at the World Trade Organization: A harvest of trouble. *Journal of World Trade* 37(6): 1083-1095.
- Isaac, G. E., M. Phillipson, and W. A. Kerr. 2002. International regulation of trade in the products of biotechnology. *Estey Centre Research Papers* No. 2. Saskatoon: Estey Centre for Law and Economics in International Trade.
- Kerr, W. A., and L. J. Loppacher. 2005. Trading biofuels – Will international trade law be a constraint? *Current Agriculture, Food and Resource Issues* 6: 50-62.
- Koerbitz, W. 2004. Newest trends in developing biodiesel worldwide. Presented at Biological Futures II, May 19, 2004, Saskatoon, Saskatchewan, Canada.
- Loppacher, Laura J. 2005. The conflicting international trade law governing products of biotechnology: The case of biofuels. *Journal of International Biotechnology Law* 2(2): 54-61.
- Organisation for Economic Co-operation and Development. 2001. *The Application of Biotechnology to Industrial Sustainability*. Paris: OECD Publication Services.
- Secretariat of the Convention on Biological Diversity. 2004a. Cartagena Protocol on Biosafety: About the protocol. Available online at <http://www.biodiv.org/biosafety/background.asp>
- Secretariat of the Convention on Biological Diversity. 2004b. Cartagena Protocol on Biosafety: Frequently asked questions. Available online at <http://www.biodiv.org/biosafety/faqs.asp>
- Secretariat of the Convention on Biological Diversity. 2001. *Cartagena Protocol on Biosafety to the Convention on Biological Diversity: Text and Annexes*. Available online at <http://www.biodiv.org/doc/legal/cartagena-protocol-en.pdf>
- Stirrings in the corn field. *The Economist*, May 12, 2005.
- Walsh, Michael P. 2000. International experience on ultra low sulfur diesel and biodiesel. Prepared for Hong Kong Environmental Protection Department Motor Vehicle Emissions Group. Available online at http://www.cleanairnet.org/infopool/1411/articles-35672_international_experience.pdf

- Werner, Carol, 2003. Biofuels: Background. Environmental and Energy Study Institute. Available online at <http://www.eesi.org/programs/agriculture/fact%20sheets/background.pdf>
- World Trade Organization. 1994. *Agreement on the Application of Sanitary and Phytosanitary Measures*. Legal text. Available online at www.wto.org/english/docs_e/legal_e/15sps_01_e.htm
- World Trade Organization. 2004. European Communities – Measures affecting the approval and marketing of biotech products: Communication from the chairman of the panel. WT/DS291/27. Available online at <http://docsonline.wto.org>
- World Trade Organization. 2006. European Communities – Measures affecting the approval and marketing of biotech products: Communication from the chairman of the panel. WT/DS29131/ Available online at <http://docsonline.wto.org>
-

Endnotes

¹ It would not be reasonable to place a restriction on all exporters, as risk factors, such as climate or disease-management practices, would not be uniform across all exporting countries.

² There is also a third concern related to the use of biotechnology, to do with the ethics of “playing God” by manipulating genes in ways that natural breeding does not allow (Gaisford et al., 2001). This issue will not be dealt with in this paper.