FREE Take me

The Real DIRT on Farming

Canadian Farming Coast to Coast

Know your food and the people behind it

Straight answers on pesticides, hormones, GMOs, antibiotics and more

Helping you make informed food choices


Jessica Richardson

Table of **Contents**

Front cover photo credits: Jennifer Eastman, Derek Van De Walle, Herbert Grain Ventures, Bethany Atkinson
Back cover photo credits: Johnnie Cluff, Jennifer Eastman, Reid William Eyre, Beracha Knor

Farm photos in this book are all taken of Canadian farms, or of Canadian farmers. Many were winning entries in Farm & Food Care Canada's Farm Photo Contest. Photo credits are listed, where available.

Sources, where noted, are available in the online version of this publication at **www.RealDirtonFarming.ca.**

Our food has a story - and it starts with **Canadian farms.**

One hundred years ago, over half of all Canadians worked on farms. Now that number is less than two per cent of the population. With so few connected to food production, it's understandable that questions about food and agriculture abound.

Canadian farming has an impressive story to tell. Advances in technology are helping us better manage the environment, while taking better care of our animals and our businesses. Tried-and-true farming practices, in conjunction with a willingness to embrace science, mean that there have never before been so many ways to farm – and eat – sustainably.

All Canadians deserve the opportunity to make informed choices about their food, and to be part of Canada's farm story. That opportunity, though, requires credible information based on sound science. By introducing you to Canadian farmers – who we are, what we do and why we do it – *The Real Dirt on Farming* is designed to answer your questions, address concerns, and debunk myths around food and farming.

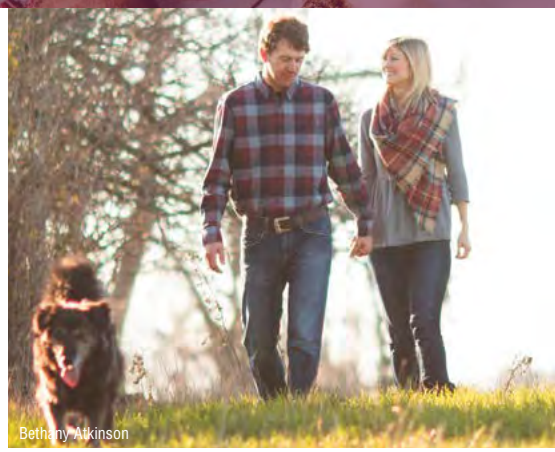
Farming remains a career and lifestyle founded on the same values held by previous generations. It's a commitment to the land, to animals, and to good food.

We hope you'll get to know us – after all, to know us is to know your food.

Sincerely,
Canada's Farmers

CHAPTER 1

Canadian farming **- the big picture**


Bethany Atkinson

Farming is like no other sector in Canada: it's both a business and a way of life. The agriculture and agri-food sector is a big deal in Canada, employing over 2.3 million people – that's one in eight jobs – and contributing $108.1 billion to our national economy.[1]

Just as Canada's provinces are different from coast to coast, so are its farms. In fact, there's no such thing as a typical Canadian farm – farms range in size and type, with farmers from Newfoundland to British Columbia growing many different crops and raising a variety of livestock and poultry.

A quick snapshot:

- **Farming means family in Canada – 97 per cent of Canada's farms are family owned.[2]**
- Statistics Canada recorded 193,492 farms in its 2016 census, which is 5.9 per cent fewer than in the 2011 census. However, that's the lowest rate of decline in the last 20 years.[3]
- The farms that remain are becoming larger, though. The average Canadian farm in 2016 was 820 acres – up from 779 acres in 2011, and 237 in 1941. This evolution is in part a result of technological advances allowing farmers to work more efficiently, as well as wider business and societal shifts.
- Ontario has the most farms – 49,600 in 2016 – but Saskatchewan's are the largest, followed by farms in Alberta and Manitoba.
- Among Canada's approximately 2.467 billion acres of land, only about 6.5 per cent - or 158.7 million acres – are being farmed.[4] The rest is made up of towns, cities, industrial areas, or land that is not suitable for farming because it is too rocky, wet or cold, or the soil is not fertile enough.
- Canada is the fifth largest exporter of agriculture and agri-food products in the world.[5] We produce about 80 per cent of the world's pure maple syrup, and are the leading global producer of maple products.[6] We are also the world's largest grower and exporter of flax seed,[7] canola,[8] pulses (such as peas, beans and lentils),[9] mustard, and durum wheat (the kind used to make pasta).[10] Due to differing climate zones across the country, Canadian farmers also grow and raise everything from bison, alpacas, and mink, to lavender, grapes, greenhouse vegetables, and hazelnuts.

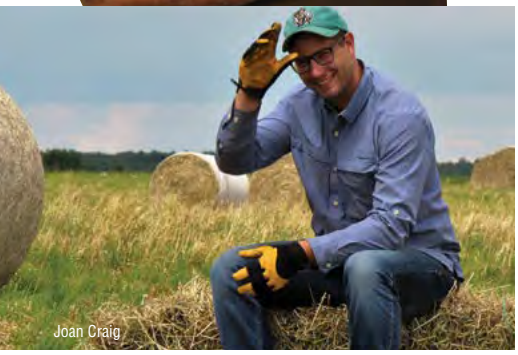
Quick Fact

How big is an acre? It's about the size of one U.S. football field (minus the end zones).[11]

Farmer demographics – who is growing our food?

Images of Old McDonald – the farmer wearing overalls and carrying a pitchfork from the popular children's song – are what many people think a farmer looks like. The reality is a lot different. Here is who is really growing our food:

- According to the 2016 census, the average age of a Canadian farmer is 55. Just over half of all Canadian farmers are aged 55 and older, but for the first time since 1991, the number of young farmers – those under 35 – has increased.[12]
- 28.7 per cent of Canadian farmers are female.
- Just over half of all farmers have some form of post-secondary education as of 2011.[13]
- About 45 per cent of Canada's farmers also work off-farm to supplement their income.[14] Farming is an expensive business with many risk factors, which makes additional sources of stable income an important means to security.



Joan Craig

Courtesy of FFC Saskatchewan

Dwane Morvik

Who is Canada's typical farmer?

There's no such thing as a typical Canadian farm or ranch, or farmer or rancher. Canada is a big country with many different types of farms, and each one is unique. What they do have in common is the commitment and dedication needed to care for land and livestock.

In Canada, farming is still about family. Many farms are handed down from generation to generation, and it's not uncommon to see parents and even grandparents working together with sons, daughters, and grandchildren, on their family farm.

The big difference from previous generations is that today, farms have become bigger, and there are more tools and technologies available to help farmers do their job better. Smartphone apps can, for example, monitor the temperature inside barns to ensure that livestock are comfortable; drones help find pest and disease problems in a field of crops; and GPS systems can help farmers pinpoint exactly where – and in what amount – fertilizer is needed.

Kathie MacDonald

Anna Haupt

Here are a few examples of how Canadian farms work:

- Most are owned and run by families (97 per cent), sometimes with multiple generations working together.
- Some are incorporated, as many Canadian businesses are. According to the 2016 Census of Agriculture, 22.5 per cent of Canadian farms are family corporations (only 2.7 per cent of Canadian farms are non-family corporations).[15] A corporation is a type of business structure that may include several family members or additional paid employees. It does not relate to a farm's size. Farmers may incorporate their farms for a variety of business reasons, including to help with succession planning for future generations.
- Family farming is the main form of farming and food production around the world, in both developing and more developed countries. According to the Food and Agriculture Organization of the United Nations, family farms produce about 80 per cent of the world's food.[16]

Farms big and small

Farms in Canada come in all types and sizes, from small orchards and vineyards, to large grain farms and cattle ranches. They also vary in environmental characteristics, and in their ability to produce food. A small piece of land, for example, can be very fertile and profitably grow specialty vegetables for a niche market. In contrast, a large 5,000-acre farm in a colder climate may be mostly trees and rocks, and better suited for grazing animals.

Farmers also tend to specialize in a specific area of food production, such as a greenhouse, or a dairy farm. This focus helps to improve both efficiency and the ability of each farmer to learn and adapt to challenges in his or her own area of expertise.

There can be nostalgia surrounding perceptions of the farms of the past. Back then, environmental awareness was lower, food quality and quantity were more unpredictable, and food was sometimes not available at certain times of the year. Research, innovation, and a perpetual commitment to learning continue to build progress in environmental and animal care, while improving food quality, safety and abundance.

A challenge for today's farms is feeding Canadians sustainably – growing enough food in ways that are good for people, animals, and the planet. All farms, large or small, have a role to play.

Inside a vegetable greenhouse

Aerial view of a Saskatchewan beef ranch

Dwane Morvik

Regional roundup

Canada is a big country – the second largest in the world, in fact – and farmers in all provinces have their own challenges and opportunities based on what they do. The key to Canada's farm and food success has always been diversity. **Here's a snapshot:**[17]

Darryl Smith

- Farms in **Newfoundland and Labrador** market their products directly to consumers to a greater extent than anywhere else in the country.
- Over 40 per cent of the land in **Prince Edward Island** is used for growing crops and raising animals.
- **Nova Scotia** grows more apples than any other province in Atlantic Canada.
- Potatoes are the dominant crop in **New Brunswick**, excluding hay and alfalfa.
- **Québec** leads the country in dairy, maple syrup, pork, nut, fruit, and berry production.
- **Ontario** produces more soybeans than any other province, and is home to two-thirds of Canada's greenhouse vegetable production.
- **Manitoba** has the highest proportion of young farmers, and the second youngest farm population in Canada after Québec.
- **Saskatchewan** is the largest producer of crops such as canola, wheat, and lentils.
- **Alberta** has the most beef cattle, with 48.6 per cent of the national herd (or 3.34 million animals) in the province.
- **British Columbia** has the largest number of small farms (those producing less than $10,000 in gross income) and more female farmers than any other province; 37.5 per cent of BC's farmers are women.
- Oats are the most common field crop in the **Yukon and Northwest Territories**, excluding hay and alfalfa, while poultry and egg farms make up 44 per cent of agricultural income in those regions.

What does sustainable farming mean to you?

If a farmer decides to grow a new crop, consideration must be given to the food safety and quality of the crop, what impact its growth may have on the environment, who might buy the crop, and where the farmer can produce it profitably. It's all part of sustainable farming.

Ashton Irwin

CHAPTER 2

Farm animals **101**

In Canada, there are thousands of farmers caring for a wide variety of livestock and poultry. Here are some basics on many of the main types raised in this country.

Turkeys and chickens

Turkeys and chickens raised for meat always roam freely around the barn. They're housed in modern barns where temperature, humidity, light, and ventilation are carefully monitored to ensure that the birds stay healthy. The barn floor is covered with a soft bedding material of straw or wood shavings. Water and pelleted feeds made of grains such as wheat, corn and soybeans (similar in appearance to hamster food) are always available, so the birds can help themselves any time they want. This feeding system is called "free choice".

Most poultry farmers put all their new birds into the barn at the same time. This makes sense from both a logistics and disease prevention perspective, as the entire flock will be shipped to market on one day. The barns are then cleaned out, and all bedding and manure are removed to get ready for the next flock, helping to keep the new birds healthy. Disease prevention is always preferred over disease treatment.

DID YOU KNOW?

No chickens, turkeys, or egg-laying hens in Canada are ever fed hormones. The idea that hormones are used in poultry production is a major misconception – they've actually been banned here for over 50 years.

Ivy Rachkewich

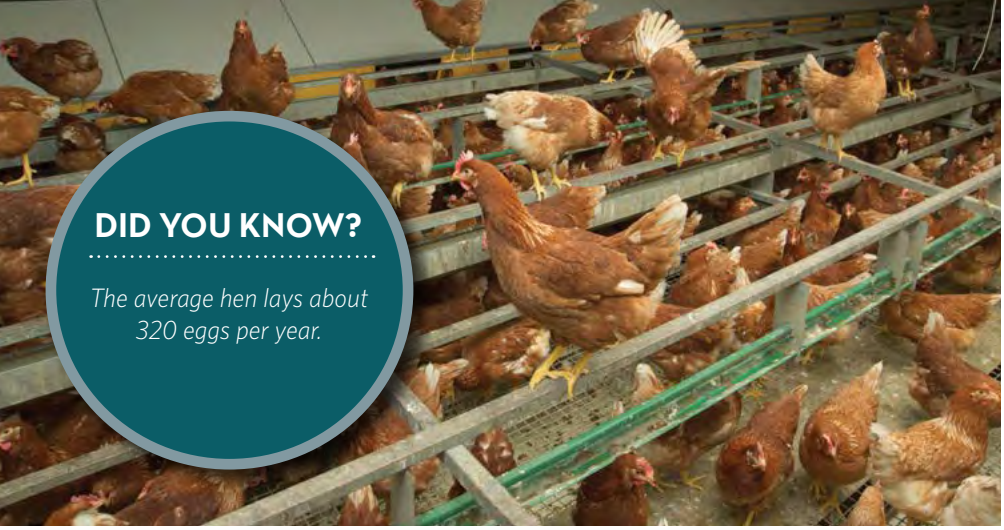
Farmer

Profile

Ivy Rachkewich

Third generation Saskatchewan chicken farmer Ivy Rachkewich has been around chickens all her life. Her husband is away a lot for work, so the mother of four is the main owner/operator of their family farm. She's also a part-time school librarian so she gets up early to make sure their 50,000 birds are fed, watered and cared for before she goes to school.

"When I'm walking through the barns I feel a sense of pride knowing that I am growing healthy, safe chickens that I feed my own kids, family and friends. I'm proud that my chickens have the best growing conditions where they don't have to compete for food or water or worry about the weather or predators," says Ivy.



DID YOU KNOW?

The average hen lays about 320 eggs per year.

Hens in an aviary

Hens in enriched housing

Laying hens

Canadian laying hens – the ones who lay the eggs we eat – live primarily in five different types of housing systems:

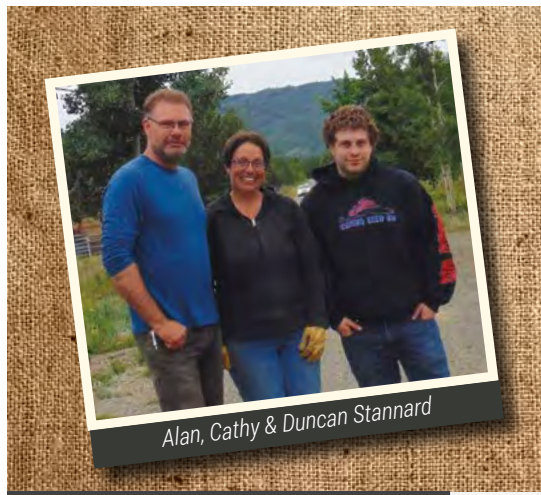
- **Enriched** – Hens are housed in smaller, more naturally sized groups with nest boxes, scratch pads, and perches, to allow them to exhibit natural behaviour. This will be the industry standard in Canada by 2036.
- **Free run** – Hens are raised inside barns, where they have access to the entire barn floor area but don't go outside. Hens are able to scratch and lay their eggs in nesting boxes.
- **Free range** – Hens are raised in barns, with access to outdoor areas when weather conditions allow. Hens are still able to scratch and lay their eggs in nesting boxes.
- **Aviary** – Hens are raised inside the barn, with several levels on which they perch, feed, and drink. They lay their eggs in nest boxes and can access the floor level to scratch and dust bathe.
- **Conventional** – Hens live in small groups with equal access to fresh food and water. They have mesh floors that allow the hens' waste to fall away, keeping the birds and eggs clean.

Check out **www.FarmFood360.ca** to see the five different types of hen housing, and to find out what the labels on the egg cartons mean.

FARM FOOD 360°

Canadian egg farmers began phasing out conventional housing systems in 2014. Any new barns being constructed, or existing barns being renovated, must follow the new housing standards. In some European countries, where consumer demand led to the end of conventional hen housing, farmers are now trying to address different animal welfare challenges: higher levels of dust and ammonia, cannibalism among the birds, and feather-pecking. Birds can be bullies too, with the stronger birds in a flock dominating the weaker ones by pecking them, and controlling access to food and water. This situation is where the expression "pecking order" originated.

Research is ongoing in Canada, and around the world, to find the best housing solutions for birds, farmers and consumers.



Alan, Cathy & Duncan Stannard

Farmer

Profile

Alan & Cathy Stannard

Alan and Cathy Stannard are the owners and operators of an egg farm outside Whitehorse, Yukon. With a passion for locally-sourced food, the couple purchased the 160-acre property in 2009. They initially grew hay and boarded horses, though also kept meat chickens and turkeys. Today, with the help of their son Duncan, they raise laying hens and provide eggs to local grocery stores.

Farming in northern regions can pose unique challenges, like high transportation costs and low winter temperatures, so Alan says they spent six years researching options before constructing a new egg barn. That barn – which was finished in 2017 – is equipped with a centrally controlled computer system designed to keep their birds healthy and comfortable, while being easy to use in all conditions.

Using eggs to fight disease?

Some fertile chicken eggs (the eggs you eat are not fertile) are specifically produced to help "hatch" vaccines in Canadian labs for people and animals. Here is a small sampling of the vaccine types produced using this method:

- **Eastern equine encephalitis**
- **Rabies**
- **Influenza**
- **Mumps**
- **Canine distemper**
- **Yellow fever**

What's a ruminant?

A ruminant is any hooved animal that digests its food in two steps: firstly by eating the raw material and regurgitating a semi-digested form known as cud, then eating the cud (a process called ruminating). Ruminants, which include cows, goats, sheep, llamas, bison, buffalo, elk, and deer, each have four compartments in their stomachs (named the rumen, reticulum, omasum, and abomasum) to help them digest their food.

DID YOU KNOW?

Mattresses are not just for people. Some farmers purchase mattresses, made from rubber and other materials, for their cattle to stand and lay down upon (sand and sawdust are also used in this way). Soft, comfortable bedding reduces stress on the animals. A more relaxed animal, after all, is a healthier and more productive animal.

Andrew & Laurie Johnson

Farmer

Profile

Andrew & Laurie Johnson

Four generations of commitment built Andrew and Laurie Johnson's farm in southeastern Saskatchewan. Together with Andrew's parents, the couple raise purebred Angus beef cattle and grow oats, barley and alfalfa. Their four children – the fifth generation – also help when not in school. For Andrew, his family's long connection to the land is what drives him. Working with animals, though, is a close second.

"The cattle and machinery can go, but the land stays. It's been at the heart of what we do for a long time as we continue to grow and develop it". (Andrew Johnson)

DID YOU KNOW?

Cattle come in different shapes and sizes depending on the breed.

Courtesy of FFC Saskatchewan

About beef cattle

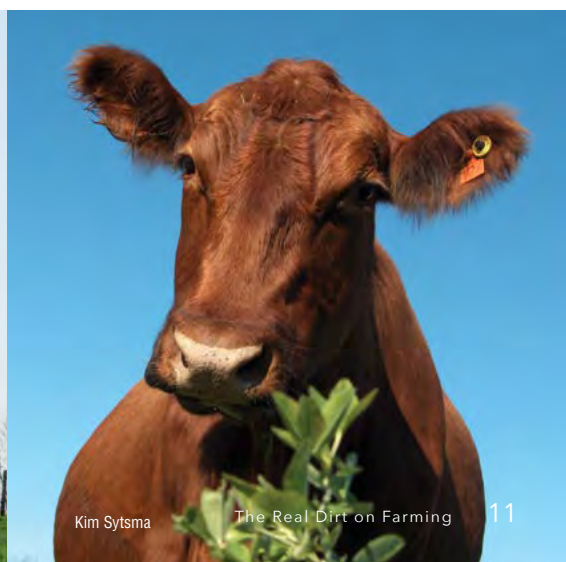
Beef cattle are specific breeds of cattle that are raised for meat. Beef cows and their calves typically live on pasture during spring, summer, and fall, with a diet composed mostly of grasses. They have a thick coat of hair, meaning that they can live comfortably outdoors year-round, as long as they have a good supply of feed and water, and adequate shelter. Canada's major beef cattle breeds include Aberdeen Angus, Charolais, Hereford, Simmental, Limousin, Maine-Anjou, Salers, Gelbvieh, and Shorthorn.

When they reach a weight of approximately 400 to 460 kilograms (about 900 to 1,000 pounds), beef cattle are usually moved from fields and ranges to penned yards or barns called feedlots. Feedlots are specially designed open pens or barns that allow for more controlled animal management, while providing full access to clean feed and water, shelter from the weather, good air flow, and safe, comfortable footings. Once in the feedlot, cattle are gradually transitioned from a diet of mainly forages (grasses and other plants) to a higher-energy diet of grains (like barley or corn), hay silage (chopped and naturally fermented plants) minerals, and hay. This diet contributes to marbled, higher quality grades of beef; marbling is the dispersion of fat within lean meat that helps to give beef flavour and tenderness.

What is "grass fed" beef?

You may see a "grass fed" label on some beef available for sale. This label means that the animal lived on a pasture for some or all of its life, until it reached market weight. In terms of nutritional value, the difference between grass and grain fed beef is small and makes little to no difference in the health benefits of one's overall diet. Generally speaking, beef from grass fed animals can be leaner by comparison, with some differences in Vitamin B, potassium and calcium. These differences, however, are minor. Other factors such as the type of beef cut, the cooking method, source of feed while on pasture, cattle breed and exercise can also contribute to variations in fat and nutrient content of the meat.[18]

Susan Sloane



Kim Sytsma

Dairy cows

Dairy breeds – cows raised to produce milk – are leaner with less muscling than beef breeds, as they put their energy into making milk. The six most common dairy breeds in Canada are Holstein, Jersey, Ayrshire, Brown Swiss, Guernsey, and Milking Shorthorn. Holsteins are the most popular milking cows in Canada, and are easily recognizable by their black and white coats.

Tim May

Jersey and Holstein dairy cows in a tie-stall barn.

A cow being milked in a milking parlour.

Canadian dairy cows live in one of three types of barns:

- **Free-stall** structures feature more open housing, where cows move around freely, and go to a central milking area two or three times a day to be milked. To keep the cows comfortable, many farmers have added large fans, backscratching stations and automated feed movers to ensure that cows always have access to feed.
- **Tie-stall** barns have an individual stall for each cow, with bedding and free access to food and water. The cows are milked by machines in their stalls. Milk flows through a pipeline in the barn directly into a milk tank.
- More and more farmers are using **robots** to help with milking. These barns resemble free-stall barns, except that the cows go any time at will to a station where they are milked and fed automatically. The station or "robot" tracks how many times a day each cow has been milked, and how much feed it has eaten.

No matter the barn system used, dairy cows have continuous access to food and fresh water. Some dairy farmers will pasture their cows in spring, summer, and fall. When it rains or is too hot, though, cows generally prefer the comfort of a cool, well-ventilated barn.

DID YOU KNOW?

The average dairy cow produces 8,830 litres of milk each year. [19]

Calf hutches

Have you ever driven past a farm and noticed calves living in what look like little igloos? These structures are called "hutches," and they allow farmers to individually monitor and care for calves when they are young, and their immune systems are not fully developed. Hutches also keep calves comfortable and protected, with farmers providing extra milk, feed, and bedding in cold weather. As the calves grow to become older and stronger, they move from the hutches to live in groups with other calves. Once they are old enough, these calves become members of the farm's milking herd.

Veal cattle in group housing

The real deal about veal

Veal cattle (bulls) are the male offspring of dairy cows. They are raised for meat since they cannot produce milk. There are two types of veal production in Canada:

- **Grain-fed** veal cattle eat a milk-based diet before being switched to grain and fibre. Grain-fed veal cattle are brought to market once they reach a weight of 285 to 323 kg.
- **Milk-fed** veal cattle are raised primarily on a milk-based diet, though some grain and fibre is also included. Milk-fed veal cattle are brought to market once they reach a weight of 200 to 225 kg. For comparison, a full-grown beef animal weighs approximately 540 kg at processing.

To prevent sickness and to promote health, veal cattle can be raised in individual stalls (i.e. hutches) during the first weeks of life. Afterwards, they move into group housing. As with any farm animal, veal health and welfare are top priorities, with research ongoing in all areas of management. The national *Code of Practice for the Care and Handling of Veal Cattle* has also been recently updated (see page 54 for more).

To take a virtual tour of two Canadian veal farms, visit **www.FarmFood360.ca**

FARM FOOD 360°

Farmer

Profile

Kirk Jackson

Kirk Jackson raises dairy cattle on the shores of the St. Lawrence River in Quebec. The farm was started by Kirk's parents in 1974, though he officially took over in 1998. Currently, he employs one full-time and one part-time employee to help manage their farm and animals. Kirk says his passion for farming is rooted in his love of animals and the land, and he likes to support other farmers by staying involved in provincial farming associations. His wife Jose is also a large animal veterinarian with her own practice, and helps take care of the animals.

"It's cliché to say, but farming really is about values," says Kirk. "You see the cycle of life, know you're producing food for people, and it's something we have a passion for".

Giant field marshmallows?

Sometimes in the summer, you'll see what look like giant marshmallows sitting in fields. They are actually hay bales containing plants such as clover, grass, and alfalfa. To make the bales, hay is cut and covered in white waterproof wrapping material. Hay is an important part of many animals' diets, and wrapping helps to keep it dry. If hay isn't as dry as it should be when it is baled, microorganisms within the hay will cause it to heat up, resulting in mold. In extreme cases, it can even become hot enough to start a fire.

Anna Haupt

Quick Fact

Did you know that the pupil of a goat's eye is rectangular, unlike that of humans and most animals, who have round pupils?

Animals get bullied too

Many terms we use in English come from agriculture. We have already mentioned the "pecking order," and "bullying" is another. Traditionally, milk-fed veal cattle were raised in individual stalls so that they could eat without the fear of bullying from other, bigger calves.

Today, thanks to technology and a more in-depth understanding of animal behaviour, many veal farmers now raise their animals in group pens where they can drink from an automated milk feeder or from troughs. The cattle in these systems are sorted according to size to help avoid "bullying" in the first place.

Sheep, goats and the dogs that help

Sheep can be raised either indoors or outside. Some are kept on pasture year-round, with farmers supplying them with hay and grain during the winter. Other shepherds prefer to keep flocks in the barn, so that they can pay close attention to lambs, and keep predators at bay. Most farms use a mix of both systems.

Guardian dogs for livestock play an important role on many Canadian sheep farms, by helping farmers with herding, and protecting the animals from predators such as coyotes. Donkeys and llamas also make effective guardian animals.

Similarly to cattle, goats can be raised for meat, or for milk production. Dairy goats live in barns, and have a regular milking routine, just like dairy cows. One goat produces about three litres of milk per day, which means it takes ten goats to produce the same amount of milk as one dairy cow. Goats raised for meat live on pasture fields, but still need protection from temperature extremes and predators.

For people with allergies or intolerances to cow's milk, goat milk can provide an excellent alternative. And the variety and availability of goat milk products is consistently growing, from milk and cheese, to ice cream. According to Statistics Canada, there are approximately 230,000 goats on almost 5,627 farms in Canada. Ontario has the most goat farms in the country, at 1,936, followed by British Columbia and Alberta.

A guardian dog

Pigs

Courtesy of FFC Saskatchewan

Generally speaking, pigs in Canada live in specially-designed barns with fans or "curtains" that can be opened to help control humidity and temperature. To keep the animals healthy, most barns have strict rules in place, called "biosecurity protocols", so that diseases are not brought into the barn (sicknesses can spread more easily through pigs and poultry than with certain other farm animals). Farmers therefore keep track of who is coming to their farm, and what they might be bringing with them – vehicles or equipment, for example. Anyone entering the barn may be asked to put on protective footwear and clean overalls. At some farms, you may even be asked to take a shower BEFORE and AFTER you enter the barn!

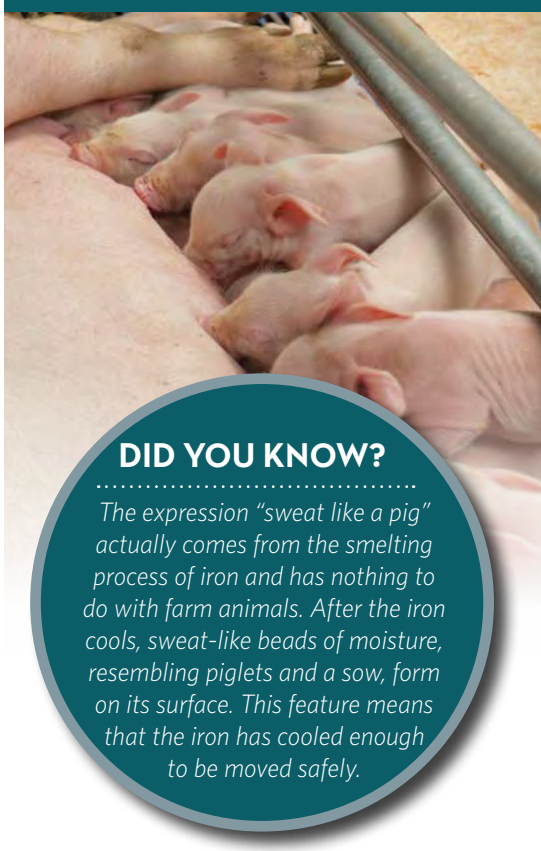
Sows are female pigs that usually birth eight to 12 piglets in a litter; they give birth – called "farrowing" – twice a year. Sows are put in special "farrowing pens" just before giving birth, and remain while they nurse their piglets. The pen's bars give each sow something to lean against when she lies down, and the piglets have a safe area, so the sow won't accidentally lie on top of them. The area where the piglets sleep can be kept warm with a heat lamp, or a heating pad. Some of these systems have even been designed to raise and lower as the sow stands up and lies down, giving the piglets a chance to jump to safety.

Pig housing types vary, with group housing barns becoming more popular. Farmers also provide things for pigs to play with (e.g. balls, tires, and hanging ropes), which help to improve animal welfare. Pigs can be raised indoors or outside, but since most breeds don't have fur or wool coats to keep them warm, Canada's cold winter weather makes it difficult for them to live outdoors all year long.

Farmers, researchers, and other welfare experts work continually to improve how farm animals are raised. Research in pig health, behaviour, and housing is ongoing, both in Canada and around the world.

Sweating like a pig? It's not possible!

Forget what you've heard about that expression. Pigs like to keep clean, and they can't sweat to cool off. Barns provide a clean, cool environment, and some even have sprinklers to keep the animals at a comfortable temperature.



DID YOU KNOW?

The expression "sweat like a pig" actually comes from the smelting process of iron and has nothing to do with farm animals. After the iron cools, sweat-like beads of moisture, resembling piglets and a sow, form on its surface. This feature means that the iron has cooled enough to be moved safely.

Nolan D'Eon

Farmer

Profile

Nolan D'Eon

When Nolan D'Eon retired from a lifetime of lobster and herring fishing two years ago, he became a full-time sea farmer. Now, his southwest Nova Scotia family business grows oysters that are marketed across North America. The Bay of Fundy tides are the highest in the world, so the oysters enjoy a 24/7 buffet of natural feed and grow quickly on the water's surface.

"I like the reaction of people who eat our product and say to us, 'wow, that was a good oyster!' Every box of oysters we sell has our tag on it, and it's a great feeling when somebody tells you what you're doing is good," says D'Eon.

Quick Fact

A tablespoon of cricket powder weighs about 10 grams, and contains seven grams of protein and 42 calories.

Courtesy of FFC Saskatchewan

Beyond traditional farm animals

Canada's growing ethnic communities, and a subsequent desire by consumers for more diverse food, means that farmers are also raising less traditional livestock, especially in Western Canada, where most of Canada's bison and elk live. These animals are mainly raised for meat, but antler velvet from elk and deer is also an ingredient in holistic medicines, which are produced in North America for export to Asian countries. Llamas and alpacas are raised for their wool, which is prized for its cashmere-like softness.

Rows of "cricket condos"

DID YOU KNOW?

Some farmers are now raising insects in Canada. Crickets, and other insect species, are a major source of protein in human and animal diets in some parts of the world. Over two billion people eat insect protein every day, from Mexico to Asia. Insect-based products, from baking flour to nutrition bars and pasta sauces, are appearing also in Canadian shops and restaurants. North America's largest cricket farm is located near Peterborough, Ontario, where the insects are raised in "cricket condos".

Fish farms

An open water fish farm

Aquaculture (fish farming) is the aquatic form of agriculture. Since Canada has the world's longest coastline, the world's largest freshwater system, and the world's largest tidal range, aquaculture is a natural choice.

In Canada, aquaculture generates $3.1 billion in economic activity and creates over 15,000 jobs throughout the food production value chain. Two-thirds of all workers are under the age of 35.[20] Most farmed fish are raised in natural water areas, but some are also grown in large tanks on inland fish farms. The water used in those tanks is recycled, and fish manure and unused nutrients can be collected and used in compost as fertilizer.

Canadian fish farmers raise more than a dozen types of fish and shellfish. The main three species of finfish raised are salmon, rainbow trout (steelhead), and arctic char. When it comes to shellfish, mussels and oysters are the most common types of shellfish farmed in Canada, while clams and scallops are also produced in smaller amounts. And some Canadian farmers have even begun raising shrimp.

Courtesy of BC salmon farmers

What about fur farming?

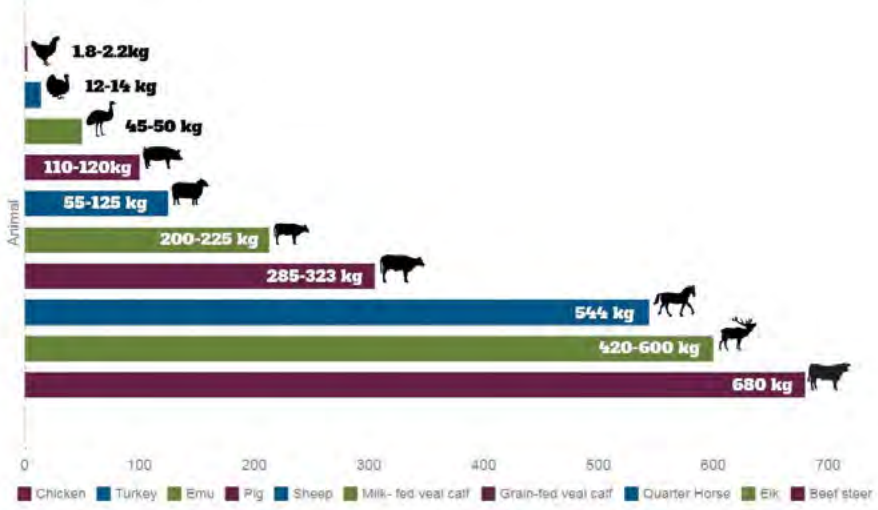
The fur trade has been part of Canada and its people since the beginning, having existed long before Canada was considered an independent country. Today, almost three million fur pelts are produced annually in this country, two million of those on farms. The most common animal raised in Canada for fur is mink; other farmed furs include fox and chinchilla. Other primary Canadian wild furs include muskrat, beaver, raccoon, coyote, and marten. Russia and Asian countries, specifically China, make up the primary export markets for Canadian fur.[21]

Farmers care for fur-bearing animals as they do other livestock. Just like any other farmed animal, there are both regulations and recommendations for raising them, including a recently updated *Code of Practice for the Care and Handling of Farmed Mink (and Farmed Fox)*.

Sustainability is also a big part of fur farming. Fur animals like mink eat leftovers from human food production – such as eggs, cheese, fish, and chicken – while used bedding (e.g. straw and wood shavings), and even the animal remains themselves, are composted and recycled as a natural fertilizer, or used in the production of biodiesel.

Tipping the scales

Curious about an animal's size? Here are the approximate weights of the average full-grown male (females weigh a bit less) for some common animal species:



Farmer

Profile

Catherine Moores

Catherine Moores never thought she'd end up running a mink farm in Newfoundland. In fact, she wasn't even supportive of animal agriculture when growing up. However, as part of her university studies she was required to work with livestock farmers – and that changed her perspective. Catherine says she realized that farmers have an appreciation for, and actually enjoy working with animals.

A few years later, she helped a fish processing company start a 10,000 breeder mink farm to make use of the high-quality fish by-products readily available from processing. Today she manages many aspects of the mink farm – including production planning and scheduling, sourcing ingredients for feed, planning diets, and mink breeding.

Catherine is an active board member of the Canada Mink Breeders Association. She is very passionate about promoting and educating the public – especially school-age children – about mink farming. She has also been involved in developing the national animal welfare standards, and certification program, for farmed mink.

"It's not just about feeding animals – the diversity in this job is incredible," she says. "Very few businesses can take you from the farm to the auction house, then to the fashion runway".

Horses

Horses have a special stomach that allows them to thrive on a diet of grasses, hay, oats, corn, or barley. If they must, they can also exist on drier plants, such as scrub brush and trees. Most horses in Canada are used for recreational purposes, but there are still many working horses on ranches that play a valuable role in helping to move and manage livestock.

Courtesy of FFC Saskatchewan

CHAPTER 3

Let's talk **crops**

Anna Haupt

Soybeans

Quick Fact

Barley, wheat, and oats have been grown in Canada for centuries, and remain significant crops to this day.

Canadian farms provide a diverse range of crops for domestic and international markets. There are literally hundreds of types of crops being grown in fields and greenhouses across the country – from grains and pulses to fruits and vegetables, as well as flowers and specialty crops. Here are some basics on the more common ones.

Barley

Courtesy of FFC Saskatchewan

Grains and oilseeds

Canada's farmers grow a wide and expanding variety of grains and oilseeds, which are crops used to make oil. Corn, soybeans, barley, oats, canola, and wheat (including durum, or the kind used for pasta) are the major ones. Soybeans are found mostly in Ontario, Québec, and Manitoba, although more farmers in Saskatchewan and the Maritimes are also growing these crops. Canola is grown mainly in Western Canada, as are barley, oats, and durum wheat. Other Canadian grains and oilseed crops include:

- Lentils
- Flaxseed
- Mustard
- Canary seed
- Chickpeas
- Sunflower seed
- Quinoa
- Peas

Canadian grain and oilseeds are consumed widely throughout the world. A significant portion of our oats, for example, are exported to the United States, while Italy imports a lot of Canadian durum wheat. We are also a leader in the production and export of mustard, as well as many, many other crops.

Courtesy of FFC Saskatchewan

Canola

DID YOU KNOW?

Canola was developed in the 1970s by Canadian plant scientists and is now the oil of choice for millions around the world. Canola grows particularly well on the prairies, where cool nights and hot days allow it to develop its unique fatty acid profile. Canola seeds are about 43 per cent oil. Low in saturated fat, the oil is used for cooking and baking at home, as well as in restaurants and food processing. It's also used in place of petroleum to make biodiesel (a more environmentally-friendly fuel) and green plastics. Canola meal (the part left over after the seeds are crushed and the oil extracted) is used in animal feed, pet food, and fertilizer.

Pulses and specialty crops

The eight major pulse crops and specialty crops grown in Canada are peas, lentils, beans, chickpeas, mustard, sunflowers, canary seed, and buckwheat. Canadian production of these crops has increased from about 1 million tonnes in the early 1990s, to 5.9 million tonnes in 2015. During that same time, Canada has become the world's largest exporter of lentils and peas, and one of the world's top five exporters of dry edible beans.[22]

Pulses are the dry, edible seeds of plants in the legume family – legumes are plants whose fruit is enclosed in a pod, like beans and peas. Pulse crops are very high in protein and fibre, and have virtually no fat. They also contain high levels of minerals like iron, zinc, and phosphorous, as well as folate and other B-vitamins. They have even been shown to lower bad types of cholesterol, and to reduce the risk of heart attack and stroke. Overall, pulses are an extremely healthy food choice.

Pulses also play a big role in sustainable food production. They are referred to as a "nitrogen-fixing crop" since they draw nitrogen from the air, and store it in their roots, meaning that farmers don't have to apply that type of fertilizer on their fields. Pulses then leave that nitrogen in the soil for the next crop, further reducing the amount of fertilizer farmers subsequently need to apply.

Canada is also a world leader in the production and export of mustard, with Saskatchewan responsible for 74 per cent of the country's production.[23] Farmers in that province grow 390,000 acres of the crop in three different types: yellow, brown, and oriental mustard.

Québec and Ontario produce a wide array of coloured beans, as well as white navy beans. Manitoba also produces beans, as well as peas and lentils. The largest producer of peas, lentils, and chickpeas is Saskatchewan, and the province has a small but growing bean industry. Alberta produces beans with the help of irrigation systems for watering them, as well as peas, lentils, and chickpeas.

Courtesy of Sask Mustard

Wanda Pleckham

Fruits and vegetables

More than 120 different fruit and vegetable crops are grown in Canada, on over 27,500 horticulture farms.[17] This range includes apples, pears, peaches, cherries, cranberries, blueberries, grapes, ginseng, garlic, onions, carrots, peppers, asparagus, lettuce, potatoes, cauliflower, cucumbers, cabbage, broccoli, herbs, and so much more.

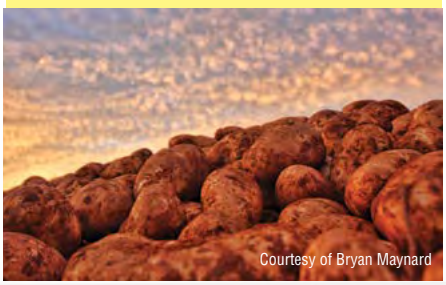
Farmers in Ontario, Québec, and British Columbia are responsible for 90 per cent of Canada's total vegetable production, and 65.6 per cent of the country's total fruit production area.[18]

DID YOU KNOW?

Archeological finds tell us that farmers have been growing pulses (beans, lentils, and peas) for almost 10,000 years. [24]

Quick Fact

Prince Edward Island produced 1.17 billion kilograms of potatoes in 2016. Every year, the small maritime province accounts for approximately 25 per cent of Canada's potato production.



Courtesy of Bryan Maynard

Mushrooms: a year-round Canadian crop

Unlike many Canadian crops, mushrooms, an edible fungus, are grown on Canadian farms year-round. Over 200 million pounds of mushrooms are produced annually on more than 100 Canadian farms; approximately 60 of those farms supply Canada's grocers. Canada's most popular mushroom is the white button, followed by brown and Portobello mushrooms. The average Canadian eats about 1.6 kilograms (3.5 pounds) of mushrooms every year.[25] Oh, and the little black specks you sometimes see on mushrooms at the store? That's peat moss from the beds where the mushrooms grow – just rinse or wipe it off before eating.

Kyle & Bryan Maynard

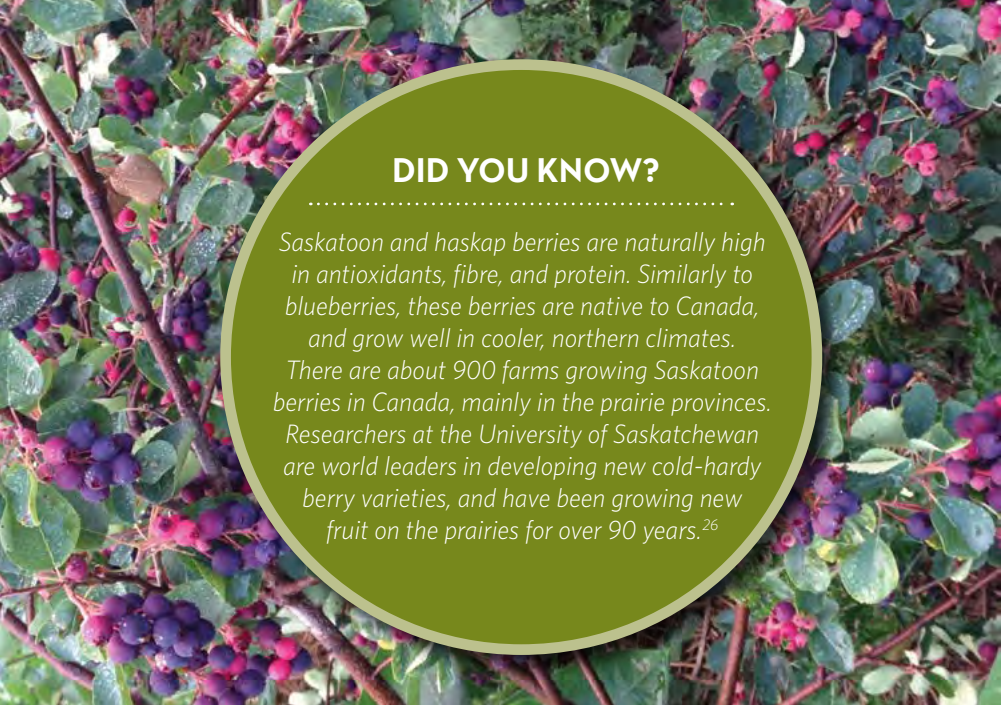
Farmer

Profile

Bryan & Kyle Maynard

Bryan Maynard is a fifth generation farmer who farms together with his brother Kyle in Prince Edward Island. Together they grow potatoes and grain on a farm they bought from their grandfather in 2015. The brothers supply potato processor Cavendish Farms, so their focus is on growing high quality, high yielding potatoes – which they do by having a separate land management plan for each field they own or rent.

"It's a really good way to ensure that we're using the land sustainably," says Bryan, who has been passionate about farming since he was young. "Farming's your life, not a job. It chose me, really".



DID YOU KNOW?

Saskatoon and haskap berries are naturally high in antioxidants, fibre, and protein. Similarly to blueberries, these berries are native to Canada, and grow well in cooler, northern climates. There are about 900 farms growing Saskatoon berries in Canada, mainly in the prairie provinces. Researchers at the University of Saskatchewan are world leaders in developing new cold-hardy berry varieties, and have been growing new fruit on the prairies for over 90 years.[26]

Greenhouses bloom year-round

More and more of the fresh vegetables – tomatoes, peppers, cucumbers and lettuce in particular – and flowers that beautify Canadian homes are grown in greenhouses. Demand for year-round fresh produce is driving new greenhouse construction. By 2016, Canada had over 250 million square feet of greenhouse space, also called "production under glass". More than half of that is for greenhouse veggies.

Ontario has more greenhouses than any other province, followed by British Columbia and Québec, and has the largest greenhouse production sector in all of North America. Over 70 per cent of Ontario's greenhouse vegetable crops are exported to the United States.[27]

Vegetable greenhouses primarily grow peppers, cucumbers, tomatoes, and lettuce, but some growers are expanding into other types of produce too, like strawberries. These local greenhouse strawberries are juicy and sweet – and on the shelf within only three days of being harvested.

There are more than 1,900 flower growers across Canada. Tulips, gerbera, lilies, daisies, daffodils, and roses are among the most frequently produced cut flowers in Canada. Almost 99 per cent of Canada's floral industry exports are to the United States.

Flowers growing in a greenhouse

Ron & Ray Van Marrewyk

Farmer

Profile

Ron & Ray Van Marrewyk

Brothers Ron and Ray Van Marrewyk grew up working in their family's greenhouse. Now, they're carrying on a farming tradition that started in the Netherlands four generations ago. They bought Westcoast Greenhouses Ltd. from their father in 2006, and are currently growing 53 acres of peppers and cucumbers near Vancouver, British Columbia. Ron is active with his provincial growers' association, and manages the farm's day to day business operations. Ray is in charge of the books and large projects. The brothers like to stay active in their community through fundraisers and other events, and enjoy learning about and promoting new ways of sustainably growing safe, healthy food.

Quick Fact

High-tech recirculation systems help modern greenhouses to conserve and continually reuse and recycle water.

DID YOU KNOW?

Greenhouses use good bugs, like bumblebees and ladybugs, to pollinate plants and control harmful insects.

DID YOU KNOW?

Carrots come in many colours. They're not just orange, but are also grown in purple, yellow and white varieties.

New Canadians = **new crops**

Okra and Asian eggplant are among Canada's newest locally grown vegetable crops. Farmers are now growing crops that are popular with new Canadians, particularly from South East Asia, Africa, and the Caribbean. Immigrants to Canada also bring with them distinct floral preferences, though some preferred flowers are not yet available here.

According to Ontario's Vineland Research and Innovation Centre, Toronto-area consumers of South Asian origin alone spend approximately $60 million annually on cut and potted flowers – and Canadian flower growers are taking notice of these consumers' preferences. Canadian flower growers brought the first locally grown jasmine, a flower in high demand for its fragrance, to market in 2017.[28]

Unripened heirloom tomatoes

Looking to the past for heritage varieties

Sometimes what is old is new again. There are farmers growing vegetable varieties that were common 50 or 100 years ago, but are no longer used in modern food production. These types are called "heirloom" or "heritage" varieties, and are popular with chefs and food lovers alike for their unique flavours. Heirloom tomatoes, for example, have an irregular shape, often a ribbed or striped skin, and come in a variety of colours. They're so popular that they're now available in major Canadian supermarkets alongside regular tomato varieties.

Pumpkins

A season for everything

We could not always buy strawberries, cherries, and sweet corn at the grocery store year-round. Every crop is ready for harvest – and eating – at a different time of year. Asparagus, for example, is one of the earliest-harvested vegetable crops in the spring. Summer means cherries, peaches, garlic, and potatoes, and fall brings apples, pumpkins, squash, carrots, onions, and much more. Refrigeration, new technology, and faster transport all mean more fresh fruit and vegetable choices for consumers at the grocery store all year long. You can now also get fresh berries outside of the traditional picking season. Berry farms are now growing day-neutral (ever-bearing) strawberries and fall-bearing raspberries, which means we can get locally grown fruit longer.

Raising a glass to wines, ciders and beer

A Canadian vineyard

Fruits such as grapes and apples aren't just consumed as food; they also make excellent beverages. Canada's main wine regions are found in Ontario, British Columbia, Québec, and Nova Scotia, where more than 670 grape wineries employ over 37,000 Canadians.[29] And Canadians like what they produce – we enjoy over a billion glasses of Canadian wine each year![30]

Long popular in the UK and other countries, the cider craze is captivating Canadians too. Many of Canada's new craft cideries are using North American apple varieties like McIntosh, Ida Red, Spy, Gala, Paula Red, and Russet to make their ciders. Some cideries are also working to bring back traditional cider apple varieties, those that have largely been forgotten and been replaced with sweeter varieties better suited to eating.

Craft beer is also popular, and becoming even more so. There are farmers who grow specialty grains and different hop varieties to help brewers make very unique types of beer. Many of these are locally made in small breweries. In 2016, Statistics Canada recorded 775 breweries across the country, more than ever before.[31]

Quick Fact

Cider is a fermented alcoholic drink made from apple or pear juice. Pear cider is often called "perry".

Stephanie Maynard & Philippe Quinn with their children

Farmer

Profile

Philippe Quinn & Stephanie Maynard

Philippe Quinn's great-great-great grandfather arrived in Eastern Canada from Ireland in 1843 to begin a new life, starting a small farm to feed his family. Today, Phil, together with wife Stephanie Maynard, is the sixth generation to run the family farm near Montreal, growing asparagus, berries, sweet corn, apples, garden vegetables, pumpkins, squash and Christmas trees.

While many local farms were sold for development, Philippe and Stephanie embraced the local food movement, selling produce and value-added local food products directly to the growing urban population nearby through their farm store, you-pick opportunities, and local markets. That's complemented by a range of agri-tourism activities that encourage families to come out for a "day at the farm".

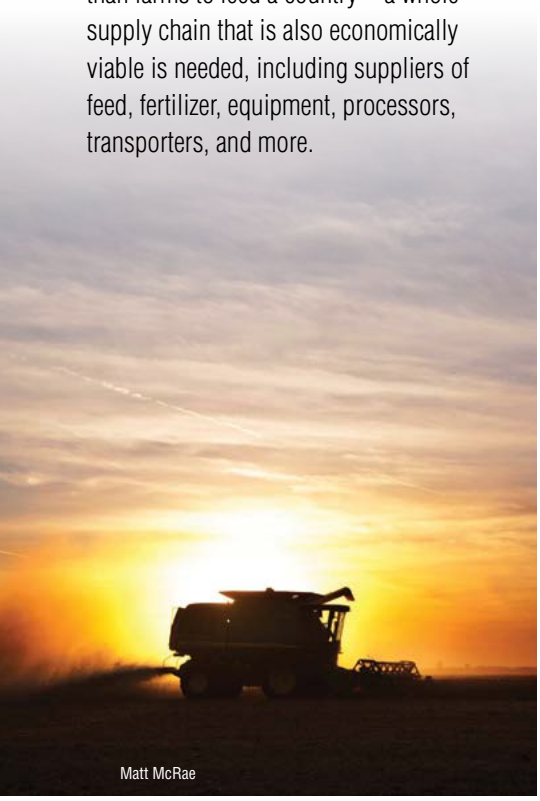
"We firmly believe that farms must be profitable to be sustainable and that simply can't be left to chance or just counting on good weather," says Phil, summing up their approach to ensuring a seventh generation on the family farm.

CHAPTER 4

Food security, affordability and the economics of farming

The economics of food

Farming is a way of life for Canada's farmers. It's also essential to food security, which means ensuring our country has enough to eat. But farms are also businesses, and they must be able to make money if they want to keep producing food. And it takes more than farms to feed a country – a whole supply chain that is also economically viable is needed, including suppliers of feed, fertilizer, equipment, processors, transporters, and more.



Matt McRae

It takes money to make money

As with any business, there are many costs that go into producing food. Farmers need electricity, equipment, water, fertilizer, seeds, and people to help them raise livestock and poultry, and grow crops, whether outside (in the field) or inside a greenhouse. All these items cost money. On average, Canadian farmers spend 83 cents of every dollar they earn on operating expenses to grow food.[32] And as the price of fuel, fertilizer, labour, and other inputs continue to increase, farmers have to become ever more productive and efficient to stay in business. Even though input costs increase, it doesn't mean that the prices they get for their products go up at the same rate.

A food policy roadmap for Canadians

Affordability and availability of food for all Canadians is a priority for farmers and consumers. In 2017, the Canadian government began developing a national food policy containing both long-term objectives and short-term actions on issues related to the production, processing, distribution, and consumption of food.[33]

Anna Haupt

Courtesy of Sask Mustard

DID YOU KNOW?

The mission of an organization called Growing North is to grow fresh food in the Arctic. They've created a specially-designed greenhouse that can withstand the colder climate and provide low cost, locally grown produce in Nunavut.[35]

Food choices and accessibility

In general, Canadians are lucky to have a wide choice when it comes to the kinds of foods available to buy, and have the freedom and opportunity to support different types of farming or production systems. Regardless of the type of diet Canadians choose to follow, or the amounts of money they have available to spend on eating, there are farmers willing and able to grow food for them.

For some Canadians, though, the problem is one of accessibility and/or affordability. "Food deserts" are neighbourhoods where residents have little or no access to grocers and restaurants that provide healthy and affordable foods.[34] In Northern Canada in particular, fresh food is scarce and the high cost of transporting food into the region makes many products, particularly healthy food choices, very expensive.

Mental health on the farm

As with any other job or business, farming can be stressful. The weather; pests and diseases affecting crops and livestock; being able to harvest a quality crop; managing employees; and keeping a farm business running successfully, can all put pressure on farmers. That's why it's important for farmers to take a break, recharge, and take care of themselves too – not just their land and livestock. Dairy farmers, for example, can often go days or months without a day off. On occasion, they will hire a person called a "relief milker" to milk and look after their cows, if they need to take a few days off, and if they don't have other employees to help.

Food Freedom Day

In Canada, we mark Food Freedom Day in early February, this being the day that the average Canadian has earned enough income to pay his or her individual grocery bill for the whole year. Canadians on average spend only about $0.10 of every dollar on food.[36] For comparison, the Portuguese spend 17.3 per cent of their income on food, the Russians 28 per cent, and Nigerians an astounding 56.4 per cent.[37]

Myrna Grahn

Farmer

Profile

Myrna Grahn

Professional Home Economist Myrna Grahn is manager of the Farm and Food Discovery Centre (FFDC) at the University of Manitoba's Glenlea Research Station and farm near Winnipeg.

Established in 2011, FFDC's large exhibit space includes displays about grain, dairy, egg, chicken, beef and pork production from farm to fork. Curriculum-based school field trips for grades 3 – 11 cover topics like research, biosecurity, environment, food processing, and animal care, and let students cook their own tasty foods to sample.

"Through tours, displays and presentations, the centre helps connect students and the general public to where our food comes from," says Myrna.

What does "organic food" mean?

Generally speaking, foods labelled as organic are grown or produced without the use of substances such as synthetic (man-made) fertilizers or pesticides, genetically modified organisms, growth hormones, or medications like antibiotics. Farmers growing organic food frequently have to adhere to production standards intended to improve environmental sustainability. This can include a focus on crop rotation, humane livestock management practices, and traceability from farm to fork.

All Canadian products bearing the Canada Organic logo are certified by an independent auditor who verifies that the farm meets the Canadian Organic standard. The Canada Organic standard specifies many production requirements, such as which crop protection products may be used, and minimum space requirements for livestock. For imported products to be sold labelled as organic, they must meet "equivalency arrangements" by which the regulations and certification process of another country are deemed consistent with Canada's.[38]

Farmers and the production techniques they use are very diverse, and organic and conventional farmers have a lot in common – some farmers even produce both conventional and organic crops. Sustainable production is key, with both types of farming focusing on a wide variety of production techniques, including crop rotation, improving soil health, building local and export markets, and using natural pest control methods. Organic farmers can in fact use naturally derived pesticides to control pests. Just as with crop protection products used by conventional farmers, however, these substances must be approved by the Pest Management Regulatory Agency, which is part of Health Canada.


Tim May

Belted Galloway beef cattle

Farming isn't easy, and organic farming poses some unique challenges as some tools available to other farmers are not available to Canada's certified organic producers. Organic techniques also tend to be more labour intensive. Other input costs (e.g. fertilizers, seeds) may be lower, though, and due to increasing demand for organic foods – plus supply shortages – farmers generally earn more for their products.

There's a growing market for organic food in Canada. Organic retail sales in Canada are worth $4.7 billion annually, growing at 13.6 per cent every year since 2007.[39] And Canadian farmers are working hard to keep up: Canada had 4,289 registered organic farms in 2016.[40] Québec has the highest number of organic farms in Canada, growing from 1,037 such farms in 2011, to 1,268 in 2016.[41]

This logo indicates a product meets Canada's organic standard.

Are organic foods healthier or safer than regular food?

Organically and conventionally produced foods are virtually the same.[42] Researchers across the globe have compared organic and conventional foods for nutritional differences, but consistent answers have not been found. Some studies have shown higher levels of some nutrients in organic food, while others have found higher levels of nutrients in food produced using conventional methods.[43] All agricultural food products – meat, eggs, dairy, fruits, vegetables, and others – are rich in nutrients and part of *Canada's Food Guide*.

Whether organically or conventionally produced, all food in Canada must meet the same food safety standards. While pesticide residues can be found on food from both production systems, federal regulations limit residues to levels far below the amount that could potentially pose a health concern.[44] Regardless of how the food you choose has been grown, you can be confident that it is a good choice.

Food labels and claims – what do they really mean?

The beauty of the Canadian food system is the amazing variety of food options from which to choose. Food labels and marketing, however, can be misleading at times. It's up to you to decide what you want to buy, but sometimes it pays to do a little research when it comes to food labels and what some of them mean.
For example:

1. **What is "natural" meat?**
   All meat is natural since it comes from animals and is not manufactured. According to government definitions, the only meat that can legally be labelled "natural" is meat raised without ANY human intervention of any kind. This rule means that only meat from animals living in the wild, like deer, moose, bear, and other wild game, may properly be referred to as "natural". Companies can, however, use the term "natural" to describe flavour.[45]

2. **What about meat free of hormones?**
   There is no such thing as hormone-free meat. All animals and plants produce hormones naturally, so all meat, including that from organically raised animals, will contain naturally-occurring hormone levels. Additionally, the use of synthetic hormones is only permitted in some beef production (see page 31 for more), and cannot be used to raise any other type of livestock.

3. **What does the term "raised without the use of antibiotics" mean?**
   In order to display the term "raised without the use of antibiotics", an animal must not have received any antibiotics at any time. In addition, no antibiotics can be administered to the mother of the animal. Any animal that receives antibiotics to manage a health issue will not be eligible to be sold with the term 'raised without the use of antibiotics'.

4. **What does gluten-free mean?**
   Gluten is a protein that's found in wheat, barley, rye, triticale, and foods made with these grains. Gluten must be avoided by people who have celiac disease (about one per cent of Canadians), and those with gluten sensitivity (six per cent), but gluten is not problematic for the rest of the population. In grocery stores, products labelled "gluten-free" are not any healthier; they are just made with ingredients that don't include gluten.[46]


Courtesy of Grain Farmers of Ontario

Eating locally

The idea of buying and eating locally produced food is very popular in Canada. The definition of "local" varies, however, and can refer to a region, province, or even the entire country.

The local food movement has resulted in more farmers' markets, local food stores, and food hubs. There are also many different "buy local" campaigns encouraging Canadians to support farmers in their own areas – by eating the fruits, vegetables, meat, cheese and yogurt, jams, honeys, and baked goods they've produced.

The Canadian climate means, though, that food cannot be grown year-round, and that there are many foods we enjoy eating that can't be grown in Canada at all – coffee, cocoa, and tropical fruits, for example.

We also grow much more of certain types of foods than we could possibly eat here at home – think of lentils, peas, chickpeas, edible beans, canola, soybeans, and wheat – so we export many of these crops to countries around the world, where they're an important part of peoples' diets.

Radishes

DID YOU KNOW?

In North America and Oceania alone, over 5.8 million tons of roots and tubers (beets, carrots, potatoes, etc.) are wasted. That's just over one billion bags of potatoes! [47]

Waste not

According to the United Nations, one-third of all food produced is lost or wasted each year. In Canada, an estimated $31 billion worth of food is wasted annually, and almost half of such loss occurs once food reaches the consumer. In developing countries, about 40 per cent of losses take place after harvest, and during processing.[48] In Africa, for example, innovations such as village-level, solar-powered cold storage for perishable foods can help small farmers reduce harvest waste and losses, and improve their market access.

Investing in strategies to help prevent food wastage, from the kitchen right through to the biggest food producers, is something we all need to support.

That need includes finding new uses for waste products, such as using coffee grounds to make recyclable single-serve coffee pods, or turning grape pomace (the skins left after ice wine is made) into cancer-fighting syrup which is high in antioxidants.

Quick Fact

Every year, consumers in more developed countries waste almost as much food (222 million tonnes) as the entire net food production of sub-Saharan Africa (230 million tonnes).[49]

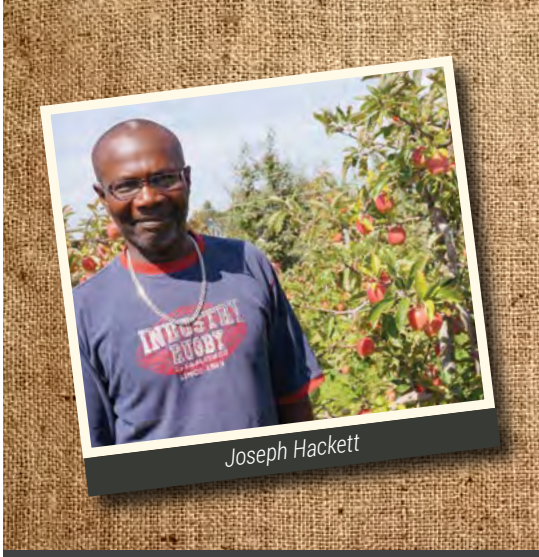
Seasonal workers planting onions

Farm labour

As with many other types of businesses, farmers often need to hire additional people besides family members to help keep things running. Technology and equipment play a large role, but people are still the most important component of every farm. Mother Nature can be a tough boss too – cows have to be milked every day, and when a fruit or vegetable crop is ripe, it must be harvested right away, or it will lose its taste and quality, and could rot in the field or on the vine.

Fruit and vegetable farmers particularly rely on many people to help them plant, manage, and harvest their crops; there is just no machine yet capable of harvesting delicate fruits like strawberries, raspberries, or peaches without damaging them.

Many Canadian farmers – who offer many seasonal positions but do not have enough workers to fill them – rely on workers from countries where there's a shortage of employment. That's why the Seasonal Agricultural Workers' Program (SAWP) was established in 1966 to bring workers from Mexico, Jamaica, and Eastern Caribbean countries, to work on Canadian fruit and vegetable farms. Many of these workers have been coming to the same farms for years, and the money they earn helps take care of their families. In some cases, their children also receive an education they wouldn't have been able to afford otherwise. Workers in the program have the same rights and responsibilities as Canadians, and there are strict rules imposed by both the worker's home country and the Canadian government that both farmers and workers have to follow.



Seasonal worker

Profile

Joseph Hackett

Joseph Hackett has been working seasonally in Canada for 14 years at Wilmot Orchards, a family-owned apple and blueberry farm near Toronto. He arrives with other workers to the farm from his native Barbados and from Mexico in early April and returns home to his wife, children and grandchildren in November. Even though he misses his family, he looks forward to returning to Canada each year.

Working in Canada has been a great experience for Hackett and he is a strong proponent in giving back to his host country. At home, he is a long-time volunteer with the Barbados Red Cross and with a disaster relief organization. In Ontario, he's now second vice president of the local Lions Club and, along with four others from his farm, has been participating annually in the Ride to Conquer Cancer (a 220 km bike ride from Toronto to Niagara). Collectively, they have raised more than $110,000 for cancer research in the years they've been doing it. "I'm not one to sit around," said Hackett. "I love doing service work".

Approximately 20,000 people come to work in Canada each year through the seasonal worker program. To learn more about the program, visit **www.farmsontario.ca.**

More than just a job

Working in agriculture goes far beyond growing crops or raising livestock. One in eight jobs in Canada is linked to agriculture.[50] In Ontario alone, the demand for graduates from the Ontario Agricultural College exceeds supply – there are approximately **four jobs available for every OAC graduate** entering the agri-food sector.[51] From communications, engineering, and economics, to food and animal sciences, tourism, and the environment, the job possibilities are endless.

CHAPTER 5

Safe food starts on the farm

Food and water are basic necessities for life. Access to safe, quality, affordable food choices is something most Canadians don't have to think about very often. Grocery stores and farmers' markets are never empty, and we rarely worry about the safety of our food because we expect it to be safe. Regardless, a food safety scare is alarming to everyone, including farmers and those responsible for getting food to your table.

Let's look at what happens behind the scenes to get safe food from Canadian farms to dinner plates.

Canada is respected around the world for the quality and safety of our food. Regulations and safety systems throughout the food production process are the checks and balances that ensure safe food starts on the farm.

Food and farming organizations, farmers, and government have developed best management practices and protocols like HACCP (Hazard Analysis Critical Control Point) to help farmers produce safe food, while minimizing risks and problems.

On-farm food safety programs identify critical points where food safety could be at risk, such as when a new animal is brought onto the farm, or when fresh produce is packed into bins. These same principles are also applied throughout the food chain, including at the mills that prepare animal feed, at food processing facilities, and even at your local grocery store.

Participating in these programs means farmers evaluate their practices, keeping records of what is done on the farm and having those records – and their farms – verified regularly by a third party. Part of the program includes what to do if problems do arise, and how to take steps to confine problems, for example.

While each program is different depending on farm type, the principles of producing safe food are the same.

Inspector checking meat quality

Cathy & Cal Penner with their children Nikki & Eric

Farmer

Profile

Cal & Cathy Penner

Second generation farmers Cal and Cathy Penner raise pigs and grow soybeans, wheat and canola in southern Manitoba. They farm with their son Eric, as well as Cal's parents Vern and Martha Penner. The family is particularly interested in genetics, and harness their interest to produce higher quality and healthier pigs. They are also involved in helping their community, and in 2016, were named "Farm Family of the Year" by their local agricultural organization.

"The health and well-being of the hogs is first and foremost to us. We have a passion for farming, the animals, and the challenges owning your own business can bring". (Cal Penner)

A milk truck picking up milk from a dairy farm

Theo Elshof


Michelle Jaelin

What about hormones?

Hormones occur naturally in humans, plants and animals. Here are some important facts and examples for you to consider.

1. Are poultry or pigs raised using hormones?

One of the biggest myths is about the use of hormones in poultry and pigs. No chickens, turkeys, egg-laying hens or pigs are ever fed hormones in Canada or the United States. Today's animals grow more efficiently and quickly thanks to better genetics and nutrition. Using added hormones would cause birds to grow more quickly than would be healthy for them.[52]

2. Are there hormones used in milk production?

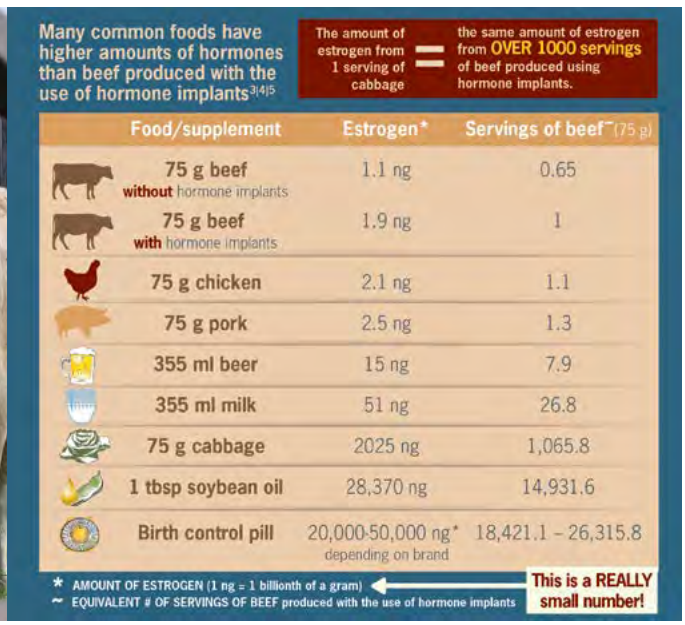
Not in Canada. Canadian dairy farmers use genetics, better nutrition, and even robotic milkers – which let each cow decide when it wants to be milked – to increase milk production. In some countries, farmers can use a hormone that occurs naturally in the pituitary glands (a part of the brain) of all cattle to boost cows' milk production. This product is not licensed for use in Canada.

3. Why are hormones sometimes used in raising beef cattle?

Hormones occur naturally in all animals, people and plants – including beef cattle. There are, however, both natural and synthetic versions of hormones approved by Health Canada for use in beef, and some beef farmers choose to use them. You may be wondering why they do that, and what that means for you and the beef you eat. Here's the scoop:

- Hormones help cattle convert the food they eat into muscle more quickly and easily, meaning that they will develop more lean meat instead of fat. This means fewer resources are needed to raise each animal.
- A growth-promoting hormone implant can be given to cattle in the form of a pellet that goes under the skin. Over the next 100 to 120 days, the pellet slowly dissolves and releases the hormone.[53]
- All beef cattle, regardless of whether a hormone implant is used, produce meat with similar levels of hormones. Hormone levels are measured in nanograms (one nanogram is a very tiny amount: one billionth of a gram). The estrogen in a serving of beef is very low, especially when compared to the amounts of hormones naturally produced in the human body.
- Worldwide, the use of hormones in cattle as prescribed has been confirmed as safe and as having no impact on human health by agencies including Health Canada, the WHO and the Food and Agriculture Organization of the United Nations.[54]
- Hormone levels from beef cattle that have received growth promoters is virtually the same as the level in beef from cattle not given growth promoters. There is more variation in the hormone levels of male versus female beef cattle than between treated and untreated animals.[55]


David Ennis & Leith Symon Ennis



Courtesy of Alberta Beef

Jennifer Huberts

Let's talk about antibiotics and antimicrobial resistance

Keeping animals healthy is a top priority for farmers and veterinarians.

A serious health problem can cause animals to suffer, and in some cases, can even wipe out all of the livestock or poultry on a farm – or even in a whole industry. Farmers use many strategies and tools to keep animals healthy – including a good environment, nutrition, antibiotics and vaccines.

Antimicrobials are medications that fight bacterial infections in humans and animals, and antibiotics are just one type of antimicrobial. Resistance – the state in which an antimicrobial no longer effectively fights a particular disease-causing organism – makes it harder to fight bacterial infections.

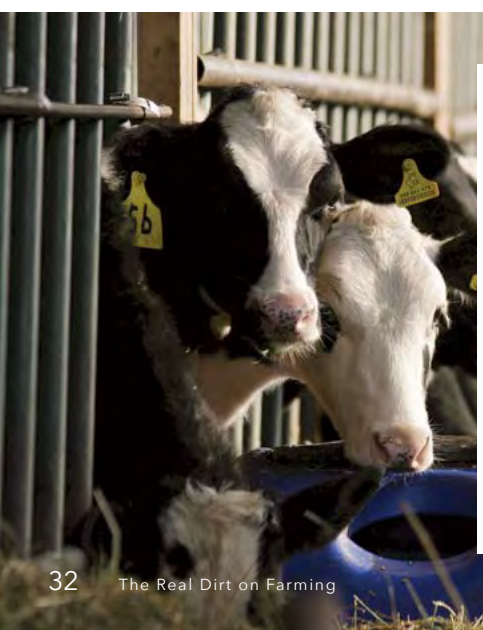
According to Health Canada, potential sources of antimicrobial resistance include:[56]

- **Using and misusing/overusing** antibiotics in human and animal medicine;
- **Misusing antibacterial cleaning products** like household disinfectants, antiseptics, or personal hygiene products with antibacterial properties;
- **Environmental contamination** through waste water and other effluents caused by the use of antimicrobials in human and animal settings.[57]

Antimicrobials are grouped into four categories based on their corresponding uses in human medicine, from Category I drugs of "very high importance" to "low importance" (Category IV) drugs.[58] These categories account for whether an antimicrobial is considered a preferred option in treating human sickness, as well as how many alternate antimicrobials are available.

At present, most antimicrobials can only be used on-farm with a veterinary prescription, similar to a prescription your own physician might provide. Health Canada's Veterinary Drug Directorate is also implementing new regulations, and strengthening existing rules and policies, for antibiotic use for farm animals. As of December 1, 2018, antibiotics in categories I, II and III may only be used with a veterinary prescription, while Category IV drugs can continue to be used over the counter, as they are not considered important to human health. Any antimicrobial product label claiming to promote more efficient animal production will also come to an end.

Antibiotics are not the only tool used to keep animals healthy. As in human medicine, vaccinations also make a big difference, as do probiotics and other immune system boosters. Research into both disease treatment and prevention alternatives is always ongoing.

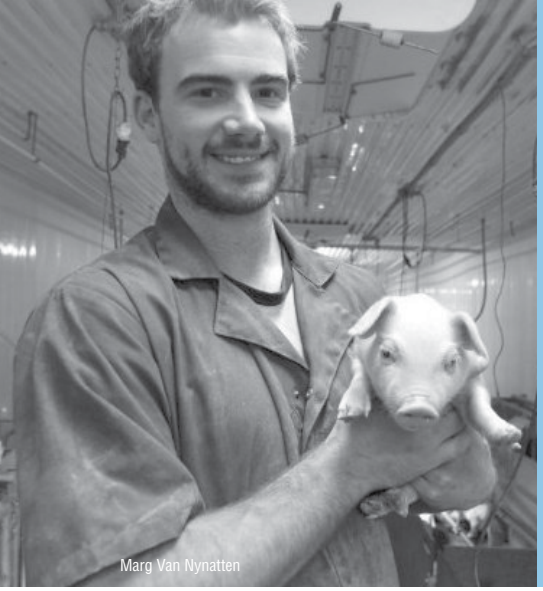


Research
Profile

Dr. Bonnie Mallard

University of Guelph professor Dr. Bonnie Mallard has developed and patented a testing method – called High Immune Response technology – to identify animals with natural immunity and better disease resistance. The goal of Dr. Mallard's research is to select naturally healthier animals to further reduce antibiotic use in livestock production. Dr. Mallard's technology is already being used in dairy cattle research, and is now being developed for beef cattle and pigs.[59]

Dr. Bonnie Mallard


Marg Van Nynatten

Resistance vs Residues – what's the difference?

Residues are traces of medication left over in the meat or milk of an animal that has been treated with a medication. Every animal health product (e.g. antimicrobials, vaccines, supplements) has a withdrawal period, or a specific amount of time a farmer must wait before sending a treated animal or its products to market. This procedure ensures that no residues are in your food. Resistance, on the other hand, is not linked to residues at all; it means that a particular antimicrobial is becoming less effective at treating or preventing disease.

Antibiotics are a go-to tool in modern medicine, so it is important they are used responsibly to ensure that we can continue to treat sick humans and animals successfully. Resistance is a complex topic, and critically important research into resistance is also ongoing in both human and animal medicine.

Animal and human health issues in the spotlight

Animal and human diseases like influenza, *Escherichia coli (E. coli)* and bovine spongiform encephalopathy (mad cow disease) are things farmers take very seriously. The food and farming sector has invested millions of dollars into research, prevention, and emergency preparedness, and continues to do so to ensure that Canadians have the safest food and the healthiest animals possible. Public health agencies and groups specializing in animal disease surveillance are always tracking, and are on the watch for diseases. This is a key reason why you must always report contact with farms and farm animals when returning to Canada from another country.

Diseases are always emerging. Here are three that have been making headlines in the last few years:

1 Influenza

Influenza – commonly called the flu – makes many Canadians sick every year. Birds and pigs can also be affected by what the media calls "bird flu" or "swine flu". You can't catch bird or swine flu from eating pork, eggs, chicken, or turkey. You should always, however, follow safe food handling practices, and cook meats thoroughly.

There are particularly aggressive strains of bird or avian flu, such as H5N1 and H7N9, which can affect humans. However, people must be in very close contact with live birds that are sick, in order to become infected. In some parts of Asia, for example, where humans first contracted these strains of bird flu, it's common for people to live in close contact with their chickens, and to buy live chickens at markets. However, even under those circumstances, it is *extremely* rare to contract bird flu.

2 *(E. coli)*

The digestive systems of all animals and humans are home to billions of essential bacteria, including *E. coli.* Most don't make healthy people sick, but some types of *E. coli* can cause severe illness, or even death. Canada's food processors use various methods to keep food free from *E. coli.* Consumers also have a role to play in prevention, by ensuring that meats are cooked to their proper temperatures, washing produce thoroughly, and cleaning hands regularly with soap and water before handling food, and after using the washroom or petting animals.

3 Porcine epidemic diarrhea (PED)

PED is a disease that affects pigs, but has no impact on human health, or on the quality of pork. It is usually fatal to piglets, but older pigs normally recover if they become sick. PED is an example of a livestock disease whose risk can be minimized by following good farm biosecurity practices, such as limiting visitors in and out of barns.

DID YOU KNOW?

Milk is labelled and sampled from every farm before it's put in the milk truck. This process ensures that each tank of milk meets strict government quality standards. In addition to farm samples, every milk truckload is tested at the processing plant. If there's a problem with the milk, the entire load is rejected and the farmer deemed responsible can be fined – and may potentially lose his or her legal right to produce milk. It is something that farmers take very seriously.


Ashton Irwin

Scanning a cow, sheep, or pig?

Canada's dairy and beef farmers must identify all their animals through the Canadian Cattle Identification Agency with individualized radio frequency identification (RFID) ear tags. These tags link electronically to a database of information about each animal, including its date of birth, farm of origin, and identification number, and they help farmers and meat processors to maintain and promote food safety and traceability.

Sheep farmers must also follow a mandatory tagging program for their animals, and a similar program for goat farmers is to be launched in 2018. Canada is one of the first countries in the world to launch a national traceability system for pigs. Livestock identification is a key step in a system that can respond quickly to disease outbreaks or food safety emergencies, should they arise.

Quick Fact

Pesticides help farmers to grow more food on less land. Without pesticides and plant biotechnology, Canada's farmers would need to cultivate 35 million more acres to produce the same amount of food. That would mean fewer natural forests, wetlands, and other wildlife habitats.[60]

What's up with raw milk?

Pathogens such as salmonella or *E. coli* can exist on many foods, from dairy products to fruits and vegetables. These pathogens can make people sick, or if severe enough, can even cause death. To eliminate this risk in milk, government health and safety standards require all milk to be pasteurized before being sold – a process whereby harmful bacteria are destroyed by heating milk to a high temperature, then rapidly cooling it. Pasteurization does not negatively affect milk quality, though it does extend the shelf-life of milk and dairy products.

Raw milk has not been pasteurized, meaning pathogens may still be present. It is illegal to sell raw milk or cream products in Canada, with the exception of certain raw milk cheeses.


Courtesy of FFC Saskatchewan

Food safety on crop farms

Farmers inspecting a field of wheat

Why do farmers use pesticides?

Pests are called pests for a reason, because they are a nuisance that can hurt and destroy crops. Together with other methods of crop protection and good management, pesticides have helped farmers to grow more and better-quality fruits, vegetables, and field crops. Being able to protect plants against pests and diseases reduces the risk of crop failures, improves the quality and quantity of food available, and helps keep food prices affordable.


Jennifer Huberts

What's being done to ensure that our **food is safe?**

Quick Fact

It can take approximately 11 years of research – and between $310 and $350 million – to develop, test, and bring a new crop protection product to market.[61] According to the PMRA's website, the process can involve the review of over 200 different types of studies in three key areas: health, environment, and value.

Canadian farmers can only purchase pesticides that have been assessed for safety, and approved for use by Health Canada's Pest Management Regulatory Agency (PMRA). Canada has some of the strictest pesticide approval and monitoring systems in the world. The Pest Management Regulatory Agency is responsible for ensuring that all pesticides, when used properly, are safe for people and for the environment.

Before being approved for use in food production, new crop protection products go through years of testing and trials to prove that they're safe and effective. When used as directed, pesticides approved in Canada do not harm people. This feature is critically important for everyone, and particularly for the farmers using those products to protect their crops.

The PMRA, which regulates pesticides and enforces rules, employs hundreds of independent scientists to review safety data and assess the risk of all pest control products to ensure that they can be used safely, before they are approved for use in Canada (see Health Canada for more information).[62]

A similar process is in place for animal health products, which are regulated by Health Canada:

- **Pharmaceuticals for animals** are regulated by the Veterinary Drugs Directorate, which is an agency of Health Canada.
- **Animal pesticides** (e.g. ear tags, sprays, and powders) used to manage pests (e.g. flies, fleas, and ticks) are under the jurisdiction of the PMRA.
- **Animal vaccines and feed additives** must meet the regulatory requirements of the Canadian Centre for Veterinary Biologics and the Feeds Division, respectively. Both are part of the Canadian Food Inspection Agency.

Research and development focused on developing better products is ongoing. New crop protection products coming to the market are regulated by Health Canada, and take into account the latest scientific advances. Once a new pest control product is approved, its use is monitored through government testing for residues, to make sure that our food and water are safe.

Prof. Suresh Neethirajan

Researcher

Profile

Prof. Suresh Neethirajan

Suresh Neethirajan, a University of Guelph bioengineering researcher and associate professor, uses nanotechnology to solve real-world problems in food safety, agriculture and animal health. Currently, he is involved with an initiative investigating how soy can help reduce the risk of food-borne illnesses. Using pathogen-fighting properties within soy flour, Suresh and his team have been able to create a natural food preservative that stops the growth of harmful bacteria – but leaves good bacteria alone.

"I have always been interested in agriculture and biology. Food is a main reason for our existence on this planet, and technology can help us protect it".

(Suresh Neethirajan)

Jessica Richardson

How do farmers know how to use pesticides properly?

We all eat the same food, so it makes sense to take pesticide use seriously. All Canadian farmers must be certified to use pesticides that have a label stating "only to be used by certified applicators," though some differences in certification requirements do exist between the provinces and territories. Farmers take courses and attend workshops to make sure that they're up to date with the latest technologies and farming practices, including following product label requirements. In Ontario, for example, farmers must pass a certification exam before they can buy and use pesticides. Their training includes pest management techniques; protecting the environment; avoiding health risks; proper storage and maintenance of application equipment; and the importance of record-keeping. Farmers must also be re-certified every five years.[63]

Most farmers live where they work, drink water from their own wells, and feed their families with the food they produce. It's in their best interest to use crop protection products responsibly, and in a sustainable way. It also makes economic sense to do the right thing – pesticides can be expensive, after all, and applying more than what's needed can be a waste of money.

Could there be another Irish Potato Famine?

In 1845, a strange disease struck potatoes growing in the fields of Ireland. With no treatments available to save the crop, the disease – a fungus known as "blight" – repeatedly devastated harvests across the island. Because potatoes were the main food source for most Irish people at the time, the ensuing famine killed over one million people; another million emigrated to escape starvation.

Farmers today still have to contend with blight and other potato diseases. However, they now have the ability to protect their crops with fungicides – a class of fungus-specific pesticides – and improved genetics. This is a clear case whereby modern agricultural technologies have increased the reliability and security of our food supply.

Pasture and fields in County Kerry, Ireland.

Do I need to worry about chemical residues in my food?

No. There's no such thing as "zero" when you're hunting for residues (or controlling risks), but Health Canada sets the acceptable amount of pesticides a person can eat at least 100 times lower than the safety limit.[64] Modern lab equipment and testing methods are so high-tech that they can find very miniscule amounts. Where once parts per million were detectable, it is now possible to detect parts per billion or even trillion. The more sophisticated the testing method, the more likely that the smallest of residue traces will be detected – amounts so tiny that they won't cause harm, but still show up in the tests.

How much is a part per billion anyway?

It's an extremely tiny amount: one part per billion is the same as one second in 32 years, a drop of water in an Olympic swimming pool, or one blade of grass in a football field.

DID YOU KNOW?

Canadian families save an average of $4,400 a year on food costs, thanks to advances in plant biotechnology and pesticide science. That's about $60 billion in savings for the country as a whole.[65]

Dana Stoyberg

Better science for more sustainable food production

Growing food means using science. Plant and animal genetics, soil management, pest and disease management strategies, nutrition and animal housing, even weather forecasting: every aspect of farming has benefited from the use of science. It's a win for Canadians too; more nutritious, abundant, reliable and affordable food is being produced using more environmentally sustainable farming methods than ever before.

Courtesy of FPC Saskatchewan

What is biotechnology or GMO?

Thanks to sensational media headlines and clever media campaigns, terms like biotechnology, GM, GE or GMO and genetic engineering can cause alarm. But what do they really mean?

Biotechnology is an umbrella term used to describe different ways of identifying genes, introducing beneficial genes, modifying existing genes – and removing detrimental ones – in plants and animals using a range of precise tools. Vaccines, antibiotics, and other medicines have been produced using biological agents. When it comes to farming, the goal is to produce more and better food by influencing or improving the natural biological processes in plants and animals.

Genetic Engineering (GE) is a form of biotechnology in which specific genes are added or removed from an organism – or genes already within the organism are turned on or off – to change its genetic makeup. The result is a genetically modified organism (GMO). GE technology has been used by plant scientists for decades. Nine different crops currently have GE varieties for sale on the Canadian market.[66] Due to climate differences, though, not all can be produced here:

Courtesy of www.BestFoodFacts.org

DID YOU KNOW?

GE technology isn't just for large corporations. Small companies, universities and other public institutions all over the world use it to develop their own unique products.

What is the "dirty dozen"? How do I know what fruits and vegetables are safe to eat?

Each year, a U.S. environmental group publishes a "dirty dozen list" of fruits and vegetables that it suggests avoiding because of high pesticide residue levels. Scientists at the University of California-Davis and elsewhere, however, have found this report to be deceptive and misrepresentative of the facts.[67]

Scientific analysis shows that, even though residues can be present, they are at extremely low levels. A child could eat 154 apples in one day, for example, without any effect – even if those apples had the highest pesticide residues recorded by the United States Department of Agriculture.[68]

Quick Fact

GMO foods are chemically identical to food grown from non-biotech crops.[69]

A more sustainable salmon?

The world's first GE animal approved for the human food chain is a salmon that uses 20 to 25 per cent less feed than conventional farm-raised salmon, while growing twice as quickly. These properties lower its environmental footprint. The fish, called the AquAvantage Salmon, was approved for sale in Canada in 2015, after many years of scientific testing and review.

AquaBounty's AquAdvantage Salmon (background) compared to conventional salmon sibling (foreground)

Courtesy of AquaBounty

Curing disease and reducing food waste – naturally?

There's a natural technology in all living organisms that could cure disease, reduce food waste, and improve the quality of the food we eat. Ribonucleic acid interference – RNAi for short – is a natural process in all plants and animals that works like an on-off switch for genes. For example, the creators of a new non-browning Arctic Apple used RNAi to turn off the gene that causes apples to brown when someone cuts or bites into them. The same approach means the Innate Potato won't turn a dark grey or black when bruised, thereby reducing food waste. RNAi has also saved much of the world's papayas from a disease called papaya ringspot virus that threatened to wipe out the crop.

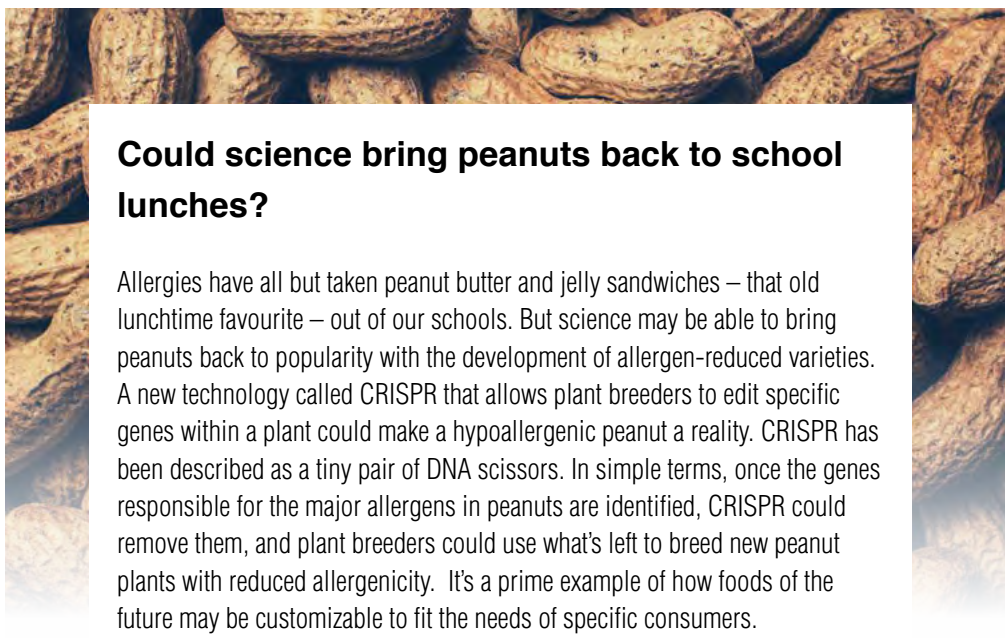
Simply put, with RNAi, scientists are using the information that is *already* inside a plant to modify or improve its behaviour or characteristics – and since the human body can't absorb DNA through digestion, eating such crops can't affect a person's genes.

DID YOU KNOW?

In 2013 alone, biotechnology helped farmers reduce global carbon dioxide emissions by the equivalent of taking 12.4 million cars off the road for a whole year.[71]

Waste-reducing crops?

A new potato variety that doesn't turn dark grey or black when bruised has been approved in Canada. Potatoes are a somewhat delicate crop, so bruising can happen quite easily, even though farmers and processors take many steps to prevent it. Bruised potatoes don't make their way into the store; instead, they are added to that food waste total. In the new Innate Potato, the enzyme causing bruising has been deactivated, so that the tuber won't turn brown for several days, compared to just minutes for a conventional spud.
This same technology has been applied the Arctic Apple – another Canadian innovation. Apples start to oxidize when cut. This change turns the fruit's flesh brown, making the apples less appealing to processors and consumers. By using modern genetic technology to turn off the gene that helps apples oxidize, the Arctic Apple resists browning for a longer period of time. This can help reduce waste.



Could science bring peanuts back to school lunches?

Allergies have all but taken peanut butter and jelly sandwiches – that old lunchtime favourite – out of our schools. But science may be able to bring peanuts back to popularity with the development of allergen-reduced varieties. A new technology called CRISPR that allows plant breeders to edit specific genes within a plant could make a hypoallergenic peanut a reality. CRISPR has been described as a tiny pair of DNA scissors. In simple terms, once the genes responsible for the major allergens in peanuts are identified, CRISPR could remove them, and plant breeders could use what's left to breed new peanut plants with reduced allergenicity. It's a prime example of how foods of the future may be customizable to fit the needs of specific consumers.

Do GMOs cause cancer?

No. There is no reputable, peer-reviewed scientific evidence that GMO foods cause cancer or any other health problems.[70] According to researchers like Dr. Kevin Folta, a professor in horticultural sciences at the University of Florida, future generations of GMO foods could actually to help prevent cancer and other common or chronic illnesses.

Young corn plants

Better health through functional foods

It's well known that fruits and vegetables are good for our health. They're a source of essential vitamins and minerals, fibre, antioxidants, and other health-boosting substances – and they're low in calories, too. And with the help of science, good-for-you-foods are becoming even better.

- In Britain, researchers have developed a purple tomato that is high in anthocyanins, the antioxidants that help fight cancer, diabetes, and inflammation. The tomato is now being grown for research trial purposes in Ontario.
- In Costa Rica, a pineapple is being developed with pink flesh that contains lycopene, the same cancer-fighting antioxidant found in tomatoes.
- Soybean, canola, and sunflower oils are in the works with fewer saturated fats and more heart-healthy omega-3 fatty acids.
- When laying hens are fed a diet rich in omega-3s (e.g. flaxseed, fish oil, or algae), their eggs contain higher levels of omega-3s as well. This feature can lower cholesterol and reduce the risk of heart disease.

Some of these new foods have the potential to save millions of lives by improving human nutrition, particularly in parts of the world where food accessibility is challenging.

A mustard field

Your food is in your hands

Farmers can do absolutely everything to produce safe fruit, vegetables, meat, milk and eggs; food processors and retailers also work to keep products safe. But once it's in your hands, it's in your hands. Handling food with unwashed hands, and inadequate washing or cooking can increase the risk of food-borne illness, or what is popularly called "food poisoning". And then everybody around the dinner table suffers. To learn more about proper food handling, visit www.befoodsafe.ca.

Sweet potatoes in the field - and after the fryer

The sweet potato – a natural GMO?

The very first GMO we know about – the sweet potato – was actually made by Mother Nature about 8,000 years ago.[72] According to experts at the International Potato Centre in Peru, genes from bacteria in the soil have been found in 291 sweet potato varieties. Thousands of years ago, that bacteria inserted some of its own genes into the sweet potato plant. This helped the plant's roots – the part we eat – to grow larger. This fact suggests that humans have already been eating GMOs for thousands of years.

Today, sweet potato is the seventh most important crop globally according to the Food and Agriculture Organization of the United Nations. Not only is it popular in countries like Canada, but it's a staple crop in parts of Africa, and used as livestock feed in China.

Dwane Morvik

CHAPTER 6

Farmers - **the active environmentalists**

Carrie Woolley

Farmers understand the importance of healthy soil, water and air: they live where they work, and depend on a healthy environment to grow crops and raise livestock successfully.

Through farm organizations, and on their own, farmers invest in environmental research and help to develop programs to share the latest findings. In fact, Canada is a world leader in on-farm environmental programs that contribute to sustainable food production.

Crop farming and the environment

Variety is the spice of life

As part of sustainable farming, farmers grow a variety of crops and avoid planting the same crop on the same field year after year. This approach is called crop rotation. Because different pests attack different crops, a rotation schedule helps to prevent major build-ups of insect pests or outbreaks of disease. Additionally, since different crops need different nutrients, changing crops each year helps the soil to stay healthy by not draining it of nutrients. On Prince Edward Island, for example, it is now mandatory to have a three-year crop rotation on all farms. The common rotation sequence is: potatoes, then grains (such as wheat or barley), and forages (types of grass).

Colby Sproat

What's the deal on no-till?

A farmer planting into corn stalk residue in a no-till field.

Farmers are on the frontline of all kinds of weather conditions, so they're among the first to experience and adapt to the changing climate. Persistent dry conditions in the prairies, for example, have elicited significant shifts in preferred tillage methods to help prevent top soil from being blown away in heavy winds.[73]

Today, crop growing methods like "conservation tillage" (working the soil as little as possible) or "no-till" (not working the soil at all) are widely used. This latter technique involves leaving leftover material from the harvested crop (roots and stalks) in the field. The next crop is then planted directly into that ground-covering material. Both these techniques help to increase the amount of organic matter and nutrients in the soil, prevent soil erosion, improve water conservation, and promote populations of beneficial insects. And as a bonus, it's also less work for farmers.

The development of crops that are tolerant to specific herbicides (through biotechnology) can have environmental benefits as well. Instead of churning (tilling) the soil, farmers growing these crops can use a spray to kill weeds – without worrying about the health of their plants.

And less time, labour, and fuel are spent preparing the field for planting. This change reduces greenhouse gas emissions, another key component of sustainable food production. In fact, plant science innovations of all kinds mean farmers have to drive over their fields fewer times, saving 126 to 194 million litres of diesel fuel every year.[74]

A prairie farmer stands in a field during The Dust Bowl (or Dirty Thirties).

Was farming more environmentally friendly in the "good old days"?

Some people believe that environmental degradation is a phenomenon of "modern" farming. History tells a different story, though. The "dust bowl" of the 1930s, for example, was caused by a combination of drought and ploughing (tilling) the land too much. Early methods of crop protection often involved significant tillage. Toxic but naturally occurring substances, such as sulphur, mercury, and arsenic compounds, were also commonly used to fight pests and diseases. Many of these older substances are no longer used because of their toxicity and inability to break down in the environment.

Newer products are safer and much more tightly controlled and regulated by government.

Trevor & Michelle Scherman with their children

Farmer

Profile

Trevor and Michelle Scherman

Trevor and Michelle Scherman, along with their family, farm wheat, canola, peas and lentils on their third generation family farm in central Saskatchewan. They have embraced new farming technologies – like new seed varieties, high-tech equipment, GPS and satellite data analysis – to grow the most food on the land they have. Trevor appreciates the challenges of farming and enjoys the opportunity to build their family business while bringing food to the world.

Courtesy of FFC Saskatchewan

Sustainable farming applies to livestock too

Increasingly, farmers are adding livestock to their crop rotation plans. This method means growing forages – grasses and plants that are part of the farm animal diet – in between field crops, and letting livestock, like cattle or sheep, graze those fields. Not only does this add an extra type of crop to the rotation, but the manure from the livestock adds natural fertilizers back into the soil. Livestock are also being grazed on land where other crops are being grown, such as in orchards between apple tree rows, for example.

DID YOU KNOW?

Animal feed plays a key role in recycling. When ethanol is made, starch is removed from corn. What's left behind – called dried distillers' grain – is an excellent feed source for pigs and cattle.

Sandi Knight

The origin of soil

Farmers have different soil types with which to work, depending on where they live. The various types of soil found across Canada are directly linked to glacial movement during the last Ice Age. About 12,000 years ago, glaciers slowly ground rocks into finer particles as they moved south. As those glaciers retreated, they left that sand and gravel behind in the soil. Combined with annual cycles of plant and animal growth and decay over millions of years, that process has built Canada's soils into what they are today.

Carrie Woolley & Brett Schuyler

Farmer

Profile

Brett Schuyler & Carrie Woolley

Brett Schuyler farms with his wife Carrie Woolley, brother, parents and aunt and uncle in southern Ontario. He had little interest in the family farm until university, but joined full-time in 2008 when he realized the opportunities it could offer – and after convincing his dad and uncle that he could add value to the business.

The farm produces apples, cherries, corn, soy, and lamb, and Brett says it's interesting how these can come together to make the farm more efficient. His favourite example: their sheep flock grazes in the farm's orchards, pastures, and fields of cover crops.

"Managing the farm is tremendously rewarding. There is a huge opportunity to find ways to have a positive effect on the environment, but we also impact people's lives. With more than 10 full time employees and 140 seasonal workers, it feels really good to see the jobs created by the farm".
(Brett Schuyler)

Soil and dirt – what's the difference?

Soil is alive. It contains small particles of sand and clay, decaying organic matter, earthworms, bacteria, fungi, insects, and microorganisms. Soil's texture, colour, appearance, smell, and even how it feels depend on the amount of each component in the blend. It's a living environment that's ideal for growing crops, whereas dirt is basically dead soil.

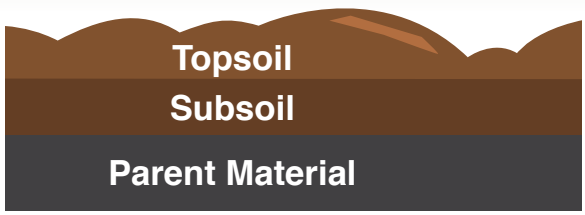
Sand – is coarse porous soil, like what you find on the beach.

Clay – is soil made of finer and more densely packed particles.

Organic matter – is composed of decaying plants and earthworms, bacteria, and other microorganisms.

Loam – is the perfect mixture of sand, clay, and organic matter (ideal for growing crops).

Soil by depth:



Topsoil (on the top) is rich in organic matter but lower in minerals.

Subsoil, right under the topsoil layer, has a higher clay and mineral content.

Parent Material is made up of deeper rock, sand, or clay, with no organic content.

The type of soil found on a farm helps influence what crops a farmer will grow, and how those crops will be grown. For example, light sandy soils let water drain easily, whereas heavy clay soils take a long time to dry out in the spring, or after a heavy rainfall. A farm's soil can't be changed, but how farmers work and manage that soil can influence how productive it will be.

Quick Fact

Soils have unique characteristics that influence the flavour and character of grapes and wines. Wine lovers call this phenomenon "terroir".

Close-up of a multi-species cover crop

Crops to cover the soil

Healthy, living soil is critical for growing healthy and productive crops. To help keep soil healthy, farmers take steps to ensure their soil doesn't erode from wind and water. One way involves planting cover crops where plants like clover, rye, and sunflowers (and many more types) are planted after farmers have harvested their main crops. Keeping the ground covered helps keep moisture in the soil, stops topsoil from eroding, and builds soil health by adding organic matter to the ground. Leaving stalks in the field after a crop is harvested can also help reduce soil erosion.

Some farmers will also use their cover crops as animal feed by letting livestock graze in those fields in the fall. Avoiding erosion also means that nutrients from fertilizers and manure stay in the soil, and are not washed into streams, lakes and rivers.

Fighting plant pests, bugs and diseases with Integrated Pest Management (IPM)

Integrated Pest Management works with nature to control disease and pest levels. Farmers monitor fields and orchards closely to know when pests reach a level at which action needs to be taken to protect the crop. IPM is often described as "good bugs fighting bad bugs," but there is more to it than that. It also uses a combination of cultivation techniques such as crop rotation, physical barriers, and the use of beneficial insects and fungi helps ensure the best combination of pest control tactics, whether they be mechanical (such as tillage), cultural (such as good bugs) or chemical (e.g. pesticides).

Environmental farm plans

For more than 20 years, farmers across Canada have voluntarily been taking part in an educational program called the Environmental Farm Plan. This program helps farmers in each province to identify environmental improvements on their farms, and set goals and timetables to complete them. It's the most widely used environmental program in Canadian agriculture, and its success and credibility are so strong that its regional components are now being harmonized into a single, national standard that can be incorporated into processor and retailer sustainability programs.

What's a buffer zone?

A buffer zone is a grassy area directly adjacent to a body of water, such as a stream or a pond. These buffers, also called "riparian" areas, bring many benefits:

- Increased shade causes cooler water temperatures that attract desirable fish species.
- More biodiversity exists through varied streamside habitats.
- Endangered or at-risk species are protected by providing habitats.
- Reduced soil erosion.
- Increased natural pollinator populations.
- Less nutrient runoff from farm fields.

Fences around ponds and streams also help maintain water quality by keeping livestock out, and farmers can use solar or wind powered pumps to provide water for grazing animals.

Soil with high organic matter
Courtesy of AgInnovation Ontario

Funky fungi

Researchers at Ontario's Brock University are working to develop an effective and more naturally derived method of pest control by studying the relationship between ground-based fungi – a naturally occurring bug-killer – and plants. Fungal traits, such as drought tolerance, or conversely a greater ability to stay fixed in the soil under wet conditions, could make for more sustainable agricultural production, and decrease the need for pesticides.

Using technology to outsmart nature

No one plays a greater role in the success or failure of farming than Mother Nature herself. Too much or too little rain, temperatures that are too high or too low, wind or snow and ice storms – all of these can wreak havoc on livestock and crops.

As in decades and centuries past, plant breeding continues to be an important tool. With both older and newer breeding technologies, researchers are able to develop crops that are more tolerant of pests, drought, heat, excess moisture, frost, and more – and the rate of development is increasing as new breeding techniques are discovered.

Technology can also help farmers cope with the changing climate. Large outdoor fans can be installed in orchards to keep the air circulating during times of possible frost. Frost damage affects the number and quality of fruit a tree will produce - or there will be no fruit at all if frost hits at blossom time. Other farmers have been known to hire helicopters to fly over their orchards on nights when there is a risk of frost. This method protects fruit by keeping warmer air circulating.

Fruit growers can use an online automated weather alert system for better management around climate-induced damage to their orchards, and crops like peaches, nectarines, cherries, apricots, and plums. A cold hardiness app provides information about the survivability of buds, and lets growers know the temperature thresholds at which they could lose 10 per cent, 50 per cent, or even 90 per cent of their fruit tree buds.

Field tile and ditches drain excess water from a corn field.

An orchard "wind machine".

Satellites running farm equipment

An in-tractor GPS

Many Canadian farmers rely on precision agriculture technology to manage field work such as planting, nutrient and crop protection application, and harvesting. Satellite-controlled Global Positioning Systems (GPS) on tractors and equipment help to ensure that fertilizers and sprays are applied in the right amounts to the right places, and that crops are planted in straight, even rows. This methodology reduces fuel consumption, and helps farmers ensure more efficient use of nutrients, seeds and crop protection products.

A prescription for fertilizer

Farmers also use technology to create precise soil maps of their fields – one single field may have more than one type of soil – and to track which areas of their fields produce more or less of a given crop. They can then use that information to create what are called "yield maps" so that they know where the soil is most productive. The technology in today's farm equipment lets them apply fertilizer at different rates, or only where the map (or "prescription") tells them that the soil needs it most.

Raising livestock is becoming more automated, too. Farmers use technology to automate feeding, and special ear tags record how many times and how much feed an animal has eaten. In this way, farmers know right away if an animal isn't feeling well. Technology also controls temperature and humidity inside barns to make sure livestock stay comfortable.

Quick Fact

More and more farmers are starting to use unmanned aerial vehicles (UAVs – commonly called drones) to help with jobs on the farm, such as identifying insect problems, or tracking down livestock that have wandered off. A drone's infrared sensors and cameras let farmers collect information that they can use to diagnose nutritional disorders in plants or detect diseases and pests.

Pest-fighting – there's an app for that!

Many different smartphone or tablet apps have been developed to help farmers identify weeds and pests quickly and easily. Farmers are also increasingly turning to social media to ask their peers for help in identifying and managing pest issues.

To the moon and back

The Canadian company that developed lunar rovers for the Canadian Space Agency has adapted the technology for use on earth. The Argo J45 XTR is an unmanned robotic platform that can travel on rough terrain through a variety of severe conditions, ranging from war zones to underground mines, without putting the operator at risk. On the Caribbean island of Martinique, the J5 is used to spray for black mould on banana plantations located on steep hillsides. At the University of Guelph, researchers are using the same robot to help with soil sampling.

DID YOU KNOW?

NASA is using Canadian bumblebees in its research to figure out how to grow food in space. Early signs show that the pollinators could help in space production of certain types of fruits and vegetables.[75]

Hop varieties at the University of Guelph

Courtesy of AgInnovation Ontario

Barcodes aren't just for supermarkets anymore

DNA barcoding is a made-in-Canada tool that helps identify pests. Here's how it works: a small tissue sample is taken from a species, and its DNA is extracted in a lab. That DNA is then amplified and sequenced for identification, in similar fashion to how a barcode is read when a product is passed over a scanner at the supermarket.

Development of this technology was led by the University of Guelph, which has become an international leader in the field and is home to both the Biodiversity Institute of Ontario (BIO) and the Centre for Biodiversity Genomics. To date, the library has collected barcodes from 137,000 animals, 50,000 plants, and 3,400 fungi and other life forms, all of which are accessible to the public.

As advanced as Canada's food system is, cases of "food fraud" can still arise, whereby a product differs from what it's being sold as. Recent examples include cheaper fish sold as more expensive seafood, or imported produce being labelled as "Canadian". In such cases, DNA coding could be used to determine quickly and exactly what a product truly is, and whether it matches the marketing, thereby helping to improve food traceability, as well as producer and consumer protection.

Energy from the sun, wind – and even plants

The world depends heavily on natural gases, petroleum, and other non-renewable resources for energy, but Canadians are also becoming more energy-conscious by looking for ways to reduce the footprint on the environment.

As energy costs rise, farmers are looking for new ways to heat their barns and greenhouses affordably and sustainably. Farmers, for instance, are installing solar panels, wind turbines, and anaerobic digesters, which create methane from organic material, to generate electricity on their farms. Some use that electricity to power their homes and farm buildings; others sell it back to the grid in order to power homes, offices, and factories in Canada's cities. Still other farmers are growing plants such as miscanthus or switchgrass – called biomass or energy crops – or using food waste products specifically to be turned into energy.

About five per cent of Canada's farms are producing their own energy; of those, 85 per cent have solar panels, and about 15 per cent are using wind turbines. Ontario has the highest number of farms producing renewable energy, followed by Alberta.[76]

Growing a greener tomato

Greenhouses in particular are looking for sustainable new sources of energy, as it takes a lot of heat, water, and electricity to grow vegetables under glass in Canada. Natural gas-powered generators create electricity, but also carbon dioxide (CO_2) and heat. Through a process called co-generation, CO_2 from engine exhaust is purified and used as fertilizer in the greenhouse, and heat is captured in thermal storage tanks and used to heat the greenhouse.

A stomach that produces electricity?

Some farms have their own electricity-producing bio-digesters (also called anaerobic digesters). These large tanks act as stomachs, where organic inputs (livestock manure and bedding, fruit and vegetable peels and scraps, or food processing waste) are fermented to generate natural gas. That gas powers a generator, which produces electricity for the grid.

Growing fields of fuel

Ethanol is a clean, renewable fuel made from plants (mostly corn) which is blended into gasoline to reduce greenhouse gas emissions. Ethanol is just one of many ways that plants and plant residues are being used for more than just feeding people and animals. Another is biodiesel, a diesel fuel substitute that can be made from soybean oil and blended with normal diesel, resulting in lower greenhouse gas emissions. And a new market opportunity is being created for corn stover – the leaves, stalks, and other parts of the plant left over after corn kernels have been harvested – by turning it into sugar that will help in the manufacture of bio-based chemicals and biofuels.


Laurel Neufeld

Farm animals and the environment

About 30 per cent of Canada's agricultural land is too hilly, rocky, cold or wet to grow crops. But it can support grazing livestock. Animals convert grasses and otherwise indigestible plant matter into nutrient and protein-rich food, while returning organic matter (manure) to the soil. It's the original recycling program – and an important part of managing a sustainable environment.

In countries without extra grain, animal feed tends to consist mostly of grasses and forages, or other suitable plants. Some animals can consume grass; pest or weather-damaged grains; crop remains such as corn stalks, leaves and straw; and byproducts from food processing, such as unusable grains (or parts of grains) left over from the production of things like breakfast cereal.


Cordy Cox & Clint Ellis

Farmer

Profile

Cordy Cox & Clint Ellis

As beef cattle ranchers from central British Columbia, Cordy Cox & Clint Ellis have to be resourceful.

Wildfires can be an annual occurrence in central B. C., and when those fires pose a risk to their animals and businesses, ranchers in the area are usually prepared to handle them. The 2017 summer season, however, brought fires of unprecedented size and number. The fires ravaged pasturelands the ranchers rely on to feed their cattle. They also destroyed endless miles of fencing, as well as ranch outbuildings and equipment. With communications and transportation lines virtually cut off from the remote areas in which many ranchers operate, it was very difficult for them to acquire the supplies necessary to keep their animals – and their homes – safe.

Cordy, Clint and many other ranchers came together during the wildfire crisis to help each other. Part of that involved helping their provincial cattle association develop a protocol with the local authorities where ranchers could move in and out of evacuation zones. In doing so, many ranchers were able to get the food and fuel they needed to save their animals and homes, and help keep the wildfires at bay in the process.

"Ranchers know the land, the winds, where the cattle are and who owns them," says Cordy. "The community really became its own fire-fighting force".


Krystal Schipper

Are cow burps and farts changing our climate?

It is estimated that about 10 per cent of Canada's greenhouse gas emissions come from farming, and that methane, coming largely from livestock, accounts for one-third of that 10 per cent.[77] So yes, burping and farting cattle are a source of methane. Every farmed and wild ruminant, including cattle, sheep, goats, deer, and bison, has a four-chambered stomach called a rumen. Bacteria in this stomach help them break down their food. Methane is generated during this process. The impact that livestock such as cattle can have on the environment can vary significantly, based on a number of factors: feed quality, genetics, and the part of the world in which the animal is being raised, just to name three.

Modern advances in genetics and nutrition have led to more environmentally-efficient animals, and farmers and scientists continue to work towards reducing the amounts of methane produced by cattle. About a decade ago, a farmer in Prince Edward Island began feeding his cattle seaweed from nearby beaches, in an effort to lower his feed costs.[78] A researcher at Dalhousie University discovered the farmer's feed mix reduced methane emissions from the cattle by up to 20 per cent – and after moving to Australia, the researcher continued experimenting with many different types of seaweed. He eventually discovered a type of seaweed that, when added to cattle and sheep feed, could reduce global greenhouse gas emissions by up to 70 per cent. That's almost equal to the amount of carbon dioxide emitted by all of India every year.[79]

DID YOU KNOW?

Greenhouse gases are not actually gases from a greenhouse. They are a series of gases such as methane and carbon dioxide, which act as a shield that traps heat within the earth's atmosphere – much like the way a greenhouse retains heat. This process is contributing to climate change.

What about manure and water?

Manure is an excellent natural fertilizer. However, farmers depend on clean water on their farms for their families, livestock, and crops, and manure can contaminate that same water if it isn't managed properly. Nutrient management planning, which covers manure, commercial fertilizers, and all other nutrient sources for farmland, makes sure that crops and soils get all the benefits of the nutrients, without harming the environment. Here's how it works:

- **Testing soil and manure:** by knowing exactly what nutrients are already present, what's needed and when, farmers can add only what the soil or specific crop in their fields can use.
- **Calibrating or adjusting manure and fertilizer spreaders:** to know exactly how much is being applied, and that it's being applied correctly.
- **Managing stored manure:** manure shouldn't be put on the land during the winter months, because there is a higher chance of it washing away with snow melt, and not penetrating frozen ground. Farmers must make sure that they have the right facilities to store safely all the manure that their livestock produce over the winter.
- **Locating new farm buildings:** making sure they're far enough away from neighbours and natural resources, like water and wetlands. How far depends on the type and number of livestock, whether there is a stream or pond nearby, etc.
- **Planning for emergencies:** knowing what to do if things go wrong, so that a response is quick and effective.

So what about the smell of manure?

There's nothing like the smell of manure to come between farmers and their non-farming neighbours. It can waft from barns and storages, but is strongest when manure is spread on fields as fertilizer. There are many different techniques and technologies to reduce the smell of manure – like composting solid manure or adding odour-minimizing additives – but unfortunately, it's a fact of farm life that isn't about to go away. To avoid affecting the plans of their neighbours, many farmers let them know in advance of manure spreading.


Kaitlyn O'Neill

Wildlife habitat isn't just in parks

Of Canada's 68 million hectares classified as agricultural land, more than 30 per cent isn't suitable for planting crops (i.e. too rocky, hilly, wet, or dry). These areas are often used as pasture for grazing livestock, but are also excellent wildlife habitat. Many farmers plant native grasses, establish buffer zones around water bodies to keep livestock out of aquatic habitats, seed strips of flowering plant species as a food source for bees and other pollinators, or move their livestock from pasture to pasture – this last way is called rotational grazing.

Some farmers will also delay cutting hay crops, in order to give grassland birds (such as the bobolink and eastern meadowlark, which rely on tall grasses to nest) a chance to hatch their young safely. These practices help to sustain wildlife populations, and promote biodiversity.

Curtis Matwishyn

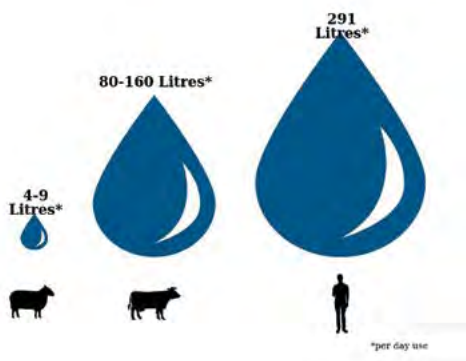
Going batty for bats

Farmers and landowners play a key role in on-farm protection of species at risk. For example, some farmers have started installing bat boxes on their farms. These boxes provide a habitat for bats, which are essential for maintaining healthy ecosystems, as they eat many insects, including farm pests.

Robert Irwin

What about water?

- A mature sheep drinks between four and nine litres of water per day.
- A dairy cow drinks 80 to 160 litres of water daily, and produces about 27 litres of milk per day.
- Canadians, on average, use 291 litres of water per day per person – the second highest rate in the world.[80]



Stacy & Gilbert Matheson with their children

Farmer

Profile

Gilbert & Stacy Matheson

Gilbert Matheson's grandparents started their family farm in New Brunswick in 1957. Gilbert has been working on the farm since he was in high-school, but took over officially in 2004. With the help of his wife Stacy and their seven children, Gilbert raises both laying hens and dairy cows, though he also hatches eggs and raises pullets – or young hens – for other egg farmers. His typical day starts at 7:00 a.m. with morning chores – mainly milking the cows and feeding all his animals – and ends at around 7:00 p.m. Gilbert says his work is his favorite hobby, though he particularly enjoys working with animals and building new things in the barn.

The original water recycling program

There are many misleading reports about the amount of water that goes into producing food. Cattle, for example, do use water – but they also return much of it, and it certainly does not require many thousands of litres of water to make one burger patty.[81] Water undergoes cycles, and only a small fraction of water consumed is retained in the body. As with any biological organism, most of the water consumed by cattle continues to cycle through the environment, and it doesn't make sense to consider it lost forever. Whether for agricultural purposes or our day-to-day lives, sustainable water use means not taxing water sources beyond their capacity to replenish. It's a matter of sustainability, or using water in balance with the environment.

Irrigating vegetables

Water, water everywhere …or not

Some crops — usually fruits and vegetables, but occasionally others — require irrigation to ensure that they have enough water to grow properly. Today's irrigation systems come in a variety of forms, and help to ensure that water isn't wasted. Sprinkler and surface drip systems are common, and some farmers use a system called sub-surface drip irrigation, by which water lines are buried in the soil and release water directly onto a plant's root system, so that no water is lost to evaporation or run-off. In greenhouses, water used for irrigation is collected and reused, ensuring sustainable use of this important resource.

Even though Canada is home to 20 per cent of the world's fresh water, its availability and quality are important issues, especially as the climate continues to change; thus, sustainable production practices become more and more important.

Sometimes the land used to grow crops does not drain well, meaning that crops have a higher likelihood of being damaged by standing water. To avoid this effect, farmers install underground tile systems to help drain surplus water from their fields. This method not only improves crop quality and yield, but also reduces soil erosion, and stops algae-promoting nutrients from running off surfaces into lakes and rivers. In some provinces, farmers must apply for a government-issued permit to use water, to ensure that they are using it in an environmentally-responsible and sustainable way.

Michelle Longman

Reta Regelink

A beekeeper checks his hives.

The buzz about bees

Honey bees, bumblebees, and many wild pollinators play a critical role in the production of fruits, vegetables, and other crops. They pollinate blossoms on plants, turning them into fruit such as blueberries, for example, or vegetables such as pumpkins. Canada also produced approximately 43.2 million kilograms of honey in 2015.[82]

The centre of every beehive is the queen bee, surrounded by a cluster of worker bees tending to her every whim. Annually, about 150,000 queen bees are imported into Canada from Hawaii, because they are available earlier in the year. The queens travel to their new homes in boxes, each with five attendant bees. While in transit, they eat from little candy plugs that provide nutrition. Canada also imports queen bees from Australia and other countries.

Donna Rogers

Courtesy of Ontario Apple Growers

You were asking about…**pollinators, bee health, and pesticides?**

Data from Statistics Canada show that the number of farmed bee hives is on the rise in Canada.[83] But for the last several years, higher than normal bee deaths have been reported in some parts of the country, as well as in Europe and the United States.

Experts from around the world are examining the many factors that can impact bee colony health and mortality. For example, beekeepers lose some of their bees each winter due to cold temperatures, inadequate nutrition, and winter's duration. Another key factor in recent years has been a parasitic mite called *Varroa destructor*, which has been devastating to Canadian bee colonies.

A lot of attention has been focused on neonicotinoids – neonics for short. Neonics are a class of insecticides designed to protect against certain harmful bugs, and are used on crops like corn, soybeans and canola, as well as in pet flea collars and home garden products.

In crop farming, neonics are most often applied directly to seeds. Farmers then plant those seeds. This approach means that neonics can be used to protect crops without having to spray them on fields, in turn helping to reduce the risk of exposure to helpful bugs, such as bees. To further reduce this type of exposure risk, farmers have adopted improved on-farm practices:

- Using an improved fluency agent (lubricant) at planting to help move seeds through planters, reducing the risk of dust drifting outside a field.
- Installing dust shields on planters to keep the spread of dust contained.
- Taking precautions when handling treated seeds to avoid generating dust to begin with.
- Monitoring weather before planting treated seeds, to avoid dry, windy conditions.
- Planting cover crops with flowering species provides bees and other pollinators natural food sources.
- Maintaining communications with neighbouring beekeepers.

Robyn McCallum

DID YOU KNOW?

There were 772,652 colonies of honeybees in 2016 – a 37.7 per cent increase from 2011. [84]

Lee Townsend

Farmer

Profile

Lee Townsend

Lee Townsend is a commercial beekeeper in Parkland County, Alberta, where he and his father have 3,300 colonies for honey production. He's been working with bees since age 10, but it wasn't until he was older that he started to love beekeeping – enough to do it for a living. Today, they're leaders in the Canadian honeybee industry and export all of their honey to Asia.

"We have always taken the attitude that you have to put back into the farm what you want to get out of it. That not only includes the work involved to be successful, but we've also invested a lot of money into our farm to make sure it is the best it can be," says Lee.

Ashton Irwin

CHAPTER 7

Caring for **farm animals**

Sharon Grose

Whether it's helping a cow to give birth to a calf in the middle of the night, or feeding pigs before opening Christmas presents, caring for animals has been at the core of what farmers do every day for generations. All animals have basic needs, like food and water, health, and quality of life, and farmers take this responsibility seriously. They choose to work with animals because they enjoy it.

Caring for livestock properly is a matter of doing the right thing, but it also makes good business sense. Content, healthy animals are more productive, and lead to higher quality products. Farmers are also continually working to improve farm animal care based on new and verified science, investing in farm animal behaviour research to better understand what livestock and poultry need and want.

A dress code for the barn? It's called biosecurity.

If you visit a barn, you might be asked to take a shower, or wear overalls and plastic boots over your shoes before entering. Other farms don't allow any visitors at all, people or animals. These approaches are called "biosecurity". Along with vaccinations, biosecurity is part of an animal health program that helps keep Canada's herds or flocks healthy. By not allowing visitors into the barn, germs and sickness are kept out. Although farmers can give their livestock medicine when they're sick, prevention is always preferred over treatment.

Quick Fact

Approximately one billion people worldwide rely on livestock for their food and livelihood.[85]


Telfer Wegg

Why are most farm animals raised indoors in Canada?

Some grazing animals like sheep, horses and beef cattle do live outside all year, with access to food, shelter, and water. However, in Canada, many animals, such as pigs and poultry, usually live inside barns, where they are protected from extremes of weather and temperature, diseases like avian influenza and, of course, predators such as wolves and coyotes.

Another reason for indoor housing is better animal monitoring and care. It's much easier to ensure that each animal receives the right food, clean water, and general care when it is inside a barn. Many barns now have side walls with curtains that can be rolled up when the weather is warmer, letting in fresh air and sunlight.

Why can't they have more space?

Farm animals have different needs from humans – and even different needs among different species. It's not always a matter of more space, but what's available to them within that space, and how they can use it. For example, research has found that a group of calves in a large open barn will choose to sleep very close to each other. Rather than make use of all space available to them, they gather together for a greater sense of protection and warmth.

Today's farm practices are a balancing act between animal needs, safe food, and environmental and economic realities – and there is ongoing animal welfare research to help learn what's best.

DID YOU KNOW?

Some barns have water sprinklers to help keep animals cool and comfortable in hot weather.

There's an app for that

Many livestock farmers have alarm systems in their barns that alert them on their mobile devices to problems, such as the power going off, feed or water lines not working, or temperatures too hot or too cold. And increasingly, farmers can control heat and electricity in their barns from their computers, tablets, or smart phones. The majority of farms also have generators to make sure that their barns have electricity if the power goes out.

A chicken barn

What are the rules for raising farm animals?

Farmers, like all animal owners, must follow laws for humane treatment. There are currently 14 Codes of Practice for raising different livestock and poultry species in Canada. These codes are created by committees of farmers, veterinarians, animal welfare experts, and humane society representatives, and they detail how animals are to be raised and treated on Canadian farms. The Codes include requirements and recommended practices for:

- Accommodation/housing/handling facilities
- Feed and water
- Health care (e.g. record keeping for sickness or injuries)
- Pre-transportation considerations
- Euthanasia
- Husbandry/stockmanship (including young and older animals/poultry)
- And more

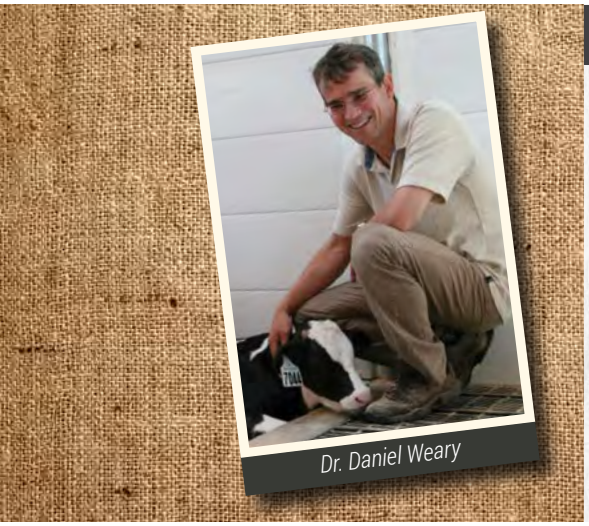
Ten codes have been updated since 2009, including those for beef and dairy cattle, chickens and turkeys, farmed fox, mink, bison, pigs, laying hens, equine species, and sheep. Two codes, for rabbits and veal cattle, are currently being developed and revised.

The National Farm Animal Care Council leads the process of updating Canada's Codes of Practice to reflect new advances in animal welfare research. A scientific committee reviews research related to priority welfare issues for the species whose code is being updated, and the committee's report is then used to develop these codes. To see all the codes, and for more information on how they are developed, please visit **www.nfacc.ca.**

Many of Canada's livestock sectors have developed, or are developing, on-farm animal care assessment programs based on the codes. Farms can be assessed on their animal care standards and protocols through self-audit, by trained auditors, or by third party company auditors. Auditing and assessments provide verification that a farm is following best practices, with the goal of finding problems quickly, and continually improving. Failure to follow audit requirements can result in fines, closure to market access, and potentially losing the legal right to produce a product altogether.

DID YOU KNOW?

There are many people with full-time careers in farm animal care. Many specialists dedicate their lives to improving humane handling of farm animals on the farm, on the truck, and at the processing plant.



Research

Profile

Dr. Daniel Weary

Dr. Daniel Weary's area of expertise initially focused on wild animals and pigs. But now, as a researcher at the University of British Columbia's Dairy Research Centre, he looks for ways to improve the lives of dairy cattle – as well as the farmers that raise them. To do so, Daniel spends a lot of time talking to farmers, and conducting research both on their farms and in the lab. He is currently investigating ways to reduce the risk of hoof and leg issues by understanding what environmental conditions are most preferred by dairy cows and calves.

"It's important to really get in the cow's head. You have to know what it finds important. We learn a lot from the farmers themselves too, and there's never just one way of doing things."
(Dr. Daniel Weary)

Livestock on the move

Making sure livestock are handled well during transport is just as important as how they're treated on the farm. Canada is a big country, and sometimes farm animals have to travel a long distance between farms, or to reach a processing plant – for example, many beef calves born in Western Canada may grow up and reach market weight on farms in Ontario. That's why the federal government reviews and updates the rules around transporting farm animals, including how long they can spend in transit, and how many animals can safely be transported together.

Technology is helping to make travel for livestock better as well. New livestock trailers based on innovations from Europe include access to drinking water and fans to keep animals cool. As well, more processing facilities are adding "fan walls" – stacks of fans that ventilate the trailers while they're waiting to be unloaded.

A national initiative called the Canadian Livestock Transport (CLT) Certification Program ensures livestock transporters and the people shipping or receiving livestock are properly trained in good animal handling techniques, during both movement and transport, to avoid livestock injuries and losses. Livestock drivers must take the course and pass an exam every three years to be certified under the program.


Hayley Mackay

Transporter

Profile

Hayley Mackay

Hayley Mackay is a livestock transport driver with a trucking company based in Southwestern Ontario. Coming from a dairy farm, Hayley always enjoyed working with animals – and being her own boss. She decided to drive full-time after helping to showcase a new livestock trailer designed to improve animal comfort at farm shows across the country.

"I get to work with animals, and see new places at the same time. It's always a rewarding thing to see the animals walk out of the trailer relaxed and healthy." (Hayley Mackay)

DID YOU KNOW?

Canada's dairy farmers have implemented a national sustainability initiative called proAction. This umbrella program covers milk quality, food safety, animal welfare, livestock traceability, biosecurity, and environmental sustainability. As of September 2017, proAction requires every Canadian dairy farmer to have completed a cattle care assessment before their already standard on-farm audit by a third-party.


Bethany Atkinson

Fire!

A barn fire can be a devastating loss for any farmer and their animals. In most cases, the exact causes of barn fires are unknown, but many are thought to start with barn electrical systems. Dust from animals and their bedding, moisture, and manure gases are not friendly to electrical components. Many methods to reduce the risk of fire exist; new barn designs, for instance, are built to prevent the spread and severity of a fire if one occurs. Heat-sensing thermal cameras can help farmers determine if electronics are in good working condition, and wireless temperature monitors can send alerts directly to a farmer's cell phone in case barn temperatures climb too high.

A veterinarian checking on a dairy cow.

Pros and cons of animal practices

You may wonder why certain procedures are performed on farm animals. In most cases, it's to enhance animal welfare, or prevent farm worker safety problems down the road. Here are a few examples:

Dehorning involves removing horns from beef and dairy calves, for the safety of both the animals and the people working with them. Research has shown that calves suffer less pain and stress if dehorning is performed when they're young, and the horns haven't yet developed. The Code of Practice requires that pain control methods be used when dehorning. Through breeding, many cattle types do not grow horns in the first place. These are called "polled" cattle.

Beak trimming is done to prevent laying hens from hurting each other. The proper procedure is to remove just the tip of the beak with an infra-red beam when the birds are very young. Picture the hook on the end of an eagle's beak, and imagine the damage that it could do. Research into behaviour, nutrition and genetics continues to look for ways to eliminate the need for this procedure.

Sheep tail docking is done to prevent manure from collecting on the tails and hindquarters of sheep, which can lead to flystrike, a condition in which flies lay eggs that hatch and attack the sheep's flesh; flystrike is a risk in most parts of Canada. Reducing the amount of manure buildup on an animal also helps address food safety concerns – there will be less chance of contact between meat and bacteria when an animal is being processed.

Are controls in place to deal with farm animal abuse?

Absolutely. Neglect and abuse of animals of any kind is against the law. Farmers and ranchers, like all animal owners, are responsible for caring for their animals properly and humanely, and for following laws and regulations, including the federal Criminal Code and provincial animal care legislation.

Most farmers and ranchers do a great job caring for animals, but sometimes, bad situations do happen. Farm organizations in some provinces have recognized this issue, and have developed their own peer services to help improve farm animal care. Farmers, veterinarians, and others who work in the field, are encouraged to call for help or report problems immediately.

Whenever there is a problem with farm animal care, Canada's farmers are actively part of the solution. In fact, the first farm animal council dedicated to responsible farm animal care was formed by farmers in Ontario 30 years ago. Similar organizations now exist at the national level, as well as in Alberta and Saskatchewan, along with several jurisdictions in the United States.

social media

Many farmers today are active on Twitter and other social media sites, so it's easier than ever to have your questions answered by someone who works with farm animals or grows crops every day. Try searching popular farming hashtags like **#OntAg** (for stories about Ontario agriculture) and **#WestCdnAg** (for stories about agriculture in Western Canada), or following **@FarmFoodCare**.


Anna Haupt

DID YOU KNOW?

Scientists at Cambridge University in the UK have invented a computer program that can detect whether farm animals are in pain. The artificial intelligence system can recognize five different facial expressions in sheep, and determine whether the animal is suffering, and the severity of its discomfort.[86]

Animal welfare or animal rights?

Most people, including farmers, believe in **animal welfare** principles: humans have a right to use animals, but also have a responsibility to ensure their wellbeing. By contrast, **animal rights** supporters don't believe humans have a right to use animals — whether for food, clothing, entertainment, or medicine. It can be difficult to sort out the many positions and groups involved with animal care or animal use issues.

Animal rights activists are not usually interested in finding common ground, and farmers are not interested in fighting with those who are fundamentally opposed to what they do. Instead, farmers support animal welfare practices and research. When based on good science, research can help improve farming practices. If you want to know more about how farmers care for their animals, please just ask – on social media, at farmers' markets, on farm tours, or at other local events.

Behind the scenes on going "undercover"

From time to time, animal rights activist groups release undercover video footage depicting alleged farm animal abuse. This footage is disturbing for everyone who cares for animals, including farmers. Here are a few points for you to consider.

Acts of cruelty towards animals are unacceptable and should not be tolerated. There are laws to deal with these cases, and they should be used accordingly. At times, however, individuals filming the undercover footage have been doing so for extended periods of time without taking action to stop abuse or questionable activity. This activity, too, is in itself unacceptable, and should be reported to the proper authorities immediately.

It's also important to keep in mind that everything may not be what it seems – and just because something is on the internet doesn't mean that it's true. Misleading messaging and targeted marketing are often a part of animal rights campaigns, and need to be approached with critical thinking in mind.

It makes no sense to mistreat animals, whether from a moral or economic standpoint. Although one extreme case is always one too many, it is far from the norm and does not reflect the care that millions of farm animals all across Canada receive every day.

See farms for yourself

To experience the many different types of Canadian farms with your home, office or mobile device, visit FarmFood360.ca and check out the many virtual farm and food tours available.

FARM FOOD 360°

Derek Van De Walle

CHAPTER 8

CONCLUSION

Food, farming and the **future**

Technology is always changing how Canadian farmers grow food, and how it gets from farm and field to our dinner tables. Farming plays an important role in our daily lives, providing both food and jobs to millions of Canadians across the country, and innovation is making things better, healthier and more sustainable for people, animals and the environment.

City farming

Food is not just grown in the countryside anymore. In some parts of the world, vertical farms are starting to be built in cities to grow vegetables and herbs on the roof tops of skyscrapers, old warehouses, and even shipping containers. In London, England, produce is even being grown underground in an old World War II air raid shelter.[87]

This new type of indoor farming makes it possible to grow fresh produce in urban areas. Other cities and towns are turning public areas like parks and boulevards into community vegetable gardens, and there are homeowners using their lawns to grow produce. It's all part of wanting to eat local, and being part of a sustainable food system.

Bio what?

A growing sector in Canada is called the bioeconomy - farmers, processors, researchers, and others, are trying to develop products that will be cheaper, more environmentally sustainable, and lessen dependence on non-renewable resources.

Courtesy of AgInnovation Ontario

Produce growing in a shipping container on an urban vertical farm

What we need for a sustainable future

- Globally, the amount of arable land – land that can be used to grow food – is shrinking. It was estimated at 0.38 hectares (about 41,000 square feet) per person in 1970, and is expected to decline to less than half, at 0.15 hectares (approximately 16,000 square feet) per person by 2050.[88]
- The world population is projected to reach 9.1 billion in 2050, and more than 70 per cent of that population is expected to be urban.[89]
- The world is also becoming richer. The global middle class is expected to grow from 1.8 billion in 2009 to 4.9 billion by 2030, changing global food consumption from basic staples to more appetizing and nourishing food, including more meat.[90]

To meet the needs of a rising population and to address nutritional challenges, we need science and cooperation. This all means using natural resources responsibly, working to ensure food is safe and affordable, and committing to continuous learning. By empowering people around the world to work together, we all benefit from a more sustainable future.

At the end of the day…

Caitlin MacLeod

While much has changed when it comes to food and farming in Canada, the most important things are the same as they were a century or more ago: growing food still starts with the values and commitment of farm families to the land, to animals, and to this special way of life.

Ultimately, all Canadians are working towards the same end goal: food that is reliable, affordable, safe, nutritious, and responsibly produced. Canada is a country that enjoys more food choices and opportunities than most places in the world, and how and what to eat is a choice each Canadian can make for him or herself.

Thank you for supporting Canadian food and for being interested in how and what Canadian farmers do to produce it. Your trust is not something farmers take lightly.

By working together, we can continue to focus on a sustainable future for our planet and its people.

With Thanks

Original text (2006) by: Alison Lane.
2010, 2014, and 2017 edition updates by: Lilian Schaer, Agri-Food Project Services Ltd.
Project Manager/Editor: Matt McIntosh
Design by: Lynn Chudleigh
Editor: Dr. Paul Ling

Published by Farm & Food Care Ontario, 2017.

www.FarmFoodCare.ca

This booklet was made possible with the generous support of farmers, farm organizations, and agribusinesses across Canada. For a complete list, visit www.RealDirtonFarming.ca.

Farm photos in this book are all taken of Canadian farms, or of Canadian farmers. Many were winning entries in the Farm & Food Care 2017 Farm Photo Contest. Photo credits are listed, where available.

Special thanks to the extensive list of participants of the national review committee who provided their subject matter expertise in reviewing the content of this publication and ensuring its accuracy.

THE REAL DIRT ON FARMING 2017: **INFORMATION SOURCES**

1) http://www.agr.gc.ca/eng/about-us/publications/economic-publications/an-overview-of-the-canadian-agriculture-and-agri-food-system-2016/?id=1462288050282
2) http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0040230&tabMode=dataTable&p1=-1&p2=31&srchLan=-1
3) http://www.statcan.gc.ca/daily-quotidien/170510/cg-a001-eng.htm
4) http://www.statcan.gc.ca/daily-quotidien/170510/cg-a002-eng.htm
5) http://www.agr.gc.ca/eng/about-us/publications/economic-publications/an-overview-of-the-canadian-agriculture-and-agri-food-system-2016/?id=1462288050282
   http://www.statcan.gc.ca/daily-quotidien/170510/dq170510a-eng.htm
6) http://www.agr.gc.ca/eng/industry-markets-and-trade/statistics-and-market-information/by-product-sector/horticulture-industry/horticulture-sector-reports/statistical-overview-of-the-canadian-maple-industry-2015/?id=1475692913659
7) http://www.agmrc.org/commodities-products/grains-oilseeds/flax-profile/
   https://flaxcouncil.ca/resources/about-flax/canada-a-flax-leader/
   http://www.statcan.gc.ca/pub/95-640-x/95-640-x2016001-eng.htm
8) http://www.worldatlas.com/articles/the-world-s-top-rapeseed-producing-countries.html
9) http://www.pulsecanada.com/pulse-industry
   http://www.cdc-ccl.gc.ca/CDC/index-eng.php?id=3801
10) http://www.openfields.it/sito/wp-content/uploads/2016/01/PASTARIA2015_N06_en-artOF.pdf
11) https://www.infoplease.com/askeds/how-big-acre
12) http://www.statcan.gc.ca/ca-ra2011/ha-sa-eng.html#a1-3-4
13) http://www.statcan.gc.ca/ca-ra2011/ha-sa-eng.html#a1-3-4
    http://www.statcan.gc.ca/eng/ca2011/ha/longdesc7
14) http://www.statcan.gc.ca/daily-quotidien/170510/dq170510a-eng.htm
15) http://publications.gov.sk.ca/documents/20/97099-Specialty%20Crop%20Report%202016%20WEB.pdf
16) http://www.fao.org/3/a-bc435e.pdf
17) http://www.hortcouncil.ca/en/about-us/horticulture-stats/
    http://www.statcan.gc.ca/daily-quotidien/170201/dq170201c-eng.htm
18) https://www.bestfoodfacts.org/grass-fed-or-corn-fed/
    http://www.sciencedirect.com/science/article/pii/S0309174013004944
19) http://www.cdc-ccl.gc.ca/CDC/index-eng.php?id=3801
20) http://aquacultureassociation.ca/
21) http://www.furcouncil.com/home.aspx
22) http://www.pulsecanada.com/pulse-industry
23) http://publications.gov.sk.ca/documents/20/97099-Specialty%20Crop%20Report%202016%20WEB.pdf
24) http://www.fao.org/3/a-bc435e.pdf
25) http://www.mushrooms.ca/production/
26) http://www.saskatoonberrycouncil.com/about/
    http://www.fruit.usask.ca/
27) http://www.ontariogreenhouse.com/default/assets/File/2014%20Fact%20Sheet%20FINAL.pdf
    http://www.statcan.gc.ca/pub/95-640-x/2016001/article/14814-eng.htm

28) https://www.aginnovationontario.ca/en/canadas-changing-face-presents-opportunity-for-ontario-flower-growers/
29) https://winesofnovascotia.ca/canadian-wine-grape-industry-2015-economic-impact-study/
30) http://www.winesofcanada.com/facts-canada.html
31) https://industry.beercanada.com/statistics
32) http://www.statcan.gc.ca/pub/95-640-x/2016001/article/14815-eng.htm
33) https://www.canada.ca/en/campaign/food-policy.html
34) http://www.ehatlas.ca/built-environments/food-deserts
35) http://www.growfarnorth.com/
36) http://www.cfa-fca.ca/programs-projects/food-freedom-day/
37) https://www.ers.usda.gov/data-products/food-expenditures.aspx
38) http://www.inspection.gc.ca/food/organic-products/equivalence-arrangements/eng/1311987562418/1311987760268
39) http://www.marketwired.com/press-release/canada-reaches-new-milestones-in-domestic-organic-production-2199900.htm
40) http://www.statcan.gc.ca/pub/95-640-x/2016001/article/14816-eng.htm
41) http://www.statcan.gc.ca/pub/95-640-x/2016001/article/14816-eng.htm
42) https://www.dietitians.ca/Downloads/Factsheets/Organic-foods-are-they-better.aspx
    https://www.bestfoodfacts.org/organicbetterthannonorganic/
43) https://med.stanford.edu/news/all-news/2012/09/little-evidence-of-health-benefits-from-organic-foods-study-finds.html
44) http://www.inspection.gc.ca/food/chemical-residues-microbiology/chemical-residues/eng/1324258929171/1324264923941
    https://www.canada.ca/en/health-canada/services/consumer-product-safety/reports-publications/pesticides-pest-management/fact-sheets-other-resources/pesticides-food.html
45) http://www.inspection.gc.ca/food/labelling/food-labelling-for-industry/method-of-production-claims/eng/1389379565794/1389380926083?chap=2
    http://www.inspection.gc.ca/food/labelling/food-labelling-for-industry/method-of-production-claims/questions-and-answers/eng/1415652072168/1415652073324
46) http://www.inspection.gc.ca/food/labelling/food-labelling-for-industry/allergens-and-gluten/eng/1388152325341/1388152326591
    http://www.inspection.gc.ca/food/labelling/food-labelling-for-industry/method-of-production-claims/questions-and-answers/eng/1415652072168/1415652073324
    https://www.bestfoodfacts.org/the-good-about-gluten/
    https://www.gluten.org/resources/getting-started/the-gluten-free-diet-facts-and-myths/
47) http://www.fao.org/save-food/resources/keyfindings/infographics/roots/en/
48) http://vcm-international.com/wp-content/uploads/2014/12/Food-Waste-in-Canada-27-Billion-Revisited-Dec-10-2014.pdf
49) http://www.fao.org/save-food/resources/keyfindings/en/
50) https://agscape.ca/growing-careers
51) https://www.uoguelph.ca/oac/sites/uoguelph.ca.oac/files/Planning%20for%20Tomorrow%202.0%20One%20Page%20Summary_AODAFinal.pdf
52) http://www.thepoultrysite.com/articles/2812/chickens-do-not-receive-growth-hormones-so-why-all-the-confusion/
53) http://www.thepoultrysite.com/articles/2812/chickens-do-not-receive-growth-hormones-so-why-all-the-confusion/
54) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3834504/
    https://www.bestfoodfacts.org/hormones-in-cattle/
    https://www.canadiancattlemen.ca/2014/12/09/straight-talk-on-hormones-in-beef/
55) https://canadabeef.ca/wp-content/uploads/2015/04/3208_CANBEEF_factsheet_HORMONE-2016-P2.pdf
    http://www.ontariobeef.com/industry/worried-about-series.aspx
    http://www.iowabeefcenter.org/information/IBC48.pdf
    https://www.bestfoodfacts.org/hormones-in-cattle/
56) https://www.canada.ca/en/health-canada/services/drugs-health-products/veterinary-drugs/antimicrobial-resistance/categorization-antimicrobial-drugs-based-importance-human-medicine.html
57) https://www.canada.ca/en/health-canada/services/drugs-health-products/veterinary-drugs/factsheets-faq/your-information-antimicrobial-resistance.html
58) https://www.canada.ca/en/health-canada/services/drugs-health-products/veterinary-drugs/antimicrobial-resistance/categorization-antimicrobial-drugs-based-importance-human-medicine.html
59) https://www.aginnovationontario.ca/en/immunity-for-life/

60) http://helpingcanadagrow.ca/
http://croplife.ca/wp-content/uploads/The-Value-of-Plant-Science-Innovations-to-Canadians_RIAS-Inc.pdf
61) http://191hmt1pr08amfq62276etw2.wpengine.netdna-cdn.com/wp-content/uploads/2016/04/Phillips-McDougall-Final-Report_4.6.16.pdf
http://www.genomeprairie.ca/files/1913/6275/9609/Janice_Tranberg.pdf
https://www.grainews.ca/2016/01/05/whats-it-take-to-produce-new-pesticides/
62) https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management.html
63) https://www.ontariopesticide.com/
64) http://www.inspection.gc.ca/food/chemical-residues-microbiology/chemical-residues/eng/1324258929171/1324264923941
65) http://helpingcanadagrow.ca/
http://croplife.ca/wp-content/uploads/The-Value-of-Plant-Science-Innovations-to-Canadians_RIAS-Inc.pdf
66) http://www.isaaa.org/gmapprovaldatabase/approvedeventsin/default.asp?CountryID=CA
https://www.bestfoodfacts.org/what-foods-are-gmo/
67) http://www.foodproductdesign.com/news/2011/08/food-scientists-debunk-dirty-dozen-list.aspx
68) www.foodandfarming.info/docs.asp?id=74
69) http://findourcommonground.com/food-facts/gmo-foods/
http://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en/
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4576180/
70) http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=23395
71) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5033196/
72) http://www.npr.org/sections/goatsandsoda/2015/05/05/404198552/natural-gmo-sweet-potato-genetically-modified-8-000-years-ago
73) http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0040205&tabMode=dataTable&p1=1&p2=-1&srchLan=-1
74) http://helpingcanadagrow.ca/
http://croplife.ca/wp-content/uploads/The-Value-of-Plant-Science-Innovations-to-Canadians_RIAS-Inc.pdf
75) https://www.greenhousecanada.com/news/biobest-part-of-the-latest-buzz-on-space-travel-31985?custnum=1521518&title=Freelance+Writer+%26+Editor&utm_source=E928&utm_medium=email&utm_campaign=170704P
76) http://www.statcan.gc.ca/daily-quotidien/170510/dq170510a-eng.htm
77) https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=F60DB708-1
78) http://www.cbc.ca/news/canada/prince-edward-island/pei-cow-farting-1.3856202
79) http://www.sciencealert.com/adding-seaweed-to-cattle-feed-could-reduce-methane-production-by-70
80) http://www.ec.gc.ca/indicateurs-indicators/477B343B-0EB0-4266-9F0E-581DD4E55C8C/CanadasWaterUseGlobalContext_En.pdf
81) http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex801
http://www.beefresearch.ca/blog/cattle-feed-water-use/
http://www.omafra.gov.on.ca/english/engineer/facts/07-023.htm#2
http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/water/livestock-watering/590301-1_livestock_water_requirements.pdf
http://beef.unl.edu/amountwatercowsdrink
82) http://www.agr.gc.ca/eng/industry-markets-and-trade/market-information-by-sector/horticulture/horticulture-sector-reports/statistical-overview-of-the-canadian-honey-and-bee-industry-2015/?id=1475694004047#a1.6
83) http://www.statcan.gc.ca/pub/11-630-x/11-630-x2016004-eng.htm
http://www.beesmatter.ca/wp-content/uploads/2015/05/Bees_Farmer_Toolkit-BW-61.pdf
84) http://www.statcan.gc.ca/pub/95-640-x/2016001/article/14814-eng.htm
85) http://www.fao.org/docrep/018/ar591e/ar591e.pdf
86) http://www.telegraph.co.uk/science/2017/05/31/computer-programme-can-detect-whether-farm-animals-pets-pain/?WT.mc_id=tmg_share_tw
87) http://www.telegraph.co.uk/news/earth/agriculture/farming/11706406/Londons-first-underground-farm-opens-in-WW2-air-raid-shelter.html
88) http://www.fao.org/docrep/014/am859e/am859e01.pdf
89) http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf
90) http://oecdobserver.org/news/fullstory.php/aid/3681/An_emerging_middle_class.html

ABOUT US

Farm & Food Care cultivates appreciation for food and farming by connecting farm gates to our dinner plates. Farm & Food Care brings farmers, agricultural professionals, related businesses and other groups together with a mandate to provide credible information on food and farming in Canada. If you have a question, we'd be pleased to answer it.

www.FarmFoodCare.org

www.RealDirtonFarming.ca

Enter to Win: **Visit www.RealDirtonFarming.ca/Contests for your chance to win one of 10 Canadian food and farming prize packs valued at $250**

Bay 6A – 3602 Taylor Street E
Saskatoon, Saskatchewan
Canada, S7H 5H9
www.FarmFoodCareSK.org

FARM&FOOD Care

100 Stone Road West, Suite 202
Guelph, Ontario
Canada, N1G 5L3
www.FarmFoodCareON.org