FEEDING CANADA

Exploring Our Food System

– A VIDEO SERIES –

BIOTECHNOLOGY

TeachNutrition.ca™
By Dairy Farmers of Canada's Registered Dietitians

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Please refer to the Curriculum Connections document at TeachNutrition.ca for specific learning outcomes associated with each video.

ACKNOWLEDGEMENTS

The Registered Dietitians at Dairy Farmers of Canada would like to thank the many people who were involved with the development of this video series and discussion guide, including the farmers, content experts, and researchers we interviewed as well as the knowledgeable reviewers, including Agriculture in the Classroom.

We would like to offer a special thanks to the advisory group, curriculum consultants, teacher consultants, and students that worked with the team of Registered Dietitians in Ontario when these videos were first created.

We would also like to acknowledge the excellent contributions of the team of creative designers, videographers, film crew, and editors who helped create a dynamic video series.

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INTRODUCTION

Rationale for the Development of the Food System Education Project

Several programs of study in Alberta's grades 7–12 curricula include learning outcomes that link to food systems, including Science, Biology, and Career and Technology Studies. These outcomes include exploration of food production, food safety, food security, sustainable farming practices, preservation of farmland, local foods, factors influencing personal food purchases, and overall environmental responsibility. Current curricula and interest in food systems from both students and teachers present an opportunity to provide accurate, evidence-based representation of farming practices in Canada.

Goal of Feeding Canada Video Series

The goal of this series is to provide a well-researched, engaging, and balanced exploration of the Canadian food system.

Purpose of Teacher Discussion Guide

This discussion guide provides you with thought-provoking questions and answers to help facilitate a robust discussion around each topic in the video series. Specific learning objectives are addressed for each video. Questions will help students think critically about the issues that will be discussed during the video, help enhance the discussion after viewing, and help to meet all learning objectives for each video.

This guide provides additional in-depth information on each topic along with credible references for further exploration. Extension ideas have also been included to enrich the student learning experience.

FEEDING CANADA

Exploring Our Food System

– A VIDEO SERIES –

Using the Feeding Canada Videos

The Feeding Canada series comprises six short videos that range from 2 to 10 minutes in length. Each video explores issues relevant to the food cycle that may broadly or specifically affect farmers, the food industry, the public, and/or the environment. For a comprehensive examination of the issues relevant to Canada's food system, we recommend that all videos be viewed throughout the semester.

Required Materials

- Internet access
- Access to video link
- Computer, screen, and projector
- Chart paper and markers

FEEDING CANADA VIDEO SERIES

Video 1: Sustainable Farming

- Introduces the concept of a food cycle
- Defines and discusses sustainable farming practices and provides examples of how Canadian farmers use sustainable farming practices

Video 2: Farm Animal Care

- Introduces the concept of animal welfare and the regulations and best practices used to ensure animal well-being

Video 3: Food Safety

- Discusses the extensive regulations and safety measures in place at various stages of the Canadian food system to maintain food safety and human health

Video 4: Antibiotics and Growth Hormones

- Identifies regulations and safeguards in place in Canada to protect human and animal health
- Examines the use and regulation of antibiotics and hormones in food production

Video 5: Biotechnology

- Introduces the concept of biotechnology and its impact on food production

Video 6: Wasted Food and Food Recovery

- Explores the impact of wasted food and examines Canadian-based initiatives at various stages of the food cycle that are helping to reduce and manage food waste

USING CREDIBLE INFORMATION IN DISCUSSIONS AND ACTIVITIES

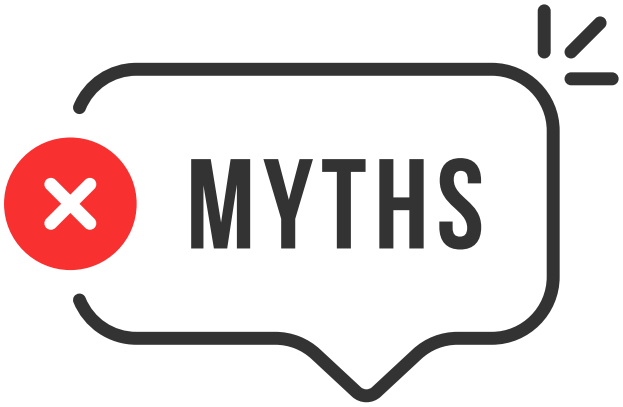
While agriculture has been prominent in Canada for more than a century, over time, our connection and relationship with food has changed. The decrease of firsthand knowledge and experience related to farming and food production increases the importance of using credible sources of information to learn about agriculture and food systems.

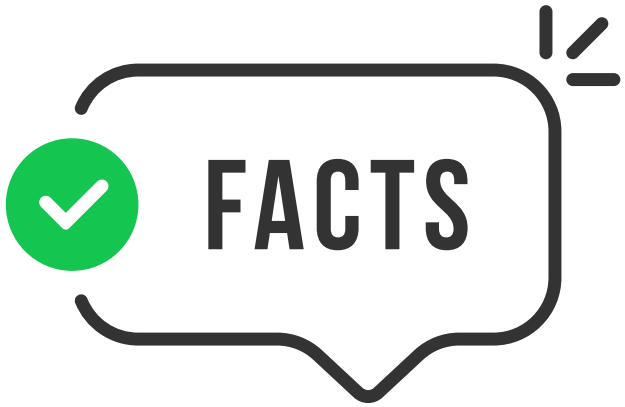
Food documentaries and farming exposés may be popular; however, they are often controversial and fraught with misinformation. Additionally, they commonly

- discuss international farming practices, which may not apply to the Canadian context;
- provide anecdotal rather than evidence-based arguments; and
- show content that is gratuitous in nature using rare examples that misrepresent what is common practice.

If students cite these types of sources, we suggest directing them to evidence-based resources that are current and Canadian-focused and that emphasize the perspectives of those working in the agricultural sector, including farmers, veterinarians, and researchers. Examples of these types of resources are found in the Additional Resources and Extended Learning sections of this guide.

We recognize that you or your students may have questions beyond the scope of what we have provided. Fortunately, there are many people and groups in Alberta that would be happy to help find answers to your questions. Reach out to people working in the agricultural sector in your community (e.g., farmers, veterinarians, agronomists), approach organizations with in-depth knowledge such as Agriculture for Life or Alberta Milk, or use reputable websites such as Agriculture and Agri-Food Canada. You can also connect with our team of Registered Dietitians at albertanutrition@dfc-plc.ca with the subject line “Feeding Canada Video”.





FOOD CYCLE INTRODUCTION

Each video in the series begins with an introduction to the food cycle. This message is reiterated throughout the series because it is important for students to have a strong understanding of the food cycle and how each component shapes the food system. Each video highlights specific issues relevant to key stages of the food cycle.

The Food Cycle

The agricultural food cycle is the journey food travels to reach the consumer. This cycle moves from the farm to food processing, distribution, access and consumption by consumers, to food waste, and back again to production. Each step of the food cycle is vital to the cycle's success and cannot work without the other steps. The food cycle includes local, household, and individual food systems and functions as part of the larger national and global food system, which has a significant impact on our health, the economy, and the environment.

Production: Farming practices that cultivate raw ingredients.

Processing: Preparation of food products from raw ingredients (e.g., the picking and packaging of fruit).

Distribution: Transportation – how food products reach the market system and the end user – the consumer.

Access: Market and retail accessibility connected to consumers through purchasing.

Consumption: Intake of food by consumers, whether at home or away from home.

Waste management: Treatment of waste from its creation to its disposal and/or recycling.

BIOTECHNOLOGY

Estimated Time: 30 minutes for video viewing and pre- and post-video discussion

Learning Objectives

Students will

- Demonstrate an understanding of how biotechnology has been used for centuries in food production
- Define traditional breeding and genetic engineering
- Identify a criticism of bioengineered food
- Identify who approves a genetically engineered food for use and sale in Canada

Background

As the world's population is projected to increase to more than 9 billion by 2050, we will have less space to grow food for more people.[1] Biotechnology may enable the production of better and more food on less land, particularly in some parts of the world. Advances in plant technology help to increase crop yields on existing land, reduce food waste, and develop new crop varieties.[2] These advances contribute to the affordability and variety of foods available to consumers.[2]

The terms **biotechnology** and **genetic engineering** have generated substantial controversy since their inception. **Biotechnology** refers to the use of living organisms or their components to produce or improve useful products.[3] For food, the goal of biotechnology is to produce more and better food. Many biotechnologies have been in use for centuries, even though that term wasn't used. For example, using bacteria in yogurt production and yeast to make beer, wine, and bread is biotechnology.[3,4]

Biotechnology also involves genetic modifications in which desirable traits from one organism are transferred to another using methods that include traditional breeding and genetic engineering.[3] **Traditional breeding** is when two parent plants or animals with desirable characteristics are bred so that the "offspring" has these desirable traits.[3] This type of breeding has been used for centuries and is also called conventional or selective breeding.[3] Genetic engineering refers to specific genes being added to or removed from an organism to improve its traits.[3] In plant agriculture, genetic engineering has been used in foods such as potatoes, tomatoes, and rice to improve nutritional value, resilience to pests, and growth rates.[4] The result of genetic engineering is a **genetically modified (GM) product** or a **genetically modified organism (GMO)**.[3]

As with any new science, debate exists over the potential risks and benefits of GMO foods. Critics are concerned about the safety of GMOs and their relationship to toxins or allergic reactions and their risk to biodiversity. However, other agencies, such as the World Health Organization and Health Canada, disagree.[5,6,7] After examining the evidence on GMOs, these organizations report that foods containing ingredients from GM crops are just as safe and nutritious as those containing ingredients from plants modified by conventional plant improvement techniques.[5,8] Additionally, GMO foods may actually reduce the impacts of agriculture on biodiversity by reducing the use of pesticides and herbicides and the need for additional cropland.[9]

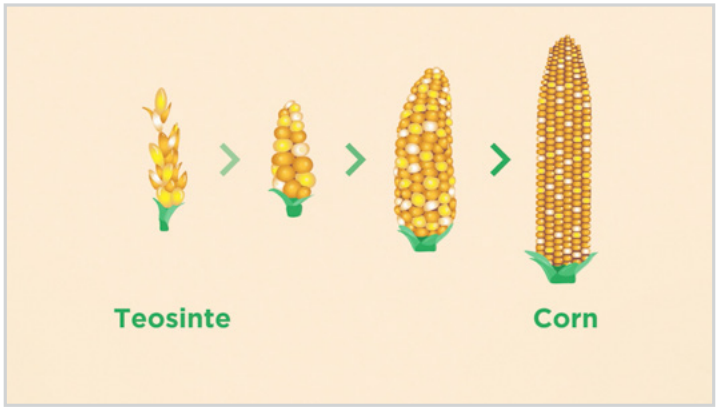
In addition, Health Canada and the Canadian Food Inspection Agency (CFIA) rigorously evaluate all individual products that use GMs or GMOs prior to their use in Canada.[10] A new genetically modified food goes through a 7- to 10-year process to research, develop, test, and approve it to ensure it is safe.[10] Multiple government acts regulate all biotechnology products, and Health Canada uses these regulations to undertake a detailed scientific assessment of any new GM foods.[10] All potential GM products are evaluated for their possible impact on human and animal health and on the environment.[10] If the GM food does not meet all requirements, it will not be deemed safe for further development and release in the Canadian food cycle.[10]

Over 100 novel foods, food products, and food ingredients have been approved for sale in Canada.[10] Canadian farmers grow a limited number of GMO crops such as canola, corn, potatoes, soybeans, sugar beets, and alfalfa.[4] More recently, GM apples and salmon were approved for production and sale.[11] The approval of GM salmon in Canada marks the first time an animal product has been approved as a GMO.[11] In addition to foods produced in Canada, some GM foods have also been approved for import. These include cotton, papaya, and squash.[11]

This video introduces the concept of biotechnology in the Canadian food cycle and explores its role and the controversies around its use.

Video 5 – Screen Sample A

Video 5 – Screen Sample B



Video 5 – Screen Sample C

DISCUSSION QUESTIONS

Pre-video

Q1: Have you heard the term biotechnology in relation to the food system? What does it mean to you?

A1: There is no wrong answer here. Instead, the hope is to get an overview of students' current knowledge about biotechnology. Often facts will be accompanied by myths that students have heard regarding this topic. You can explain that **biotechnology** refers to the use of living organisms or their components to produce or improve useful products.[3] For food, the goal is to produce more or better-quality food using fewer inputs such as fertilizers and pesticides. The video will explore more about what biotechnology means and how it is used in Canada.

Post-video

Q2: Why do you think biotechnology is used in food systems?

A2: As the world population is projected to surpass 9 billion by 2050, some experts feel there will be an increased need to use the food supply more efficiently to provide adequate nutrition to the growing population.[1] This means that biotechnology is likely to play an essential role in the future health of our food system.

It is important to recognize that while biotechnology is generally viewed as a new process, it has been used in agriculture for centuries. What is new is the commercialization of biotechnology, which has shown promising results. The potential benefits of genetically modified (GM) foods is that they may be more weather resistant, require fewer resources to produce, are more productive, bruise less easily, are pest resistant, are less susceptible to disease, and may be more nutritious.[2,4]

In addition to the use of GM foods to feed the global population, some researchers and food experts feel these crops can also create more economically sustainable farming conditions, enabling farmers to maintain their crop yields in the face of droughts, cold snaps, and pest infestations.[4,6]

Other scientists question the longer-term value of genetic engineering and feel there could be unintended consequences with their use (e.g., weeds becoming resistant to certain herbicides, resulting in increased use of other herbicide formulations).[12] Additionally, some scientists feel that reducing food waste would result in enough food to feed an expanding population globally.[13]

Q3: What are the two methods of genetic modification in food production? How do they differ?

A3: The two methods of genetic modification are traditional breeding and genetic engineering. Traditional breeding is when two parent plants or animals with desirable characteristics are bred so that the "offspring" has these desirable traits.[3]

In **genetic engineering**, specific genes are added to or removed from an organism to improve its traits.[3] The result of genetic engineering is a **genetically modified (GM) product** or a **genetically modified organism (GMO)**.[3] Examples of genetic engineering in plant agriculture include using it in potato, tomato, and rice production to improve growth rates, resilience to pests, and nutritional value.[4] Canadian farmers grow a limited number of GMO crops such as canola, corn, potatoes, soybeans, sugar beets, and alfalfa.[4]

Q4: What are some of the concerns with GM crops? What does the evidence say?

A4: Opponents of GM crops have suggested that GM foods can cause allergic reactions, cause resistance to antibiotics, contaminate regular crops, reduce biodiversity, and produce toxins. While the field of genetic engineering is relatively new and there is still a lot to learn, current evidence indicates there is no increased risk associated with GM foods.[5,8] In fact, numerous reputable organizations such as the World Health Organization and Health Canada have concluded that foods containing ingredients from GM crops are just as safe as those containing ingredients from plants modified by conventional plant improvement techniques.[5,6,7] Additionally, numerous regulations are in place in Canada to ensure that ingredients from GM crops that reach consumers are safe for consumption and pose a low risk.[5,8]

Q5: How are genetically engineered food products regulated in Canada?

A5: Health Canada and the CFIA rigorously evaluate all individual products that use GMs or GMOs prior to their use in Canada.[10] New genetically modified foods undergo a 7- to 10-year process to research, develop, test, and approve to ensure they are safe.[10] Multiple government acts regulate all biotechnology products, and Health Canada uses these regulations to undertake a detailed scientific assessment of any new GM foods.[10] If the GM food does not meet all requirements after going through this process, it will not be deemed safe for further development and release in the Canadian food cycle.[10] As research continues to build within the biotechnology field, the regulation process will continue to adapt to ensure that only quality food reaches the consumer.[10]

Q6: Now that you have learned more about biotechnology, have your views on genetically modified products changed? If so, how?

A6: There is no one answer expected for this question. The aim is to get students to understand how GM foods are often portrayed and what the evidence says. Students likely will have differing opinions about GM foods depending on their previous exposure. In the end, the goal is for them to recognize that Canada has a rigorous approval process for GM foods and that if they are approved for use in the food cycle, they have been deemed safe and of similar nutrient content to non-GM foods.

ACTIVITIES

My Food Cycle

Have students summarize their learning by creating a visual representation of the food cycle as they currently understand it, including what is involved at each stage. Encourage students to add to their visual representation as they progress through the video series. Options may include creating a sketch or drawing, or making a mind map or chart.

Free Writing and Reflection

After viewing the video series (or as many of the videos as deemed appropriate for a specific course), have students complete the following reflection activity:

Give students 5–10 minutes to free write about their key learnings from the video series as well as any lingering questions. The aim is for them to recognize their learning and any changes in their knowledge or perceptions. Then encourage students to share highlights from either their visual representation or free writing with the class.

Food Biotechnologist for the Day

Students will develop an idea for a new food variety. Divide students into small groups of about two to four and ask them to think of a problem they have noticed in a vegetable, fruit, or grain product. Have students brainstorm ideas about how plant biotechnology, either through traditional breeding or genetic engineering, could address this problem and make the product better.

Groups then choose one idea and create an infographic that includes a drawing or sketch of what the food looks like before and after the modification. Include a short description of the potential advantages of the new food variety. Have each group present their infographic to the class.

If students need support and idea starters, refer to Additional Resources.

Option 1: Have students complete the activity individually and present their ideas in a slide deck, infographic, video, or one-page report.

Option 2: Have students research an approved GMO food in Canada (e.g., Arctic® nonbrowning apple) to learn about why the food was developed and what type of biotechnology was used. Students can present their findings in a slide deck, infographic, video, or one-page report.

Additional Resources

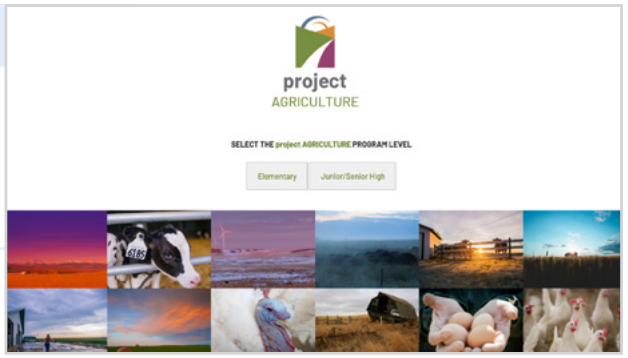
- History of Plant Breeding snapAg
- Advanced Plant Breeding snapAg
- What Are GMOs snapAg
- GMO Foods snapAg
- GMOs and the Environment snapAg
- The Real Dirt on Farming

EXTENDED LEARNING

If you would like to continue exploring food systems in Canada and Alberta, check out the following. Each includes free teacher and student resources for junior high and high school with links to the Alberta curriculum.

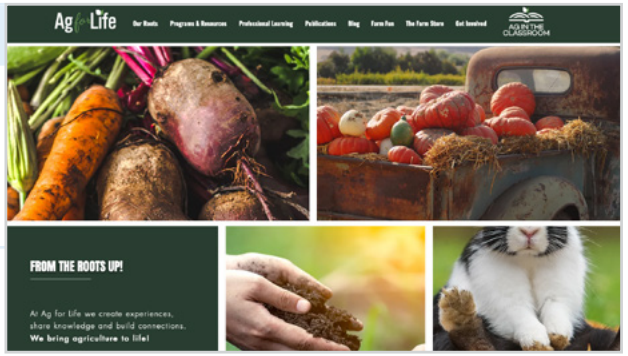
project AGRICULTURE

Website address: www.projectagriculture.ca
A project-based learning resource that provides opportunities for students to explore the impact and importance of agriculture in Alberta and Canada.



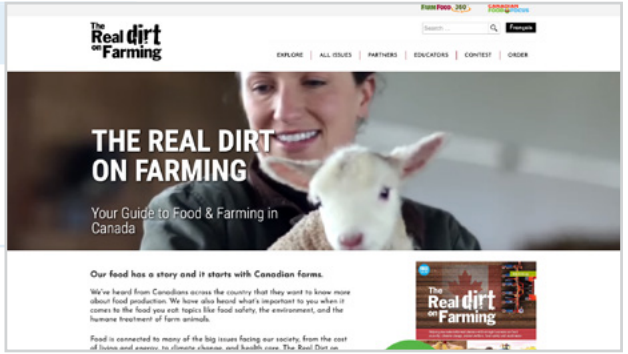
Ag for Life

Website address: www.agricultureforlife.ca
A variety of programs designed to empower audiences to think both critically and creatively and to give students a real awareness of agriculture and food production.



The Real Dirt on Farming

Website address: www.realdirtonfarming.ca
A digital magazine about food and farming in Canada that covers topics such as food safety, the environment, and the humane treatment of farm animals.



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GLOSSARY

Access: Market and retail accessibility connected to consumers through purchasing.

Biotechnology: The use of living organisms or their components to produce or improve useful products. For food, the goal is to produce more and better food. It includes genetic modifications, in which desirable traits from one organism are transferred to another.

Consumption: Intake of food by consumers, whether at home or away from home.

Distribution: Transportation – how the food products reach the market system and the end user – the consumer.

Genetic engineering: A process in which specific genes are added to or removed from an organism to improve its traits. The result of genetic engineering is a genetically modified (GM) product or a genetically modified organism (GMO).

Genetically modified (GM): An organism, such as a plant, animal, or bacterium, that has had its genetic material altered through any method, including conventional breeding. A genetically modified organism is a GMO.

Processing: Preparation of food products from raw ingredients (e.g., the picking and packaging of fruit).

Production: Farming practices that cultivate raw ingredients.

Traditional breeding: When two parent plants or animals with desirable characteristics are bred so that the "offspring" has these desirable traits.

Waste management: Treatment of waste from its creation to its disposal and/or recycling.

Tell us how you used this resource with your class and let us know if you have any suggestions for improving it by emailing albertanutrition@dfc-plc.ca.

We appreciate your feedback!

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