How does **mechanization** impact the **food system?**

the impact of innovation

Innovation has always been part of agriculture. Canada's population growth and the creation of railway towns and cities in the western prairie provinces was made possible, in part, because more food was able to be produced.

Why were farmers able to feed so many more people? One of the most important changes was the invention and development of engines and machinery that were powered by gas.

The increasing use of this machinery on farms was called **farm mechanization**. It meant that farmers could do more with fewer people and farms could grow larger. More food could be produced by fewer people.

What does innovation mean to you? **Innovation** can be described as a new idea, product or practice that is an improvement over an idea, product or practice that has been used previously. Consider how this applies to the food you eat and how it is produced.

Photos courtesy of Libraries and Cultural Resources Digital Collections, University of Calgary/NA-4174-13 & NA-2160-4

mechanization over time

Over time, the tools and implements needed for farming evolved and changed to allow farmers to better prepare the land, cultivate the soil, sow and plant seeds, water crops and harvest them. The energy sources needed to power these implements also changed.

Before mechanized equipment evolved, farming was mainly done through the use of tools such as ploughs, axes, scythes and hoes. Some farmers used hoes with iron blades, while others who owned horses or oxen used ploughs.

The top photo shows an Alberta farmer in 1904, handling a plough while an oxen team provides the power to pull it. The bottom photo from 1918 shows a team of two horses used with a walking plough.

The plough is probably one of the oldest farm tools. Early ploughs were made of wood, but iron and steel ploughs become more common in the mid to late 1800s. The **plough** was used to break up the soil and turn it over to make it easier to plant.

Walking ploughs

The walking plough played an important role in Canada's farm history. The Scotch Walking Plough from the early 1900s was designed in Scotland and imported by Scottish farmers and blacksmiths. It was manufactured by the McArthur Foundry in Ontario.

The plough has multiple surfaces that work together to lift and turn over the soil. The knife coulter in the front of the plough cuts vertically to loosen the ground. Then the pointed horizontal blade of the share slices through the soil, lifting it up and directing it along the curved surface of the mouldboard which rolls and flips the earth. This results in the exposure of the nutrient-rich soil. The farmer required the help of workhorses to pull these ploughs. The farmer needed a great deal of strength to control the depth, angle and direction at which the plough moved through the soil in order to create straight and even furrows. Farmers used the walking plough until the advent of riding ploughs in the early twentieth century.

From a description of Scotch pattern walking plough - Canada Agriculture and Food Museum YouTube: Online. www.youtube.com/watch?v=L3QeM8B2AJc

Farmers such as those shown in the photos below, often used a combination of horse or oxen powered ploughs and manual tools like hoes. The photo to the right shows a farmer tilling with a six-horse team in the Hanna area in the 1920s. How is this farming implement different than the ploughs pictured in the photos on the previous page?

The difference between ploughing and tilling

Ploughing and tilling are both practices used to prepare the soil. However, while ploughing digs deep into the soil and flips it over – like flipping a pancake – tilling runs a blade through the soil – like combing or raking. Tilling stirs up the soil but does not dig as deep as ploughing will.

In the past, tilling was done manually with hoes, rakes and shovels. Ploughing was done by pulling a plough behind horses, cattle or oxen.

Photo courtesy of Libraries and Cultural Resources Digital Collections, University of Calgary/NA-3596-53

Photos courtesy of Libraries and Cultural Resources Digital Collections, University of Calgary/NA-4155-41 & NA-4181-32 & NA-3803-2

After the land was cleared with a plough, a **harrow** was used to spread out and even the dirt for planting. For hundreds of years, grain was sowed by hand. The photo above shows a harrow, being used at Red Deer Lake in 1919.

In the 1700s and 1800s, inventors came up with seed drills, which made it much easier to plant crops. The **seed drill** spread seeds spaced evenly into a **furrow** – a long narrow trench – at a consistent depth. The drill then re-covered the seeds over with soil. Early seed drills used horse or oxen power, such as in the photo to the right that shows seed discs and drills used to seed barley in 1912 and the photo below, showing a farmer with a seed drill in 1928.

?

What examples of change do the agricultural machines described and in the photos represent? Describe two examples.

changing approaches to sustainability

When European settler farmers started to use prairie land for their farms, the soil had high organic content and was very fertile. There was very little concern about soil conservation.

After the Depression, the practice of summer fallow started to be used to conserve moisture and help control weeds. Jump forward to the late 1900s and early 2000s, and farmers changed from conventional tillage of their land to zero tillage. Many of these farming practices depended on mechanization.

During the first half of the 1900s, farmers relied upon animal manure and household waste to fertilize their fields. There wasn't much they could do to eliminate pests. Manure was shovelled off a cart. In the early 1900s a manure spreader, like the one in the photo below, was used to distribute the manure more evenly and quickly on the field.

Photo from Huron County Museum & Historic Gaol

Fallow and tillage

Summer fallow is the practice of leaving the land without a crop during the growing season.

Tillage involves preparing soil for planting or seeding by ploughing, cultivating or otherwise turning it. Tillage loosens the soil, which allows for the deeper penetration of roots.

Conventional tillage buries most of the crop residue from the previous harvest into the soil. Tillage that retains most of the crop residue on the surface and involves minimal tillage is known as **conservation tillage**.

No-till or **zero-till** is also a farming practice. Seeds are spread on the surface without disturbing the soil. Crops are usually seeded without the use of tillage, although some farmers use a seed drill to plant the crop into the crop stubble from the previous year without disturbing the soil. These practices conserve moisture and reduce soil erosion.

Today, fertilizer can be applied by applicator machines that are pulled behind trailers. Liquid-based fertilizers can be injected into the soil or sprayed on a growing crop. Solid-fertilizer (such as manure) applicators can have a wide container with holes in the bottom to spread the fertilizer.

Definitions from Conventional tillage: How conventional is it? Statistics Canada: Online. www150.statcan.gc.ca/n1/pub/16-002-x/2008003/article/10688-eng.htm

Water was obtained from nearby freshwater sources, which were used to flood fields. Farmers watered and weeded by hand. Family members or hired workers did the work. Compare this to mechanized irrigation used today, which uses centre pivots or linear machines to irrigate land.

Harvesting and threshing depended on both tools and farm labour. Harvesting grain was hard work – many farmers had to manually remove the dried seeds from the chaff.

Before mechanization, farmers used winnowing baskets and flails to separate the dried seeds. A **flail** was made from two or more large sticks joined with a short chain or leather and was swung against a pile of grain to loosen the grain from the **chaff** - its inedible covering.

A **winnowing basket** held the grain, which would be tossed in the air on windy days so the lighter chaff blew away.

Threshing machines were later invented to mechanically knock the grain off the chaff. These were initially powered by steam engines.

The photo below shows an early threshing machine in the Rumsey area of Alberta in 1919. A tractor can be seen in the background.

Photo courtesy of Libraries and Cultural Resources Digital Collections, University of Calgary/NA-3045-3

Farm labour

Threshing and harvesting wheat in the fall was usually too large a job for a farm family to handle on their own.

It took a crew of 10 to 12 men about a week to thresh and harvest an average farm. Many men and boys travelled to prairie farms from eastern provinces, the United States and even Britain.

Cyrus McCormick of Virginia invented the **mechanical reaper** in 1831. It cut the standing grain and swept it onto a platform. The calendar cover shown here illustrates where the grain was piled from this platform. This machine could harvest more grain five times faster.

Self-raking reapers were another version that continued to make harvesting faster and easier. These reapers cut the grain and prepared it for binding and tying. Mechanized binders were later added to reaping machines, using twine to tie the cut grain into **stooks**, bundles of grain stalks.

Photo courtesy of Libraries and Cultural Resources Digital Collections, University of Calgary/NA-3545-1

effects of mechanization on the food system

Ongoing mechanization reduced the amount of labour needed over time to harvest crops. More technology and larger machines has meant that many crops which might not have been seeded or harvested years ago are now available for the food system.

At the same time, new technologies that are environmentally friendly allow farmers to produce crops more efficiently while using less power and conserving natural resources.

The Food and Agriculture Organization of the United Nations calls this **sustainable agricultural mechanization**. Sustainable agricultural mechanization covers all levels of farming and the technology used to produce food, from simple and basic hand tools to more sophisticated and motorized equipment.

It makes farming activities such as seeding, the use of fertilizer, irrigation and weed and pest control, as well as harvesting and distributing food products easier, while protecting the soil, conserving water and using less energy.

From Food and Agriculture Organization. What is sustainable mechanization? FAO United Nations: Online. www.fao.org/sustainable-agricultural-mechanization/overview/what-is-sustainable-mechanization/en/

What farm practices are dependant on mechanization? What range of functions do these machines provide? Describe two examples.