

CHAPTER Da

Agriculture

Editor: Alan L. Olmstead

*Associate Editors: Julian M. Alston, Bruce L. Gardner, Philip G. Pardey,
Paul W. Rhode, and Daniel A. Sumner*

INTRODUCTION

Alan L. Olmstead

Underlying the data in this chapter is one of the epic stories in world history. In the nineteenth and twentieth centuries powerful forces continuously reshaped American agriculture. A hallmark of the nineteenth century was the settlement of the continent with the addition of hundreds of millions of acres of farmland and millions of farms and farmers. In the twentieth century, the amount of farmland changed little, but the growing gap in opportunities between the farm and nonfarm sectors led to a massive exodus from America's farms. In the 1950s alone, more people moved off farms than resided on farms in 2000. Over the course of the past 200 years, mechanical and biological innovations dramatically increased farm productivity and changed the nature of farm work. At the new millennium, the typical farm worker produced more than fifteen times as much output as did a worker in 1900.

New transportation and communications technologies – such as railroads, automobiles, surfaced roads, telephones, radios, and televisions – significantly reduced the distance between farm and urban life. Along with these changes, improvements in the storage and handling of goods and the growth of urban populations broadened the market for farm goods, creating incentives for farmers to specialize. With this came an increase in farm size and income, along with a growing dependence on nonfarm inputs in the production process. Until the 1930s, American agriculture closely approximated the competitive ideal of a large number of producers who were subject to the dictates of the marketplace. This changed in the 1930s as the federal government responded to prolonged

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agricultural crises by dramatically increasing its role in the farm economy.

The data presented in this chapter documenting these enormous structural, demographic, and economic changes are crucial to our understanding of the past and to our ability to develop appropriate policies for the future. Throughout most of human history, and even in large parts of the world today, the dominant concern has been how to produce enough food and fiber to feed and clothe the population. Unlocking the causal relationships that explain the sources of productivity growth in American agriculture remains one of the important intellectual challenges of our time. This task requires a better understanding of such issues as the linkages between the scientific research community and the farm sector, and of the role of market forces and government policies in the invention and diffusion of new technologies. To grapple with all of these issues, measurement and data are called for.

Agriculture is no stranger to controversy, especially regarding distributional questions and labor market institutions. The information presented in this chapter offers a valuable starting point for the study of such complex issues as the prevalence of tenancy and sharecropping in the American South, the decline in the number of family farms, and the distribution of government support payments. The series on the output and prices of specific crops and livestock provide the basic data for our understanding of the health and performance of the farm economy. The sections dealing with farm structure, productivity, and government policy provide the data or raw materials for analyzing the transformation and integration of the American farm sector over the past two centuries.

The five essays that follow offer an overview of the major trends in American agricultural development. Table Da-A draws on issues relevant to all five to provide a unifying overview of key landmarks

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TABLE Da-A Chronology of U.S. agricultural history: 1609–2000

1609	Settlers at Jamestown learned from Indians how to grow corn.
1769	The orange was introduced into California, but the first grove was not planted until 1804.
1793	Eli Whitney invented the cotton gin, which he patented in 1794.
1820	U.S. population: 9,638,453; 72 percent of workforce in agriculture. Fifty to sixty hours of labor were required to produce one acre (twenty bushels) of wheat with a walking plow, a bundle of brush for a harrow, hand broadcast of seed, harvesting by sickle, and threshing by flail.
1825	Thomas Kensett secured a patent on the use of tin cans in preserving food.
1831	Cyrus McCormick invented his grain reaper, which he patented in 1834.
1836	Hiram Moore and J. Hascall invented the grain combine.
1837	John Deere began manufacturing plows with steel share and smooth wrought iron moldboard.
1840	Justus von Liebig's <i>Organic Chemistry in Its Applications to Agriculture and Physiology</i> appeared.
1844	George Easterly patented a grain header.
1846	Robert Reid developed a corn variety (Reid's Yellow Dent) that eventually dominated the Corn Belt.
1850	Thirty to thirty-five man-hours were required to produce one acre (forty bushels) of corn using a walking plow and harrow and planting by hand. Total U.S. population: 23,191,876. Farm population: 11,680,000; 64 percent of the workforce in agriculture.
1856	The first butter factory was established.
1862	President Abraham Lincoln signed legislation that created the U.S. Department of Agriculture. President Lincoln approved the Homestead Act and the Morrill Land-Grant College Act.
1865	Slavery was abolished by the thirteenth amendment to the Constitution.
1867	Oliver Hudson Kelley, an employee of the U.S. Department of Agriculture, organized the Patrons of Husbandry, later known as the National Grange. This was the first general farmers' organization to permit women equality of membership and privilege.
1868	A refrigerator car widely used by railroads in the 1870s was patented by William Davis.
1869	James Oliver patented a plow made of chilled iron. The gypsy moth was brought to the United States and accidentally established in Medford, Massachusetts. David L. Garver of Michigan patented the first practical spring-toothed harrow, which eliminated breaking teeth on roots and stones.
1870	The New York Cotton Exchange opened, followed by one in New Orleans a year later.
1871	The first Granger law regulating railroads and warehouses was passed in Illinois.
1872	Luther Burbank produced the Burbank potato, the first of a long series of new or improved varieties of vegetables, fruits, and flowers.
1873	The "Washington navel" orange was introduced to California from Brazil.
1874	Manufacture of oleomargarine began in the United States. The first important introduction of Turkey wheat by Mennonites into Marion and Harvey Counties, Kansas, was made. The Glidden barbed wire patent was granted. Barbed wire contributed greatly to the agricultural settlement of the Great Plains.
1875	The first state agricultural experiment station in the United States was established in Middletown, Connecticut, through the efforts of Samuel W. Johnson. In the same year, the California Agricultural Experiment Station was founded at the University of California by Eugene W. Hilgard.
1884	An epidemic of a contagious bovine pleuropneumonia of foreign origin led to the adoption by the Congress of the first federal animal quarantine law. The Bureau of Animal Industry was established in accordance with an act of Congress.
1887	The Hatch Experiment Station Act was approved, providing federal grants to states for agricultural experimentation.
1888	Refrigerated rail cars were used to ship meat and to haul fruit from California to New York.
1889	The Bureau of Animal Industry found that cattle fever was carried by ticks. The U.S. Department of Agriculture was raised to cabinet status.
1890	Eight to ten man-hours were required to produce one acre (twenty bushels) of wheat with a gang plow, a seeder, a harrow, a binder, a thresher, wagons, and horses. U.S. population: 62,947,714. Farm population: 26,379,000; 43 percent of the workforce in agriculture.
1892	The first successful gasoline tractor was built by John Froelich. The cotton boll weevil was found near Brownsville, Texas, and began to spread north and east.
1895	Sunkist Growers, Inc., for many years called the California Fruit Growers Exchange, was incorporated as the Southern California Fruit Exchange.
1898	The U.S. Department of Agriculture started to introduce large numbers of soybean varieties. Commercial production of durum wheat began.
1900	Kharkof wheat, a bearded hard red winter variety, was introduced from Russia. Wilt-resistant cotton varieties were developed. U.S. population: 75,994,575. Farm population: 29,414,000; 38 percent of the workforce in agriculture.
1901	The Bureau of Plant Industry (which included Forestry, Chemistry, and Soils) was established under the authority of the appropriation act of March 1901, but not confirmed by an act of Congress until June 3, 1902.
1904	The Holt Company fitted a steam tractor with "caterpillar" tracks.
1906	The Holt Company produced a caterpillar tractor powered by a gasoline engine. The first-known rural electric line was constructed at Hood River, Oregon. The Pure Food and Drug Act was approved.

TABLE Da-A Chronology of U.S. agricultural history: 1609–2000 *Continued*

1907	The U.S. Bureau of Animal Industry at Ames, Iowa, demonstrated a successful hog cholera serum. The American Society of Agricultural Engineers was founded.
1910	U.S. population: 91,972,266. Farm population: 32,077,000; 31 percent of the workforce in agriculture.
1911	The first Farm Bureau was formed in Broome County, New York.
1912	Marquis wheat, which had been developed by A. P. Sanders in Canada in 1892, was introduced into the United States. The Plant Quarantine Act was approved.
1913	The Bull Tractor Company introduced a 4,650-pound machine, the “Bull with the Pull,” which was the forerunner of the light tractor.
1914	The Smith–Lever Cooperative Agricultural Extension Act, which formalized cooperative agricultural extension work, was introduced.
1916	The Federal Farm Loan Act, providing for twelve farmland banks, was approved. The law grew out of Country Life Commission recommendations. The U.S. Warehouse Act, authorizing licensing, bonding, and inspection of public warehouses storing agricultural products, was approved.
1917	The European corn borer was discovered near Boston, Massachusetts. Japanese beetles were discovered in New Jersey.
1918	The development of a system for growing modern hybrid seed corn was completed by Donald F. Jones.
1920	U.S. population: 105,710,620. Farm population: 31,614,269; 27 percent of workforce in agriculture. Enclosed gears developed for a tractor. The American Farm Bureau Federation was formally organized and its constitution ratified.
1922	The first electrically heated and electrically regulated incubator used for chickens was patented by Ira M. Petersime. The Capper–Volstead Act declared that a cooperative association was not, by reason of the manner in which it was organized and normally operated, a combination in restraint of trade in violation of the federal antitrust statutes.
1926	Henry Wallace developed commercial hybrid seed corn. The Congress passed the Cooperative Marketing Act, which created a Division of Cooperative Marketing in the U.S. Department of Agriculture.
1928	John D. Rust patented the first successful spindle cotton picker.
1929	W. Gericke invented hydroponics. The Mediterranean fruit fly was discovered in Florida, and an all-out program was instituted to combat it.
1930	U.S. population: 122,775,046. Farm population: 30,445,350; 22 percent of workforce in agriculture. Six to eight man-hours were required to produce one acre (forty bushels) of corn with a two-bottom gang plow, a seven-foot tandem disk, a four-section harrow, a two-row cultivator, a two-row planter, and a two-row picker. Three to four man-hours were required to produce one acre (twenty bushels) of wheat with a tractor, a three-bottom gang plow, a ten-foot tandem disk, a harrow, a twelve-foot combine, and trucks. Fifty-eight percent of all farms had cars; 34 percent had telephones; and 13 percent had electricity, including home generating plants. The estimated average equity of farm operators in the land they farmed was 41 percent. The Plant Patent Act was approved.
1933	The Agricultural Adjustment Act was approved. The Commodity Credit Corporation was established.
1935	The Rural Electrification Administration was established by Executive Order 7037, and it was incorporated into the U.S. Department of Agriculture on June 1, 1939. A one-man combine was developed for harvesting wheat.
1937	The first soil conservation district in the United States was organized.
1938	The Agricultural Adjustment Act of 1938 provided for farm price support and adjustment programs based on an “ever-normal granary” concept. It replaced and invalidated the Agricultural Adjustment Act of 1933.
1940	U.S. population: 131,820,000. Farm population: 30,840,000; 18 percent of workforce in agriculture. Fifty-eight percent of all farms had automobiles; 25 percent had telephones; and 33 percent had electricity.
1946	The Research and Marketing Act was signed.
1949	The usefulness of antibiotics in promoting animal nutrition was demonstrated.
1950	U.S. population: 151,132,000. Farm population: 25,058,000; 11 percent of workforce in agriculture.
1968	Ninety-six percent of all cotton was being harvested mechanically.
1970	The Plant Variety Protection Act was passed. Approximately 70 percent of corn produced in the five principal Corn Belt states was harvested by combines equipped with corn heads.
1985	In the 1980s “no-till” or “low-till” methods of preparing land for planting were used by more farmers on a variety of crops. The objective is to enhance yields while lessening erosion. More herbicides are used than under high-till conditions, and a greater degree of management control is required.
2000	U.S. population: 282,000,000. Farm population: 4,591,000; 2.4 percent of the workforce in agriculture.

Sources

Julian M. Alston and Philip G. Pardey, *Making Science Pay: The Economics of Agricultural R&D Policy* (AEI Press, 1996), pp. 116–21; Maryanna S. Smith and

Dennis M. Roth, “Chronological Landmarks in American Agriculture,” U.S. Department of Agriculture, Agriculture Information Bulletin number 425, revised (November 1990).

in American agricultural development. This table highlights scientific and technological breakthroughs, the course of labor productivity, and important legislative changes. Together these developments have revolutionized rural life and farm productivity.

FARMS AND FARM STRUCTURE

Alan L. Olmstead and Paul W. Rhode

It is currently popular to conceive of the American economy as undergoing a fundamental transition from an industrial to an information-based economy. Dramatic structural changes associated with globalization, de-industrialization, and rapid technological innovation have generated considerable controversy as old ways of living and doing business have been superseded by the new. History offers evidence on several earlier structural transformations, but few have been as significant as that summarized in the data contained in this chapter. The history of American agriculture is in large part the story of the transformation of the United States from a predominantly rural, agricultural economy to an urban, industrial, and service economy.

Farm Population and the Number of Farms

Figure Da-B displays national statistics on the farm population, the number of farms, and farm employment.¹ As these numbers show, the size of the agricultural sector continued to grow rapidly during the late nineteenth and early twentieth centuries while the country was industrializing. Of course, the farm sector's relative size fell over this period as the nonfarm sector grew even more rapidly. As one indication of these crosscutting trends, the farm population increased from 22 million people in 1880 to 32 million people in 1910 whereas the sector's share of the national population declined from 44 percent to 35 percent during this period.

The size of the farm sector, measured in terms of the value of agricultural output, has continued to grow over the long run. The nominal value of farm products sold rose from about \$858 million in 1925 to about \$196 billion in 1997 (series Da423). However, the size of the U.S. farm sector, measured in terms of the number of farmers and farms, reached a plateau in the period between 1910 and 1940. The number of farms varied between 6.4 and 6.8 million units throughout this thirty-year period while the farm population hovered in a range of 30.5 to 32.5 million persons. Although U.S. agriculture suffered "hard times" during much of the 1920s and 1930s, there was little tendency for the sector to contract. Indeed, as the figures on off-farm migration indicate, three quarters of a million people, on net, moved "back to the farm" between 1931 and 1933 (series Da3). After World War II, however, U.S. agriculture entered a period of rapid adjustment that witnessed wholesale changes in the labor force and the structure of farming. Between 1945 and 1960, more than 15 million people migrated out of the farm sector. By 1960, there were about 16 million people remaining on the nation's 4 million farms. By the eve of the new millennium, these numbers fell to fewer than 5 million people living on the

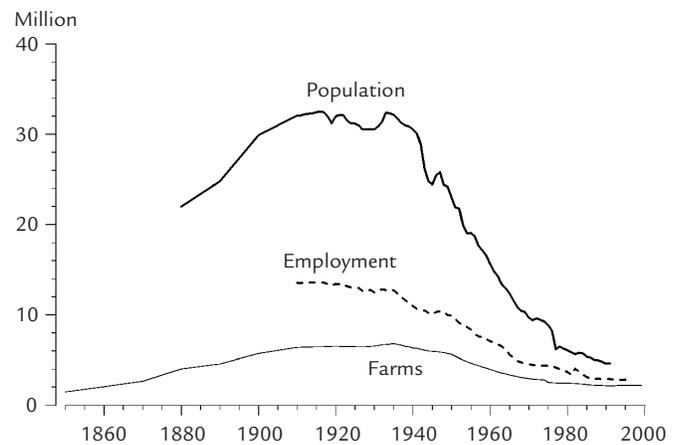


FIGURE Da-B Farms, farm population, and farm employment: 1850–1999

Sources

Farms: 1850–1900, series Da16; thereafter, series Da4. Population: 1880–1900, series Da14; thereafter, series Da1. Employment: series Da612.

nation's 2 million farms. Although the actual decline in the farm population was largely a post-1940 phenomenon, the decline in the relative size of the farm population dates back to the early nineteenth century. Every decade between 1880 and 2000 has witnessed at least a modest decline in the farm population as a percentage of the total population, with the ratio falling from about 42 percent in 1900, to 15 percent at midcentury, to less than 2 percent in 2000.²

The aggregate national data mask significant variations in agricultural development at the regional level (Olmstead and Rhode 1993). By its nature, farming is characterized by substantial differences (e.g., climate, terrain, soil quality, and distance from market) across geographic areas – avocados can be grown in Southern California but not in North Dakota. To highlight these important differences, this chapter departs from the general design of this volume, which focuses on the national picture, by including extensive data at the state and regional levels. The disaggregated series on the farm population and the number of farms included in the census (Tables Da28–158) make clear that over the early twentieth century, when the national aggregates were roughly constant, substantial regional differences existed. For example, the farm population in the (census's) Northeast and North Central states was declining after 1900, whereas that in the South and West continued to expand until 1935. Similarly, the numbers of farms in the Northeast, which peaked in 1880, and the East North Central states, which peaked in 1900, fell steadily during the early twentieth century, whereas those in the West North Central states, the South, and the West continued to grow. It is notable that after World War II, the farm population and the number of farms declined in virtually every state in the nation.

Figure Da-C shows the trends in the acreage of U.S. farmland over the past 150 years. The figure illustrates one of the most significant developments in U.S. agricultural history – the enormous

¹ The definitions of the many terms used in this chapter – such as the “farm population,” what constitutes a “farm,” and “farm employment” – can be found in the text for each table. Such notes also document how many of these definitions have changed over time.

² An important caveat is in order when using these data to assess productivity growth. The raw data showing the farm population, the number of farm operators, and farm employment do not take into account the changing productive quality of the agricultural population and thus may significantly overstate the actual decline in labor inputs. On average, farmers today have far more education and skills than did farmers in 1850 or 1900. As a result an hour of agricultural labor in 2000 embodies more inputs than an hour of labor in 1900.