



Comments submitted to the Canadian Food Inspection Agency (CFIA) on the “Summary of Submission” for Approval of Novel Food, Livestock Feed and Unconfined Environmental Release for Apple Genetically Engineered To Be Nonbrowning (GD743 and GS784) from Okanagan Specialty Fruits Inc.

Submitted by the Canadian Biotechnology Action Network, July 3, 2012

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Introduction

The Canadian Biotechnology Action Network provides the following questions and remarks to the Canadian Food Inspection Agency (CFIA) in response to Okanagan Specialty Fruits’ “Summary of Submission.” According to Okanagan Specialty Fruits, the company submitted requests for approval of its genetically engineered (GE) apple to the CFIA and Health Canada in December 2011. On May 2, 2012, the public was notified via the “Summary of Submission” (written by the company) posted for comment on the CFIA website. Okanagan Specialty Fruits is widely quoted in the media referring to this CFIA “public comment” period.

Comments on the Notices of Submission Project

Before commenting on the “Summary of Submission”, such as is possible without access to any of the data submitted, it is important that the Canadian Biotechnology Action Network (CBAN) outline our analysis of the “Notices of Submission Project” itself.

The CFIA Notices of Submission Project does not provide a true public comment period. The CFIA “comment period” cannot be considered a true invitation to public comment because the public is invited to comment on a submission whose contents remain secret.

CBAN does not consider the “Summary of Submission” a true summary.

What has been posted on the CFIA website is a series of bullet points written by the company that refer to the content of the submission, a submission that, as yet, remains inaccessible to the public. This posting is called a “summary” but is more a table of contents. The CFIA says, “The CFIA and Health Canada post "notices of submission" on the CFIA website that describe the product and the data they receive from certain product developers who have requested safety assessments of plants with novel traits (PNTs) for unconfined release and safety assessments of novel feeds and novel foods derived from PNTs.”ⁱ However, arguably, the posting does not achieve even this but is a rudimentary table of contents that does not actually describe the data providedⁱⁱ - it does not, for example, list specific scientific questions examined or studies done. The content of the summary is not instructive of the contents of the submission for the purposes of scientific comment.

The CFIA’s evaluation of the GE apple excludes “non-scientific” considerations such as the potential economic consequences of GE contamination for apple growers and yet the CFIA invites “non-scientific input” from the public.

The public is invited by the CFIA to comment on non-scientific considerations (such as economic impacts) but the CFIA does not consider non-scientific concerns in its decision-making. As stated on the Notices of Submission project webpage: “**Scientific questions or information** will be forwarded to CFIA and Health Canada evaluators for consideration in the assessment. **Non-scientific input** will be evaluated and appropriate ways of addressing it will be explored.”ⁱⁱⁱ The public may not be aware that non-scientific input will be excluded from CFIA and Health Canada decision-making over the GE apple. Ministers are clear that, “The CFIA's science-based environmental and livestock feed safety assessments assesses potential risks to the environment and livestock health caused by introducing a PNT into the environment, not potential risks related to the marketing of such crops.”^{iv}

The scope of the CFIA assessment is narrowed to scientific concerns and those concerns themselves are narrowed. For example the question of gene flow relates to the potential of the GE plant to “become a weed of agriculture, become invasive of natural habitats or be otherwise harmful to the environment.” We maintain that the following considerations are not inclusive of the full environmental and socio-economic consequences of gene flow:

- Does the plant have the potential to become a weed of agriculture or to be invasive of natural habitats?

- Is there a potential for gene flow to wild relatives whose hybrid offspring may become more weedy or invasive?
- Does the plant have the potential to become a plant pest?
- Is there a potential impact on non-target organisms?
- Is there a potential impact on biodiversity?
- Is there a potential impact of the plant or plant products on livestock feed or food safety?

The “Notices of Submission Project” is a voluntary system that exists courtesy of an agreement from industry group CropLife whereby its members (companies) are invited to permit the CFIA to notify the public (via a posting of a “Summary of Submission” drafted by the company) that a request for approval of a “Plant with Novel Trait” has been submitted. This arrangement permits companies to withhold notice of requests for approval from the Canadian public. Furthermore, it does not provide for notification from companies who are not members of CropLife nor does it capture potential submissions of GE animals including fish. Canadian regulatory agencies should notify the Canadian public of all submissions for approval of GE organisms/foods.

1. Gene Transformation

Information on the technology used to genetically engineer the apple is itself not apparent in the “Summary of Submission”. There appear to be no peer-reviewed studies describing this technology, including from the Australian researchers who first developed it.

From a review of the company’s publicity materials we understand that the gene sequence inserted into the apple makes use of the Cauliflower Mosaic Virus promoter, Nopaline synthase terminator, *Agrobacterium tumefaciens*, and the kanamycin antibiotic resistant marker gene.

It is not clear if double stranded RNA have been created. If so, then relevant literature on the question of RNAi needs to be considered. For example, the scientific literature shows that RNAi, naturally occurring in plants, survives digestion and moves through the gut wall and can influence gene expression.^v Studies would need to investigate potential effects.

The “Mendelian inheritance of the insert” and “Clonal stability of the insert” that were submitted by the company to assess the inheritance and stability of the transformation are crude measures of stability. Measurement of stability would require molecular characterization, including across number of environments and generations.

Regarding characterization: It is not clear if the flanking sequences have been sequenced and characterised and if rearrangements of the plants DNA have taken place due to the insertion. Such data should be made available. Exact sequences should be looked at over

environments and generations to observe any rearrangements or mutations within the sequence itself.

2. Unnecessary Use of Antibiotic Marker Gene

Okanagan Specialty Fruits makes use of the antibiotic resistant marker gene kanamycin resistance gene nptII (neomycin phosphotransferase II).

- **Antibiotic resistance is serious public health challenge**

Antibiotic resistance is a serious challenge to public health. Widespread use of antibiotics has resulted in the selection of antibiotic-resistant strains. Horizontal gene transfer from another organism is one mechanism by which antibiotic resistance can be established.

- **Kanamycin is an important (reserve) antibiotic**

Kanamycin is rarely used because of its considerable side effects and is reserved for use where pathogens have developed multiple resistance to other drugs previously effective in treatment. Kanamycin plays a critical role in human therapy as a last resort antibiotic.

- **Technologies exist to excise antibiotic marker genes before marketing**

It is not clear if Okanagan Specialty Fruits has excised the antibiotic marker gene. If not, why has the company not used a technology to enable them to remove the antibiotic resistant marker gene and ensure it is not present in the GE apple tree?

On its website for the public, Okanagan Specialty Fruits says: “Marker genes are but a tool for scientists and are non-functional in the final plants. No ‘resistance genes’ are found in the fruit, so no such resistance is transferred to humans.” Elsewhere the company says that the protein produced by the marker gene: “is only produced in leaf tissue in sufficient quantities to make the leaves resistant to kanamycin, allowing our scientists to use this ‘marker’ to identify successful and precise placement of our nonbrowning genes. No nptII protein is expressed in Arctic Apples.” These statements imply that the antibiotic resistant marker gene is still present in the cells of the apple itself, though not necessarily expressed. Thus anyone eating the GE apples would ingest the antibiotic resistance gene.

- **Antibiotic resistant marker genes may survive the gut**

It is a possibility, and risk, that gut bacteria pick up the antibiotic resistance marker gene via horizontal gene transfer, which ultimately could lead to antibiotic resistant disease-causing bacteria in the gut. For example, one study detected DNA from Bt corn in the digestive tract of sheep.^{vi}

- **The use of alternative markers is recommended**

In 2001, the Royal Society of Canada Expert Panel on the Future of Food Biotechnology recommended that “in view of the availability of suitable alternative markers, antibiotic resistance markers should not be used in transgenic plants intended for human consumption.” While stating that there are other practices in agriculture that are more likely to cause antibiotic resistance, “The Panel endorses the position already adopted by others (OECD, 2000; WHO, 2000d) on this topic and recommends that antibiotic resistance markers should not be used in any GM food intended for sale in Canada.”^{vii}

In the development of the U.S. Food and Drug Administration (FDA) guidance on the use of antibiotic resistant marker genes, the FDA published a dissenting opinion:

“Some members of the committee, while convinced by the information presented at the meeting that the transfer of the kan^r gene from tomato plants to microorganisms in the soil was improbable, expressed concern regarding the use of the kan^r gene in other crops that may be grown on a wide scale. In addition, some committee members were concerned that a determination of safety with regard to the use of kan^r gene in Calgene's tomato might signal to producers that it is now permissible to use the kan^r gene in other crops. In light of such concerns, these committee members advised that use of the kan^r gene in other crops should be evaluated on a case-by-case basis.”^{viii}

Why was the antibiotic resistant marker gene used when alternatives exist? CFIA does not weigh the possible public health risks relating to the use of antibiotic resistant marker genes against the benefits to consumers, farmers or society as a whole. If the CFIA did so, we could ask why this antibiotic resistant marker gene is used to create a product that has little or no consumer demand or public health benefit.

3. The Potential Weakening of Plant Defenses

According to OSF, the level of polyphenol oxidases (PPO) in the GE apple is extremely low, in order to produce the non-browning effect. The company states, “Apples have at least 8 PPO genes, in three main PPO gene families. To breed a truly nonbrowning apple, all of the active PPO genes must be silenced. Arctic Apples have been genetically engineered to produce little or no PPO enzyme, so cell disruption doesn't lead to browning.” Elsewhere the company states that Arctic Apples “produce less than 10 percent of the PPO in conventional cultivars.”

As well as being involved in the function of browning, however, the enzyme Polyphenol oxidases (PPO) is involved in plant defense against pests and pathogens. As Mayer points out, “The function of the enzyme is in most cases still not unequivocally known or defined” but the “correlations between PPO gene expression and defense reactions and stress are now well established”.^{ix}

Given the defensive roles of PPO, the following basic question requires study: Are the GE apple trees less resistant to disease and pests than their conventional counterparts?

It is clear that the physiological functions of PPO in plant growth and development need to be considered.

Okanagan Specialty Fruits' "Summary of Submission" posted on the CFIA website makes reference to "Agronomic and pest and disease data showing that GD743 and GS784 and equivalent to their untransformed parent cultivars" but this data is not posted for the public and we are given no further information.

There is a significant body of literature confirming the role of PPO in plant defenses, including studies that show that overexpression of PPO increases plant defenses.^x Transgenic tomatoes overexpressing PPO, exhibited less severity of disease symptoms, with over 15-fold fewer lesions and strong inhibition of bacterial growth, with over 100-fold reduction of bacterial population in the infected leaves. This and other studies demonstrate the importance of PPO-mediated phenolic oxidation in restricting plant disease development and show that phenolic compounds change disease susceptibility. Vulnerabilities could include susceptibility to Lepidopteran and beetle pests, and fungal disease

This question of increased pest and disease susceptibility also needs to be studied in relation to the use of the Cauliflower Mosaic Virus sequences in the GE Apple. The use of the constitutive CaMV 35S promoter means that PPO silencing is not tissue specific (suppression cannot be selectively turned off and is not therefore isolated to the fruit) but is induced in each cell and at all development stages, raising the question of the possibly significant impact of PPO suppression on the health of the whole apple tree.

- **Has the company provided data from studies that examine the possible increased sensitivity of the GE apple tree to pathogens and insects?**
- **If the GE apple trees are more susceptible to fungal disease and pest infestation, is there an associated risk of increased pesticide use with the cultivation of the GE apple?**
- **If the GE apples/apple trees are more susceptible to disease and pest infestation how will increased disease and pest activity impact neighbouring orchards?, potentially encouraging increased use of pesticides in non-GE orchards and increased management challenges for organic orchards.**

4. Gene Flow Risks

On its website and in its media communications Okanagan Specialty Fruits repeatedly and incorrectly minimizes the risk of gene flow^{xi}. Public communications from the company about gene flow risk appear to rest on a number of assumptions that are either incorrect or do not universally apply to the diversity of orchard models in BC and other provinces, and/or emerging trends in apple production.

- **The Role of Native Bees in Gene Flow**

The company's conclusions, as stated on their website, of "unlikely" pollen flow appear to be based on assumptions relating, primarily, to orchardist reliance on honey bee rentals for pollination. For example, the company states on their website that "bees stay very close to their hive where ample food is present (such as in an orchard in bloom)". While this is true, this factor is less relevant where native/wild bees are present or relied on for pollination.

The question of gene flow relating to the role of native bees/wild pollinators and the increased use of diverse wild bee species in pollination needs to be considered in relation to the question of gene flow risk.

There are over 20,000 species of bees in the world and approximately 4000 species in North America. There are approximately 450 native bee species in BC and the Yukon (there are about 450 species in New York State with 100 of these visiting apple orchards^{xii}).

Gene flow scenarios will change dramatically depending on farm size and production model, including because of the presence of diverse bee species. The number of bee species is correlated to farm size, with smaller orchards supporting a great variety of wild/native bee species and larger growers relying on renting honey bees for pollination. For example, 96% of growers in NY state with more than 100 acres in apple production exclusively rented honey bees for pollination while 73% of orchards with under 10 acres never rented honey bees (this did not consider people who keep their own bees).^{xiii} Additionally, the decline in honey bee populations in North America is leading to an increased use and exploration of alternative bee species for pollination. For example, a current study underway in Georgia seeks to determine if other species, such as mining bees, specifically *Andrena crataegi* or the mason bee of the genus *Osmia* can carry the pollinating workload currently carried by the honeybee.^{xiv}

There is increasing evidence that suggests native bee species are contributing significantly to crop pollination, especially in apple orchards^{xv}. Grower surveys in New York and Pennsylvania reveal that, when abundant, wild bees provide all the pollination orchards need.^{xvi} Pollination studies have also shown that wild bees can be more effective pollinators than honey bees on a per-visit basis, meaning they do not need to be as abundant as honey bees to provide the same level of pollination.^{xvii} A 2010 Cornell University survey of bees in New York state concluded that, "Numerically, our surveys

suggest that native bees are very abundant in apple orchards and a number of previous studies have suggested that native bees, such as *Andrena* (Kendall 1973, Kendall & Solomon 1973), *Osmia* (Bosch & Kemp 2001) and *Bombus* (homson & Goodell 2001) are effective vectors of apple pollen.”^{xviii}

- **The Ineffectiveness of Buffer Zones**

Okanagan Specialty Fruits also states on its website that, “Additionally, dense orchard plantings and buffer rows make it very difficult for bees to maneuver far, so the risk of bees carrying pollen far enough to be an issue is almost nonexistent.” Many orchardists in British Columbia dispute this assertion. Apple growers do not agree that this is a sufficient obstacle, especially if the behavior and diversity of native bees is considered.

The proposal to use other tree blocks, for example cherry blocks, to limit the movement of pollen also assumes models of production that may not exist for every farmer or in every area.

Okanagan Specialty Fruits also refers to “grower stewardship standards” that will define buffer distances between GE apples and other apple orchards as a mechanism to “further reduce this already-low risk.” The question of enforcement will be important especially if growers who plant the GE apple are asked to implement buffer zones when there is little or no economic incentive for them to do so.

- **Impacts on Wild Species**

It appears that gene flow to wild species is possible: “In many parts of the UK the commonest crab apples show evidence of introgression with cultivated apple (Raybould & Gray, 1993) and thus the likelihood of gene flow between cultivated and crab apples is high.”^{xix}

- **Gene Flow from Seed**

If an apple tree is pollinated with GE pollen, the genes would be present in the resulting apple seeds, not the apple flesh. If pollen from GE apple trees moves into a non-GE apple block, some seeds in apples from the non-GE trees that were pollinated could carry the new gene sequence and could express the new trait.

It is unclear why Okanagan Specialty Fruits states on its website: “even if someone were to attempt to grow a tree using these seeds, the “Arctic” trait wouldn’t be expressed.” This requires clarification.

While apple seeds do not breed true, they can germinate and result in GE apple trees. There are numerous scenarios for the spread of GE apple seeds including compost piles, randomly discarded apple cores, and deliberate plantings.

- **Broad Environmental Consequences**

Gene flow (GE contamination) will have serious negative impacts on apple markets and the future of organic orchardists. Such economic and social impacts need to be considered especially as these will also result in additional and broad environmental consequences. For example, the environmental consequences of gene flow include the threat to the economic survival of small and/or organic orchardists that provide important environmental services. Small and organic orchards that support diverse populations of wild bee species are at particular risk of gene flow from GE trees and these are the very orchards that provide important environmental services such as the maintenance of bee diversity itself.

5. Health Effects

- **Use of Assumption-Based Substantial Equivalence**

The analysis of potential health effects - allergenicity/toxicity - is assumption-based analysis. The company does not appear to have done any tests. The genetic changes to the organism need to be tested, for example the potential side-effects of the absence of PPO is unknown.

In the “Summary of Submission” the company says, “the nutritional composition of the novel plant has been compared to an unmodified apple“ however the question of potential health impacts requires animal feeding trials.

Nutritional evaluation needs to be based on a broader nutritional profile. Such a minimal nutritional compositional analysis will not provide sufficient information.

The company appears to have taken the assumption-based approach of substantial equivalence whereby the GE apple was compared to the non-GE apple, without studies to investigate.

- **Heightened Risks for Children and Vulnerable Populations**

The dietary exposure to the GE apple needs serious examination. Apples are a whole, unprocessed food that is consumed, sometimes daily or several times a day, by children and other vulnerable groups. Any health issue specific to the GE apple would be heightened by factors including the regularity of consumption and consumption by children at important stages of development. Any potential health risks of consuming the GE apple could be magnified for children because of their immature immune systems and guts, with sick children being at particular risk.

The Royal Society of Canada Expert Panel on the Future of Food Biotechnology noted that, “The potential widespread use of GM food products as food additives and staple foods, including use in baby foods, may lead to earlier introduction of novel proteins to

susceptible infants either directly or via the presence of the maternally ingested proteins in breast milk,” and result therefore in greater potential to develop allergies.^{xx}

6. The GE Apple will Mislead Consumers

The GE apple itself will mislead consumers. Browning is important information for the consumer as to the freshness of an apple/apple pieces. The GE apple will mislead consumers into believing that cut pieces of GE non-browning apple are fresh when they are not. According to the company, “Arctic Apple” pieces can remain white for 15-18 days.^{xxi}

The fact that the GE apple will mislead consumers as to its freshness, may have public health consequences. Bruised apples will not appear bruised but their texture will be changed nonetheless. The nutritional quality of the apple will degrade but the consumer will not see this. The consumer has not asked for this change to the apple and will not benefit from a GE nonbrowning apple.

The CFIA has a mandate to ensure that food labels are truthful and not misleading. This mandate has often been repeated by the CFIA in the debate over the question of mandatory labelling for GE foods and it is therefore clear to the Canadian public that this concern is a major priority for the CFIA. The Minister of Agriculture has, for example, said, “The Government of Canada supports the principle of providing consumers with credible, useful and clear information about the foods they buy.”^{xxii}

Conclusion

The Canadian Biotechnology Action Network has participated in this exercise of preparing comments to the CFIA on a submission whose contents are not public. This one invitation for comment from the CFIA is the only formal invitation for public comment before a GE product is approved. Given the lack of consideration for economic and social concerns and the lack of public consultation of any kind prior to the approval of a GE product, this invitation is a completely inadequate exercise.

The “Summary of Submission” is instructive as to the degree of secrecy surrounding the science behind government decision-making on GE products. The comment process highlights how deeply non-transparent and undemocratic the regulatory system for GE products is. The Canadian Biotechnology Action Network reminds the CFIA and Health Canada of the 58 recommendations made in 2001 by The Royal Society of Canada’s Expert Panel on the Future of Food Biotechnology, of which two have been implemented.^{xxiii}

After almost 30 years of the National Biotechnology Strategy, GE crops have provided no benefit to consumers, virtually eliminated organic canola production in Canada, continue to proliferate (via GE corn, canola, soy and sugar) on grocery stores without

labels, jeopardize domestic and export markets, threaten organic certification, and create social conflict.

CBAN endorses the recommendation of the People's Food Policy that:

“Existing GM crops should be phased out and there should be no further approvals of GM crops and animals. A just transition process, including financial and technical support, needs to be established to assist farmers to shift back to non-GM seed sources and to adopt ecological agriculture practices.”^{xxiv}

This conclusion is based on an analysis including the following, from the People's Food Policy, that is relevant to the GE apple:

“Genetically-Modified Organisms (GMOs) are living pollution that self-replicate. They cannot be recalled or controlled once they have been released and can spread and interbreed with other organisms, thereby contaminating ecosystems and affecting future generations in unforeseeable and uncontrollable ways. Genetically-Modified (GM) crops threaten agro-biodiversity which is fundamental to global food security, as well as threaten the future of organic food and farming through contamination.”^{xxv}

ⁱ <http://inspection.gc.ca/plants/plants-with-novel-traits/general-public/fact-sheets/transparency/eng/1338143383841/1338144227355>

ⁱⁱ The Summary is provided by the company and cannot be accurately referred to as data received as the CFIA has not validated the contents of the submission, it is data submitted.

ⁱⁱⁱ <http://inspection.gc.ca/plants/plants-with-novel-traits/notices-of-submission/eng/1300143491851/1300143550790>

^{iv} Joint Response: Agriculture and Agri-Food Canada, Environment Canada, Health Canada, “Response of the Federal Departments and Agencies to the petition file August 16, 2004, under the Auditor General Act: December 24, 2004” http://www.oag-bvg.gc.ca/internet/English/pet_125_e_28851.html

^v Herve Vaucheret and Yves Chupeau, “Ingested plant miRNA regulate gene expression in animals” *Cell Research* 22:3-5. 2012

^{vi} Duggan PS, Chambers PA, Heritage J, Michael Forbes J. Fate of genetically modified maize DNA in the oral cavity and rumen of sheep. *Br J Nutr.* Feb 2003; 89(2): 159–166

^{vii} “Elements of Precaution: Recommendations for the Regulation of Food Biotechnology in Canada.” The Royal Society of Canada Expert Panel on the Future of Food Biotechnology. 2001. page 49

^{viii} Guidance for Industry Use of Antibiotic Resistance Marker Genes in Transgenic Plants Draft Guidance, United States Food and Drug Administration, September 4, 1998

^{ix} "Polyphenol oxidases in plants and fungi: Going places? A review" by AM Mayer, from 2006 issue of *Phytochemistry*.

^x For example, "Overexpression of polyphenol oxidase in transgenic tomato plants results in enhanced bacterial disease resistance" by Li and Steffens from 2002 *Planta* ; "Antisense downregulation of polyphenol oxidase results in enhanced disease susceptibility" by Thipyapong

et al. from 2004 *Planta*: "Suppression of polyphenol oxidases increases stress tolerance in tomato" by Thipyapong et al. from 2004 *Plant Sci*.

^{xi} For example: <http://www.cbc.ca/daybreaksouth/2012/05/22/organic-orchardist-opposes-nonbrowning-apple/>

^{xii} "The Role of Native Bees in Apple Pollination", Mia G. Park, Michael C. Orr, & Bryan N. Danforth Department of Entomology Cornell University, Ithaca, New York Fruit Quarterly Volume 18, Number 1, Spring 2010.

<http://www.danforthlab.entomology.cornell.edu/files/all/nyfq-danforth-spring2010.pdf>

^{xiii} Ibid

^{xiv} Candace Pollock, Some Native Bees May Be Valuable for Commercial Pollination Services, May 8, 2012 <http://www.southernsare.org/News-and-Media/Press-Releases/Some-Native-Bees-May-Be-Valuable-for-Commercial-Pollination-Services>

^{xv} Danforth Lab, Cornell University, Pollination biology: The role of native bees in apple pollination, <http://www.danforthlab.entomology.cornell.edu/pollination-biology.html>

^{xvi} Wild pollinators of eastern apple orchards and how to conserve them, Danforth Lab, Cornell University

http://www.danforthlab.entomology.cornell.edu/files/all/apple_pollinator_guide_final.pdf

^{xvii} Ibid.

^{xviii} The Role of Native Bees in Apple Pollination, Mia G. Park, Michael C. Orr, & Bryan N. Danforth Department of Entomology Cornell University, Ithaca, New York Fruit Quarterly Volume 18, Number 1, Spring 2010.

^{xix} Genetically modified organisms (GMOs): The significance of gene flow through pollen transfer, European Environmental Agency, Environmental report No 28, 2002

^{xx} "Elements of Precaution: Recommendations for the Regulation of Food Biotechnology in Canada," The Royal Society of Canada Expert Panel on the Future of Food Biotechnology. 2001. page 59.

^{xxi} <http://www.kelownadailycourier.ca/front-page-news/okanagan-gm-apple-doesnt-go-brown-when-sliced.html>

^{xxii} Response from the Minister of Agriculture Gerry Ritz to Petition 305 – "Accountability for labelling of genetically modified organisms" Commissioner of the Environment and Sustainable Development, a 23 December 2010

http://www.oag-bvg.gc.ca/internet/English/pet_305_e_34997.html

^{xxiii} Please see "Is the Canadian Government Implementing the Royal Society of Canada's Recommendations?" by Peter Andrée and Lucy Sharratt, October 2004.

<http://www.cban.ca/content/view/full/583>

^{xxiv} Resetting the Table: A People's Food Policy for Canada. April 2011. Page 19

<http://peoplesfoodpolicy.ca>

^{xxv} Ibid.