

Photo credit: Manitoba Crop Alliance

## HISTORY

Wheat was first cultivated in 8500 BC in the Fertile Crescent, an area between the Mediterranean Sea, Red Sea and Persian Gulf. It was one of the first crops to be domesticated, which helped make large-scale food production possible and paved the way for civilizations to grow. Because of its adaptability, wheat spread beyond the Middle East, and the crop is now grown all around the world.

The first known plantings of wheat in Canada were in 1605 in Nova Scotia and 1617 in Quebec City. In Manitoba, wheat was first planted by the Selkirk Settlers. The wheat seed they had brought with them was not well suited to our Manitoba climate. They harvested their first wheat crop in 1815 after experiencing crop failures in 1813 and 1814.

*Red Fife* wheat, which was first grown in Ontario in 1842, was a more suitable seed. It became the most widely grown wheat on the Canadian prairies between 1860 and the early 1900s, and led to increased land development and railway expansion. But *Red Fife* crops failed in years with early fall frost.

Dr. Charles Saunders, using new crossbreeding technology, spent over a decade breeding *Red Fife* with another wheat variety, *Hard Red Calcutta*, to produce *Marquis* in 1903. *Marquis* was a superior variety of wheat that matured earlier and generated a larger yield than *Red Fife*. *Marquis* wheat was soon planted across 80 to 90 per cent of the total wheat acreage in Canada and covered more than 20 million acres. It was exported around the world, and aided Canada's allies during the Second World War. *Marquis* wheat hasn't been grown commercially for years, but virtually every new wheat variety produced in Canada over the past 100 years traces back to crosses made with *Marquis*.

## PRODUCTION

In Canada, wheat is grown from the United States-Canada border in the south to the fringes of cultivated land in the north. In Manitoba, it is grown across all soil types.

Farmers begin seeding as early as possible to ensure higher yields. Many farmers first prepare the seed bed through *tillage*. Tilling with tools or equipment turns over and breaks up the soil, which loosens and aerates it. More farmers now practice *reduced tillage* or *conservation tillage*, techniques that minimize disturbing the soil, help conserve water, capture or sequester CO<sub>2</sub> from the air, prevent erosion, and reduce fuel emissions from farming vehicles and equipment. Other farmers *direct seed*, which means they plant the seed directly into untilled soil.

Farmers use a range of practices to manage insects, weeds and disease. *Integrated pest management* involves carefully selecting the variety of wheat they grow, scouting (monitoring) their crop as it grows, and crop rotation. Farmers implement cultural, mechanical, biological and pesticide control measures that consider potential damage, costs and value, as well as impacts on other pests, beneficial organisms, and the environment.

*Spring wheat* is seeded in May and harvested in August. *Winter wheat* is seeded in September, lies dormant in the winter, and is harvested in July or early August. Seeds are planted 4 to 7.5 centimetres beneath the soil – just deep enough to reach moisture – and are usually fertilized with nitrogen, phosphate, potassium and/or sulphur, depending on the soil. Sometimes farmers treat the seed with *fungicide* to protect against a wide range of diseases. Insecticides can also be used in seed treatments to further protect the vulnerable seedlings.

*Germination* begins when the seed begins to absorb water. This triggers enzymes in the seed that break down starch and protein in the *endosperm*, which move into the embryo and



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provide energy for growth. Soil temperature and moisture determine how quickly germination occurs. Soon, the embryo pushes out a *radicle* or seed root, which grows downward, followed by the *coleoptile*, a tube that grows upward to the surface. The first true leaf of the wheat seedling emerges from the coleoptile and begins to grow. The resulting seedling usually emerges above the soil about seven days after germination.

Once the wheat plant develops three to four leaves, it begins growing *tillers* (additional stems). The stems elongate and grow *heads* or *spikes*. This starts the flowering or reproductive phase. Most wheat is *self-pollinating*, which means pollen fertilizes the ovary of the same flowering parent plant. After pollination, the plant begins to *ripen* or mature, turning a straw colour. The *kernels* or seeds in the head become very hard.

At harvest time, a farmer might choose to *swath* their wheat with a machine called a *swather*. This occurs once the crop has matured, but before it has fully dried down (to around 35 per cent moisture), and then it is allowed to fully dry down in the *swath* (row) before combining. A farmer can also choose to *straight cut* their wheat by skipping the swathing process. This requires allowing the wheat to dry completely (to around 14 to 20 per cent moisture) and using a combine to cut and thresh the wheat in a single pass. A *combine* is a piece of equipment that cuts the stems and separates the wheat kernels from the seed stalks.

After harvest, wheat farmers transport their harvested grain to storage bins on their farms for later delivery to grain elevators, where their wheat is blended with wheat from other farmers and stored. Elevators separate wheat of the same class and protein level before shipping it to market. Grain is also delivered directly to buyers, such as feed mills.

The wheat Manitoba (and Canadian) farmers grow is internationally recognized for its quality and is exported around the world. It is also used domestically for food, feed and fuel. Manitoba is currently home to three mills.



## PROCESSING

The *kernel* is the wheat seed that, when planted, grows to become the *wheat plant*. Some wheat plants can grow as tall as seven feet, but most commercial varieties reach a height of two to four feet. The *wheat head*, the part of the plant harvested for food production, can yield 25 to 50 seeds. The kernels are small and dry, making them well suited for storage and transport.

Wheat seeds get *milled* into flour. Processing wheat involves the following basic steps (however, milling is far more complex than this simplified breakdown can fully convey):

1. **Preparing the wheat:** the wheat is weighed, inspected and graded.
2. **Cleaning:** impurities like stones, dirt, metals and other seeds are removed.
3. **Tempering:** the wheat is soaked in water to make it easier to remove the outer bran layer.
4. **Gristing:** different types of wheat are mixed to create a specific kind of flour.
5. **Milling:** involves a series of repeated steps:
  - *Grinding* the wheat using a machine equipped with rollers that breaks it into pieces.
  - *Sifting* the wheat through sifters that separate the meal from coarse to fine white flour, wheat bran and wheat germ. The milling process can produce distinct products (e.g., wheat bran, refined white flour, and wheat germ) that can be packaged and sold separately, milled together to produce a whole grain flour, or blended to form different flours.
  - *Blending* different components back together forms different flours. For example, whole wheat flour is a blend of white flour and wheat bran.
  - *Enriching* and *fortifying* add vitamins and minerals identified in government regulations.

## THE WHEAT KERNEL

Sometimes called the *wheat berry*, the kernel is the seed from which the wheat plant grows. Each tiny seed contains three distinct parts that are separated during the milling process to produce flour:

- **Endosperm:** About 83 per cent of the kernel weight and the source of white flour. The endosperm contains the greatest share of protein, carbohydrates and iron, as well as the four major B-vitamins: riboflavin, niacin, thiamine and folic acid. It is also a source of soluble fibre.
- **Bran:** About 14.5 per cent of the kernel weight. Bran contains dietary fibre, a small amount of protein and significant quantities of vitamin E, B-vitamins, minerals, antioxidants and phytochemicals.
- **Germ:** Makes up about 2.5 per cent of the kernel weight. The germ is the embryo or sprouting section of the seed, often separated from flour during milling because the fat content (10 per cent) limits flour's shelf life. The germ contains minimal quantities of protein and a greater share of B-complex vitamins and trace minerals.

## VARIETIES

Wheat is a hardy plant. Over the years, plant researchers have developed new varieties of wheat that are higher quality, higher yielding, and adapt well to Canada's growing season.

In Canada, the type of wheat most often grown is *bread wheat*, which is classified as either *hard* or *soft*. *Durum* wheat is sometimes also grown.

### DID YOU KNOW?

In 1970, **Dr. Norman Borlaug**, an American agronomist, won the Nobel Peace Prize for developing a shorter, high-yielding wheat variety that was more resistant to disease and *lodging* (bending and breaking of the stalk). This new breed is considered a significant advance in the fight against world hunger.

- **Hard wheat** includes hard winter wheat and hard spring wheat, which contain more gluten-producing proteins than soft wheat. Used for making bakery flours, bread flours and all-purpose flours.
- **Soft wheat** is low in gluten-producing proteins. Usually milled into cake and pastry flours.
- **Durum wheat** is generally high in gluten-producing proteins. Used for making semolina and flours that are used to make Indian flatbread, macaroni and other pastas.

## TYPES OF FLOUR

### All-Purpose Flour

*All-purpose flour* is the finely ground endosperm of the wheat kernel, separated from the bran and germ during the milling process. All-purpose flour is made from hard wheat, or a combination of soft and hard wheat, from which bakers can make a complete range of baked products such as yeast breads, cakes, cookies and pastries.

*Enriched all-purpose flour* has iron and four major B-vitamins (thiamine, niacin, riboflavin and folic acid) added in amounts equal to or exceeding that in whole wheat flour. All enriched flour and whole wheat flour has double the folic acid of standard all-purpose flour.

*Bleached all-purpose flour* is exposed to chlorine gas or benzoyl peroxide to whiten and brighten its colour. Chlorine also affects baking quality by "maturing" or oxidizing the flour, which is beneficial for cake and cookie baking. The bleaching agents do not leave harmful residues or destroy nutrients.

*Unbleached all-purpose flour* is bleached by oxygen in the air during an aging process and has an off-white colour. Nutritionally, there is no difference between bleached and unbleached flours.

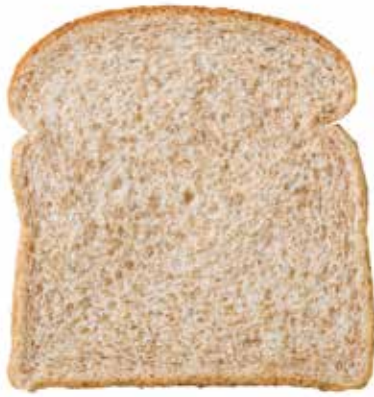
### Whole Wheat Flour

*Whole wheat flour* is coarse-textured flour containing the bran, germ and endosperm. The presence of bran reduces gluten development, which means baked goods made from whole wheat flour tend to be heavier and denser than those made from white flour.

### Other Types of Flour

Many other kinds of flour are derived from different parts of the wheat and milling stages. These flours, including *bread flour*, *self-rising flour*, and *cake and pastry flour*, are often used for specific purposes. *Farina*, *semolina* and *durum flour* are often used to make pasta.





## NUTRITION

Whole grains are a major source of complex carbohydrates (starches), fibre, iron and B-vitamins, and are generally low in fat. One serving size equals one ounce, or about one slice of bread, so a sandwich provides two servings.

### White Bread

One slice of enriched white bread gets 76 per cent of its calories from carbohydrates (mostly complex) and only 11 per cent from fat. The remaining calories (13 per cent) come from protein. White bread has 0.5 grams of soluble fibre per slice, which contributes to your recommended daily 25 to 38 grams of fibre.

### Whole Wheat Bread

The nutritional content of whole wheat breads varies between brands. An average slice of whole wheat bread gets 69 per cent of its calories from carbohydrates and 15 per cent from fat, because the wheat germ in the whole wheat flour is about 10 per cent fat. The remaining 16 per cent of calories come from protein.

The wheat germ contains protein in addition to fat and several minerals. However, the nutrient profile of whole wheat bread

remains excellent. It contains two grams of fibre, primarily insoluble. Foods containing insoluble fibre have been shown to help prevent colon cancer and possibly breast cancer. Almost a milligram of iron per slice, a substantial amount of folic acid (17.5 micrograms), vitamin E, copper, vitamin B<sub>6</sub> and the three major B-vitamins make whole wheat bread a nutrient-dense food.

To be considered a whole grain food, the ingredients label on your bread should first list “whole wheat flour” or a combination of whole grain ingredients. Not all brown-based bread is whole wheat! A brown colour may reflect caramel colouring, which will be listed on the label. Its nutrient value is similar to white bread.



## BY-PRODUCTS

Besides flour, wheat is used to make a variety of non-food items, including concrete, paper products, adhesives, cosmetics, plastic film and bags, and soaps and shampoos.

## FARMER PROFILE



### JOSÉE SAQUET Laurier, Manitoba

“Being able to grow world-class crops for the entire planet is incredibly fulfilling. Knowing that we as farmers are helping feed the world is a great feeling. I am truly blessed to live and work in Manitoba doing what I love.”

### INDUSTRY IN MANITOBA

**Production:** 5,273,900 tonnes (2020)

**Number of Producers:** 5,913 (2016)

**Value to Economy:** \$1,131,445 (not including durum) in farm cash receipts (2018)



### INDUSTRY IN CANADA

**Production:** 31,769,100 tonnes (2018)

**Value to Economy:** \$6,705,413,000 in farm cash receipts (2018)



### ENVIRONMENT

Manitoba farmers put tremendous effort into making sure the crops they produce are safe and grown in a sustainable way. They use modern agriculture practices and tools to reduce greenhouse gas emissions, address climate change and help build biodiversity. Some of the innovations they use to grow wheat crops include:

- **Reduced tillage and conservation tillage**
- **Plant breeding research and techniques** to develop high-quality varieties of wheat that are more resilient, better yielding and sustainable.
- **GPS and precision agriculture** that help farmers reduce unnecessary seed, fertilizer and pesticide use, and reduce fuel consumption from farming vehicles and equipment.

Manitoba and Canadian farmers are setting the standard for modern farming practices in other ways. By growing winter wheat, they support the nesting habitats of prairie wildlife.



## CAREERS

- » Farmer
- » Milling technologist
- » Wheat breeder
- » Research technician
- » Agronomist
- » Soil scientist
- » Farm machinery technician
- » Grain trader



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