



Project Report

PHASE I REPORT

ECONOMIC IMPACT STUDY: POTENTIAL COSTS OF MANDATORY LABELLING OF FOOD PRODUCTS DERIVED FROM BIOTECHNOLOGY IN CANADA

Prepared for

Steering Committee
Economic Impacts of Mandatory Food
Labelling Study
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Executive Summary

1. This report presents findings from an exploratory investigation of the potential impacts of mandatory labelling of food products from biotechnology

This report presents the findings from an exploratory investigation of the potential economic impacts if Canada were to introduce mandatory labelling of food products containing ingredients from biotechnology and non-biotechnology. Canada does not currently require mandatory labelling of foods containing biotechnology ingredients except where the composition, nutritional value or safety of a product is significantly different from its conventional counterparts or where allergen risks exist. The findings presented are based on a program of interviews with a limited number of Canadian industry participants at each level in the supply chain for grain and oilseed products plus a review of relevant secondary research.

The analysis was based on the assumption that labelling would apply to food products derived from genetically modified plants, animals or microorganisms, as defined by the novel food regulations contained in the Canadian Food and Drugs Regulations and Guidelines for the Safety Assessment of Novel Foods. Genetic modification is currently defined in the regulations as: “... *any change to the heritable traits of an organism achieved by intentional manipulation. This includes, but is not limited to: recombinant nucleic acid techniques, somaclonal variation, electroporation, artificially induced mutagenesis, and the like.*” We have additionally assumed that labelling of food products that can be shown to be free of biotechnology-based ingredients (“GM-free” products) would also be permitted, which is often referred to as negative labelling.

2. Labelling costs could be equivalent to at least 9-10% of the retail price of processed food products, and 35-41% of producer prices

Our analysis suggests that, as a minimum, mandatory labelling of processed food products produced from biotechnology products or their derivatives could result in cost increases through the supply chain equivalent to 9-10% of the retail price of such products. Equivalent products labelled as biotechnology-free would be subject to similar cost increases. This finding is based on an analysis of the impacts involved in labelling products using grain and oilseed products (corn, canola, soybeans) or derivatives from these commodities. **This cost impact for labelling would be equivalent to 35-41% of the prices paid to producers for grain and oilseed commodities.**

The key factor driving the cost of labelling would be the need for all organizations in the food industry supply chain to keep their biotechnology and non-biotechnology product variants physically separate, and to be able to demonstrate the presence or absence of modified material in compliance with labelling regulations.

The following systems and capabilities would be required to enable accurate labelling:

- Separate production, harvesting, storage, handling and processing of biotech and non-biotech primary products.
- Separate manufacture of processed food products containing biotech, and non-biotech, based ingredients, and separate SKUs for inventory control and physical distribution.
- Testing and validation to determine the presence (or absence) of modified materials, and incidence of such material, in agricultural products and derived food ingredients.
- Management of shelf space allocations and inventory of biotech and non-biotech variants of processed food products by retailers.

Organizations at each level in the supply chain would be required to establish and operate various combinations of the above systems and processes to ensure that they could purchase and sell products that can be warranted as being either “GM” or “GM-free”.

Preliminary estimates of the composition of the cost impacts of introducing systems to enable labelling, using the example of processed products that use grains and oilseeds, such as cooking oils and fats, are summarized in Exhibit I, below. In reviewing the information in the exhibit the following points should be noted:

- The majority of the information used in our analysis to arrive at the estimated cost impact was expressed as percentages of the prices paid to grain and oilseed producers. The column headed “Expressed in terms of base commodity prices” in Exhibit 1 shows the cost components in these terms.
- Retail price impacts were then estimated taking into account the relative share of retail prices represented by prices paid to producers, which average 23% across all food commodities, and assuming product margins at each level of the supply chain are maintained. For example, the price of a product with a 10% margin prior to any labelling impacts would be adjusted to maintain the 10% margin after labelling costs had been incorporated. The column headed “Expressed in terms of retail prices” shows the composition of the estimated retail price impact.
- Estimates of the cost impacts for some levels in the supply chain are not available and have not been included in the estimated cost impact figures. The main items among these are the costs to establish regulatory mechanisms for compliance monitoring and enforcement by the Canadian Food Inspection Agency, costs for seed producers to introduce systems to ensure the seed they sell can be sold as either “GM” or “GM-free”, and liability insurance against the risk that products sold by industry participants may be non-compliant. Establishment of the regulatory oversight mechanisms would be expected to involve additional costs to the Canadian Food Inspection Agency. Consistent with the federal government’s cost recovery policy, we would expect that at

least some part of these costs would be passed on to industry, and ultimately, to consumers.

- We have assumed that cost impacts at each level in the supply chain will be passed through the supply chain and on to consumers.

Exhibit I
Composition of the estimated cost impact of mandatory labelling

Stage in Supply Chain	Components of the Estimated Cost Impact	
	Expressed in Terms of Producer Prices	Expressed in Terms of Retail Prices
Seed Production	(not available)	(not available)
Grain/Oilseed Production	~14%	~3.6-3.4%
Elevator/Grain Handling	~10-11%	~2.6-2.7%
Processing	~5-7%	~1.3-1.7%
Manufacturing	6-9%	~1.5-2.2%
Retailing	(not available)	(not available)
Regulatory Monitoring and Enforcement	(not available)	(not available)
Cumulative Total	~35-41%	~9-10%

Mandatory labelling may modify the ability of the industry to pass on additional costs incurred to consumers, compared to voluntary labelling. A mandatory requirement to label implies that the beneficiaries of such a policy—consumers seeking to make more informed food choices—should pay, or make a major contribution to, the costs associated with such labelling. In turn, the ability of industry participants at all levels of the supply chain to recover their additional costs will depend on their power in the supply chain; the level of price-elasticity for non-biotech product variants; and the relative availability and prices of alternative sources of supply. Equally, if producers and processors are unable to recover the additional costs they incur, they will be unlikely to elect to produce commodities that can be certified as being “GM” or “GM free”.

3. The estimated total cost of labelling to consumers would be approximately \$700 – 950 million per year

The estimated total annual cost to consumers for labelling would be between \$700 and \$950 million per year if the average cost increase for all processed food products subject to labelling is 9-10%. An increase of this magnitude would add approximately 1.3-1.8% to the value of retail sales of all food products, which have a current annual value of \$53.3 billion.

This estimate of the total annual cost of labelling is a function of:

- The proportion of processed food products that use ingredients from biotechnology products. Participants in our interviews suggested that as many

as 70-85% of all processed food products could be subject to labelling under the scenario used in the interviews.

- Average household expenditures on processed food products. Information published by Statistics Canada on household food expenditures in 1996¹ suggests that expenditures on processed food products were approximately \$20 per week, out of a total average expenditures on food products of approximately \$80 per week.
- The number of households in Canada. Statistics Canada's analysis of household food expenditures used an estimate of 11.3 million households.

Processed food products would not be the only food products subject to labelling. Fresh products that are marketed as being produced using biotechnology or as being biotechnology-free, for example, table potatoes, would also be subject to labelling, and producers and distributors of these products would have to take steps to ensure segregation and proper labelling. Costs associated with the labelling of these products have not been analyzed in the present study, and would be in addition to the above estimates.

4. The potential breadth and depth of labelling cost impacts will also depend on the scope and structure of the labelling regulations

The extent to which food products could be subject to labelling regulations and the magnitude of attendant cost impacts would also be influenced by decisions regarding the breadth and depth of any labelling regulations. In particular:

- **Threshold levels for the adventitious presence of modified material** in non-biotech products. Industry views appear to suggest that a 5% threshold is quite manageable but a 1% level will pose significant challenges and additional costs.
- **Canada's legal definition of novel foods and biotechnology.** Canada's definition of novel food products focuses on the characteristics of such products, not the processes used to produce them, and, as such, applies to products with traits altered using a variety of different processes. The intent of the novel food regulations is to assess the safety of novel food products prior to their market introduction rather than determining labelling requirements. Use of a more limited definition of novel foods for the purposes of labelling would reduce the number of processed food products subject to labelling requirements.
- **Inclusion or exclusion of processed derivatives of biotech/non-biotech products.** A significant number of processed food products use small amounts of processed derivatives from biotech grain and oilseed products, such as soy flour, cornstarch, and cooking oils. Processing of the grains or oilseeds results in the removal or inactivation of the genetically modified material used in these products. As noted above, industry participants estimate that, if these derived

¹ Statistics Canada, *Family Food Expenditure in Canada: 1996*, Catalogue No. 62-554-XPB, Ottawa, October 1998.

additives, processing aids and flavourings are subject to labelling, as many as 70-85% of all processed food products may require labelling.

- **Time frame allowed for implementation.** Most participants in our interviews emphasized the need for any labelling policy to have adequate time for the policy requirements to be communicated and explained to the industry, and to allow sufficient time for the necessary systems to be established.

5. Further, more detailed research is necessary to obtain a more definitive estimate of the economic impacts mandatory labelling may have

More detailed research will be required to obtain a more definitive understanding of the potential economic impacts that mandatory labelling of the presence or absence of biotechnology products and ingredients may have taking economic and cost impacts in such areas as consumer benefits and costs, value and burden to industry, and international trade implications into account.

Particular areas of focus for this research could include:

- More structured and extensive analysis of the means by which compliance by industry participants at each level on the food industry supply chain would be achieved, and associated decision choices and costs, differentiating between upfront capital costs to establish systems and capabilities to enable the labelling regulations to be applied and compliance to be monitored, and ongoing operating costs. Potential impacts to consider in this analysis could span the range of changes in the level and structure of demand; retail prices; responses of, and returns to producers, processors and manufacturers; cost structures; R&D expenditures; and farming practices (e.g., use of insecticides).
- Investigation of potential approaches to the provision of regulatory oversight of mandatory labelling, and their associated costs and benefits.
- Investigation of potential impacts on importers of processed products, and on export competitiveness of Canadian agricultural biotechnology products.
- Investigation of potential consumer reactions to mandatory labelling and propensities to pay the additional costs involved in creating and maintaining the industry's capacity to accurately label products as being produced with biotechnology based, and non-biotechnology based, ingredients.

Introduction

This report summarizes the findings from a preliminary, Phase I investigation of the potential economic impacts that mandatory labelling of food products containing biotechnology (“GM”) or non-biotechnology (“GM-free”) ingredients may have. The report intentionally focuses on potential cost implications and related qualitative considerations and, as such, is not designed to provide a detailed economic impact study at this stage. The findings are based on information collected through interviews with Canadian industry participants at various points in the supply chain for products using, or derived from, grains and oilseeds, and a review of relevant background literature. The appendices to the report contain a list of the organizations that participated in the interviewing program and a list of the main documents and reports consulted.

This preliminary analysis should facilitate discussion on the subject of labelling of biotech food products and provide directions for further, more detailed research in a Phase II study.

A. Background

Labelling of food products that contain, or exclude, inputs obtained through biotechnology has developed into a major issue for the food processing and retailing industry around the world in recent years. However, these moves were initially made in the absence of a consistent set of legal standards defining the conditions under which food products can be labelled as containing, or excluding, biotechnology ingredients.

At an international level, the Codex Committee on Food Labelling (CCFL) is engaged in a debate to develop harmonized recommendations on the labelling of foods obtained through biotechnology. In parallel, mandatory labelling requirements have been introduced in a number of countries. For example, Japan intends to introduce mandatory labelling of foods containing genetically modified ingredients in April 2001, Europe introduced labelling requirements for foods and food ingredients containing genetically modified material in April 2000, and the Australia New Zealand Food Standards Council has approved mandatory labelling requirements for genetically modified food.

In North America, the United States and Canada have voluntary labelling policies that are based on a regulatory framework of “substantial equivalence”. This approach is consistent with recommendations made by the FAO/WHO joint consultation for assessing the safety of foods produced by biotechnology, and principles for the evaluation of food products derived by modern biotechnology by the OECD in 1993. (29,30,25)

In Canada, the Canadian General Standards Board is developing guidelines for voluntary labelling of both biotech and non-biotech foods with the involvement and support of a wide range of industry stakeholders. This study provides a starting point for such study; it focuses on the implications of mandatory labelling and is intended to complement the work of the CGSB on voluntary labelling.

B. Objectives and scope of this exploratory investigation of the direct economic impact of mandatory labelling

KPMG Consulting prepared this report on behalf of a consortium of interested stakeholders, under the leadership of the University of Guelph. Appendix A contains a list of the Steering Committee members.

The objectives set for KPMG's work were to:

1. *Determine key processes and requirements for mandatory labelling of food products obtained through biotechnology.*
2. *Provide indicative qualitative analysis of the costs to provide mandatory labelling.*
3. *Examine the economic impact by key sector.*

In carrying out the study, KPMG:

- Developed a “labelling requirements scenario” that might apply in Canada, to provide a focus for subsequent interviews with industry participants. For the purposes of the research, we focused on the production and use of biotech, and non-biotech, grains and oilseeds, and the human food products produced using material from these products.
- Conducted a series of interviews with representatives of 16 stakeholder organizations, using the labelling scenario and supporting interview guide. These interviews covered small numbers of industry representatives at all key levels in the food industry supply chain.
- Reviewed information published in industry and research media examining aspects of the labelling of biotech, and non-biotech, foods, and the operation of identity preservation (IP) and segregation systems required to ensure the accuracy of label statements.
- Analyzed the findings from the two previous steps and prepared this report, for review by the project Steering Committee

In reviewing the findings a number of caveats need to be borne in mind. Firstly, this was an exploratory study, which meant that we collected “snapshots” of relevant information from small numbers of key executives at key levels in the food industry supply chain. It

cannot be assumed that the views and opinions expressed by these participants necessarily reflect the views of all participants in the industry.

Secondly, many industry participants do not, as yet, have any clear estimates of the likely cost impacts that mandatory labelling would have on their operations, products or business performance. Taken in combination with the first point, this means that the estimates of potential cost impacts are indicative, at best, and further research and review is necessary to arrive at a more definitive estimate.

Thirdly, the primary focus in the information collection and analysis was on the impacts of labelling of grain and oilseed products, and processed food products containing ingredients obtained from these primary products. As such, it has taken this segment of the food industry and used it as a proxy indicator of the nature of the impacts and costs that might be experienced if mandatory labelling were to be introduced. Further work will be necessary, however, to obtain a more precise understanding of the impacts related to other segments of the food industry, such as potato and dairy products, and meat products, where animals consume feed made from biotech plants or where biotechnology has been used to modify the traits of the animals themselves.

C. Organization of the report

The next chapter briefly reviews and summarizes the key issues that need to be considered in analyzing the potential impacts of mandatory labelling, and presents the “labelling requirements scenario” used in the interviews and analysis. The following chapters summarize the actions and issues that would need to be considered by operators in each of the key stages in the food industry supply chain—from producers through to retailers—and the potential consequences for prices paid by consumers for processed food products. The final chapter presents our conclusions and suggestions for further research.

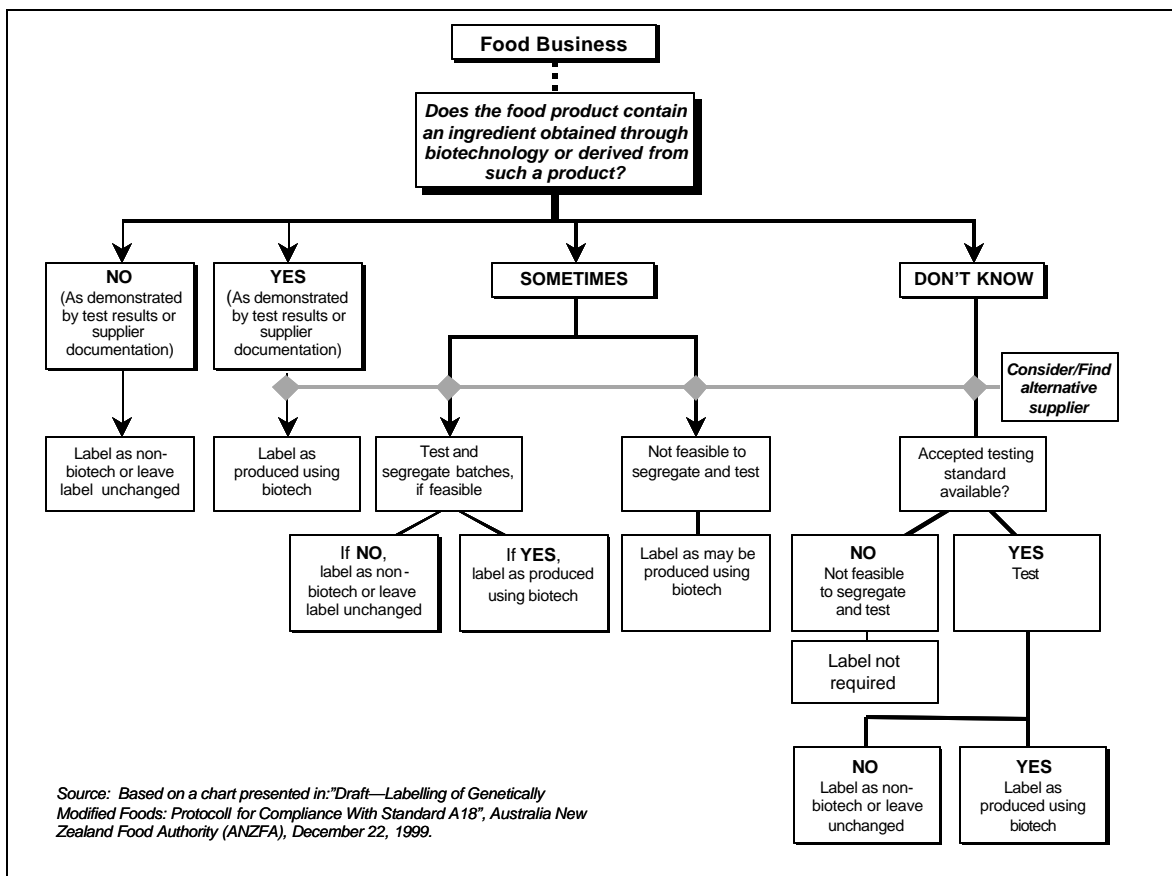
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Key Considerations In Analyzing The Impacts Of Mandatory Labelling

A. Potential labelling situations and choices

Food labelling in Canada is regulated under the Food and Drugs Act, which requires information on labels to be neither false, misleading or deceptive, or likely to create an erroneous impression regarding, amongst other things, value, composition, merit or safety, and non-compliance is subject to criminal law. For biotech and non-biotech foods this means that the regulatory framework would need to allow for a range of possible labelling outcomes or situations, and present food manufacturers and retailers with a range of potential labelling strategies, as summarized in Exhibit II-1.

Exhibit II-1
Potential labelling situations for biotech and non-biotech foods



B. Points of impact of labelling in the food industry supply chain

The potential impacts that mandatory labelling of biotech and non-biotech foods may have extend throughout the food industry supply chain, from seed production through to retail marketing. At each stage of the supply chain changes in production and/or handling processes will be required. Making these changes will involve costs to operators which may, or may not, be passed on to buyers at the next level and, cumulatively, through to final consumers.

Production decisions for participants in the supply chain will be difficult, in that many of the segregation actions required will be necessary regardless of whether they decide to produce non-biotech products only, biotech products only, or some combination. Estimation of the impacts is further complicated by the fact that even non-biotech grain or oilseed crops are unlikely to be completely free of modified product, and tolerance levels for adventitious mixing of modified and non-modified products (commingling) have not been set or may vary from one country to another.

The basic actions required to establish identity preservation and segregation systems and enable mandatory labelling to be implemented focus on preventing, or at least minimizing, inadvertent commingling, and involve:

- Establishment of threshold levels for the adventitious presence of biotech material in products labelled as containing non-biotech ingredients.
- Systems to provide for separate production, storage and handling of biotech and non-biotech products by producers, elevators and transport operators to ensure that products with value-added characteristics are kept separate from the commodity variants of the same products. This may require the construction of new capacity or modification of existing capacity.
- Similarly, separate storage, handling and processing systems for the processing of biotech and non-biotech products, and the manufacture of food products using ingredients derived from these products.
- Testing and certification systems, and supporting record management systems.
- Methods for systematic cleaning of production, handling, storage and processing systems for biotech and non-biotech products, and separate storage and inventory control of biotech and non-biotech variants of processed food products.
- Training of operators.
- Development of suitable label statements—that have meaning to consumers and can be readily accommodated within the size and space constraints of many product labels—and the creation of new product labels.
- Creation of additional SKUs in manufacturers' and retailers' inventory control and category management systems.
- Establishment of supporting regulatory systems to oversee compliance.

Identity preservation and segregation practices are not a new phenomenon, and the need for such systems is increasing as the production of primary inputs with special traits for use in the manufacture of value-added food and feed products increases. Development of these systems poses challenges, and tensions, for Canada's elevators, grain traders and transportation systems, which are heavily oriented towards bulk storage and handling of limited numbers of varieties.

Mandatory labelling would also generate additional demands on the food inspection and regulation system in Canada. Health Canada would need to develop appropriate regulations and the Canadian Food Inspection Agency would be called upon to monitor and ensure compliance. This role may potentially take one of two forms—a direct monitoring role in which the CFIA would undertake all aspects of monitoring and enforcement work or a more indirect role, in which, monitoring could be undertaken by approved monitoring and certification organizations that, in turn, are regularly audited and certified by the CFIA.

C. Labelling scenario used to facilitate information collection

Given that Canada does not currently have mandatory labelling of foods containing biotechnology ingredients (except where the composition, nutritional value or safety of a product is significantly different from its conventional counterparts or where allergen risks exist), it was necessary to develop a hypothetical labelling scenario to provide a focus for our interviews with industry participants at various levels in the supply chain. Exhibit II-2 contains the labelling scenario developed in consultation with the Steering Committee and provided to all participants in the interviewing program.

Exhibit II-2

Labelling scenario used to facilitate interviews

1. Assumptions regarding the application of mandatory labelling

- ◆ Mandatory labelling will be required for all novel foods, that is, foods and food ingredients obtained through biotechnology.
- ◆ The key definitions here are:
 - Biotechnology: "... the application of science and engineering in the direct or indirect use of living modified organisms or parts or products of living organisms in their natural or modified forms." (From the Canadian Environmental Protection Act (CEPA).)
 - Novel Foods: "c) a food that is derived from a plant, animal or microorganism that has been genetically modified such that:
 - i) the plant, animal or microorganism exhibits characteristics that were not previously observed in that plant, animal or microorganism.
 - ii) the plant, animal or microorganism no longer exhibits characteristics that were previously observed in that plant, animal or microorganism, or

Exhibit II-2 Labelling scenario (Cont'd.)

- *one or more characteristics of the plant, animal or microorganism no longer fall within the anticipated range for that plant, animal or microorganism.* (Health Canada, Food and Drugs Regulations).
- Genetic modification: *"... any change to the heritable traits of an organism achieved by intentional manipulation. This includes, but is not limited to: recombinant nucleic acid techniques, somaclonal variation, electroporation, artificially induced mutagenesis, and the like."* (Health Canada, Guidelines for the Safety Assessment of Novel Foods)
- ◆ A food or food ingredient would need to be labelled if appropriate documentation identifies that it has been produced using biotechnology or if appropriate testing can demonstrate the presence of a food or food ingredient produced using biotechnology. This labelling requirement would apply to all organizations that produce, process or manufacture foods and food ingredients throughout the supply chain, spanning the following range of industry participants:
 - Technology manufacturers and seed companies
 - Producers
 - Transport services
 - Traders
 - Food processors
 - Food manufacturers
 - Importers
 - Food retailers
- ◆ A maximum threshold level of 1% would be permitted to allow for the adventitious presence of product produced using biotechnology. This threshold level may be subject to change. It is consistent with the EU's maximum threshold level whereas Japan is proposing to use a 5% maximum threshold for the top three ingredients used in a food product.
- ◆ Approaches to regulatory oversight and compliance enforcement by regulatory agencies would also be necessary as part of the labelling framework. (The potential implications of these changes will also be explored as part of the study.)

2. Label statements

- ◆ Foods and food ingredients that are produced using biotechnology would be required to contain statements to this effect on their labels. Two types of labels may be required:
 - Short statements making allowance for the inclusion of specific food products or ingredients. Three categories would need to be considered:
 1. Foods/ingredients that can be shown to have been produced using biotechnology:
*"(Food/food ingredient) produced using biotechnology", or
"Produced from genetically modified (food/food ingredient)".*
 2. Foods/ingredients where the presence or absence of biotechnology-based inputs cannot be demonstrated, recognizing that all reasonable steps must be taken to ascertain the status of the food or food ingredient:
*"May contain products of biotechnology", or
"May contain genetically modified ingredients".*

Exhibit II-2 Labelling scenario (Cont'd.)

3. Foods/ingredients that can be demonstrated as having no biotechnology based inputs would be permitted to be labelled as such (but not required):

*“Not made with ingredients produced using biotechnology”, or
“Not made with genetically modified ingredients”.*

- Generic label statements:

*“Contains products of biotechnology”, or
“Contains genetically modified ingredients”.
“Does not contain products of biotechnology”, or
“Does not contain genetically modified ingredients”.
“May contain products of biotechnology”, or
“May contain genetically modified ingredients”.*

3. Supporting process requirements

- ◆ In order for food products to be appropriately labelled it will be necessary to either:
 - Maintain Identity Preservation (IP) systems throughout the supply chain accompanied by verifiable documentation that a shipment or batch of product contains (or excludes, as the case may be) material produced using biotechnology. For a manufacturer, this would involve:
 - Ensuring shipments of inputs received and stored are accompanied by verifiable documentation as to the presence and concentration of material produced using biotechnology.
 - Supporting capabilities to test and confirm shipments meet contracted specifications.
 - Traceability of the shipments received.
 - Physical separation and storage of biotechnology-based inputs and outputs. This could include dedicated storage, handling, processing and packaging facilities or rigorous systems to ensure co-mingling in storage, handling and processing is avoided or kept within adventitious limits.
 - Similar requirements would apply to each of the preceding levels in the supply chain, and to importers of final and intermediate products.
 - Maintain systematic sampling and testing systems to measure the presence and concentration of material produced using biotechnology, where this is possible (and noting that test kits that are currently available enable testing for specific proteins or the detection of specific DNA sequences, may involve duration periods as high as 4-6 days, and require special training and equipment). As products go through further processing and the protein components are separated out then testing will not be an option further along the supply chain.
- ◆ Additionally, compliance monitoring and enforcement activities would need to be undertaken by the CFIA. This would potentially mean that the CFIA would have to establish and maintain a capability to audit organizations' IP and testing systems, conduct product tests, investigate complaints, and undertake compliance enforcement actions.

The scenario used in our interviews was based on a number of key assumptions that determine the potential range of products that labelling may be required for or the potential effort required through the supply chain to ensure food products are labelled accurately, especially those that would be sold as non-biotech. These key considerations underlying these assumptions are as follows:

- ***Narrow or broad definition of the range of the types of food products subject to labelling?*** Canada's definition of novel foods (reproduced in the scenario description in Exhibit II-2, above) uses a broad definition of genetic modification, compared to many other countries. It includes modification resulting from such techniques as mutagenesis in addition to recombinant techniques that commonly viewed as being the methods of "modern biotechnology". If a future labelling regime were to include mutagenesis then the potential range of products that would be subject to labelling could go well beyond those involving rDNA gene insertion and modification identified as potential targets for labelling in other countries, such as Europe, Japan, Australia and New Zealand.
- ***Labelling of products containing rDNA modified material only or inclusion of derived products that do not contain any rDNA modified material?*** At present, many food products produced from genetically modified grains and oilseeds do not contain any modified material, that is, are the equivalent to products produced from non-biotech inputs. For example, processing of canola results in two main products—canola meal and canola oil. The oil from biotech canola contains no measurable rDNA material and is used in a wide range of food and industrial products while the meal contains modified material and is used in animal feeds. Inclusion of processed food products that contain ingredients produced through biotechnology but no rDNA or protein would significantly increase the range of products subject to labelling and complexity of identity preservation and certification systems.
- ***Use of threshold limits for modified material in non-biotech products?*** Production of 100% non-biotech products is next to impossible in tightly integrated global supply chains that depend on the transfer and processing of large volumes of bulk products between growers, processors, manufacturers and retailers. However, at present time, a number of different approaches to the use of threshold tolerances are under consideration in different markets. For example:
 - ◆ The European Union has introduced regulations that provide for a 1% de minimis threshold for adventitious commingling of non-biotech soya and maize.
 - ◆ The Australia New Zealand Food Standards Council has recently agreed that a food ingredient can contain up to 1% of unintended modified material.
 - ◆ Japan's labelling approach, to be introduced in April, 2001, will allow for up to 5% of the total content of non-biotech foods to be modified material

and exempts any ingredient that is not one of the top three ingredients in the food product.

- ***Inclusion or exclusion of additives and processing aids?*** A wide variety of food additives and processing aids are produced using products from grains and oilseeds. These products may be present in minute amounts in a highly processed product or, in the case of processing aids, may be present at levels that are essentially undetectable. Application of labelling requirements to these products also has the potential to significantly increase the number of products that would require labels.

Responses to these considerations will ultimately determine the range of products to which mandatory labelling would apply and the complexity or extensiveness of testing and certification that would be necessary. For example, the percentage of processed foods that may be subject to labelling would be significant if Canada's current broad definition of a novel food were to be used (i.e., covering products developed through mutagenesis as well as modern biotechnology), use of food additives and flavourings derived from biotechnology products were to be subject to labelling, and if a low threshold for adventitious commingling were applied. A recent paper by the U.S. Institute of Food Technologists on the subject of labelling, noted that 70% of processed food products contain corn or soy-derived ingredients, including use as carriers for flavours, colouring and vitamins, and potentially, could be subject to labelling. (20)

III

Potential Impacts On Production And Handling

This chapter reviews the issues facing those sectors concerned with the production and consolidation of biotech and non-biotech products, focusing on the production of grains and oilseeds, and summarizes our findings relating to the potential direct economic impacts that mandatory labelling may have.

As shown in Exhibit III-1, capabilities to separate biotech and non-biotech products, and demonstrate that such products are in fact non-biotech, or not, will be required to enable mandatory labelling to be implemented. While the general requirements are essentially the same from one level to the next, each of the stages in the primary production side of the supply chain will face specific issues and challenges.

Exhibit III-1 Requirements—primary production and handling

Supply Chain Stages	Key Requirements to Enable Biotech and Non-biotech Labelling
1. <i>Seed production and distribution</i>	<ul style="list-style-type: none">▪ Separate production and storage of biotech and non-biotech varieties.▪ Testing and certification systems for demonstrating the presence, or absence, of genetic material.
2. <i>On-farm production, storage and/or transportation to collection point</i>	<ul style="list-style-type: none">▪ Physical separation of biotech and non-biotech crops, including measures to prevent adventitious commingling.▪ Separate storage, handling and transportation of harvested products.▪ Testing and certification systems, and supporting documentation of field histories.▪ Methods for systematic cleaning of equipment.▪ Training of operators.▪ Liability insurance.
3. <i>Discharge and storage at collection point.</i>	<ul style="list-style-type: none">▪ Processes to review and record details of delivered loads and supporting certification.▪ Testing and certification systems, and supporting documentation of product received.▪ Physical separation and storage of non-biotech products, and different biotech products.▪ Methods for systematic cleaning of handling equipment and storage facilities.▪ Training of operators.▪ Liability insurance.
4. <i>Transportation to processors and export points</i>	<ul style="list-style-type: none">▪ Separate handling and transport of biotech and non-biotech products (e.g., separate rail cars, separate unit trains, containerized transport).▪ Testing and certification of shipments from producers and/or review of certifications.▪ Methods for systematic cleaning of handling equipment and transport rolling stock.▪ Training of operators.▪ Liability insurance.

A. Testing of product samples

Testing of products at various stages in the supply chain would appear to be a necessary requirement to enable accurate labelling. At present, the two most common types of testing available for products modified using recombinant DNA techniques are:

- **PCR (polymerase chain reaction)** tests, which detect the presence and level of inserted DNA sequences in a specific crop variety. PCR tests are very sensitive; while they can measure the presence of minute quantities of modified genes (for example, 0.1–0.05%), they can also be prone to false positives. Most PCR tests are qualitative in nature, that is, designed for a “yes” or “no” detection, although work is underway to develop quantitative PCR methods. PCR testing must be done in a laboratory and requires trained staff and specialized equipment. Cost per sample for testing ranges from \$US200 to \$US450 (~\$300-670 Canadian) with a turnaround time of 2-10 days, according to information published by the USDA’s Economic Research Service. (7)
- **ELISA (enzyme linked immunosorbant assay)** tests, which detect the presence of specific proteins that have been inserted into a specific crop variety. ELISA tests are less sensitive than PCR tests in detecting the incidence of genetic modified protein present in samples. A variation of the ELISA test—lateral flow strips—is suitable for field use and can be used to quickly determine if the seed tested is genetically modified or not, but not to provide a percentage measure. The cost per sample for ELISA tests is significantly less than for PCR tests. According to the ERS the cost for a test that enables quantitative determination of the amount of biotech material can be up to \$US10 (~\$15 Canadian) and take about 2 hours. Lateral flow strip or dipstick types of test can give a “yes/no” answer within 20 minutes at a cost of \$US1-5 (~\$1.50-7.40 Canadian). (7)

Additionally, the sensitivity of tests available to the industry diminishes as the level of processing increases, especially for ELISA tests. This suggests that requirements for testing and documentation of test results will be heavily concentrated on primary producers, elevators and traders. Potentially, as the number of genetically modified products increases, organizations using ELISA methods will need to conduct batteries of screening tests on products to determine if a product is non-biotech or contains specific modifications. A related issue would be the sampling requirements, that is, the number of samples to be drawn by producers or traders to reliably demonstrate the absence, or presence, of modified material. For example, would each truck load delivered to an elevator need to be tested or would it be sufficient for a farmer to draw and test a sample from each on-farm storage bin?

While many of the participants in our interviews recognized this potential need none could provide estimates of typical incidence rates for testing (that is, rate of sampling) or average costs per tonne of product produced or purchased. The above information, however, can be used to provide an indicative example of the potential significance of testing costs: for example, if each truck load of soybeans delivered to an elevator was tested using a lateral flow strip and the average load was 20 tonnes, the testing cost would amount to about \$0.07-0.37 per tonne (Canadian) for a single test for the presence of a particular modified protein; additional tests to check for the presence of other modified proteins would require

additional tests. Alternatively, if PCR testing was required to quantitatively measure the amount of modified DNA material the cost per tonne would be of the order of \$14.70–33.08 (Canadian). If the farmer receives a price of \$257.40 per tonne for his soybeans the PCR testing cost would be equivalent to 5.7–12.9% of the selling price.¹

B. Seed producers

The Canadian Seed Growers' Association is the official agency responsible for prescribing standards and issuing crop certificates for pedigreed seed that is then sold to commercial grain and oilseed farmers. Seed producers are most likely to have many of the requirements for producing certifiable biotech and non-biotech seed in place, due to the requirement for these producers to comply with the standards for pedigree seed. As such, seed producers would be expected to implement identity preservation systems with relatively low difficulty and nor would they need extensive training. The major incremental impact on seed producers' operations and the costs of producing seed would be the need to undertake a higher level of testing and certification than might otherwise be the case.

C. Commercial farmers

Mandatory labelling would require the majority of farmers to make significant changes in the way they operate, if they are to produce and supply products with specific (and non-visible) characteristics. These changes would be in such areas as the following, and would involve additional costs to producers:

- Establishment and maintenance of records relating to such areas as: field histories, production practices (e.g., buffer zones), varieties grown, seed used, seed suppliers, testing undertaken and results thereof, storage and handling systems, cleaning methods and logs, and so on.
- Adoption of more stringent production methods designed to reduce risks of cross-pollination (e.g., increased buffer zones for corn).
- Adoption of rigorous cleaning protocols to minimize risks of adventitious commingling or acquisition and use of separate production, handling and storage equipment dedicated to specific products.
- Additional storage capacity may also be required if the operation of identity preservation systems through the supply chain also requires farmers to maintain higher levels of on-farm storage or if farmers produce both biotech and non-biotech crops, or several varieties of such crops.

¹ Estimates based on: cost per ELISA test in the range of \$US1-5; cost per PCR test in the range of \$US200-450. The cumulative 1999/2000 average exchange rate for the Canadian dollar is \$CAN1.47 : \$US1; and the cumulative 1999/2000 average price for soybeans is that quoted for No.2 C.E. Chatham. Exchange rate and soybean price information are from AAFC's "Weekly Price Summary", July 7, 2000.

- Longer trucking distances, if elevator operators designate certain elevators as receiving points for specific products, which would require many farmers to truck their production over longer distances.
- Testing to ascertain the presence or absence, and incidence, of biotech or non-biotech product in their harvests.
- Potentially, supporting documentation and certification from a recognized certification authority to support this testing activity as well as physical segregation processes.
- Liability insurance, to protect against the risks of supplying grains or oilseeds that may not be compliant with buyers' specifications or claims made on testing documentation accompanying shipments.

Farmers' decisions as to whether to produce biotech or non-biotech crops depend on a complex evaluation of relative product demands, market prices (including opportunities to lock in prices), incidence of pest problems, proximate availability of buyers, production costs, and likely margins. Limited availability of relevant cost information adds to the difficulty of judging whether the costs associated with various alternatives can be recovered and returns commensurate with the risks achieved.

Participants in our interviewing program were not able to provide any estimates of the likely cost impacts that labelling may have. However, we believe it is possible to provide an illustrative estimate using published information from a number of sources, using the cost of producing corn in Ontario as a starting point.

Exhibit III-2 provides an estimate of the average cost to produce corn in Ontario, using 1997 cost information, from the Ontario Corn Producers' Association web site. To this information we have added our estimates of the likely costs to this hypothetical producer if they were to produce certifiable non-biotech or biotech corn for sale into segregated distribution and processing channels.

Based on the assumptions shown in the following table, the estimated cost of producing biotech-free corn could be of the order of 12% higher than the cost of producing biotech corn. This difference, estimated at \$0.39 per bushel in the indicative example and based on the supporting assumptions in Exhibit III-2, is equivalent to approximately 14% of the 1999/2000 Cumulative Average price for Ontario corn published by AAFC.(2) Note that this cost estimate excludes any allowance for additional capital costs that may be incurred if the farmer has to increase the amount of on-farm storage.

The major contributors to this additional cost over biotech corn would be: additional trucking costs (4%), additional on-farm storage time (2%), higher land costs due to a reduction in the effective production area, testing and certification costs (2%), plus the effects of a lower yield, higher herbicide use/cost and lower seed cost.

Exhibit III-2

Indicative estimates of the cost impacts of producing certifiable non-biotech and biotech corn in Ontario

Cost Item	Cost ¹			Estimated Biotech Corn Cost	Estimated Non-biotech Corn Cost
	\$/acre	\$/bu.	\$/tonne	\$/bu.	\$/bu.
Soil Tillage	20	0.17	6.70	0.17	0.17
Seed	42	0.37	14.40	0.40	0.37
Planting	10	0.09	3.40	0.08	0.09
Fertilizer	70	0.61	23.90	0.58	0.61
Herbicide/Pesticide	32	0.28	11.10	0.24	0.28
Harvesting	34	0.30	11.80	0.30	0.30
Trucking	15	0.13	5.00	0.13	0.26
Drying	35	0.30	12.00	0.30	0.30
Crop Insurance	10	0.09	3.40	0.09	0.09
Interest	8	0.07	2.70	0.07	0.07
Other costs	10	0.09	3.40	0.09	0.09
Land costs (rent)	90	0.78	30.80	0.75	0.82
Additional Storage				0.00	0.08
Certification				0.00	0.04
Testing				0.00	0.02
Total	376	3.28	128.70	3.20	3.59

1. Costs published on the Ontario Corn Growers' Association website (www.ontariocorn.org/cost.html).

Supporting Assumptions:		
Cost Item	Biotech Corn	Non-biotech Corn
Yield	<ul style="list-style-type: none"> 5% increase per acre (from 115 bushells to 120.75), leading to 4.8% reductions in the cost per bushel for growing costs (seed, planting, fertilizer, and herbicide/insecticide). <i>Research suggests that herbicide tolerant and Bt Corn use results in modest increases in yields and lower herbicide/insecticide costs¹.</i> 	<ul style="list-style-type: none"> No change.
Herbicide/Insecticide	<ul style="list-style-type: none"> 10% reduction. <i>Limited evidence available of reductions attributable to use of biotech seed. Usage surveys show a long term declining trend in herbicide consumption per acre for corn.</i> 	<ul style="list-style-type: none"> No change.

Supporting Assumptions:		
Cost Item	Biotech Corn	Non-biotech Corn
Seed	<ul style="list-style-type: none"> ▪ 15% increase. <i>Study of 1999 US prices for biotech and conventional corn found cost differences of 15% to 20%².</i> 	<ul style="list-style-type: none"> ▪ No change.
Land Costs	<ul style="list-style-type: none"> ▪ No change. 	<ul style="list-style-type: none"> ▪ Increased due to need for buffer zones to reduce cross-pollination risks. Assume a 5% reduction in the effective production area.
Storage	<ul style="list-style-type: none"> ▪ No change. 	<ul style="list-style-type: none"> ▪ 2 months of additional on-farm storage, at \$1.50 per tonne per month, to allow for longer period for contract calls and consolidation by elevator/trader. <i>Storage cost from Ontario Cornrowers web site.</i>
Transport	<ul style="list-style-type: none"> ▪ No change. 	<ul style="list-style-type: none"> ▪ Doubled. <i>Grain received at an elevator with identity preservation and segregation systems. Assumed distance is double that of closest other elevator.</i>
Certification	<ul style="list-style-type: none"> ▪ Not required. 	<ul style="list-style-type: none"> ▪ Arbitrarily estimated at \$5/acre (\$0.04/bu.).
Testing	<ul style="list-style-type: none"> ▪ Not required. 	<ul style="list-style-type: none"> ▪ 1 test for every 25 tonnes of product, testing for the presence of herbicide tolerance and insect resistant traits. <i>3 ELISA strip tests for 3 different traits at a cost of \$US3.50 per test³.</i>

1. Fernandez-Cornejo J. and McBride W.D., "Genetically Engineered Crops for Pest Management in U.S. Agriculture: Farm-Level Effects", Agricultural Economic Report, ERS/USDA, Number. 786, April 2000.
2. General Accounting Office (GAO), "Information on Prices of Genetically Modified Seeds in the United States and Argentina", Report No. GAO/RCED/NSIAD-00-55, January 2000.
3. Based on testing cost information reported by ERS/USDA in "Biotechnology: U.S. Grain Handlers Look Ahead", in Agricultural Outlook, April 2000, p.33.

D. Grain elevators and handlers

The potential economic impacts of mandatory labelling would probably be the most significant for grain elevators and handlers, requiring operators to find ways of handling identity preserved and segregated products in a system that is focused on the rapid collection, consolidation and transfer of a small number of bulk commodities. Key issues facing organizations in the grain elevator and grain handling industries span:

- Many *elevator designs* are not well suited to the demands of identity preservation and segregation. A key issue facing operators is how to maintain segregation and prevent commingling while achieving an optimal capacity utilization rate. Elevators that have multiple pits for the receipt of incoming product will be better placed to keep non-biotech product separate and to establish parallel queues for incoming trucks (and to minimize delays due to

load testing). Similarly, elevators with larger numbers of smaller storage bins will be better placed than sites with fewer, larger bins, and are able to minimize the risk of commingling in the movement of product from pits to bins.

- Operators will need to ensure that they can ***segregate non-biotech products from biotech products at all points*** through their operations. They may choose to designate elevators as being receiving points for non-biotech products only to prevent commingling. Alternatively, they may choose to receive non-biotech products on different days from biotech products to enable handling equipment to be cleaned at regular intervals and to optimize queue lengths. On-farm storage of non-biotech products, and value-added, differentiated biotech products (in the longer term) is also expected to increase in importance.
- Operators will also need to ***establish and maintain more rigorous approaches to cleaning*** their storage and handling equipment to minimize risks of adventitious commingling during receipt, storage and transfer of biotech and non-biotech products.
- ***Testing protocols and paper trails*** will be necessary, to ensure that product received and shipped is compliant with buyers' order specifications. Testing kits that can be deployed on a large scale, and are quick and simple to apply, are still in the development stage. Elevator operators, in particular, will need to have ways of using such tests on both truckloads of products coming into their elevators (or to test product stored, and secured, in on-farm storage bins), and on shipments leaving the elevator for delivery to terminal elevators or processors. At this stage, it appears that ELISA tests could be used on incoming shipments from farmers and PCR tests used for consolidated quantities destined for terminal elevators and processing.
- Potentially, ***needs for smaller shipments*** of non-biotech and other segregated products from country elevators to terminal ports and processors instead of the use of unit trains able to move large volumes at lower costs. Alternatively, and depending on the economics, containerized transport may be used for these products. Estimates prepared by the USDA's Agricultural Marketing Service in January 2000 suggest that containerization could involve a cost premium over bulk handling of 36% (based on shipping soybeans from Iowa to Japan), but part of this cost could be offset by benefits in other areas, such as reduced needs for testing, greater security of IP segregation or faster shipping times. (27)
- Needs for operators to develop, or modify, their ***contracting structures***—for the purchase and sale of biotech and non-biotech grains and oilseeds—and purchase ***liability insurance***, to protect against the risks of supplying products that may not be compliant with buyers' specifications or claims made on testing documentation accompanying shipments.

Participants in our interviews were not able to provide estimates of the likely cost impacts of having to establish and operate identity preservation systems through the grain handling system in Canada, beyond qualitative judgements ranging as high as “double”.

Recently published information relating to the U.S. provides some insights and a basis for developing an indicative assessment of the potential impacts that mandatory labelling might trigger. Of particular note are the following comments from the April 2000 issue of *Agricultural Outlook*, published by the USDA's Economic Research Service:

In February 2000, the Farm Progress Company's survey of 1,200 U.S. elevators indicated that 24 percent plan to segregate corn and 20 percent plan to segregate soybeans in the fall. Elevators are likely anticipating food labelling regulations in other countries. ...

However, the National Grain and Feed Association estimates that, at a 1 percent or lower tolerance level for biotech content, roughly 5 percent of the (U.S.) elevators can achieve segregation without major new investments. ...

*According to the North American Grain Exporters Association, setting acceptable biotech content levels at about 5 percent or higher would increase costs only modestly. But if biotech-free thresholds were increasingly stringent, costs would rise. **One industry source suggested that if the threshold for biotech content were as low as 1 percent (a threshold that would likely require IP), transportation costs could potentially double.** (Emphasis added.) (8)*

Another report—*Alternative Market Channels for Specialty Corn and Soybeans* (5)—provides proxy indicators of the cost impact on handlers of specialty corn and soybean products (high oil corn, food corn, food soybeans and Synchrony Treated soybeans (STS)) in the U.S., principally grain elevators and specialty grain firms. Information for this report was collected from a sample of such firms in spring 1998, using a mail survey. Average differences in the costs of handling these products compared to handling of generic bulk corn and soybeans were as follows:

- Purchasing costs, including premiums paid to farmers, were \$US0.19 per bushell higher for specialty corn (\$US0.18 for grain elevators and \$US0.24 for specialty grain firms) compared to standard bulk corn handling. This was equivalent to 9%, 8% and 11%, respectively, of the 1998/99 average No. 2 Chicago price for corn. For specialty soybeans the purchasing costs were \$US0.74 per bushel higher (\$US0.36 for grain elevators and \$US1.67 for grain firms), and was equivalent to 15%, 7% and 33% of the 1999/98 average No.1 Chicago price.
- These purchasing/premium figures contrast with reported premiums paid to producers during the 1999/2000 crop year of \$US0.05-0.10 per bushel for non-biotech corn and \$US0.10-0.15 for non-biotech soybeans, with the higher premium paid for product with lower threshold levels for modified traits. (8)
- Average additional handling costs for specialty corn products were \$US0.08 per bushel (+4%) for grain elevators, \$US0.53 (+25%) for grain firms, and \$US0.17 (+8%) across both types of firm. The costs of handling/segregation and, for specialty grain firms, transportation and monthly storage costs were the major drivers of these additional costs. Specialty firms were more likely to purchase food corn (versus high oil corn) and to purchase over a larger geographic area (i.e., to have higher origination distances).

- For specialty soybean products the average additional handling costs were \$US0.21 (+4%) for grain elevators, \$US1.08 (+22%) for grain firms, and \$US0.48 (+10%) across all firms. Major contributors to these additional costs were handling/segregation and risk management for grain elevators, and transportation, handling/segregation, marketing and conditioning. Grain firms were more likely to purchase food soybeans than STS beans.

Drawing on these findings for specialty corn and soybeans, the ERS/USDA estimated that additional handling costs for non-biotech corn would be of the order of \$US0.22 per bushel and \$US0.54 for non-biotech soybeans. (9) These amounts are approximately equivalent to 10% and 11% of the cumulative average Chicago prices for commodity corn and soybeans. Estimated costs for handling non-biotech corn and soybeans were higher than the calculated averages for specialty corn and soybeans (of \$US0.17 and \$US0.48, respectively) due to higher estimated costs for handling, testing and risk management (for example, risks of not complying with specified threshold levels).

These estimated additional costs should be viewed as being at the low end of the spectrum, given the qualitative judgements expressed in our interviews and the views reported by the North American Grain Exporters Association regarding threshold levels under 5% biotech content.

IV

Potential Impacts On The Processing, Food Manufacturing And Retailing Sectors

Introduction of mandatory labelling would also have a major direct impact on the processing and manufacturing segments of the food industry supply chain and a lesser impact on retailers, especially if minor use products such as additives, flavourings and processing aids made using biotech or non-biotech products are subject to labelling requirements. These impacts, as shown in Exhibit IV-1, are expected to be concentrated in the areas of handling and segregation, cleaning systems and other measures to prevent commingling, monitoring supplier compliance, inventory management and labelling.

Exhibit IV-1

Mandatory labelling impacts—manufacture and sale of processed foods

Supply Chain Stages	Key Requirements to Enable Biotech and Non-biotech Labelling
1. Processing and supply to food manufacturers	<ul style="list-style-type: none">▪ Processes to confirm status of delivered products (documents, testing).▪ Methods for systematic cleaning of handling, processing, packaging and transport equipment or, operation of separate, dedicated processing lines.▪ Separate storage, handling and transportation of biotech and non-biotech products and product derivatives, pre- and post-processing.▪ Preparation of supporting documentation and supporting paper trail).▪ Training of operators.▪ Liability insurance.
2. Food manufacture and distribution (either directly or via wholesalers)	<ul style="list-style-type: none">▪ Processes to confirm status of delivered products (documents, testing).▪ Separate storage, handling, inventory control and transportation of biotech and non-biotech processed products, pre- and post-manufacture.▪ Methods for systematic cleaning of handling, manufacturing packaging and transport equipment or, operation of separate, dedicated processing lines.▪ Changes to labels and other consumer information, supported by changes to systems to ensure correct labels are used.▪ Creation of additional (biotech and non-biotech) SKUs for inventory management.▪ Preparation of supporting documentation (with access to supporting paper trail).▪ Training of operators.▪ Liability insurance.
3. Retail sale	<ul style="list-style-type: none">▪ Additional SKUs in shelf-space and category management processes, particularly if both biotech and non-biotech variants of products are carried.

A. Processors

The processing sector is the point in the supply chain where the focus of operations switches toward the production and marketing of a wider variety of differentiated products, away from handling bulk commodities. The relative importance of maintaining separation of biotech and non-biotech products may change as a result of this transition due to the fact that only a proportion of the processed products will be destined for human food products and, of these, not all will necessarily be sold into markets requiring labelling of non-biotech products.

However, these processed ingredients are used in an enormous variety of processed food products, ranging from oils, margarines and shortenings to precooked and dry mix products, bakery and cereal products, beverages, confectionery, and so on. A number of the participants in our interviews suggested that about 70% of all processed food products may require labelling as a result, including products that use additives and processing aids produced from biotech/non-biotech inputs.

Processors would be expected to incur additional costs in such areas of their operations as:

- ***Production planning and scheduling***, and associated planning and management of purchasing and scheduling of inbound deliveries.
- ***Separate handling and storage of biotech and non-biotech inputs and outputs*** that will be sold to manufacturers of human food products, plus supporting testing and/or document management systems. Additional storage capacity may also be required if processors have to hold non-biotech or biotech product for longer periods if market opportunities for these products are more limited.
- ***Down time for cleaning handling, processing and storage equipment.*** Alternatively, and depending on the volumes of input product available, processors may choose to establish parallel processing lines for non-biotech products or to designate certain plants as being for non-biotech products only, assuming it is feasible to achieve a high level of capacity utilization.

It was not possible to obtain estimates of the potential costs of these activities from our interviews or other research. We believe that, in the grains and oilseeds sector, the cost impacts for processors will be similar to those incurred by grain elevators and handlers but that the costs will only be attributable to, and recoverable from, those products subject to mandatory labelling requirements. If the additional cost factors for storage, handling/segregation, and analysis/testing incurred by elevators and grain handlers (from the ERS estimates for elevators and grain handlers) are used as a proxy indicator, **the estimated additional costs—for non-biotech corn and soybeans—would be equivalent to about 5-7% of their Chicago marker prices (using cumulative 1999/2000 averages). If this cost is attributable to only a proportion of the output products then the actual cost impact will be magnified.**

B. Food manufacturers

The success of food manufacturers is heavily dependent on branding and marketing, geared to winning and defending market share, often against private label brands marketed by food retailers (e.g., Loblaw's President's Choice brand). This means that they must be highly responsive to consumer preferences and retailer requirements, and able to maintain the consistency and quality of their products.

The issues posed by the introduction of mandatory labelling would be somewhat different for food manufacturers, compared to producers and processors, including:

- ***Need to deal with a complex mix of ingredients***, particularly if additives, flavourings and processing aids need to be considered in the determination of a product's non-biotech status and labelling. For example, one industry participant indicated that they used about 20-40 core ingredients across their product range plus approximately 700 minor ingredients and additives. Establishing and maintaining systems to monitor the biotech or non-biotech status of each of these ingredients across multiple suppliers would be a major undertaking, and require a high degree of dependence on the quality and accuracy of suppliers' measures to maintain identity preservation and the accompanying "paper trail" of testing and certification documentation.
- ***Production planning and inventory management may also become more complex***, particularly if a manufacturer produces both non-biotech and biotech variants of products from the one production plant. As with processors and grain handlers/elevators, food manufacturers would need systems to accommodate segregated handling, storage, manufacture, cleaning and inventory control functions. The impact of establishing these systems will vary from product to product, and plant to plant, depending on whether the biotech and non-biotech products are primary ingredients, or secondary ingredients and additives used in small batches. Additional capital, operating and input costs would be incurred in making these changes to the way products are manufactured. Alternatively, manufacturers may choose to dedicate separate plants to biotech and non-biotech variants or even to manufacture only non-biotech or biotech versions of their products, depending on their brand development and marketing strategies.
- Potentially, manufacturers may face the ***risk of not being able to procure sufficient quantities of non-biotech inputs***, at least during the initial start-up period for a mandatory labelling regime while producers and manufacturers are still establishing the necessary systems, or have to consider re-formulating products to facilitate compliance with labelling requirements. For example, following the announcement of Japan's new labelling requirements a number of Japanese brewers announced they would stop using biotech corn to produce their beer and a flour miller indicated it was considering switching from cornstarch to wheat starch in its flour products.
- Depending on the timing of the introduction of labelling, manufacturers may also incur ***costs to re-design product labels*** to incorporate the required label

messages. If reasonable notice of the introduction of labelling were to be given then the re-design of many product labels could be integrated into the manufacturers' regular programs for reviewing and revising labels and packaging. Alternatively, if labels had to be re-designed purely to make them compliant with the labelling requirements then all the costs would be attributable to this step. According to one manufacturer the cost to redesign product labels would run at about \$6,500 per SKU which, in their case, would represent about 0.4% of the average sales per SKU.

- ***Optimizing procurement and production within a North American supply chain.*** Most major food manufacturers operate with closely integrated North American supply chains. If labelling were to be required for products sold into the Canadian market but not for the U.S. market then each company would need to determine how it could best procure ingredients and manufacture non-biotech or biotech products while minimizing the impact on the overall efficiency and cost of the supply chain. Conceivably, Canadian plants could become the centres of expertise for manufacturing foods that are compliant with mandatory labelling requirements in Canada and elsewhere in the world. The issue of whether these operations would supply mainstream or niche markets would depend on the level of consumer demand for labelled products, be they non-biotech, “current generation biotech” (i.e., produced from modified products that benefit producers) or “next generation biotech products” (providing consumer benefits).

In summary then, food manufacturers' decisions will be shaped as much by marketing strategy considerations, focusing on the protection of brand equity and market share, as by production and procurement issues. In addition to potentially having to incur cost premiums for the purchase of non-biotech inputs food manufacturers would also incur costs of their own, for the establishment and ongoing operation of systems to test or monitor inputs and suppliers, to maintain dual handling, storage, processing and inventory control systems, and to make required changes to their product labels.

According to the food industry representatives interviewed for this report, estimates of the potential cost impacts are not available. **In the absence of quantitative estimates, the estimated additional cost of segregated handling, storage and testing at grain handling and elevator operations may be used as proxy indicator, and suggests costs would rise by the equivalent of 5-7% of the grain/oilseed price paid to producers plus another 1-2% for the cost of redesigning and implementing re-designed labels.** It should also be noted that this estimate—of an increase equivalent to 6-9% of the price to producers—does not incorporate any specific allowance for the cost of changes to production lines, and thus may be quite conservative.

C. Food retailers

Food retailers would not need to incur the same costs to comply with mandatory labelling, with their major impacts expected to be the incremental costs associated with the establishment and management of additional SKUs if they are stocking non-biotech and

biotech versions of products and brands. The real impact at this level would be in terms of how different chains, and different stores, are able to:

- ***Modify their stocking policies and category management strategies*** to cater to consumer demand for either biotech or non-biotech versions of different food products. For instance, they may choose to stock only non-biotech versions—including non-biotech versions of their private label products; stock both biotech and non-biotech versions of the same products—with the non-biotech products selling at a premium; or to sell biotech versions if they believe the majority of their customers will opt for lower cost biotech versions over premium priced non-biotech.
- ***Capture premium prices for non-biotech products that reflect the additional costs incurred through the supply chain.*** Without this willingness, and assuming any premiums are distributed back through the supply chain to provide incentives for the production and segregation of the key primary and processed products, there will be little or no interest on the part of domestic producers to supply certifiable non-biotech inputs into the supply chain.

Estimates of the potential costs for retailers to make changes to their stocking policies and category management strategies, and to implement systems to ensure private label products are accurately labelled, are not currently available. These cost impacts are not expected to be on the same scale as those incurred at earlier levels in the supply chain.

V

Summary Conclusions—Assessment Of The Economic Impacts Of Mandatory Labelling

A. Pre-conditions for a mandatory labelling system

The introduction of mandatory labelling for biotech and non-biotech food products would require the establishment of an integrated capability to separate and trace the production of agricultural and food products, to ensure non-biotech and biotech products can be accurately labelled. In the case of products made from, or using inputs derived from, grains and oilseeds this capability would need to flow from seed production through to food products on supermarket shelves. In addition, processes for regulatory oversight and enforcement would need to be established and appropriate label statements defined. In this regard, label statements would need to be carefully researched to ensure that they are understood by consumers while complying with legal prohibitions of false, misleading and deceptive claims.

Establishment of the capability to separate and trace would require a combination of:

- **Segregation**—where non-biotech and biotech products and their derivatives are kept physically separate through the supply chain. This may be through:
 - ◆ Identity preservation (IP), requiring physical separation of products and processes through the supply chain to prevent commingling. This may extend to the use of separate processing and manufacturing lines in separate facilities.
 - ◆ Segregation, in which products are kept separate as they travel through the supply chain but the facilities and handling equipment may be used for both biotech and non-biotech products, and thoroughly cleaned as part of the changeover from one to the other.

In both cases, third party review and certification, or accreditation, of production and processing organizations' segregation systems would also be expected, to enable these organizations to demonstrate that their systems are consistent with best practice and/or industry standards. Certified organizations may be able to use a lower rate of testing than might otherwise be the case.

Tolerance levels—for the adventitious commingling of biotech and non-biotech material—are expected to have a major impact on the cost of segregation systems. Many industry participants and analysts have suggested that as the

tolerance threshold goes lower the cost of ensuring products are compliant will increase exponentially.

- **Testing and documentation**—where specialized tests are deployed on a large scale to verify the presence and levels of genetically modified material in product samples. Two main types of tests are currently available to test for the presence of modified proteins (ELISA) or DNA (PCR) in a product and to measure the level of such material. However, adaptation of these tests for use in high volume, quick turnaround time situations has not been perfected and continues to be a “work in progress”.

The use of IP and segregation systems is not restricted to the production and processing of biotech products. In fact, demand for such systems is becoming quite widespread and is expected to continue to expand further in the future. Future applications of biotechnology in the agriculture and food sectors will be highly dependent on their use if “next generation” products that provide value-added benefits for consumers but are otherwise impossible to visually identify and separate are to be brought to market. Industry analysts expect IP systems to account for 25-30% of U.S. agricultural production in ten years time, up from 8-10% in 1999.⁽⁶⁾ In this sense, the introduction of labelling initiatives for biotech and non-biotech foods may be providing a catalyst for the wider application and refinement of IP systems within the industry.

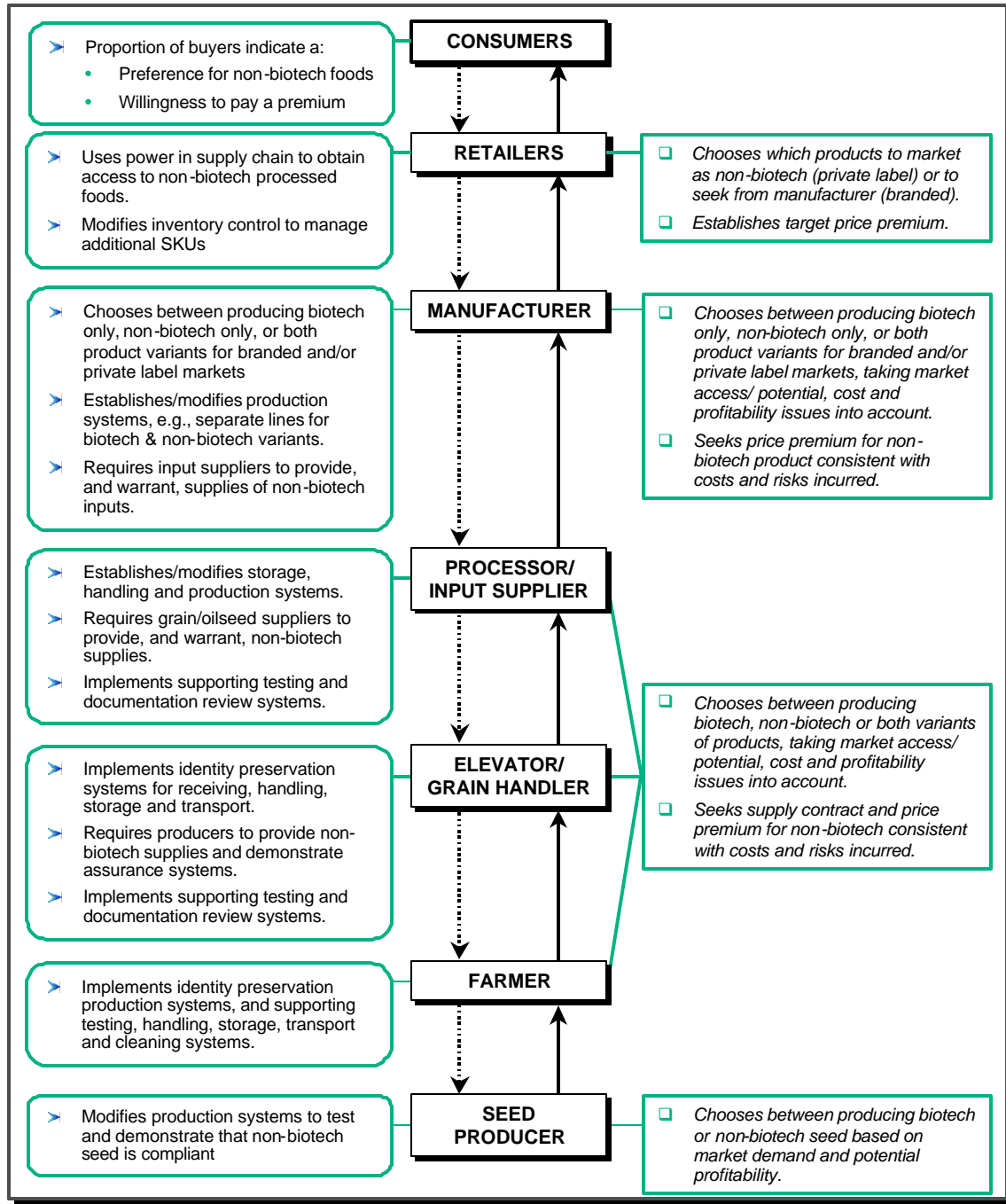
B. Implications of mandatory labelling for the food industry supply chain

Identifying and estimating the range of impacts that mandatory labelling is highly complex, due to a high level of interdependence between different levels in the supply chain and to a range of other economic and behavioural factors. Exhibit V-1 summarizes the nature of the decision choices and actions that players at each level in the supply chain would be expected to face, and illustrates how mandatory labelling would have impacts through the entire length of the chain.

Participants in the supply chain would be expected to face a variety of factors in determining how best to respond to the introduction of mandatory labelling, spanning such areas as the following:

- **Participants in the supply chain can elect to opt in, or out**, of engaging in activities geared to the production of biotech and non-biotech food products for human use, depending on their assessments of the relative market potential and returns from targeting either biotech, non-biotech or both applications of food products, or (for farmers, grain handlers and processors) targeting non-food applications versus food applications.

Exhibit V-1 Requirements to enable labelling of non-biotech and biotech foods



- *Scope to recover the additional costs incurred in establishing and maintaining the segregation and testing systems* required to ensure non-biotech (or, as the case may be, biotech) food products and derivatives are compliant with labelling regulations. In turn, recovery of additional costs or premiums paid by buyers would depend on such factors as:
 - ◆ Elasticity of consumer demand, which would be influenced by the willingness of consumers to pay premiums for non-biotech products or, longer term, biotech products with value-added traits; and the availability of substitute products at competitive prices.
 - ◆ Relative power of buyers and sellers at different levels in the supply chain, and thus their ability to pass on the additional costs incurred.

Mandatory labelling may modify the ability of the industry to pass on additional costs incurred to consumers, compared to voluntary labelling. A mandatory requirement to label implies that the beneficiaries of such a policy—consumers seeking to make more informed food choices—should pay, or make a major contribution to, the costs associated with such labelling. In turn, the ability of players at all levels of the supply chain to recover their additional costs will depend on their power in the supply chain; the level of price-elasticity for non-biotech product variants; and the relative availability and prices of alternative sources of supply, for example, where manufacturers source their inputs from grain and oilseed producing countries that have not approved the commercial use of biotech seeds and can segregate supplies of imported biotech product used in their processing sectors.

C. Preliminary estimates of the cost impact if mandatory labelling is required

Based on the findings from our interviews and a review of published assessments of the impacts of labelling of biotech and non-biotech foods, we have developed a preliminary estimate of the potential direct cost impacts of labelling. Further, more detailed research (as outlined in the following section) will be necessary to develop a better qualified and quantified estimate of the full range of potential economic impacts.

Exhibit V-2 summarizes the main findings relating to cost impacts at each stage of the supply chain, expressing the estimated cost impacts in terms of the prices paid to producers for grain and oilseed products. **If the various estimates of the potential cost impacts were passed through the supply chain the cumulative cost impact, measured relative to marker prices for grain and oil seed products, would be equivalent to 35-41% of producer prices, and potentially much higher.** For farmers, the estimated cost increase—of the order of 14%—compares with reported premiums from grain handlers of about 2-6% for the supply of non-biotech corn and 2-3% for non-biotech soybeans.(7)

Exhibit V-2
Estimated potential cost impacts of labelling

Stage in Supply Chain	Potential Areas of Major Cost Impact	Estimated Impact (% of Producer Price) ¹
Seed Production	<ul style="list-style-type: none"> ▪ Higher level of testing and certification of seed. 	(not available)
Grain/Oilseed Production	<ul style="list-style-type: none"> ▪ Altered production costs for non-biotech products versus biotech—lower seed cost, higher fertilizer, herbicide/insecticide, and land costs. ▪ Additional costs for on-farm storage, transport, testing and certification. 	~14% <i>(KPMG estimate, for Ontario corn)</i>
Elevator/Grain Handling	<ul style="list-style-type: none"> ▪ Separation of receiving and storage facilities for non-biotech products plus supporting testing and documentation, and cleaning systems. ▪ Potentially, dedicated elevators for receiving non-biotech or biotech product. ▪ Potentially, smaller scale rail shipments (vs. unit trains), dedicated rolling stock and/or systems for systematic cleaning and checking of rolling stock. 	~10-11% <i>(ERS/USDA)</i> (Up to 100%, if 1% threshold - <i>U.S. industry source</i>)
Processing	<ul style="list-style-type: none"> ▪ Separate storage and handling systems or systems for cleaning handling facilities between changeovers. ▪ Dedicated processing lines or downtime for cleaning of processing lines. ▪ (Additional costs would be attributed to output products subject to labelling requirements (i.e., products for human food use). 	~5-7% (Before attribution to human food use outputs.) <i>(KPMG estimate, based on ERS estimates)</i>
Manufacturing	<ul style="list-style-type: none"> ▪ Dual storage and handling systems or systems for cleaning facilities between changeovers. ▪ Dedicated processing lines or downtime for cleaning of processing lines. ▪ Changes to product labels (if outside of regular label revision cycles) plus establishment of testing and/or document review and record management systems. ▪ Due diligence checks on ingredient suppliers. 	6-9% <i>(KPMG estimate, based on ERS estimates plus industry estimates of costs for new labels)</i>
Retailing	<ul style="list-style-type: none"> ▪ Creation of additional SKUs. ▪ Modification of merchandising strategies, and inventory control and category management systems. ▪ Due diligence checks on suppliers of private label products. 	(not available)

1. Using 1999/2000 Cumulative Average marker prices published in AAFC's "Weekly Price Summary" on July 7, 2000, (www.agr.ca/policy/winn/biweekly/index.htm).

Retail price impacts of an increase of this magnitude would vary between product categories depending on the proportions of retail prices that are accounted for by the costs of biotech and non-biotech ingredients, costs of compliance with the labelling requirement that may be established, and the willingness of consumers to pay higher prices for labelled food products.

To illustrate this first point, estimates prepared by General Mills for their products show that for each dollar of the retail price, "... inputs and seed get 8 cents, the farmer, 29 cents; country elevators and processors, 7 cents; food manufacturers and finishing processors, 30 cents; and retailers (including marketing/advertising) 26 cents."(21) More broadly, 1997 data compiled by the USDA, shows that the average farm value of retail prices (that is, the

prices received by producers for commodities used in retail food products) averaged 23% across all food categories, and 21% for fats and oils.

This suggests that, in the case of a product category such as fats and oils (e.g., cooking oils), a cost increase due to labelling impacts, that is, equivalent to 35-41% of the farm price for oilseed products, would translate into a retail price increase of the order of 9-10%, including changes to maintain the percentage margins charged by processors, manufacturers and retailers, and assuming all costs are passed on to consumers. For products where the significance of the modified ingredients in the overall retail price is higher the magnitude of the labelling impact will be greater. For example, if the modified ingredients represent 30% of the retail price the increase required to recover costs attributable to labelling would be of the order of 12-14%; and 16-19% if the modified ingredients represent 40% of the retail price.

The estimated total annual cost to consumers for labelling would be between \$700 and \$950 million per year if the average cost increase for all processed food products subject to labelling is 9-10%. An increase of this magnitude would add approximately 1.3-1.8% to the value of retail sales of all food products, which have a current annual value of \$53.3 billion.

This estimate of the total annual cost of labelling is a function of:

- The proportion of processed food products that use ingredients from biotechnology products. Participants in our interviews suggested that as many as 70-85% of all processed food products could be subject to labelling under the scenario used in the interviews.
- Average household expenditures on processed food products. Information published by Statistics Canada on household food expenditures in 1996¹ suggests that expenditures on processed food products were approximately \$20 per week, out of a total average expenditures on food products of approximately \$80 per week.
- The number of households in Canada. Statistics Canada's analysis of household food expenditures used an estimate of 11.3 million households.

Processed food products would not be the only products subject to labelling. Fresh products that are marketed as being produced using biotechnology or as being biotechnology-free, for example, table potatoes, would also be subject to labelling, and producers and distributors of these products would have to take steps to ensure segregation and proper labelling. Costs associated with the labelling of these products have not been analyzed in the present study, and would be in addition to the above estimates.

¹ Statistics Canada, *Family Food Expenditure in Canada: 1996*, Catalogue No. 62-554-XPB, Ottawa, October 1998.

D. Comparison to other analysts' estimates

The indicative estimate of the potential cost impact of mandatory labelling, relative to farm gate prices, presented in the previous section is towards the high end of the range of estimates of the cost impacts of IP systems for biotech, non-biotech and specialty products published elsewhere, and summarized below.

- Estimates published by the European Commission based on a synthesis of available literature:

Grain/Oilseed Product	Country	Year	Impact: % of farm gate price
Oilseed rape—herbicide resistant	Canada	1996	6-8%
Soybean—modified quality traits	U.S.	1997	6-9%
Sunflower—high oleic content	U.S.	1997/98	7-10%
Oilseed rape—herbicide resistant	Canada	1996	9.5%
Corn—post-harvest chemical-free	U.S.	1997	16%
Corn—high oil content	Europe	1997/98	17%
Soybean—herbicide resistant (non-biotech)	U.S.	1998	50%*

* Cost of IP for soya meal protein, as a percent of the commodity price.

Source: Directorate-General for Agriculture, "Economic Impacts of Genetically Modified Crops on the Agri-Food Sector", Working Document, Brussels, March, 2000, p.30.

- Cost to establish an IP system for "non-GM" (not necessarily "GM-free") soy protein products manufactured by the Australian operations of Protein Technologies International (PTI) was estimated to be equivalent to 10-15%.(16)
- Estimate by a representative of Bestfoods of the cost to separate non-biotech products destined for export from the U.S. to Europe: "... about \$1.41, or 70 percent above current market values (for corn, and) for soybeans, the cost would rise by about \$2.07 per bushel, roughly 40% above current prices".(22)

The actual impact would also be influenced by a number of other public policy decision variables:

- **Threshold levels for the adventitious presence of modified material** in non-biotech products. Industry views appear to suggest that a 5% threshold is quite manageable but a 1% level for adventitious commingling for ingredients—as provided for in European Union regulations and agreed to by the Australia New Zealand Food Standards Council—will pose significant challenges and costs.
- **Scope of the definition of biotechnology and thus the range of products that may be subject to labelling regulation.** Canada's definition of novel foods focuses on the characteristics of such products, not the processes used to

produce them, and, as such, applies to products with traits altered using a variety of different processes including, but not limited to, products developed using “modern biotechnology” techniques. The intent of the novel food regulations is to assess the safety of novel food products prior to their market introduction rather than determining labelling requirements. Recommendations to the Codex Committee on Food Labelling on the labelling of foods obtained through biotechnology call for the exclusion of such techniques as mutagenesis, unless the donor/recipient organism is derived using techniques of modern biotechnology.(26)

- **Extent to which processed derivatives of biotech/non-biotech products are subject to labelling regulation.** A significant number of processed food products use small amounts of processed derivatives from biotech grain and oilseed products, such as soy flour, cornstarch, and cooking oils. Processing of the grains or oilseeds results in the removal or inactivation of the genetically modified material used in these products. If these derived additives, processing aids and flavourings are made subject to labelling regulation the potential range of products requiring labels will be significantly greater, as high as 70-85% of all processed food products according to some industry estimates. Significantly, the Australia New Zealand Food Standards Council meeting on July 28 agreed that the revised Australian and New Zealand labelling standard would exempt: *“highly refined food where the effect of the refining process is to remove novel DNA and/or protein; (and) processing aids and food additives except those where novel DNA and/or protein is present in the final food”*.(4)
- **Time frame allowed for implementation.** Most participants in our interviews emphasized the need for any labelling policy to have adequate time for the policy requirements to be communicated and explained to the industry, and to allow sufficient time for the necessary systems to be established. As part of this, industry participants would need information—relating to the segregation systems needed to ensure labelling can work effectively, estimates of the potential demand for non-biotech food products in Canada and international markets, and estimates of the pricing premiums that may be accessible by producers of non-biotech products. Time would also be required to establish suitable standards for sampling and testing methods.

Further research and analysis is needed to develop a more definitive estimate of the likely cost impacts on Canadian consumers and food industry supply chain than that obtained from our preliminary analysis.

E. Unanswered questions and potential areas of focus for further research

The findings presented in this report are the outcome from a preliminary, Phase I analysis of the potential economic impacts of mandatory labelling of the products of food biotechnology. They provide evidence of the expected direction and magnitude of the potential impacts but they do not provide what may be considered to be a definitive answer. The Phase I research also highlighted a number of unanswered questions and identified and

qualitatively explored many of the issues that need to be considered in the assessment of the benefits and costs of a mandatory labelling policy.

These unanswered questions include:

- What label statements are most likely to be understood and useful to consumers, and can these label statements be accommodated within the size and formatting constraints of most product labels? Or, what alternative means of providing information on the biotech status of products could be used?
- What would the potential cost implications be if, for example, more detailed information was required on labels, for example, if the biotechnology status of individual ingredients or specific traits had to be assessed and reported on product labels?
- What regulatory approaches to the monitoring and enforcement of compliance with labelling requirements appear to be most feasible? What costs would be involved and who would pay these costs? What steps and actions would be necessary if a product had to be recalled because of incorrect labelling?
- How can the status of imported ingredients and processed food products be verified, recognizing that Canada's food supply system is highly dependent on imported products? What are the implications of any initiatives to monitor the status of imported products for processors, manufacturers, retailers and the regulatory system?

Additional research is desirable to provide answers to these questions, generate more reliable estimates of the likely economic impacts of mandatory labelling, and to obtain a better understanding of the way in which labelling may influence consumer behaviour. Potential areas of focus for this Phase II research include:

- **More structured and extensive analysis of the means by which compliance at each level in the supply chain would be achieved, and associated decision choices and costs**, differentiating between upfront capital costs to establish systems and capabilities to enable the labelling regulations to be applied and compliance to be monitored, and ongoing operating costs. One means of undertaking this work may be to conduct a number of detailed case studies working from a range of representative retail food products back through the supply chain to farmers and their input suppliers, or to review the experiences with IP systems currently in place, for example, experiences with the IP system implemented for soybeans in Ontario, or responses to McCain's decision to purchase only non-biotech potatoes. Potential impacts to consider in these case studies would span the range of changes in the level and structure of demand; retail prices; responses of, and returns to producers, processors and manufacturers; cost structures; R&D expenditures; and farming practices (e.g., use of insecticides).
- **Investigation of potential approaches to the regulatory oversight of mandatory labelling, and their associated costs and benefits.** (Some

interviews in the Phase I work were concerned with the potential regulatory framework but were largely qualitative in nature.)

- **Investigation of potential impacts on importers of processed products, and on export competitiveness** of Canadian agricultural biotechnology products.
- **Investigation of potential consumer reactions to mandatory labelling**—including responses to, and comprehension of, alternative labelling statements (as well as other methods of providing such information—and propensities to pay the additional costs involved in creating and maintaining the industry’s capacity to accurately label products as being produced with biotechnology based, and non-biotechnology based, ingredients.

Appendix A

Steering Committee

Appendix A

Steering Committee Members

Chair:

Dr. L. P. Milligan Vice-President (Research), University of Guelph

Members:

Scott Campbell Policy Analyst, Canadian Chamber of Commerce

Bob Ingratta Director, Government Regulatory Affairs, Monsanto Canada Inc.

Ron Knight Director, Scientific Relations, Kraft Canada Inc.

Carolyn O'Brien Director, Scientific and Regulatory Affairs, Food and Consumer
Products Manufacturers of Canada

Gord Surgeoner President, Ontario Agri-Food Technologies

Alfons Weersink Professor, Agricultural Economics and Business, University of
Guelph

Alan Wildeman Director, Food System Biotechnology Centre, and Professor,
Molecular Biology and Genetics, University of Guelph

Appendix B

Participants In The Interviewing Program

Appendix B

Participants In The Interviewing Program

1. Agriculture and Agri-Food Canada—Policy Branch
2. Agriculture and Agri-Food Canada—Market and Industry Services Branch
3. Canadian Council of Grocery Distributors
4. Canadian Federation of Agriculture
5. Canadian Food Inspection Agency
6. Canadian Grain Commission
7. Canadian Importers Association
8. Canadian Seed Trade Association
9. Canola Council of Canada
10. Consumers' Association of Canada
11. Department of Foreign Affairs and International Trade
12. Health Canada
13. Kraft Canada Inc.
14. Lipton, Unilever Canada
15. Ontario Corn Producers' Association
16. Ontario Soybean Growers Marketing Board
17. Western Grain Elevator Association

Appendix C

Reference Documents and Reports

Appendix C

Reference Documents and Reports

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