

Frequently Asked Questions

with farmer Will Bergmann

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Agriculture in the Classroom-Manitoba (AIRC-M) gathered accurate, balanced and current information to address frequently asked questions students and teachers have about Canadian agriculture. We even asked a local Manitoba farmer, Will Bergmann, how he produces safe and nutritious food for us to eat. Click [here](#) to watch the full video.

Part 1: Farming Methods

1. What is organic farming?

The term “organic” refers to an agricultural production method. Organic farming focuses on the following without using synthetic fertilizers, synthetic pesticides or genetically modified organisms¹. Read more about Canadian Organic Standards and Regulations [here](#).

- enhancing the health and vitality of the soil
- preserving biodiversity
- promoting animal welfare
- preserving the ecological integrity of our environment



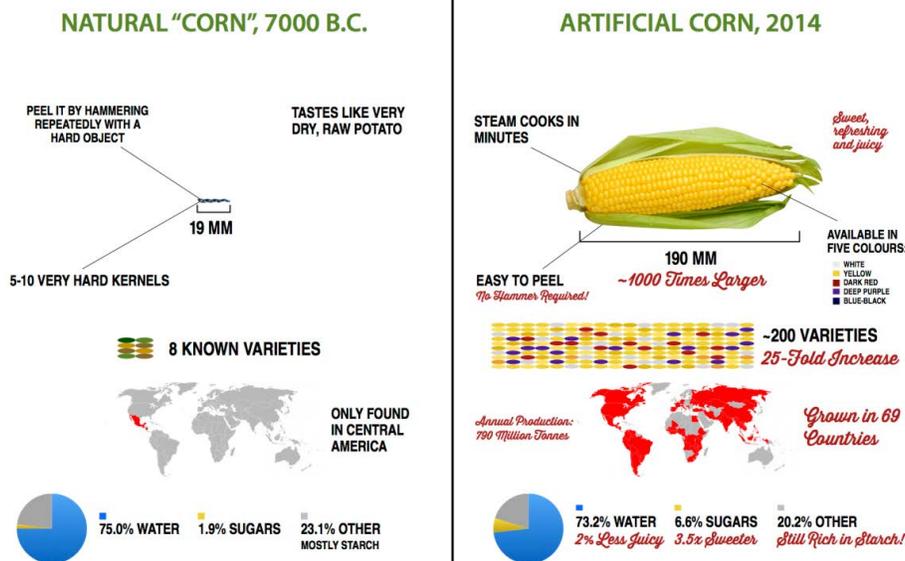
This logo guarantees consumers that all ingredients and livestock feeds used to make the product are truly organic.

2. How is conventional farming different from organic farming?

Conventional farming uses all of the tools available to organic farmers, such as crop rotation, cover crops, poly-cropping and manure, and can also use the latest technological advances in synthetic fertilizers, pesticides, antibiotics and GMOs to maintain healthy soils, environment, crops and livestock. Because of this, conventional farmers can produce from 5% to 50% more food per acre of land².

3. What is a GMO?

GMO stands for genetically modified organism. In truth, all food is genetically modified. Take for example the corn we eat today. It is a GMO created by humans using various plant breeding techniques. You would not likely recognize the natural ancestor of corn nor would you want to eat it! Today's corn tastes delicious but is technically artificial when compared to its 'natural' ancestor.



There are three techniques used to genetically modify plants:

1. **Plant breeding** is when researchers select plants, such as a wild relative, that show the trait they want. They don't need to know the exact gene or genes causing the trait. Then they cross this selected plant and a crop plant. They grow the resulting seeds and choose the ones that are closest to what they want. Over many, many generations, researchers may be able to get a crop variety that has the trait they want, but it can be difficult and time consuming since the selected plant or wild relative may also have many undesirable traits.

2. **Mutagenesis** is based on H. J. Muller's discovery that X-rays could induce genetic mutation in 1927. When it's not possible to find the trait you want in a crop relative researchers can use mutagenesis to create a new trait. This involves using chemicals or radiation to cause random changes in the plant's DNA. The researchers then have to screen hundreds or thousands of plants to choose the one that has the desired trait.



3. Genetic engineering is often interchanged with GMOs but they are different. When people mention GMO's they usually mean genetically engineered crops, also know as GE crops. Genetically engineered crops start with researchers finding a gene that causes a desired trait, such as disease resistance. Then, they need to get that gene into the plant they want to change. There are different ways to do this.

The most basic starts with extracting DNA from the species that has the gene. They use molecular scissors to remove the gene. Then use a gene gun to push the gene into plant cells, and some of those cells will take up the DNA into their genomes. The researchers grow the cells into whole plants and choose the ones that have the trait they want.

Another method uses a natural soil bacteria called **Agrobacterium**. This bacteria has the ability to move its genes into a plant and force the plant to grow food for it. Researchers can swap out the bacteria's genes with the genes they want, and let the bacteria do its work. Again the researchers grow the cells into whole plants and then choose the plants that have the trait they want.

Benefits of genetically engineering crops:

- Genetic engineering is very specific, unlike both plant breeding and mutagenesis where there is no control over exactly what genes get affected.
- Genetically engineered crops are highly regulated by Health Canada and the Canadian Food Inspection Agency (CFIA) unlike crops from plant breeding or mutagenesis.

View our quick video, [Plant Breeding \(3:38\)](#), for an illustration of these plant breeding techniques.

4. Why do farmers choose to grow genetically engineered (GE) crops?

GE crops allow farmers to grow more quality food and be more environmentally friendly.

Crops with built-in pest resistance require fewer pesticides to protect the crop from being destroyed. This reduces input costs for farmers, allows more quality food to be produced for consumers and protects the environment for all of us.

Genetically engineered crops have allowed farmers to adopt no-till farming, which

- greatly improves soil health, water and carbon retention, crop health, and food production while reducing greenhouse gas emissions and the risk of flooding.
- means fewer trips with a tractor over the field which reduces soil compaction, fuel use and greenhouse gas emissions. Good for the soil, good for the farmer and good for our environment.

New genetically engineered crops are being developed to withstand drought, frost, and salinity to give farmers the tools to handle adverse weather caused by climate change and meet the challenge of feeding the expected 9 billion people in 2050.

ASK WILL

5. Why do you choose to grow organic vegetables but then grow conventional crops and genetically engineered, often called GMO, crops?

It's all about strengthening our business by diversifying.

Since our farm is close to Winnipeg, there is a large group of consumers interested in being part of our Community Supported Agriculture Vegetable Garden. That makes our two acre garden an economically viable operation for us. Plus it gives me the opportunity to share our story and communicate with the population about farming. I love doing that!

On our remaining acres, it is more efficient and economically viable to grow bulk commodity crops. We grow genetically engineered canola, corn and soybeans because it allows us to get the best yields while reducing the amount of pesticides we use and the amount we cultivate or disturb the soil. We also grow conventional cereal crops like wheat and oats.

There are no genetically engineered seeds currently available for cereal crops.



Part 2: Pesticides

1. What are pesticides?

A pesticide is any product used to prevent (tetanus vaccine), repel (insect repellent), decrease (sterile mosquito release) or kill (mouse trap) a pest. But usually people mean chemical pesticides when they mention pesticides.

Farmers also use many practices to prevent pests such as maintaining healthy soils, using crop rotation and applying chemical pesticides when necessary. Organic farmers use chemical pesticides found in nature³. Conventional farmers use synthetic or man-made chemical pesticides, which today are much more targeted and safer than chemical pesticides of past generations. Chemical pesticides are used to treat specific crop diseases or control crop pests that have the ability to completely destroy food crops and create food shortages like the Phytophthora infestans or late blight in potatoes that caused the infamous Irish Potato Famine.

2. Are chemical pesticides safe?

When used properly yes. For example, it wouldn't be safe to take a bath in insect repellent but spraying it on your skin to prevent getting West Nile virus or Lyme Disease from insect bites is safe and recommended.

When a crop is suffering from a disease or pest and needs to be treated then farmers follow label directions for the prescribed pesticide to safely apply the lowest dose needed to protect the crop. Since pesticides break down over time, farmers also follow mandated wait times before harvesting the crop. This is true for both the natural chemical pesticides organic farmers use and the synthetic pesticides conventional farmers use.

Health Canada regulates all pesticides used in Canada and only registers pesticides that meet its health and environmental protection standards. Health Canada re-evaluates registered pesticides every 15 years or as new data becomes available⁴. Health Canada states, "to date, there is no evidence to show that there is a health risk from eating conventionally grown produce because of pesticide residues, or that organic foods are safer to consume than conventionally produced food."

Watch our video [Crop Protection \(2:53\)](#) for more information on crop protection practices including chemical pesticide use.

3. Should I worry about pesticides on the food I buy?

The answer is no. Canada has a very safe food supply. The Canadian Food Inspection Agency (CFIA) tests both domestic and imported food for pesticide residue based on the maximum residue levels (MRL) set by Health Canada for each pesticide⁵. Health Canada builds in extra safety by setting each MRL at levels 100 to 1,000 times below the amount that is considered safe for humans. And our detection systems can measure miniscule parts per billion (ppb). 1ppb would = 1 cent in 10 million dollars. To understand how effective these MRL's are, consider that a teen could consume 680 apples in one day without any effect even if the apples have the highest pesticide residue ever recorded for apples in the USA.

Have some fun and check out this Pesticide Residue Calculator at [SafeFruitsandVeggies.com](#) for more examples of how safe our food is! Read more on pesticides and food from Dr. Joe Schwarcz, McGill University [here](#).

ASK WILL

4. What did you mean when you said that most of our food has some sort of chemicals in it?

Everything in our universe is made up of chemical elements including you and the food you eat! Just like us, food is made of chemical elements such as carbon, nitrogen, zinc, and magnesium as well as chemical molecules such as dihydrogen monoxide (water) to name just a few. Check out the chemical composition of an all-natural – not so scary – banana.

Don't be afraid of the word "chemical" – do research and ask questions. Just because you can't pronounce the word, doesn't mean it's bad for you. Even certified organic crops and produce can have certain chemicals used on them. Conventional farms can use pesticides that are made from synthetic chemicals. All of these pesticides have gone through intense government testing and regulation to make sure they are safe.

View AsapSCIENCE video, [This is Not Natural](#) based on this infographic. Read more about chemicals from Dr. Joe Schwarcz, McGill University [here](#).

All-Natural Banana



INGREDIENTS: WATER (75%), **SUGARS (12%)** (GLUCOSE (48%), FRUCTOSE (40%), SUCROSE (2%), MALTOSE (<1%), STARCH (5%), FIBRE E460 (3%), **AMINO ACIDS (<1%)** (GLUTAMIC ACID (19%), ASPARTIC ACID (16%), HISTIDINE (11%), LEUCINE (7%), LYSINE (5%), PHENYLALANINE (4%), ARGININE (4%), VALINE (4%), ALANINE (4%), SERINE (4%), GLYCINE (3%), THREONINE (3%), ISOLEUCINE (3%), PROLINE (3%), TRYPTOPHAN (1%), CYSTINE (1%), TYROSINE (1%), METHIONINE (1%)), **FATTY ACIDS (1%)** (PALMITIC ACID (30%), OMEGA-6 FATTY ACID: LINOLEIC ACID (14%), OMEGA-3 FATTY ACID: LINOLENIC ACID (8%), OLEIC ACID (7%), PALMITOLEIC ACID (3%), STEARIC ACID (2%), LAURIC ACID (1%), MYRISTIC ACID (1%), CAPRIC ACID (<1%)), ASH (<1%), PHYTOSTEROLS, E515, OXALIC ACID, E300, E306 (TOCOPHEROL), PHYLLIQUINONE, THIAMIN, **COLOURS** (YELLOW-ORANGE E101 (RIBOFLAVIN), YELLOW-BROWN E160a), **FLAVOURS** (3-METHYLBUT-1-YL ETHANOATE, 2-METHYLBUTYL ETHANOATE, 2-METHYLPROPAN-1-OL, 3-METHYLBUTYL-1-OL, 2-HYDROXY-3-METHYLETHYL BUTANOATE, 3-METHYLBUTANAL, ETHYL HEXANOATE, ETHYL BUTANOATE, PENTYL ACETATE), 1510, NATURAL RIPENING AGENT (ETHENE GAS).



Part 3: Consumer Choices - Local, Fresh, GMO

1. Is buying local always the best environmental choice?

Usually but not always.

Rich Pirog, the associate director of the Leopold Center for Sustainable Agriculture at Iowa State University says that food miles/kilometers don't tell the whole story. "Food miles are a good measure of how far food has traveled, but they're not a very good measure of the food's environmental impact."

That impact depends on how the food was transported, not just how far. For example, trains are 10 times more efficient at moving freight, ton for ton, than trucks are. So you could eat potatoes trucked in from 100 miles away, or potatoes shipped by rail from 1,000 miles away, and the greenhouse gas emissions associated with their transport from farm to table would be roughly the same.

The environmental impact of food also depends on how it is grown. Swedish researcher Annika Carlsson-Kanyama led a study that found it was better, from a greenhouse-gas perspective, for Swedes to buy Spanish tomatoes than Swedish tomatoes, because the Spanish tomatoes were grown in open fields while the local ones were grown in fossil-fuel-heated greenhouses.

As with everything, food production from gate to plate is complex and while you would think that buying local would always be environmentally beneficial, it is not always true.

2. Is buying fresh fruits and vegetables always the best choice?

Again, not necessarily.

In season, fresh ripe fruits and vegetables from your garden or a local farmer's market which you consume soon after picking or buying provide the best nutrition.

But fresh vegetables or fruits that travel many kilometers are usually picked before they are ripe, so never reach their peak nutrition. Also all of the time that they are travelling or sitting in a warehouse, on the store shelf, or in your refrigerator they deteriorate slowly losing some of their nutrients.

Frozen fruits and vegetables tend to be processed at their peak ripeness, a time when—as a general rule—they are most nutrient-packed. Then they are flash frozen to lock them in a relatively nutrient-rich state⁶. Some even pack a bigger nutritional punch when frozen. For instance, one cup of frozen spinach has more than four times the amount of nutrients, such as fiber, folate, iron and calcium, than a cup of fresh spinach⁷.

Off season, frozen produce is usually less expensive than fresh produce which makes it more economical to get your recommended five to 10 servings of nutritious vegetables and fruits each day.

Canned vegetables tend to lose a lot of nutrients during the preservation process so are usually not the most nutritious choice. But there are notable exceptions such as pumpkin and tomatoes. Canned tomatoes are preserved using heat, which releases lycopene—a carotenoid that may help prevent prostate and breast cancer. So even in season, canned tomatoes offer something that fresh can't⁸.

Check out AsapSCIENCE's video "[Fresh vs Frozen Food.](#)"

3. Is genetically modified food just as nutritious as other food?

Health Canada states, "Foods from genetically modified plants are as safe and nutritious as foods from traditionally bred plants."

ASK WILL

4. Does your family eat food made from the GMO crops you choose to grow on your farm?

Absolutely, I wouldn't grow food I wasn't happy to feed to my own family. I am proud of both the organic and conventional crops that I am producing.



Part 4: Crop Rotation

1. What is crop rotation?

A farming method where each year over a period of three to four years a different crop is grown on a field so that the soil stays healthy and fertile.

One common crop rotation used on Manitoba farms is

- Year 1 - oilseed crop (canola, soybean, sunflower or flax)
- Year 2 - cereal crop (wheat, barley, oats or corn)
- Year 3 - pulse crop (field peas, lentils, beans, or chickpeas)
- Year 4 - cereal crop (oats, barley, corn or wheat)

2. Why do farmers use crop rotation?

Crop rotation is one of modern agriculture's best management practices (BMPs).

Farmers understand that different crops require different amounts and types of nutrients. They also know that crops in the legume family which includes alfalfa, clover and soybeans as well as pulses such as peas and beans are actually able to fix nitrogen, one of the three main plant nutrients, in the soil.

Changing which crop is grown in a field each year is the most efficient way of providing crops with the nutrients they need while reducing the amount of added fertilizer needed.

Different diseases and pests attack different crops as well. Changing the type of crop grown in the field each year helps break the pest cycle, prevents the build-up of diseases or insects and decreases the need to treat crops with chemical pesticides.

3. What are other best management practices (BMP) used by farmers to improve farm production and environmental sustainability?

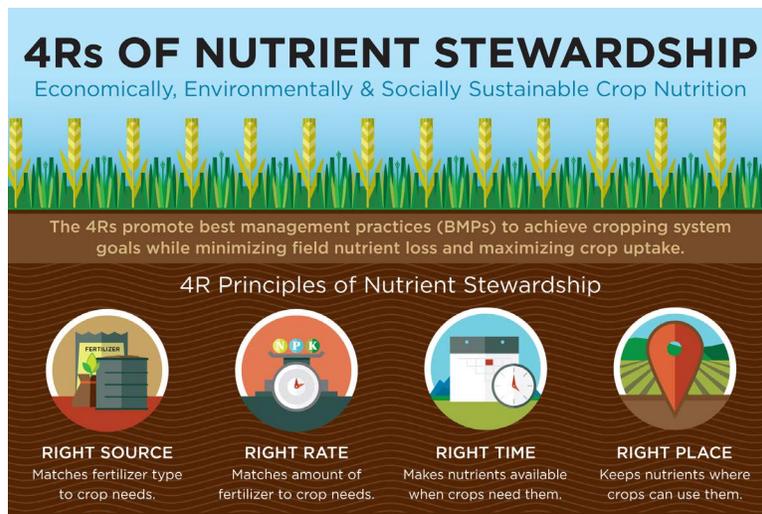
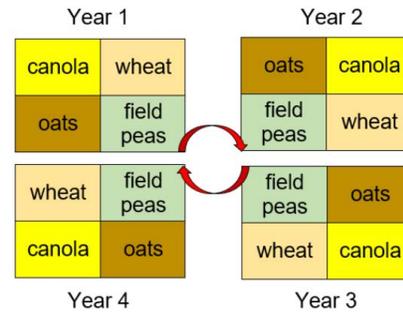
Here are three widely used modern BMPs:

1. No-till is a BMP that replaces the age-old practice of tilling or plowing up the soil. Plowing the soil leaves it susceptible to erosion. Improved science and technology such as equipment and some genetically engineered crops allow farmers to use no-till which means they can plant straight into the soil without plowing it. No-till benefits include:

- Plant materials from the previous year's crop are left on the soil to build up its organic matter and improve water retention.
- No need to burn stubble.
- Populations of beneficial insects are maintained
- Soil erosion is greatly decreased so no repeat of the 'Dirty Thirties'
- Fewer nutrients are lost from the field
- Less fuel is used to prepare the field for planting so fewer greenhouse gasses are produced.

2. 4 Rs Nutrient Stewardship is the BMP used to maximize crop production while minimizing use and environmental impact of fertilizers.

Watch our quick video, [Crop Nutrients \(2:07\)](#), for a discussion on crop nutrients and an illustration of 4R nutrient stewardship.



3. Precision Agriculture is when fields are mapped and analyzed for levels of nutrients, moisture, etc. through special software or apps.

Tools like auto-steer together with satellite-controlled Global Positioning Systems (GPS) on tractors and equipment ensure there is no overlap when planting, fertilizing and/or spraying. Benefits from precision agriculture include:

- allowing farmers much greater control over amount and placement of fertilizers and crop protection products as they travel over a field which reduces waste and environmental impact.
- reducing fuel consumption and lowering greenhouse gas emissions

ASK WILL

4. What best management practices, besides crop rotation, do you use on your farm?

Like most farmers, we incorporate ideas from precision agriculture and 4R Nutrient Stewardship and constantly evolve our management practices to become the best at what we do. Together they allow me to be more efficient and environmentally friendly. Plus I get to use all kinds of cool apps, GPS and my drone.

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