

Agriculture in Motion

Objective

Students will read about machines used in agriculture, answer comprehension and vocabulary questions, write research papers, sort common farm machines into simple and complex tools, and examine and discuss some examples of ag machines in art.

Background

Early in our nation's history, nearly everyone was involved in food production. Most families raised their own food, with every able-bodied family member working long, hard hours to help. In 1830, it took 250 to 300 labor hours to produce 100 bushels of wheat. Here are some of the steps involved:

Step 1—Plowing

A heavy iron plow was used to break up the soil and turn it over. Usually a horse, ox or mule pulled the plow while someone walked behind to steer it, row by row, until the whole field was plowed.

Step 2—Harrowing

After plowing, a brush harrow was dragged along the rows to smooth the soil for planting and to clear away debris. A brush harrow was made of small rigid tree branches interwoven into a frame so that the brush stuck out underneath. (See "Simple Farm Tools" worksheet.)

Step 3—Planting

Seeds were broadcast (scattered) by hand. Then the brush harrow was dragged through the field again to cover the seeds.

Step 4—Weeding

As the crop grew, hoes were used to keep out weeds.

Step 5—Harvest

When the wheat was ready to be harvested, the farmer used a sickle to cut it by hand. Then it was tied into bundles.

Step 6—Threshing

The wheat had to be threshed to separate the wheat kernels from the rest of the plant. The implement used was a flail—a wooden handle with a stouter and shorter stick hung at the end so it would swing freely.

All this motion didn't even include milling (grinding) the wheat and baking the bread.

It took a lot of motion to produce food back then, but it would have taken more if it hadn't been for the machines the farmer used—the plow, the brush harrow, the hoe, the sickle and the flail.

Over the years machines were developed that combined some of these tasks so that farmers could produce food for more people with fewer hours of hard labor. The steel plow was invented in 1834. It was

Oklahoma Academic Standards

GRADE 3

Speaking and Listening: R.1,2,3;
W.1,2

Fluency: 1,2

Reading and Writing Process: R.1,3

Critical Reading and Writing: R.6,7

Research: R.1,3,4; W.1,2,3

Number & Operations: 2.1,6,7,8

Algebra: 1.1; 2.1

Economics Literacy: 1

Geography Literacy: 2B

History Literacy: 1

Physical Science: 2-1

Visual Art History and Culture: 1,5

Visual Art Appreciation: 4

GRADE 4

Speaking and Listening: R.1,2,3;
W.1,2

Fluency: 1,2

Reading and Writing Process:

R.1,3,4

Critical Reading and Writing: R.6,7

Research: R.1,3; W.1,2,3

Number & Operations: 1.3,5

Algebra: 2.1,2

Physical Science: 3-2,3; 4-3

Geography: 4,5

Visual Art History and Culture: 1,2,5

Visual Art Appreciation: 4

GRADE 5

Speaking and Listening: R.1,2,3;
W.1,2

Reading and Writing Process: R.1,3

Critical Reading and Writing: R.6

Research: R.1,2,3; W.1,2,3,4

Number & Operations: 1.2,4

Algebra: 2.1

Visual Art History and Culture: 1,2,5

Visual Art Appreciation: 4

What is a machine?

A machine is a device that makes jobs easier by changing the size or direction of a force. People use machines because they save time and human energy. Almost everything we do depends on machines.

When you brush your teeth you are using a lever, a simple machine. When you unscrew the lid off the peanut butter jar you are using a screw, another simple machine. When you turn the door knob you are using a simple machine known as a wheel and axle. A complex machine uses two or more simple machines to make work even easier.

lighter and cut through the soil more easily than the earlier wood and iron plows. This made it easier to farm the thick thatch of grassland that would become Oklahoma. The McCormick Reaper used a wheel and horse power to make harvest easier and faster. By the 1860s, many other farm tasks had been combined and made easier by machines. Human energy was helped along by that of horses, oxen or mules. Chemical fertilizers cut down on the work by helping the farmer grow more of the crop on less land. Hybrid seeds produced better crops. Pesticides helped control weeds and insects.

The first gasoline tractor was built in 1892 by John Froelich. All purpose, rubber-tired tractors were introduced in the 1930s, along with machines that could be used with the tractor. These tractors were practical and affordable for the average farmer. Soon gasoline replaced animals as the most common source of energy on the farm. In 1954 there were more tractors than horses on farms for the first time.

In the 1970s farmers in Oklahoma and the US learned to save energy by not using their machines as much. No-till agriculture helped hold the soil in place and prevent erosion. Rather than plow the field after harvest, the farmer would leave the stubble from the harvested crop in place. Besides holding the soil in place, this method also saved fuel because the farmer took fewer trips across the field. Integrated Pest Management (IPM) helped the farmer cut pesticide use. Under this method chemicals are used only when absolutely necessary.

In the early 1990s farmers started using computers to make their work easier. “Smart tractors” use satellites and computers to tell the farmer exactly how much fertilizer and pesticide is needed in the field. This is called “precision agriculture.” Computer software also saves work by helping the farmer with planning.

All these developments save time, money and energy. Today one farmer can feed many more people than just the family. One American farmer today can grow enough food to feed 130 people. This frees the rest of us to work in other areas—medicine, communications, science, art and agricultural research—to develop even better machines and technology for feeding the world.

Source: “A History of American Agriculture, 1607-2000” USDA Economic Research Service, 2000, <http://www.agclassroom.org/gan/timeline/index.htm>

Language Arts

1. Read and discuss background and vocabulary.
 - Students will use index cards to record the steps described in the background for production of wheat in 1830.
 - Students will write one step per card and write the correct number on the back of the card.
 - Scramble the cards.
 - Students will work in groups to place the cards in the correct sequence. They can check their work by looking at the numbers on the back.
 - Give students four index cards each and ask them to think of something they do that takes motion and produces a result.
 - Students will write and/or draw the steps on the index cards, then

explain the sequence to a partner. (Example: Making a peanut butter sandwich)

2. Hand out copies of the “Reading Comprehension” worksheet included with this lesson.
—Students will read the passage and follow the instructions.
3. Hand out the “Comparing Old With New” page included with this lesson.
—Read and discuss the differences between the farm implements used now and those used earlier in our history.
—Students will use Venn diagrams to compare and contrast the farm implements.
4. Use these online resources to discuss writing a research paper: “How Reliable Are your Sources?” and “How to Write a Research Paper,” available from the “Additional Resources” link on the Oklahoma Ag in the Classroom website.
—Students will use online or library resources to research and write papers on one of the following topics:
 - Select one of the operations described in the background— plowing, harrowing, planting, harvesting, threshing—and trace the ways in which those tasks have changed from 1830 until now.
 - Research the machines used in animal agriculture to care for cattle and calves, swine, poultry, sheep or goats.
 - Trace the changes in machines used to produce another one of the crops grown in Oklahoma—soybeans, corn, hay, rye, peanuts, pecans, watermelons, peaches, strawberries, vegetables, etc.
—Students will share their reports with the class.

Social Studies

1. Students will discuss the economic impact of changing from horses to tractors on the farm. What did the change mean to people who worked as blacksmiths, wagon makers, store owners, field hands? What jobs might have been created to support tractor use. Discuss advances in modern technology that have changed the kind of work people do. (Oil industry converting to wind and other green technology, for example)
2. Students will work in groups to develop commercials or ads for the new tractor or pretend they are radio broadcasters and cover the arrival of the first tractor in their area, with on-the-scene interviews.

Science

1. Hand out copies of the “Classes of Levers” worksheet included with this lesson.
—Review the three classes of levers.
—Hand out copies of the “Simple Farm Tools” worksheet included with this lesson.
—Use the background and common knowledge to review the use of each of the farm implements pictured.
—Students will identify the class of lever that is used in each of the implements. (Hint: They are all class 3 levers, but let students discuss

Vocabulary

crop—a plant or animal or plant or animal product that can be grown and harvested

energy—the capacity for doing work

fertilizer—a substance (as manure or a chemical) used to make soil produce larger or more plant life

flail—a tool for threshing grain by hand

harrow—a cultivating tool that has spikes, teeth, or disks and is used for breaking up and smoothing the soil

harvest—the gathering of a crop

hoe—a farm or garden tool with a thin flat blade at nearly a right angle to a long handle used especially for weeding and loosening the earth

hybrid—an offspring of parents with different genes especially when of different races, breeds, species, or genera

kernel—a whole grain or seed of a cereal

machine—an instrument (as a lever or pulley) designed to transmit or change slightly the application of power, force, or motion

pesticide—a substance used to destroy pests

plow—a farm machine used to cut, lift, and turn over soil

reaper—a machine for harvesting grain

screw—a simple machine consisting of a solid cylinder with a winding groove around it and a correspondingly grooved hollow cylinder into which it fits

(Continued on Next Page.)

and defend their reasons if they place them in the other categories.)

Math

1. With a team of horses, a farmer planted 3 acres of corn a day. Calculate how many days it took a farmer to plant 35 acres of corn. (11.666)
2. If a fast corn picker could pick 95 bushels of corn per day (10 hours of work), how many bushels was he picking per hour? (9.5)
3. If a corn picker was paid a nickel per bushel, how much did he make if he picked 95 bushels in one day? (\$4.75) How much would he make in five days at that rate? (\$23.75)

Visual Art

1. Go to “Additional Resources” on the Oklahoma Ag in the Classroom website and click on “Ag in Art” (<http://oklahoma4h.okstate.edu/aitc/lessons/extras/art.html>)
 - In the “Crops” and “Farm Scenes” columns, locate paintings that depict the work involved in agriculture over the years. Use a smart board or overhead projector to show students some examples.
 - Students will compare and contrast the different styles used to portray the different aspects of farm work.
 - Use some of the following questions to discuss specific paintings:
 - The painting “Fall Plowing” by Grant Wood shows a very simple hand plow with apparently enormous fields in the background. Consider the amount of work it would have taken to plow all those fields using the plow that is pictured.
 - Identify and discuss the tools used in “Haymaking,” by Pieter Brueghel the Elder.
 - In Winslow Homer’s “The Brush Harrow” what is providing the energy for the work taking place. (the horse)
 - Look at the painting “The last Furrow,” by Winslow Homer. Compare and contrast the plow shown in this painting with the modern plow shown on the “Modern Farm Implements” worksheet included with this lesson.
2. Students will create posters with the theme “Agriculture in Motion.”
 - Students will share and explain their posters to the class.

Extra Reading

- Connor, Leslie, and Mary Azarian, *Miss Bridie Chose a Shovel*, Houghton Mifflin, 2005.
- Geisert, Bonnie, *Haystack*, Houghton Mifflin, 2003.
- Greenwood, Barbara, and Heather Collins, *A Pioneer Sampler: The Daily Life of a Pioneer Family in 1840*, Ticknor Fields, 1999.
- Hill, Lee Sullivan, *Farms Feed the World*, Carolrhoda, 1997.
- Mayo, Gretchen Will, and Susan Nations, *Cereal*, Weekly Reader, 2004.
- Stevens, Jan Romero, *Carlos and the Cornfield/Carlos y la milpa de maiz*, Rising Moon, 1995.
- Williams, Sherley Anna, *Working Cotton*, Harcourt, Brace, Jovanovich, 1996.
- Yolen, Jane, and Greg Shed, *Harvest Home*, Harcourt, 2002.

Vocabulary (Cont.)

scythe—an implement consisting of a long, curved, single-edged blade, with a long, bent handle, used for mowing and or reaping

sickle—a tool with a sharp curved metal blade and a short handle used to cut grass

stubble—the stem ends of herbs and especially cereal grasses remaining attached to the ground after harvest

thresh—to separate seed from a harvested plant especially by using a machine or tool

tractor—a vehicle that has large rear wheels or moves on tracks and is used especially for pulling farm implements

Name _____

Reading Comprehension

In the past, families grew all their own food on the farm. There were no tractors or other machines to make the job easier. A heavy iron plow was used to break up the soil and turn it over. Usually a horse, ox or mule pulled the plow while someone walked behind to steer it, row by row, until the whole field was plowed. Everyone helped with planting the seeds in rows. Children worked in the fields, using hoes to help keep the weeds out. When the crop was ready, the farmer used a sickle—a hooked blade on a handle—to cut the wheat. Children helped by tying the wheat into bundles. Then the wheat had to be threshed, or beat, to shake the wheat kernels loose. After that the wheat still had to be ground into flour and baked into bread. All this work was just for the family’s bread. There was more work to be done to get the other food the family needed. The



work would have been harder without the machines the farmer used. There was the plow that cut into the soil, a harrow for smoothing out the soil, a sickle for cutting the wheat and a flail for threshing. A machine is any thing used to make a job easier. People use machines because they save time and human energy. Many machines have been invented to make farm work easier. Someone invented a plow that wasn’t so heavy, so that job became faster and easier. Someone invented a machine to cut the wheat. It was on wheels and pulled by horses. Harvesting became easier. Eventually, a tractor was invented. This made work on the farm even easier, and the farmer could grow enough food for

the family, with extra to sell to other people. These days farmers use computers to help them use less gasoline and grow more food. They have smart tractors that use satellites and computers to tell them exactly how much fertilizer is needed in a field. Farming is still hard work, but today one farmer can feed many more people than just the family. One American farmer today can grow enough food to feed 123 people.

1. Read the passage above. What would be a good title for the passage? _____
2. Underline the part that tells what the farmer used to cut the wheat.
3. Circle the word that means “anything used to make a job easier.”
4. Complete this sentence. People use machines because they save _____
5. Draw a box around the name of the machine that uses satellites and computers to tell farmers how much fertilizer should be used.
6. List three ways that machines help farmers or make their work easier.

1. _____
2. _____
3. _____

Oklahoma Ag in the Classroom is a program of the Oklahoma Cooperative Extension Service, the Oklahoma Department of Agriculture, Food and Forestry and the Oklahoma State Department of Education.

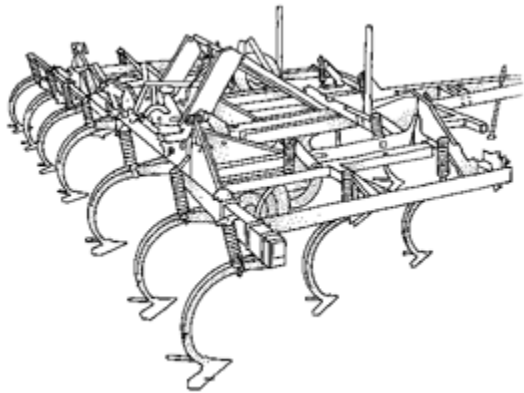
Comparing Old With New

On a separate sheet of paper, draw Venn diagrams to compare and contrast the tractor with man or horse power, the new with the old plow, the combine with the sickle and the flail and the seed drill with broadcasting by hand.

New



tractor



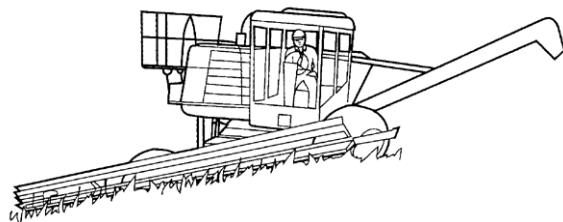
chisel plow

Old

A tractor is a vehicle that has large rear wheels or moves on tracks and is used especially for pulling farm implements. In the old days the farmer had to use his own power. Later machines were invented that could be pushed or pulled by horses and other animals.



The chisel plow loosens and aerates the soil. The chisel plow was invented by Oklahoman Fred Hoeme. The plow is pulled through the soil by a tractor. In the old days plows had to be pushed by the farmer. Later plows were invented that could be pulled by horses, mules or oxen.

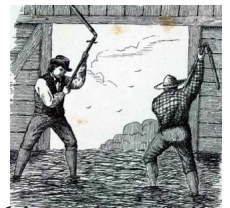


combine

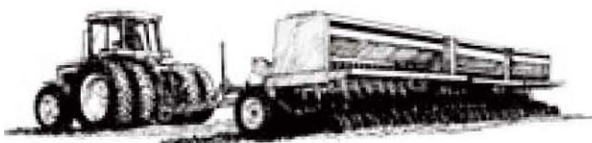
A combine is a machine that harvests, threshes, and cleans grain while moving over a field. Some Oklahoma crops harvested with a combine are wheat, oats, rye, barley, corn, and soybeans. In the old days the farmer had to cut the grain with a scythe or sickle and thresh it with a flail.



sickle



threshing with a flail



seed drill pulled by tractor

A seed drill is used for planting seeds in the soil. In the old days seed was broadcast, or scattered, by hand.

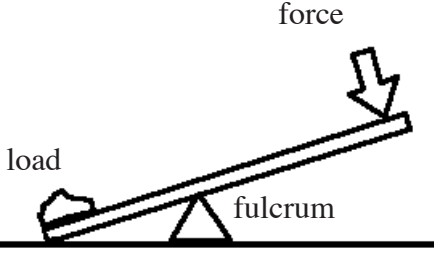
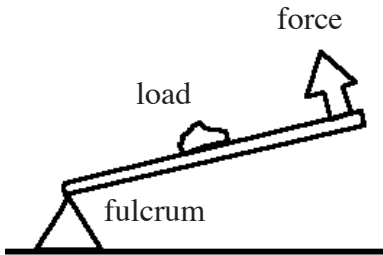
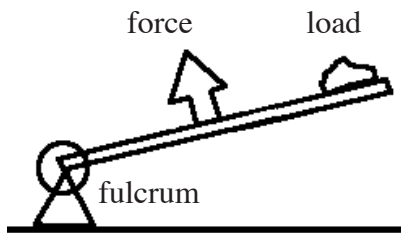


broadcasting seed by hand

Name _____

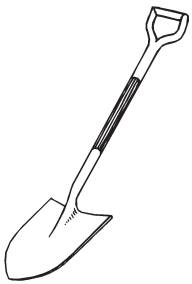
Classes of Levers

Simple machines are tools used to make work easier. There are six simple machines: lever, pulley, wedge, inclined plane, screw, and wheel and axle. Every simple machine is used in some way to make farm work easier. A wedge is an object with at least one slanting side ending in a sharp edge, which cuts material apart. Every farm implement that has a blade for cutting makes use of the wedge. Many farm tools make use of the lever. There are three classes of levers. Read below about the three classes of levers. Then read the descriptions of the farm tools on the following page. Decide where each farm tool belongs on this chart and write your answer in the correct space..

 <p>Class 1 Lever A class 1 lever is one in which the fulcrum is between the load and the force. With this kind of lever, the direction of forces changes. You push one way, and the lever goes the other way. Examples include a seesaw, a crowbar, scissors, and pliers.</p>	 <p>Class 2 Lever A class 2 lever has its fulcrum at one end of a lever arm. The load is between the fulcrum and the effort. With this kind of lever the direction of effort is not changed. Examples include a wheelbarrow, a nutcracker, and a bottle opener.</p>	 <p>Class 3 Lever A class 3 lever is one in which the force is between the fulcrum and the load. With this kind of lever, the direction of effort is not changed. The load moves in the same direction as the effort. Examples include a fishing pole, a hammer, a baseball bat, and a pitchfork.</p>

Simple Farm Tools

Decide where each of the following tools belongs on the “Classes of Levers” chart.



A shovel is a broad scoop with a handle used for lifting and throwing loose material.

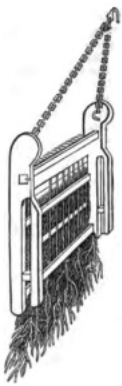
When you use a shovel:

- Where is the load?
- Where is the effort or force?
- Where is the fulcrum?

A hoe is a farm or garden tool with a thin flat blade at nearly a right angle to a long handle that is used especially for weeding and loosening the earth.

When you use a hoe:

- Where is the load?
- Where is the effort or force?
- Where is the fulcrum?



A brush harrow is a farm implement made of small rigid tree branches interwoven into a frame so that the brush sticks out underneath. It is dragged across the field to smooth the soil or to cover seeds (like a rake).

When you use a harrow:

- Where is the load?
- Where is the effort or force?
- Where is the fulcrum?

A flail is a farm implement used for threshing, or beating a pile of wheat so that the kernels come loose from the plant. It is a wooden handle with a stouter and shorter stick hung at the end so it will swing freely.

When you use a flail:

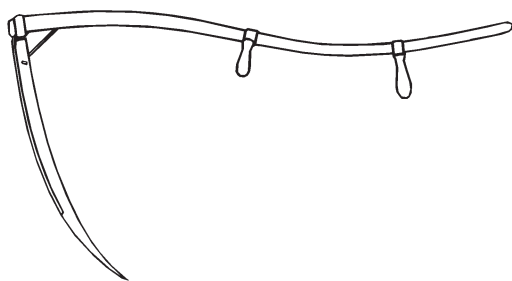
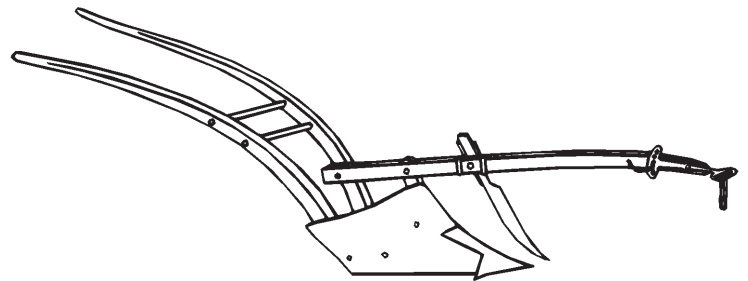
- Where is the load?
- Where is the effort or force?
- Where is the fulcrum?



A plow is a farm machine used to cut, lift, and turn over soil. The blade of the plow is pushed into the soil, and then the plow is pushed forward.

When you use a plow:

- Where is the load?
- Where is the effort or force?
- Where is the fulcrum?



A scythe is a tool that has a curved blade on a long curved handle and is used for mowing grass or grain by hand. The farmer holds the scythe by the handle and swings it into the grain.

When you use a scythe:

- Where is the load?
- Where is the effort or force?
- Where is the fulcrum?