ColoradoKids
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High-Tech Farming


Photo by Shelby Fisher

In the 1940s, one farmer in the United States produced enough food to feed 19 people. Today, one U.S. farmer produces enough to feed 165 people. The advancement of agricultural technology is directly related to the increase of U.S. food production.

The Food and Agriculture Organization (FAO) of the United Nations (UN) projects the world's population to reach 9.7 billion people by the year 2050. With 9.7 billion people on Earth, the world's farmers will need to grow about 60-70 percent more food than what is now being produced. As the global population increases, farmers will need to utilize innovative technologies to produce more food with fewer resources.

Precision agriculture is an information technology-based, site-specific farm management system that collects and responds to data ensuring that crops receive exactly what they need for optimum health and productivity. Precision agriculture technologies help farmers identify and manage variability within fields and can optimize crop yields, maximize crop quality, and minimize the use of resources. Rather than apply water, fertilizer, and pesticides uniformly across entire fields, farmers can use data to target specific areas within the minimum quantities required. More efficient food production means lower costs to consumers, greater consumer choice, convenience, safer food, and greater food security.

Milking - Then Verses Now

Technology is being used by dairy farmers to milk their cows. Take a look at these two videos to see the difference of how cows were milked in the 1850s verses how cows can be milked today.

Milking at the 1850 Farm: Click the link to watch this YouTube video http://bit.ly/2Hd6GYN

Today's farmer relies on data and technology to enhance sustainability, productivity and efficiency. Automatic Milking Systems are one way robotics have dramatically changed the way dairy farmers work.

Robotic Milkers - Discovering Farmland: Click the link to watch this 360 video http://bit.ly/2TtMiJy

Vocabulary

acre: a unit of area equal to 43,560 square feet (about the size of a football field)

autonomous vehicle: a vehicle that can guide itself without a human operator

bushel: a measure of capacity usually for dry goods equal to 64 pints

drone: an unmanned aircraft guided by remote control or onboard computers

Global Positioning System (GPS): a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth

laser: a device that produces a narrow and powerful beam of light

precision agriculture: an information technology-based, site-specific farm management system that collects and responds to data ensuring that crops receive exactly what they need for optimum health and productivity

robot: an automatically operated machine used to do work usually performed by humans

self-driving tractor: autonomous farm vehicle that uses GPS and other wireless technologies to farm land

variable rate application: a method of applying varying rates of a material in appropriate zones throughout a field based on the precise location or qualities of the area

How Technology is Used in Agriculture

Precision farming began in the 1990s when **Global Positioning System (GPS)** technology became available to the public. GPS uses satellites and computers to determine positions on Earth. GPS-based applications in precision farming are being used for farm planning, field mapping, soil sampling, tractor guidance, crop scouting, **variable rate applications**, and yield mapping.

Agricultural **robots** automate repetitive farming tasks. Robots are used for harvesting, weed control, mowing, pruning, seeding, spraying, sorting, and packing. Robots can be seen as a solution to food production labor shortages. There are jobs on the farm that do not create value at or above minimum wage. By automating sub-minimum wage jobs, more food can be produced at a lower cost.

Advanced technology is used on farms to deter birds, level fields, guide harvesting machines, sort agricultural products, and monitor field conditions. Birds are naturally drawn to food growing in fields and can transmit diseases and damage crops. Laser beams are used to repel birds in a safe, silent manner that the birds do not become used to. Laser leveling can enhance productivity on uneven fields by improving drainage and decreasing water usage. In the laser leveling process, a tower mounted laser level is used in combination with a sensor on a tractor-scraper. Machines used to pick vegetation from fields can be guided using laser rangefinders which instantaneously communicate the height of the vegetation relative to the ground. Lasers are also used to sort agricultural products by identifying items that do not meet optimal specifications. Used in combination with sprayers, lasers can monitor for specific field conditions to ensure that only the necessary amount of chemical is applied to each specific area of the field.

Self-driving tractors are **autonomous vehicles** that use GPS and other wireless technologies to farm land. Self-guidance systems reduce the amount of overlap caused when tractors crisscross a field. Reducing overlap cuts down on seed, fertilizer, and pesticide waste. Driving hands-free enables the farmer to manage other aspects of their operation from the cab of their tractor. Farmers are also able to continue working their fields during low visibility conditions such as rain, dust, fog, and darkness. In 2015, it was estimated that self-guidance systems were being used on about 30 percent of the farmland in North America, 50 percent of the farmland in Europe and South America, and 90 percent of the farmland in Australia.

Drone applications in agriculture include mapping, surveying, monitoring, planting, crop dusting, and spraying. Precise soil analysis maps produced by drones help direct seed planting patterns, irrigation, and nitrogen-level management. Nutrients, moisture levels, and overall crop health is monitored in real-time by drones equipped with hyper-spectral, multispectral, and thermal sensors. Scanning crops with visible and infrared (IR) light, drones can identify plants infected by bacteria or fungus, helping to prevent disease from spreading to other crops. This technology enables detection of some diseases before they are visible to the human eye.

Did You Know? (Ag Facts)

- In 1850, 100 bushels of corn required 83 labor hours and 2.5 acres of land. Today, only two labor hours and 0.6 of an **acre** of land are needed.
- A modern combine can harvest 350 acres of corn per day (4,500 bushels per hour) and it can unload 3.8 **bushels** per second.
- If the world's farmers would have continued to grow crops at 1961 productivity levels, they would need almost 2.5 billion acres of new farmland to maintain today's food supply, which is more than the total land area of the United States.

Self-Driving Tractors Sow the Seeds for High-Tech Farming

Farmers have been able to drive tractors hands-free for years. Now, there's even more technology to help with planting and harvesting. *Source: CNET News*

Watch this YouTube video: http://bit.ly/2tOMmFf

Agrobot Automates the Work of Berry Harvesting

A machine developed by a Spanish entrepreneur automates the process of picking small produce like strawberries. Many farm owners hope it will help alleviate the impact of labor shortages. *Source: Wall Street Journal*

Watch this YouTube video: http://bit.ly/2SHiSDe

Agricultural Technology Timeline

Agriculture began around 10,000 BC when humans started domesticating plants and animals to ensure a more reliable food source when compared to hunting and gathering. At that time, most work was accomplished by hand with few tools available. The introduction of powered machinery replaced work previously performed by people and animals (horses, mules, and oxen). Throughout history, scientific and technological advancements have impacted the agricultural industry by increasing food production and farm efficiency.

Create a timeline of agricultural technology by matching the pictures below with the appropriate year the technology was introduced.

A. Jethro Tull introduced the seed drill, a device that cuts trenches and drops in seeds.

B. Eli Whitney invented the cotton gin, a machine that separates seeds from fiber.

C. Cyrus McCormick patented the McCormick reaper, a grain harvesting machine.

D. John Deere invented the steel plow, which was stronger, sharper, and more efficient.

E. Joseph Dart invented and built the first grain elevator, a wooden structure with buckets used to load and unload ships.

F. Silos, structures that store grain, came into use.

H. Glidden barbed wire, an inexpensive fencing used for livestock on rangeland, was patented.

I. The horse-drawn combine, used to harvest wheat, came into use on West Coast farms.

J. The first gasoline tractor was built by John Froelich.

K. The mechanical tomato harvester, used to harvest, sort, and load tomatoes, was developed.

L. Farmers began using computers to manage farm operations and monitor weather conditions.

M. Farmers began using satellite technology to track and plan their farming practices.

N. Farm equipment manufacturers install GPS systems in tractors.

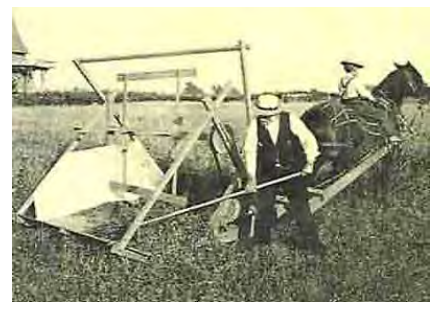
O. The first self-driving, autonomous tractor was unveiled at the Big Iron Farm Show in North Dakota.

P. Widespread use of drone technology by farmers.

Year: 1980

Year: 1884

Year: 2013



Year: 1834

Year: 1793

Year: 1842

Year: 1994

Year: 1701

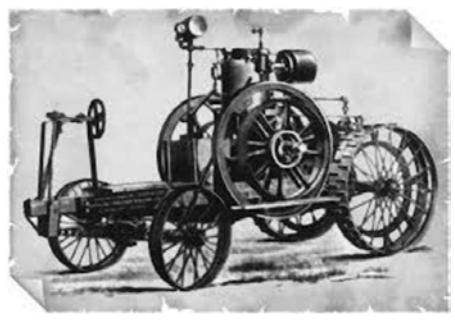
Year: 2012

Year: 1873

Year: 1959

Year: 2003

Year: 1874



Year: 1892

Year: 1837

Drones and the Future of Farming - National Geographic

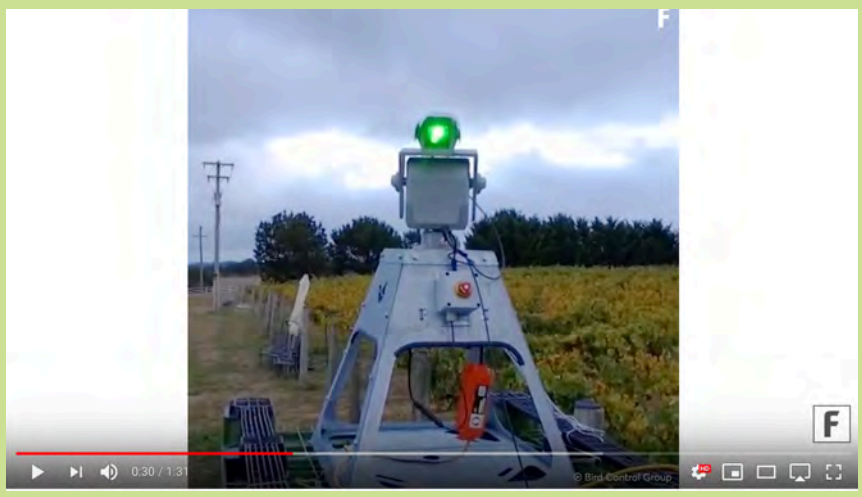
From driverless tractors to unmanned aerial vehicles (UAVs), farming technology is rapidly evolving. Farmers can use drones to identify specific plants that are diseased or infested with bugs, to save water and resources, and to get a bird's-eye view of their crops.

Watch this YouTube video: http://bit.ly/2HbxFUE

This Laser is Keeping Crops Safe

Pests mistake the laser for a predator, leaving crops undamaged.

Watch this YouTube video: http://bit.ly/2EwfUMN



Agricultural Technology Timeline Answers

1701: Jethro Tull introduced the seed drill, a device that cuts trenches and drops in seeds.

1793: Eli Whitney invented the cotton gin, a machine that separates seeds from fiber.

1834: Cyrus McCormick patented the McCormick reaper, a grain harvesting machine.

1837: John Deere invented the steel plow, which was stronger, sharper, and more efficient.

1842: Joseph Dart invented and built the first grain elevator, a wooden structure with buckets used to load and unload ships.

1873: Silos, structures that store grain, came into use.

1874: Glidden barbed wire, an inexpensive fencing used for livestock on rangeland, was patented.

1884: The horse-drawn combine, used to harvest wheat, came into use on West Coast farms.

1892: The first gasoline tractor was built by John Froelich.

1959: The mechanical tomato harvester, used to harvest, sort, and load tomatoes, was developed.

1980: Farmers began using computers to manage farm operations and monitor weather conditions.

1994: Farmers began using satellite technology to track and plan their farming practices.

2003: Farm equipment manufacturers install GPS systems in tractors.

2012: The first self-driving, autonomous tractor was unveiled at the Big Iron Farm Show in North Dakota.

2013: Widespread use of drone technology by farmers.

Content for this issue of Colordo Kids was adopted from a lesson entitled "High-Tech Farming" available on the National Center for Agricultural Literacy Curriculum Matrix. Search for this lesson and additional lessons at AgClassroom.org

Colorado Foundation for Agriculture

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Food, Fiber, and More! Summer AgriCULTURE Institute

A five-day course designed for teachers who have little or no agricultural background. This is an opportunity to go "behind the scenes" of Colorado agriculture and learn innovative ways to incorporate food, fiber, fuel, and natural resource topics into academic curriculum. One highlight is the day spent one-on-one working with a producer, gaining hands-on experience on a farm or ranch. Continuing Education Units and CSU graduate level credits are available. Mark your calendars and plan to attend one of these 2019 Institutes: June 10-14 in Greeley; June 24-28 in Yuma; July 8-12 in Castle Rock. Registration is open available on our website GrowingYourFuture.com.

Curriculum Matrix

The Agricultural Literacy Curriculum Matrix is an online, searchable, standards-based database of classroom ready lesson plans and resources for K-12 educators. The Matrix contextualizes national education standards in science, social studies, and nutrition education with relevant instructional resources linked to Common Core Standards. Start searching the Matrix now on our website GrowingYourFuture.com.

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