Ag@School

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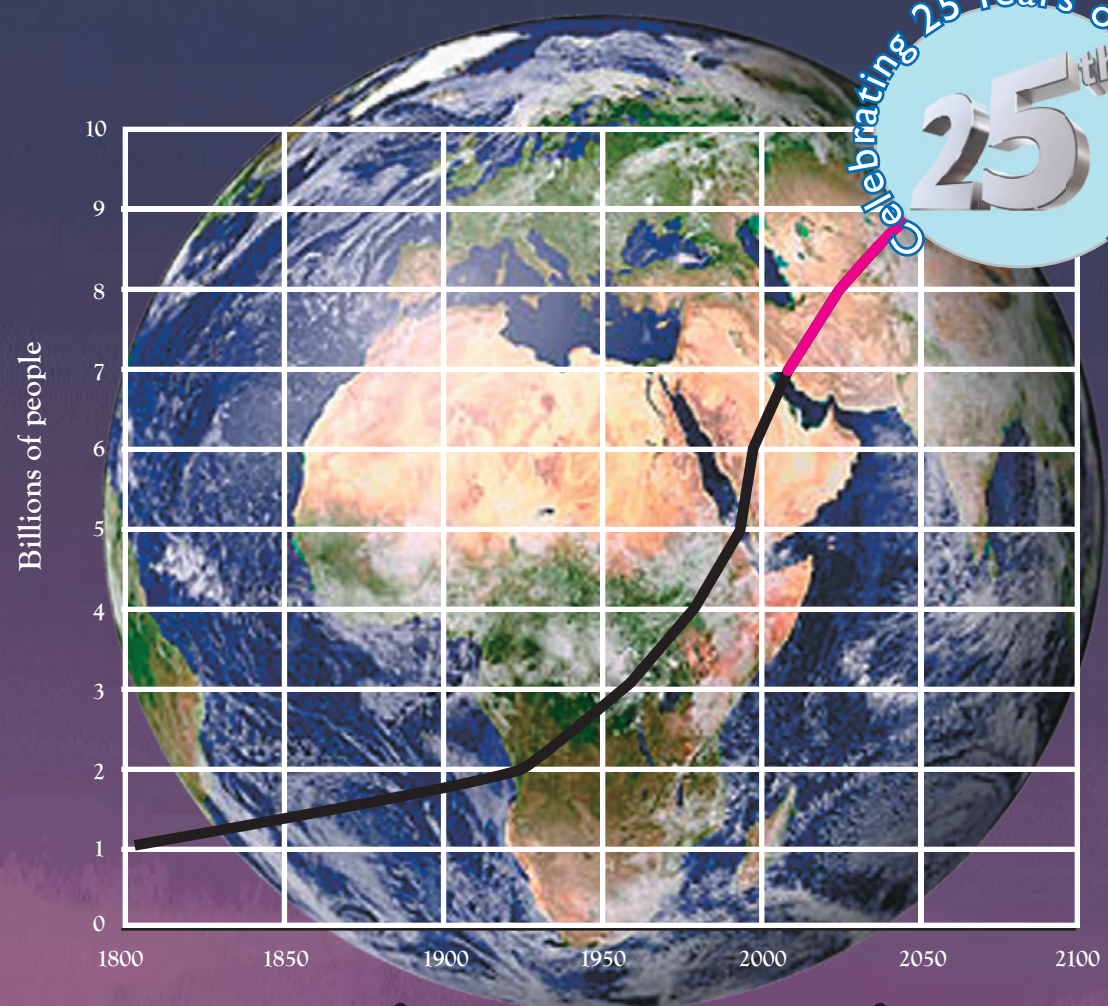
CAN AGRICULTURE CONTINUE TO FEED THE WORLD?



Celebrating 25 Years of Ag@School

25th

YES! BY USING TECHNOLOGY!

Our world population will grow to more than 9.8 billion people by 2050!
The world's farmers & ranchers will have to grow 60% more food
than what is now produced.




Today's Children...**Tomorrow's Leaders**

tech•nol•o•gy (tek nol´ə je), n. using scientific knowledge to find a better way of doing something.

501c3 nonprofit - fully funded by donations

AGRICULTURE IN A CHANGING & GROWING WORLD

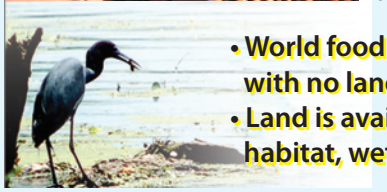
People continually find better ways of doing things. When people apply what they have learned about science; that's technology!

No industry has made better use of technology than agriculture. Improvements to agriculture have changed America from an **agrarian** to an **urban** society. Less than 1.5% of our people now work the land. This allows everyone else to live in cities and work in other careers. This means more doctors, more teachers, and more scientists.

Even though less than 1.5% of the US lives on farms, 17% of our total workforce is employed in agriculture. Growers produce the raw products and others turn them into things we eat and use.

Historically, the early 20th century mechanical revolution put tractors, combines, and other specialized machinery in use rather than horses and mules. Then in the mid-20th century, agriculture experienced a revolution in chemical and genetic knowledge that allowed **high-yield agriculture**. In the late 20th century, agriculture benefited from the electronic revolution, using computers and satellites.

Prior to 1900, nearly all increases in food production came about because more land was brought into production. Now in the 21st century almost all increases must come from higher yields and be based on science and technology.



High-Yield Agriculture

Farmers grow more food on each acre by using technology. They choose improved seeds, add plant food (fertilizer) to the soil, manage pests, and use better equipment and techniques. As a result…

- **World food production has tripled since 1950 with no land use increase**
- **Land is available for other uses like wildlife habitat, wetlands, and recreation**

New Food Pyramid

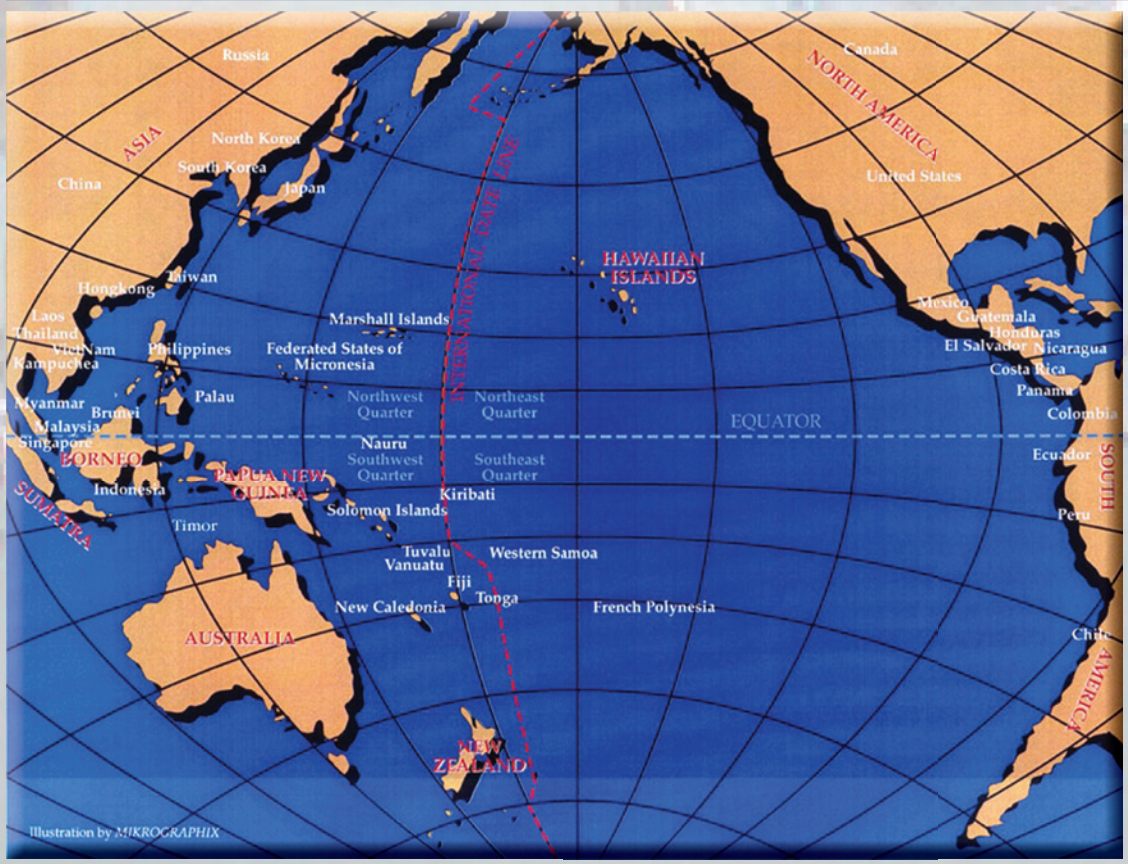
The New Dietary Guidelines (2025-2030)

emphasize simple, flexible guidance rooted in modern nutritional science:

- Prioritize protein at every meal
- Consume full-fat dairy with no added sugars
- Eat vegetables and fruits throughout the day, focusing on whole forms
- Incorporate healthy fats from whole foods such as meats, seafood, eggs, nuts, seeds, olives, and avocados
- Focus on whole grains, while sharply reducing refined carbohydrates (grains or sugars processed to remove fiber, bran and germ, leaving mostly starch for quick digestion)
- Limit highly processed foods, added sugars, and artificial additives
- Eat the right amount for you, based on age, sex, size, and activity level
- Choose water and unsweetened beverages to support hydration

Washington Trade Is Boosted By The Pacific Rim

Washington's location on the **Pacific Rim** allows for advantageous international trade. Canada, Japan, Mexico, China, South Korea, Philippines, Taiwan, Indonesia, and Hong Kong were Washington's top exporters in 2025. By ship, Washington ports are about two days closer than California ports to the Asian Markets. In 2025, Washington-grown or processed food and agriculture exports totaled $7.64 billion (WSDA 2025). Washington consistently ranks in the top five largest exporters of food and agriculture products in the US.



THE DEFINITION OF **EXPORT** IS:
to send to another country for trade or sale

THE DEFINITION OF **IMPORT** IS:
to bring in from another country for trade or sale

Activity

1. What is the Pacific Rim?
2. Can you name five countries on the Pacific Rim
3. On the map, put an "X" on Washington
4. Use a globe to trace the polar air routes from Washington to Europe

How do we increase exports?

Trade is not always a simple process. Countries can impose **tariffs** (taxes on imported products). If consumers want to buy the imported products they must pay a higher price to cover the cost of the tariff. Tariffs and other trade barriers can be used to protect producers within a country from foreign competition. Tariffs can lead to trade wars as exporting countries retaliate with their own tariffs on imported goods.

One method of increasing trade is to make trade agreements between countries. **Free Trade Agreements** (FTAs) have proven to be one of the best ways to open up foreign markets to U.S. exports. We currently have 14 agreements with 20 countries around the world.

Trade – A Heritage In Washington

Our tradition as a trade state began back in the early nineteenth century with the fur trading activities of Hudson's Bay Company and the Canadian North West Company. Seattle became a major seaport during the Klondike gold rush by selling provisions to miners and transporting prospectors to the Alaskan gold fields. In 1916, William Boeing started building wooden airplanes in a small red barn. Today Boeing Company is the country's largest exporter.

Global demand for the things we produce helped to build our state and drives our economy today. More than 40% of all Washington jobs are linked to trade. Washington products that are especially reliant on global trade include wheat (up to 90% of the crop is exported each year), potatoes (up to 70% are exported in the form of French Fries), and tree fruit (approximately 30% of apples and 25% of cherries are exported each year).

1790 — 4 million Americans, 90% lived on farms

1850 — 23 million Americans, 64% lived on farms

1950 — 151 million Americans, 12.2% lived on farms

Agriculture in a

Revolution: A "sudden

1820 - 1870 Industrial Revolution in the US
A change from hand and home production to machine and factory production

1920 - 1950 Mechanical Revolution in agriculture
Change from machinery being pulled by horses and mules to using tractors, combines, and oth

1945 - 1960 Chemical Revolution in agriculture
Use of man-made fertilizers and chemical pesticides targeting specific weeds and insects

1965 - 1975 Green Revolution
Dramatic increases in production of wheat and rice in developing countries due to use of geneti

1975 - Electronic Revolution
Using computer technology in agriculture. Rotary combines are introduced allowing crops to be cut a

1980s - Biotechnology Revolution
Using biology and cellular technology to develop new products.

1982 - Produced human insulin from bacteria.

First genetically modified plant cell! 5 years later they were testing genetically modified crops (GMO) to

1990s - Electronic Revolution continues
Use of computer technology and global positioning satellites (GPS) to guide equipment
1996 – GPS plus GIS Revolution - Farmers use satellite technology (Global Positioning System) to track and plan their fa

2000s - High Speed information and the latest in technology
Software and mobile devices help farmers have better harvests by allowing them to stay connected to colleagues while data while on-the-go. In addition to the unprecedented ability to order seed or fertilizer at any time or in any place

Ground-based and unmanned aerial vehicles (drones) were piloted on farms in the early 2000s, Today, drones are use farmers all over the globe.

Major farm equipment manufacturers introduced auto-steer capabilities and other automated functions in tractors, spra

2008- GMO algae is used to make fuel

2010s - Digital Data revolutionizes agricultural technology
Through access to real-time data, farmers can make better-informed decisions that allow them to use r data from on-farm practices and agronomic models with local weather and soil conditions to provide f

2012s - CRISPR technology
CRISPR technology is developed which opens the door to genome editing (a method for making specifi CRISPR stands for – Clustered Regularly Interspaced Short Palindromic Repeats. Today, this technology - scientists to improve yield or resistance to diseases and pests and even climate resilience. A genome is containing all the DNA needed to build, function, and maintain that organism, residing in the chromos

2020s - AI, machine learning and digital modeling revolutionize agriculture
Advancements in data analytics have enabled researchers to make incredible strides toward building a These digital tools are helping unlock entirely new possibilities in crop protection, plant breeding, and ma Digital modeling is creating a virtual, often three-dimensional (3D) representation of an object, system, o allowing for visualization, simulation, and design refinement before physical creation, common in gamin

The Future - Driving new possibilities

Agriculture has come a long way and there's much more on the horizon - finding new ways to apply a needs in agriculture in order to produce quality food while preserving precious resources and limited re

2010 | 2020 | 2025

315.5 million Americans
1.8% live on farms

331 million Americans,
less than 2% on farms

347 million Americans,
less than 1.5% on farms

a Changing World

en or complete change"

1837 John Deere invents self-cleaning plow

Massey Harris 25 Tractor 1931 - 1938

l other specialized equipment

enetically improved seeds

Modern Combine Harvestor

ut and separated in one pass over the field

Wheat Plant

GPS Lightbar Guidance System

O) to resist disease & pests

eir farming practices with Geographic Information Systems (GIS)

hile in the field. This also meant they now had access to

e used in agiculture by both large scale and smallholder

sprayers and combines

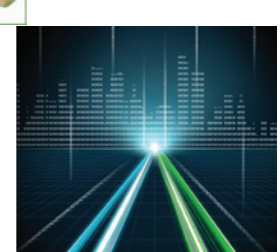
Some crops are GMOs (genetically modified organisms) where a precise gene has been altered to improve the plant in a specific way

Some algae contains more than 60% oil and can even be grown in salty water.

se resources more sustainably. Digital data that combines
de farmers a more detailed understanding of their fields.

ecific changes to the DNA of a cell or organism).
gy – known as genome editing – is being used by plant
e is the complete set of an organism's genetic instructions,
mosomes within a cell's nucleus, plus mitochondrial DNA

g a more productive—and resilient—global food system.
more - the applications of these technologies are endless!
m, or phenomenon using specialized computer software,
ming, engineering, architecture, and medicine



ly agricultural technology to some of the most pressing
d resources.

Information courtesy of WASHINGTON WHEAT FOUNDATION

How Washington's wheat farmers get bread and more to your table

Washington's wheat farmers follow a year-round cycle rooted in tradition, innovation, and stewardship. From preparing the soil and planting to protecting the crop and bringing in the harvest, each step is managed with care. The result is high-quality wheat that not only supports local communities but also feeds people around the world.

Step 1: SEEDING

Today's seeding process is guided by advanced technology. GPS systems steer tractors and sprayers with precision. Seed monitors track planting rates down to the seed. Variable-rate fertilizer application ensures nutrients are applied exactly where they're needed—saving resources and protecting the land.

Step 2: CROP PROTECTION

Once wheat emerges from the soil, it faces threats from weeds, insects, and disease—much like a yard full of dandelions. To protect their crop, farmers closely monitor their fields and apply crop protection products only when needed.

Using tools like herbicides for weeds, insecticides for pests, and fungicides for disease, farmers target specific problems to keep their wheat healthy. All of these products are approved by the EPA and USDA, and are used responsibly and precisely. They're costly, so farmers apply only what's necessary—never more—ensuring both crop health and environmental care.

Step 3: HARVEST

When the wheat has fully headed out, turned golden, and dried down to around 10–12% moisture, it's ready for harvest. Using modern combines, farmers cut the wheat and separate the kernels from the stalk and chaff in one smooth process.

The clean grain is then loaded into trucks and hauled to local elevators for storage. From there, it's transported by rail, truck, or barge to domestic mills or export terminals—on its way to becoming food for families around the world.

What's Happening?

Technology in food packaging, processing and preservation

What was happening at the same time in Washington?

1803 – Dairyman Thomas Moore patented the first refrigerator - an ice-filled tub lined with rabbit fur and wrapped in metal. His butter could now be transported in warm weather without melting. And, folks were willing to pay more for butter that wasn't soft.

1805 – Two years after Moore invented the first icebox Lewis and Clark arrived in what is now Washington State.

1847 – Industry begins in the Washington Territory with the opening of the first sawmill on Puget Sound.

1858 – The humble metal can was patented in 1810 as a way of preserving food. Cans weren't popular with housewives until 1858 when the first can opener was invented. Mason jars, used for home canning, were first sold in 1858 too.

1865 – The world's first salmon cannery is started at Eagle Cliff, near Longview on the Washington/Oregon border.


Louis Pasteur

1862 – Frenchman Louis Pasteur found he could kill bacteria and mold in food by applying heat at temperatures below the boiling point. This process, called pasteurization, is one of the greatest public health advances of all time.

1875 – A petition was presented to the Legislature to ban pigs from running in the streets! It's true! The law finally passed in the 1880's because politicians felt hogs running in the streets might lead Easterners to think that Washington was not civilized enough to be allowed entry into the Union.

1889 – Washington becomes the 42nd state.

1867 – The first ice-cooled railcar was patented and two years later the first fresh fruit was transported from the west coast to the east, beginning the age of transcontinental shipping.

1902 – The Reclamation Service begins irrigation projects in Yakima and Okanogan Valleys to facilitate farming.

1920 – While Birdseye was inventing frozen vegetables, Adams County farmers still needed 15,939 horses and 2,239 mules just to farm their wheat

1803

1805

1847

1858

1862

1865

1867

1875

1889

1902

1920

1803

1923

1933 – Construction began on the Grand Coulee Dam (the largest power producing facility in the US). Completion was largely complete by 1942.

1923– Using an electric fan and slabs of ice, Clarence Birdseye invented a system of packing fresh food into cardboard and freezing it. Today Birdseye is the U.S. leader in frozen vegatables.

1948 – Columbia River Irrigation project began irrigating 2,000 acres of desert into fertile farm ground producing major crops.

Dairy – Hand Milking to High Tech

When the first dairy cow arrived in Washington more than 75% of the US population lived on farms and most of them had a cow or two for fresh milk. Milking was done by hand into a metal bucket. Without refrigeration excess milk had to be sold or traded quickly to neighbors.

Mechanical milking machines were developed around 1930 but even then the average herd size was only 11 cows. The most modern dairies at the time could only milk 30 cows per hour and there was still much hand labor involved.
Average yearly production was only 718 gallons per cow.

Today, technology has dramatically changed the dairy industry. Milk is never touched by human hands nor is it exposed to open air. Closed systems transfer milk directly from the cow through pipes to cooling tanks. Then tank trucks deliver the milk to processing plants. Modern dairies can milk 300 cows per hour and computers record each cow's production. (In fact the largest rotary parlor can milk nearly 700 cows per hour as they take a nine minute ride around the carousel). Advances in animal nutrition and health have increased average production per cow to 2500 gallons per year.

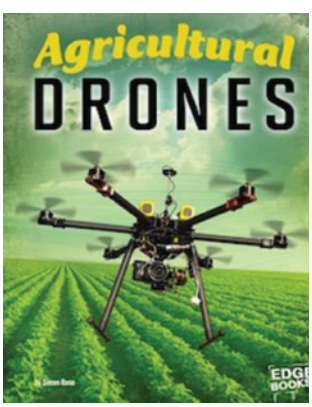
Some farms have added robotics to their dairies with individual robots that do specific tasks to entire robotic milking machines that milk the cow! Each cow has a neckcollar that contains her personal data. After the cow enters the robot machine, she is identified by that collar which triggers the milking process.

This includes 3D cameras and lasers within this technology that aids in the process.

Next time you drink a glass of milk or enjoy ice cream, remember the technology that made it possible!

LIBRARY CORNER

Farm fields can span hundreds of acres. With so much area to cover, checking crops and livestock can be difficult. But with an agricultural drone, this job becomes much simpler. Young readers will discover how drones help farmers maximize efficiencies and bring abundant harvests.



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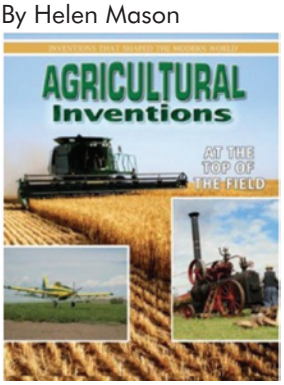
LIBRARY CORNER

Agricultural Inventions:

At the Top of the Field

By Helen Mason



Historically, farming was an exhausting, physical task. Bright-minded individuals revolutionized agriculture with inventions that eased tasks and sped up production. The invention of milestone machines, such as Eli Whitney's cotton gin, are explored chronologically.