



TECH NOLOGY IN AGRICULTURE

Technology is the practical application of science. In agriculture, you'll find technology on the farm, in research laboratories, in factories where equipment is designed and manufactured, in processing plants where food and fiber products are made, and in stores where products are sold to you.

VIDEO: The Future of Farming
<https://bit.ly/TDCFUTUREOFFARMING>

Technology MATH

Technology helps farmers and ranchers produce more food at less cost and better quality. Here are some examples how:

1. If a farmer planted 5 acres per hour with a horse-drawn planter in 1900, how many acres did he plant in an 8-hour day?

2. Today's farmer can plant 50 acres per hour with a tractor and seeder. How many acres can she plant in an 8-hour day?

3. How many more acres can a farmer plant in a day now compared with 1900?

4. Before milking machines were invented in 1894, a farmer could milk 6 cows per hour by hand. How long would the milking take if the farmer had 15 cows?

5. Farmers now can milk a cow in about 6 minutes with a milking machine. If a farmer has 12 milking machines going at once, how many cows can be milked in one hour?

6. If a prize-winning cow produces one calf per year, how many calves will she have in 5 years?

7. If 10 embryos from the cow are transferred to 10 other cows each year, how many calves will there be in 5 years?

From Hand Tools to Big Machines

When people started farming, they did everything by hand. But today, farmers rely on the help of machines.

In the boxes, write the name of each hand tool and machine. Choose from: truck, horse-drawn plow, hand planter, plow, wagon, planter, combine, scythe. Then **place the number** of the hand method in the box of the similar machine method.

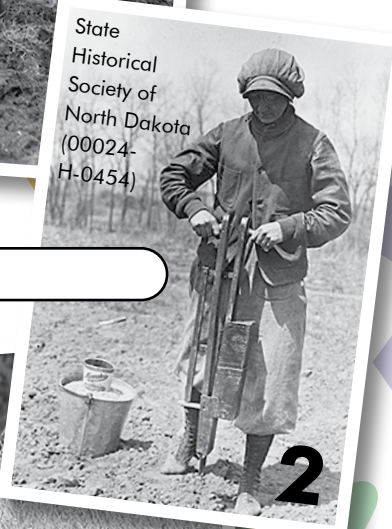
Hand Tools

1



State
Historical
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(00024-
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2



3



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4



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Machines

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Technology Then to Now

Number these tools in order from earliest (1) to present (7).

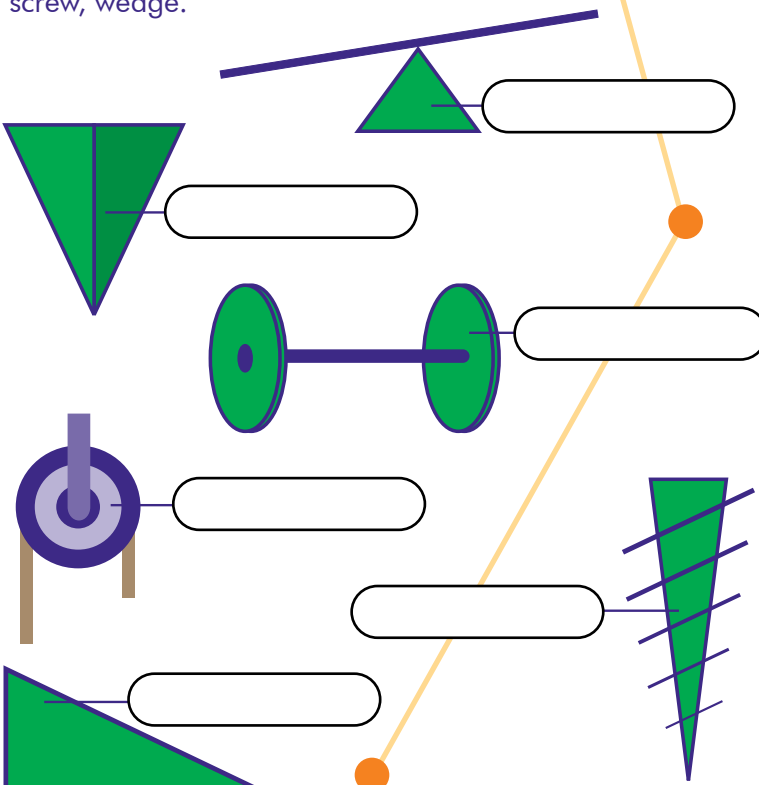
- ☐ small tractor
- ☐ horse-drawn plow
- ☐ laser weed-zapping robot
- ☐ walking cultivator
- ☐ four-wheel drive tractor
- ☐ drone
- ☐ hoe



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Name That Tool

Name these simple tools. They are all parts of machines today. They make lifting, pulling and moving things easier. Choose from: wheel and axle, inclined plane, lever, pulley, screw, wedge.



Technology in Agriculture

Check the correctly spelled word to complete each sentence.

- Satellites and drones can take photos or video of (☐ **feilds** or ☐ **fields**) and feedlots to help farmers and ranchers grow crops and livestock more efficiently.
- They also help protect the (☐ **environment** or ☐ **enviroment**).
- Global Positioning Systems (GPS) identify the exact (☐ **coordinates** or ☐ **coordinants**) – latitude and longitude – in the photos.
- Photos can show where some of plants are more yellow so may need more (☐ **nitrogen** or ☐ **nitrojen**) fertilizer.
- Computers use GPS so the tractor can plant (☐ **strait** or ☐ **straight**) rows, avoid placing fertilizer or pesticides where not needed, and steer and turn itself.
- A drone can fly over a beef cattle feedlot and identify a steer that has a high (☐ **temperture** or ☐ **temperature**).
- The sick animal can be (☐ **seperated** or ☐ **separated**) from the others.
- A (☐ **veternarian** or ☐ **veterinarian**) can treat the sick animal.
- A drone might find cattle that may be separated from the rest of the (☐ **herd** or ☐ **heard**) in a pasture.
- An autonomous robot is a machine that can (☐ **preform** or ☐ **perform**) tasks without direct human control.
- The field robot knows what to do by using (☐ **artifishal** or ☐ **artificial**) intelligence.



Drones in Agriculture



Artificial intelligence can help farmers recognize plants and weeds. In this drone photo, the percentage value means AI prediction accuracy. In other words, 100% means the software is totally confident in its identification. The highest prediction accuracy for corn is 77%. The prediction accuracy for identifying the weed is 51%.



John Nowatzki, NDSU

In this photo from a drone, how many young corn plants are in the 1 meter X 2 meter rectangle?

See where it looks like a plant didn't grow in a row. Check the possible reasons why there is no plant:

- ☐ The planter didn't drop a seed.
- ☐ The seed didn't germinate.
- ☐ The planter planted the seed too deeply.
- ☐ Insects ate the small plant.

What two things are needed for most seeds to germinate?

Technology in Animal Agriculture

- **VIDEO:** Robotic Dairy, bit.ly/RoboticDairy
- **VIDEO:** Cattle GPS Collars and Smart Tags, bit.ly/GPSCollars
- **VIDEO:** The Future of Livestock Farming, bit.ly/FutureofLivestockFarming



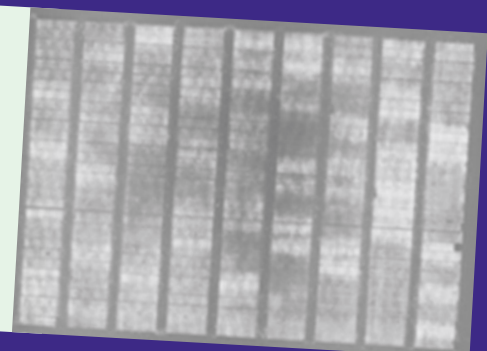
NDSU

Photography from Drones

In addition to regular photos like the ones above, drones with special cameras can take near infrared photos. Infrared waves cannot be seen by the human eye but detect heat. Near infrared photos can show a farmer:

- If an area of a field needs more or less fertilizer or water
- Which part of the crop is ready to harvest
- Where disease might be affecting a crop
- Other growth details

Examine this photo of a research trial studying nitrogen in a crop. The darker colors are healthier plants.



Mike Ostlie, NDSU

Career Corner

Ian Hall, Product Manager
Aigen, Fargo, ND

Every morning, Ian Hall gets out of bed thinking, "How can I help farmers and ranchers keep running efficiently, profitably and sustainably?"

The Nebraska native brought this passion to North Dakota. "At Aigen, we're using cutting-edge technology to do one of humanity's oldest jobs — keeping the field free of weeds — without chemicals, fuel or labor."

"We use technology to do a job that used to require hands-on involvement," Ian said. "A robot can go into the field with knowledge of the field, the crop and the obstacles in the way, and it can remove weeds using steel blades."

Chemicals may be ineffective and can pollute the environment. The solar-powered Aigen robot "hoes" each weed without chemicals. One person can control up to 20 robots in the fields, and the hoe-like tool is smaller than a cell phone.

Ian helps develop the robot, from researching problems to helping farmers after the sale.

"I focus on the 'what' of the business. What problem are we solving? What do we build to solve the problem? What do we say to make people interested in the product? What do we demonstrate to show its usefulness? What do we price the product at? What does the farmer need to do to adopt a new piece of equipment? And most importantly, what do we do when the robot doesn't work?"

Ian completed his bachelor's degree in agricultural economics and agronomy from the University of Nebraska-Lincoln. He encourages students to consider careers in ag technology.

"I think the most impressive people I've ever met are farm kids who learned how to use digital technology to help other people solve a problem on their farm or in their community," Ian said. "North Dakota is a great place to be for ag tech, and you don't have to leave home to find great opportunities."



Aigen photos



Grand Farm's Grand Plan

Grand Farm is an organization where people all across agriculture work together to find new and better ways to grow food and take care of farmland. Farmers, scientists, teachers, business people and government leaders team up to solve real problems in agriculture using tools like robots, sensors, drones, AI and smart technology.

Grand Farm's Innovation Campus near Casselton is a 590-acre site where startups, corporations, growers, researchers and educators come together to develop, test and refine agricultural technologies.

Insert the letter of the definition below with the word in this story to better understand Grand Farm.

Grand Farm...

1. ☐ Is building a global **ecosystem** where farmers, scientists and businesses share ideas and solve problems in agriculture together.
 2. ☐ Helps turn grower challenges into new tools through **collaboration** with many different groups.
 3. ☐ Supports **innovation** by helping people test new ideas and tools to improve farming.
 4. ☐ Works with **startups** to help turn ag tech
 5. ☐ **prototypes** into real tools that farmers can use.
 6. ☐ Hosted a **field trial** to test a new tool that works like a paper puncher to check how healthy plants are as they grow.
 7. ☐ Has many projects and demonstrations that use **autonomous** equipment like drones or tractors.
- A.** The creation, development and implementation of a new product, process or service with the aim of improving efficiency, effectiveness or competitive advantage
 - B.** A preliminary model to test a concept from which other forms are developed
 - C.** Operates on its own by learning from its surroundings and completing tasks without continuous human input
 - D.** Working with other people or groups to achieve, create or do something
 - E.** An assessment done on a farm to carry out research projects, test experimental technologies and gather together to create connections
 - F.** A new company that is just starting out with a big idea
 - G.** A community of people with similar interests from across the globe who interact



Emerging Prairie photos

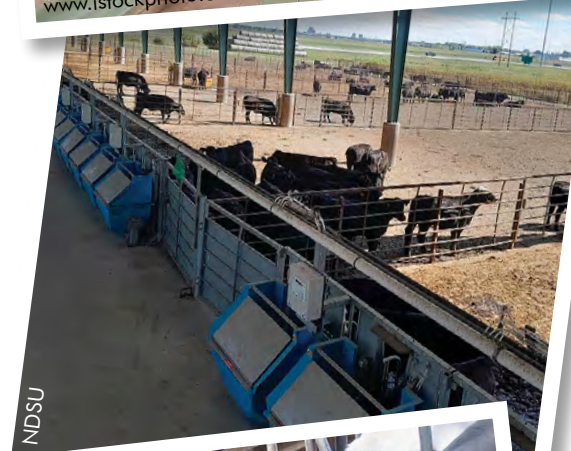


More Agricultural Technologies

Use this word bank to select the correct word to complete each sentence.

sensors, virtual, hydroponic, feed, camera, vertical, apps, ear tags, rainfall, precision, fences

1. Lettuce grows well in _____ systems, which have a water-based nutrient solution for the plants rather than soil.
2. Indoor _____ farming reduces land requirements, water usage and pesticide use by controlling the environment.
3. Plant identification _____ use artificial intelligence to compare a photo to a known plant in a large, searchable database.
4. AI-powered robots can provide _____ to livestock.
5. Individual cattle that are to receive a specific amount of feed wear _____ to trigger a gate that releases that much feed to them.
6. _____ livestock farming or ranching means using sensors and smart tools to track each animal's health, feed and behavior.
7. A sheep farmer can use a _____ fence to easily move them to a new grazing area.
8. Ranchers can use drones to check _____ and gates.
9. A remote _____ allows a turkey farmer to watch the flock for signs of stress.
10. _____ throughout barns can automatically adjust temperatures for livestock and poultry.
11. The North Dakota Agricultural Weather Network (NDAWN) has more than 200 stations across North Dakota and border regions of surrounding states that measure _____, air and soil temperatures, wind speed and direction, and more.



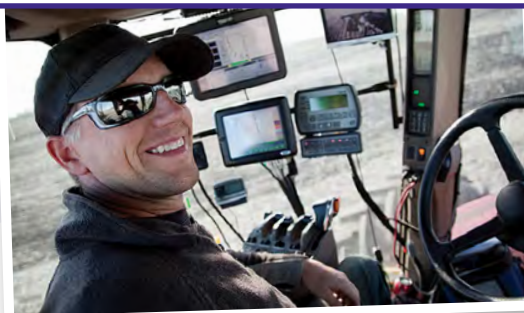
Why Technology in Agriculture is Important

Today more than 8 billion people live on Earth. The United Nation predicts world population will reach more than 10 billion by 2100. They all will need to eat every day. Technology will help make that possible.

Use these numbers to fill in the missing numbers in the U.S. Farm Productivity chart: **77, 1850, 166, 1910**

U.S. Farm Productivity

Year	Ag Technology	Number of People Each Farmer Feeds
	Horse-drawn plow	4
	Steam tractor	7
1986	Combine	
2026	Artificial intelligence and drones	



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