

lesson 14 Agriculture

ADVANCES IN AGRICULTURE

OVERVIEW

This lesson introduces students to a few of the advances in technology that have had an impact on agriculture in California. *In Lesson 14, students use the Sacramento History Online database at <http://www.sacramentohistory.org>.*

STUDENT OBJECTIVES

1. Explain how technological improvements made growing, harvesting, and preserving crops easier.
2. Identify some of the problems farmers encountered in using steam-powered equipment.
3. Use the SHO database to find specific historical information.

CALIFORNIA HISTORY STANDARDS

4.1 Physical and human geographic features that define places and regions in California

4.4 California's rise as an agricultural and industrial power

BACKGROUND ARTICLE 14

Advances in Agriculture (pages 14-5 through 14-7)

STUDENT ACTIVITY SHEET 14 AND KEY

Advances in Agriculture (pages 14-9 and 14-10)

DOCUMENTS TO DISCUSS

The documents below relate to technological advances in agriculture.



1. Asparagus cannery
[1911]
Interior of an asparagus cannery.



2. Drying peaches
[1922]
Peaches drying on racks.



3. Sorting almonds
[ca. 1920]
Six women sort and inspect almonds. Large machines shown are dryers. After being sorted, the almonds continued through another machine.



4. Almond processing
[ca. 1920s]
Interior of Almond Grower's plant showing two men standing next to sorting and cleaning machinery.



5. Steam Power of California

[unknown]
This booklet illustrates some early steam-powered equipment that was developed by Californians.



6. Steam harvesters

[ca. 1924]
Seven steam harvesters with 54 horse teams hauling five tons of hay each. The hay was cut, loaded on barges and on its way 100 miles down stream to the Sperry Flour Mills, all on the same day.



7. Best's traction engine

[1891]
This engraving shows Best's Engine pulling seven carts of gravel in Sacramento.



8. Holt tractor and harvester

[ca. 1924]
Holt-built tractor towing a harvester. Four men (possibly the Sieferman Brothers) and a dog pose on the equipment near Woodland.



9. Mowing tules

[ca. 1917]
Men operate a mowing tractor in preparation for plowing. The tractor is pulling a large wooden barrel which flattens the tules. One man is on the roof to look out for hazards and holes.



10. Steam tractor

[ca. 1880s]
Ten people pose in front of a steam tractor.



11. Refrigerator car

[unknown]
Pacific Fruit Express refrigeration car No. 50187.



12. Icing a refrigerator car

[unknown]
Men load ice into Fruit Growers Express refrigerator car.



13. Icing a refrigerator car

[unknown]
Fruit Growers Express car No. 35832 restored to its 1938 appearance, and on display at the California State Railroad Museum.



14. Southern Pacific Bulletin [1927]

This bulletin includes The story of a half-million cakes of ice, an article describing how ice was cut at the Pacific Fruit Express' natural ice plant at Carlin, Nevada, a re-icing station for perishable shipments.

INSTRUCTIONS

1. Print any of the images shown above that you will use in your discussion, as well as **Student Activity Sheet 14 and Key**. (Label the images by their number to identify them in the instructions).
2. Read **Background Article 14**. You may wish to read it to your students or have them read it by themselves. Discuss any questions that they may have.
3. Show and discuss **Document 1, Asparagus cannery** and **Document 2, Drying peaches**. Tell students that this image shows different ways that people learned to preserve food. What canned and dried fruits and vegetables have they eaten? Have any of their relatives dried or canned fruits or vegetables? If so, what steps did they have to take to do so? What foods would not be available in their community if canning had not been invented?
4. **Document 3, Sorting almonds** and **Document 4, Almond processing**. These images show how processing of almonds began to involve machines and assembly lines. However, some of the processing still required tedious hand labor, such as the sorting shown in **Document 3**. Have your class investigate how almonds are harvested and processed today.
5. **Document 5, Steam Power of California**. This document illustrates some of the early steam equipment used for harvesting. Identify the purpose of each machine shown. Discuss how farm equipment has changed since 1911.
6. **Document 6, Steam harvester**, illustrates the size, horsepower requirements, and weight of steam-powered equipment, as well as the scope of the harvest on a large tract of land. It also illustrates how equipment owners would combine labor and machines to harvest one farm at a time. Have students calculate how many tons of hay the seven harvesters hauled. (*35 tons*) How many pounds? (*70,000*)
7. **Document 7, Best's traction engine** and **Document 8, Holt tractor and harvester**. Ask students to describe the differences between the traction engines shown. They may note that Best's engine had a distinctive tall boiler, and Holt's has a track-type crawler. Discuss the pros and cons of different steam engine and tractor designs. Have students suggest other approaches or come up with their own designs that would help keep tractors from sinking in the Delta mud. Compare these tractors to modern tractors. Are any of the features of the modern machines similar to the older equipment? How have they been improved?
8. **Document 9, Mowing tules**. This image depicts a specialized machine designed to help farmers in the Delta area. Ask students if they have seen tules. Why would these plants grow in the Delta area? (*grow in wet areas*)
9. **Document 10, Steam tractor**. This image is another example of a steam tractor showing its size and wide wheels. Based on the students' knowledge of Holt and Best, whose machines do they think this tractor most resembles. (*probably Best*)

10. **Document 11, Refrigerator car** and **Documents 12 and 13, Icing a refrigerator car** show refrigeration cars and how they were filled or iced. Read the article *The story of a half-million cakes of ice* in **Document 14, Southern Pacific Bulletin** to students or have them read it independently. Assign several students to find out how modern foods are kept cool for shipping and report to the class.

11. Give students **Activity Sheet 14: Advances in Agriculture** (page 14-9). After they have completed the activity, discuss their answers as a group.

FOLLOW-UP

1. **Search the SHO collection** together, using the keyword and advanced searches. Find additional examples of mechanical harvesting and processing equipment.

2. Print **Document 5, Steam Power of California**. Create additional illustrations showing later inventions and bind all the pages into a booklet for the class.

3. **Play the role of Best or Holt** to sell one of your engine designs to your class.

4. **Identify at least five other sources** that might help you identify the specific builder and date of the tractor shown in **Document 10**, and use the sources to search for the information.

5. In Sacramento, visit the **California State Railroad Museum** to see a railroad refrigeration car or the **Discovery Museum** to see Holt and Best steam tractors.

REFERENCES AND RESOURCES

Blandford, P.W. *Old farm tools and machinery: An illustrated history*.

Fort Lauderdale, FL: Gale Research Co., 1976.

Martin, G.A. *Farm equipment and hand tools* Brattleboro, VT: The Stephen Greene Press, 1980. (facsimile of a book printed in 1887)

Murphy, J. *Tractors: From yesterday's steam wagons to today's turbocharged giants*. New York: Lippincott, 1984. (juvenile)

RELATED LINKS

California State Railroad Museum, Sacramento,
(<http://www.californiastaterailroadmuseum.org>)

Canning industry history (<http://www.cancentral.com/brochure/enterprise.htm>)

Coast to coast (shipping oranges in a refrigerated railroad car in 1947)
(<http://www.sdrm.org/stories/reefer/>)

Discovery Museum, Sacramento,
(http://www.thediscovery.org/technology/tec_agr.html)

The Holt family business history (<http://www.holtpipeline.com/history.htm>)

Heidrick Ag Center Antique Ag Collection, Woodland, CA
(<http://www.aghistory.org/equipment.html>)

Monterey County agriculture history, includes description of wheat harvest
(<http://www.pebble-beach-real-estate.com/index.cfm?pageID=480>)

background 14 ADVANCES IN AGRICULTURE



Many advances in agriculture were made in the nineteenth and twentieth centuries, including improvements in planting, cultivating, harvesting, processing, and distribution. Early inventions included John Deere's 1827 steel plow, which eventually replaced wooden plows for cultivation. In the 1830s, Cyrus McCormick patented a mechanical reaping machine for cutting hay. New horse-drawn equipment that made work easier for farmers included gang plows, which used multiple blades to cultivate the soil. Seed drills cut a furrow and dropped seeds into it while a farmer rode behind the drill.

A big boom in farming in the second half of the nineteenth century was also accompanied by advancements in mechanized farming, including the use of steam-powered equipment. Although machines were developed to help with many farm tasks, especially for harvesting wheat, many crops in California continued to require manual labor. However, eventually, specialized machines also were created for harvesting and processing many row crops and specialty crops such as almonds.



Agricultural Equipment. The first large mechanical farm equipment was pulled by horses, and, by the 1860s, mechanical, horse-drawn cutting and threshing machines were used to harvest California wheat. Threshing separates wheat grains from other parts of the wheat plant by removing what is called the *chaff*. Mechanical binders were also used in some areas, where wheat could not be left to dry in the field. The machines commonly used in California did not have a binder, but were called *headers*.

Around the mid-1800s, combine machines were invented, to do both jobs of cutting and threshing. Steam-powered threshers became common in California in the 1880s, and steam-powered combines soon followed. These combines required a boiler for water and were extremely heavy. They could weigh as much as 15 tons, need at least 40 horses or mules to move them, and have a 40-foot wide header.

Wheat harvesting was a big operation. Farm equipment was so expensive that machines were moved from farm to farm at harvest time. Farm owners either hired crews that traveled with the equipment or went in with a group of other farmers to purchase equipment that was shared by the group.

In the 1880s and 1890s, two California men, Daniel Best and Benjamin Holt, both competed to build machinery to match the soft and often soggy soil conditions that farmers encountered in the Delta area, and both men built steam-powered threshers and combines. They also experimented with ways to keep the heavy steam-powered equipment from sinking in the mud. One of Holt's combines had 9-foot diameter wheels that were 15 feet wide. Best also used wide wheels on his combines, which had tall vertical boilers.

By the 1870s, some inventors had designed steam traction engines, or steam tractors, which could pull other equipment. Best and Holt worked to develop wide-wheeled steam traction engines that could replace the large teams of horses and mules required to move their heavy steam combines.

Neither steam tractors nor combines were very successful because they were so heavy and difficult to move and could easily explode or start a fire. Steam traction engines were difficult to turn and still could bog down in the wet Delta soil. To overcome the latter problem, Holt is known for inventing a steam-powered, track-laying tractor or crawler, which he first tried in 1904. However, it was not until tractors were powered by internal combustion gasoline engines that they became safe, reliable, and cost-effective. Until self-propelled gasoline tractors were widely available, the first gasoline engines were stationary, meaning they did not move, and even gasoline-powered farm equipment was sometimes pulled by horses.

John Froelich produced one of the first successful gasoline-powered traction engines in 1892. Eventually, his work led to the creation of the John Deere Tractor Company. Best soon built his own gas-powered tractor engine, and Holt added a gasoline engine to his track-laying tractor. Best's sons continued their father's work and also built a crawler-type tractor. Eventually, the Best Company and the Holt sons' company merged to form the Caterpillar Tractor Company.



Canneries. Many of the farm crops produced in California did not ship well and were grown and sold to feed only the local residents. However, once methods were introduced to preserve foods, new agricultural products could be shipped to distant locations. Canning was invented in the early 1800s, to provide food for soldiers in the French army. Early canners knew how to use pressure and heat, but did not know about bacteria that caused food to spoil. Seafood was one of the first foods to be canned, and canned milk and other foods were available by the time of the Civil War.

In California, canning was introduced during the Gold Rush. In the 1860s, a salmon canning industry began on the Sacramento River. However, it was soon discontinued because debris from hydraulic mining damaged the salmon population and eventually the fishing industry. By the 1870s, canned fruit from California was being shipped to the east coast. The popularity of canned foods led to the development of specialized processing equipment such as cherry pitters and fruit peelers.

Making cans and bottles for the canneries also became a big industry. Early cans had a plug design, so that food had to be small enough to fit through a hole on top of the can. The invention of conveyor systems to move cans and of equipment to handle open-top cans made it possible to can larger amount of foods in a shorter time.

Many canneries were started to handle the specialty crops introduced into California, including asparagus, tomatoes, peaches, and pears. By the turn of the nineteenth century, many of these canneries had merged to form the California Packing Corporation under the Del Monte brand. Like the California Fruit Growers Exchange, the canning organization helped coordinate marketing and distribution efforts for owners of small canneries.



Railroad cars. Different styles of railroad cars were designed and built to ship different products. For example, special cars were designed to transport fish in water, while tank cars were used to ship wine. Some crops, such as potatoes, didn't need refrigeration and were shipped in cars that were ventilated by opening the hatch cover. Railroad cars were first cooled with ice to ship milk and seafood in the 1840s. Later, others shipped fish, game meat, and birds.

J.B. Sutherland patented an early method of refrigeration for railroad cars in 1867. His system combined air circulation, insulation, and ice compartments on each end of a wooden car to keep it cool. Refrigerated railroad cars began to be widely used in the second half of the nineteenth century, especially after the width of railroad tracks (called the gauge) was standardized. Having standard gauges meant that the fresh food that railroads hauled across the country did not have to be transferred from car to car before reaching its destination.

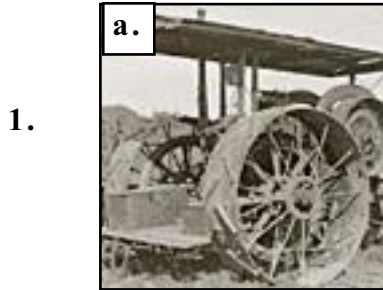
Because railroad refrigeration required a constant supply of ice, ice harvesting became an important business in some communities along the railroad lines. In California, almost all refrigerated cars headed east, taking produce to markets in other states. Some stops in California and Nevada became icing stations, such as Truckee, California, and Carlin, Nevada. Although mechanical methods were eventually developed to manufacture ice, icing stations were first established in areas with cold winters. Residents would cut pond ice into blocks and store it in an icehouse. When the railroad stopped, they would replenish the ice that had melted. Refrigeration cars could travel between 200 and 400 miles between icing stops. The container area in the railroad car that held the ice was called an ice bunker, which was filled from the top. Salt was often used to help keep the ice from melting. Loading the railroad car with ice sometimes required an icing deck or platform. At large icing stations, the bunkers were filled with huge ice blocks suspended from overhead cables.

Refrigeration cars were not cheap to operate. They required extensive cleaning after each load, held less than a regular car and often made their westbound return trip empty. However, some railroads continued to use diesel-powered, iced refrigerator cars until the 1950s, when refrigerated trucks were introduced.

activity sheet 14
ADVANCEMENTS IN AGRICULTURE

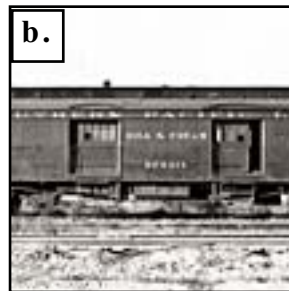
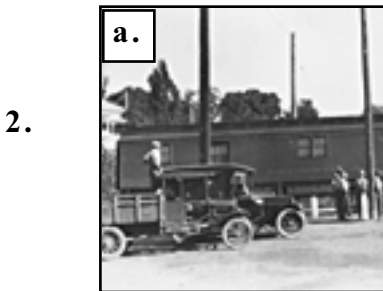
I. Which Is Which?

Find each pair of images in the database, using the keyword search.
Write an *a* or *b* in the blank to identify which picture is which.



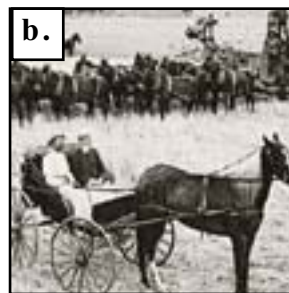
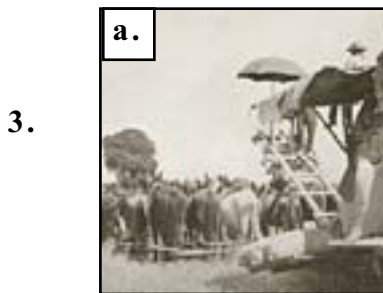
Which shows a Holt product?

Which shows a Buffalo Pitts product?



Which shows a railroad car to carry milk and cream?

Which shows a railroad car to carry fish?



Which shows a 26 horse harvester?

Which shows a 22 mule harvester?



Which shows asparagus canning?

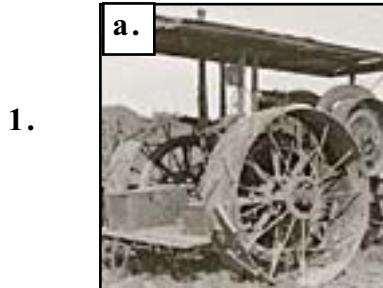
Which shows a peach cannery?

activity sheet 14
ADVANCEMENTS IN AGRICULTURE

I. Which Is Which?

Find each pair of images in the database, using the keyword search.

Write an *a* or *b* in the blank to identify which picture is which.

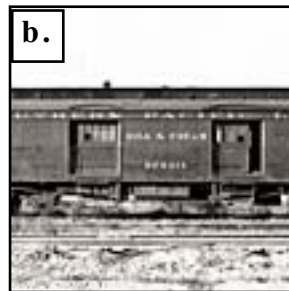
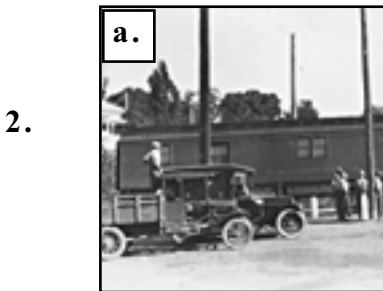


Which shows a Holt product?

_____ **a** _____

Which shows a Buffalo Pitts product?

_____ **b** _____

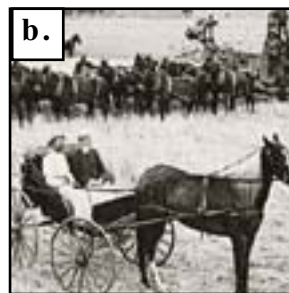


Which shows a railroad car to carry milk and cream

_____ **b** _____

Which shows a railroad car to carry fish?

_____ **a** _____



Which shows a 26 horse harvester?

_____ **a** _____

Which shows a 22 mule harvester?

_____ **b** _____



Which shows asparagus canning?

_____ **b** _____

Which shows a peach cannery?

_____ **a** _____