

## SOME SIGNIFICANT ASPECTS OF THE AGRARIAN REVOLUTION IN THE UNITED STATES

The economic history of American agriculture may be divided into four distinct periods: first, the foundations of American agriculture from 1607 to 1783; second, the westward movement of pioneer and planter into the Mississippi Valley from 1783 to 1860; third, the agrarian revolution and the opening of the Far West from 1860 to 1890; and fourth, the reorganization of agriculture from 1890 to the present.<sup>1</sup> It is the aim of this paper to review some of the more significant aspects of the third period.

By the agrarian revolution is meant the transformation of agriculture from a primitive, pioneer, largely self-sufficing type of industry into a modern business organized on a scientific, capitalistic, commercial basis. The principal factors contributing to this revolution in the United States were: first, the existence of a vast public domain and the policy of the government favoring its rapid transference to private ownership; second, the growth of population and immigration; third, the introduction of farm machinery; fourth, the extension of transportation facilities; fifth, the growth of domestic and foreign markets; and sixth, the development of various agencies for the promotion of scientific knowledge relating to agriculture. The revolution in agriculture which these and other contributing agencies brought about extends from 1860 to the last decade of the century.<sup>2</sup> By 1890 the various elements entering into this

<sup>1</sup> This plan of division is substantially in accordance with that adopted in the writer's *Topical Studies and References on the Economic History of American Agriculture* (McKinley Publishing Company, Philadelphia, 1919).

<sup>2</sup> The agrarian revolution in England took place in the period from 1760 to 1825; in France from the Revolution to 1860; and in Germany from 1860 to 1900. For a brief discussion of the agricultural revolution in these countries

revolution were in working operation. While the agencies bringing about a transformation in agriculture had already been set in motion in the fifties, the real significance of these forces was not apparent until the Civil War which hastened the changes and tendencies that were destined to produce a revolution in our whole economic development.<sup>3</sup>

#### THE LIBERAL LAND POLICY OF THE FEDERAL GOVERNMENT

Among the factors contributing to the revolution in agriculture, the existence of the public domain and the policy of the government favoring its rapid transfer to private ownership commands primary consideration. The public domain originally included all the territory of the continental United States except the thirteen original States and the States of Kentucky, Tennessee, and Texas. This represents an area of 1,442,200,320 acres, or about three-fourths of the entire land area of the country which amounts to 1,903,289,600 acres. Of this vast heritage the government had by 1860 disposed of 394,089,000 acres, thus leaving for future disposition an area amounting to 1,048,111,000 acres, the greater portion of which lay in the States and Territories west of the Mississippi River.<sup>4</sup>

The period of rapid disposal of the public lands dates from the enactment of the Homestead Law in 1862. Ac-

see Ogg's *Economic Development of Modern Europe*, Chs. VI, IX. As England, France, the United States, and Germany underwent a revolution in agriculture during the nineteenth century, so Canada, Australia, Russia, and the leading Latin-American countries have already begun to undergo a similar revolution in the twentieth century.

<sup>3</sup> For a brief survey of the economic revolution in the United States after 1860, see Johnson's *History of Domestic and Foreign Commerce of the United States*, Vol. I, Ch. XV. The economic revolution is characterized by two closely related lines of development: the revolution in industry; and the revolution in agriculture, which for historical purposes may conveniently be treated as distinct phases of economic history.

<sup>4</sup> The statistics used in this paragraph are taken from the *Annual Report of the Commissioner of the General Land Office*, 1860, p. 25, 1914, p. 47.

According to the provisions of this law any person had the right to locate upon 160 acres of unappropriated public land in any of the States and Territories in which there was such land subject to entry at a United States land office, to live upon the same for a period of five years, and upon proof of a compliance with the law, to receive a patent therefor free of cost or charge for the land. Full citizenship was required in obtaining final title. In case the settler desired to obtain a title for his land before the expiration of the five-year period, he might do so by paying the regular purchase price of \$1.25 or \$1.50 an acre, as the case might be, "on making proof of settlement and cultivation as provided by existing laws granting preemption right". This latter provision was known as the commutation of a homestead. The Homestead Law therefore made it possible for every able-bodied person to become a land-owner upon actual settlement and cultivation; at the same time the land laws secured to the proprietor perfect title, absolute ownership, complete control, and easy sale or transfer. The opportunity to own a homestead on such liberal terms was eagerly seized by thousands of settlers and millions of acres of virgin land were added to the farming area of the country.<sup>5</sup>

The rapid alienation of the public lands was still further

<sup>5</sup> The number and area of entries under the Homestead Act by States and Territories from 1862 to 1880 inclusive is given in Donaldson's *Public Domain* (Washington, 1884), pp. 351-355. The total number of entries during this period was 469,782, including an area of 55,667,045 acres.

"The homestead law is now the approved and preferred method of acquiring title to the public lands. It has stood the test of eighteen years, and was the outgrowth of a system extending through nearly eighty years, and now, within the circle of a hundred years since the United States acquired the first of her public lands, the homestead act stands as the concentrated wisdom of legislation for settlement of the public lands. It protects the Government, it fills the States with homes, it builds up communities, and lessens the chances of social and civil disorder by giving ownership of the soil, in small tracts, to the occupants thereof. It was copied from no other nation's system. It was originally and distinctively American, and remains a monument to its originators."—Donaldson's *Public Domain* (Washington, 1884), p. 350.

encouraged by the Preëmption Law of 1841 which still remained on the statute books, the Timber Culture Law of 1873, and the Desert Land Law of 1877, which together with the right granted under the Homestead Law, enabled any person to secure title to 1,120 acres of government land;<sup>6</sup> while large quantities of timber, coal, and mineral lands could be acquired under various other acts. These methods of disposing of land to individuals were supplemented by huge grants to railroads and to the States for various purposes — grants which were immediately opened for sale at reasonably low prices to the incoming settlers.

This legislation favored the rapid disposition of the public domain which characterized the period from 1860 to 1890 during which the government disposed of 461,894,000 acres. The entire area of the public domain alienated from 1785 to 1890 therefore amounted to 855,983,000 acres.<sup>7</sup> This represents an area twenty-four times the area of Iowa and, together with the States of Kentucky, Tennessee, and Texas which are not included in the list of public land States, comprises the great agricultural empire of the Mississippi Valley and the major portion of the lands of the Pacific Coast States. The number of farms was increased from 2,044,000 in 1860 to 4,565,000 in 1890 and the number of acres in farms was increased during the same period from 407,213,000 to 623,219,000; while the average number of acres in each farm

<sup>6</sup> This was changed in 1891 by a law which provided that the maximum amount of agricultural land which could be entered by one person under these laws was 320 acres.

<sup>7</sup> *Annual Report of the Commissioner of the General Land Office*, 1890, p. 121. This report shows that the entire area of vacant public land (both surveyed and unsurveyed) remaining undisposed of and therefore subject to private entry in 1890 amounted to 586,217,000 acres. Subtracting this area from the 1,048,111,000 acres remaining unsold and unappropriated in 1860, it is found that the area disposed of during the period from 1860 to 1890 amounted to 461,894,000 acres to which should be added the 394,089,000 acres disposed of before 1860 which gives a total area of 855,983,000 acres of public land which had been alienated by 1890.

was reduced from 199 to 137. The greatest expansion in the agricultural area took place in the North Central States in which the number of farms increased from 772,165 in 1860 to 1,923,822 in 1890 and the number of acres in farms increased during the same period from 107,900,000 to 256,587,000.<sup>8</sup> The natural result of the policy of the government favoring the rapid transfer of the public domain to private ownership was therefore a great expansion in the farming area of the country by the addition of 2,511,000 farms embracing an area of 216,006,000 acres — a fact which is of primary significance in the study of the agricultural development of this period.

#### THE GROWTH OF POPULATION AND IMMIGRATION

The population of continental United States doubled during this period, increasing from 31,443,000 in 1860 to 62,-

<sup>8</sup> These statistics are taken from tables in the *Twelfth Census of the United States*, 1900, Vol. V, pp. xvii, xix, xxi. These tables give the number of farms, the number of acres in farms, and the average number of acres per farm for the entire United States and for each of the several geographic divisions. These divisions and the States composing each, according to the United States Census Reports of 1890 and 1900, are:

(1) The North Atlantic Division comprising: (a) the six New England States of Massachusetts, Connecticut, Rhode Island, Maine, New Hampshire, and Vermont; and (b) the three Middle Atlantic States of New York, Pennsylvania, and New Jersey.

(2) The South Atlantic Division comprising the eight States of Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, and Florida. The District of Columbia is also included in this division.

(3) The North Central Division comprising the twelve States and Territories of Ohio, Indiana, Illinois, Michigan, Wisconsin, Missouri, Iowa, Minnesota, Kansas, Nebraska, South Dakota, and North Dakota.

(4) The South Central Division comprising the eight States of Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Oklahoma, and Texas.

(5) The Western Division comprising: (a) the eight mountain States and Territories of Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, and Idaho; and (b) the three Pacific States of California, Oregon, and Washington.

995,000 in 1890<sup>9</sup>— an increase equal to that of the previous two hundred and fifty years. One third of this increase was composed of foreign immigrants numbering 10,374,000,<sup>10</sup> who came in to recruit the labor forces of the country. Population continued to move westward as it had before 1860;<sup>11</sup> and the agricultural States of the Mississippi Valley were rapidly filled with settlers;<sup>12</sup> while the Pacific Coast States were added to the agricultural empire which was being founded in the Central West. The abundance of new and cheap land led to the emigration of great numbers of people from New England and other eastern States into the North Central States. To this section was also attracted a large proportion of the immigrant population which was, as a rule, thrifty, industrious, and experienced in European methods of agriculture.<sup>13</sup> The population of these States increased from 8,097,000 in 1860 to 22,410,000 in 1890 — the largest numerical increase of any of the several geographical divisions of the country — while the number of inhabitants in the South Central States during the same period

<sup>9</sup> *Thirteenth Census of the United States*, 1910, Vol. I, p. 24.

<sup>10</sup> Hall's *Immigration*, p. 9.

<sup>11</sup> For a study of the westward movement in American history before 1860, see the writer's *Topical Studies and References on the Economic History of American Agriculture* (McKinley Publishing Company, Philadelphia, 1919), Topic XII.

<sup>12</sup> For maps showing the distribution of rural population outside of the municipalities having 8,000 or more inhabitants for the decennial years 1790 to 1910, see the *Statistical Atlas of the United States* (Washington, 1914), Plates 3 to 15 inclusive. See also *Thirteenth Census of the United States*, 1910, Vol. I, pp. 56, 57, for tables giving the distribution of rural and urban population in the United States for the decennial years 1880 to 1910 inclusive. In 1860, forty and six-tenths per cent of the population lived on farms; in 1880, this had been increased to forty-four; and in 1900, this population had been decreased to thirty-nine and two-tenths per cent. — King's *Wealth and Income of the People of the United States*, p. 16.

<sup>13</sup> The influence of foreign immigration on the agricultural development of the United States is a subject worthy of historical study. See, for example, Faust's *The German Element in the United States*, Vol. II, Ch. II.

increased from 5,799,000 to 11,170,000; and in the Pacific Coast States from 444,053 to 1,888,000.<sup>14</sup>

## THE INTRODUCTION OF FARM MACHINERY

No less significant as a factor in the agricultural revolution was the introduction into general use of improved labor-saving machinery and the consequent transformation in the methods of farming. Although most of the epoch-making machines — notable among which were the plow, the corn-planter, the two-horse cultivator, the mower, the reaper, and the steam thresher — had been invented in the period ending with 1860, and although the application of this machinery had spread to a considerable extent in the fifties,<sup>15</sup> it was not until the decade which witnessed the Civil War that agricultural machinery was popularized and brought into widely extended use. The withdrawal of hundreds of thousands of men from the farm to enlist in the army greatly stimulated the use of machinery while the war was in progress. Improved plows, cultivators, mowers, reapers, and threshing machines, and other labor-saving devices, including the substitution of horse-power and steam-power for manual labor, overcame the conservatism of the farmers, who, before the war when labor was plenty and cheap, had failed to appreciate the advantages of labor-saving machinery. Confronted with the alternative of los-

<sup>14</sup> These statistics are taken from a table in the *Thirteenth Census of the United States*, 1910, Vol. I, pp. 30, 31. This table gives the distribution of population of the United States by States and by geographic divisions, together with the rank of each, for the decennial years from 1790 to 1910 inclusive.

<sup>15</sup> "The year 1850 practically marks the close of the period in which the only farm implements and machinery other than the wagon, cart, and cotton gin, were those which, for want of a better designation, may be called implements of hand production. The old cast-iron plows were in general use. Grass was mowed with the scythe, and grain was cut with the sickle or cradle and threshed with the flail."— *Twelfth Census of the United States*, 1900, Vol. V, p. xxix.

ing their crops for want of labor the farmers became thoroughly interested in these new inventions, only to become convinced of their utility when they saw it demonstrated that a reaper operated by one man could cut from ten to twelve acres of wheat in a day, whereas one man with a grain cradle was able to cut only an acre and a half or two acres in the same length of time.

New implements and machines of many kinds were introduced into widespread and general use. The value of farm machinery in use increased from \$246,118,000 in 1860 to \$494,247,000 in 1890. The North Central States showed the greatest advance in the use of farm machinery, the value of which increased during this period from \$72,817,000 to \$232,225,000. The Western States ranked next with an increase of from \$449,000 to \$30,366,000. The North Atlantic States showed an increase of from \$73,825,000 to \$116,868,000 and the South Atlantic States of from \$34,046,000 to \$36,444,000; while the South Central States showed a decrease of from \$72,283,000 to \$58,344,000—the values of the last two named groups of States reflecting the disastrous effects of the Civil War on Southern agriculture.<sup>16</sup> The use of improved labor-saving machinery not only made possible the cultivation of a much larger area of land but it also added greatly to the productivity of each unit of land and of labor, the productive capacity of an individual farmer being multiplied more than twelvefold in the period from 1830 to 1880.<sup>17</sup> With the introduction of this machinery into general use and the consequent improvement in the

<sup>16</sup> These statistics are taken from tables in the *Twelfth Census of the United States*, 1900, Vol. V, pp. xxix, xxx.

<sup>17</sup> For the importance of farm machinery as a factor in the agricultural revolution, see Quaintance's *Influence of Farm Machinery on Production and Labor* in *Publications of the American Economic Association* (Third Series), Vol. V, No. 4, pp. 1-103. See also Brewer's *Report on Cereal Production in the United States* in the *Tenth Census of the United States*, 1880, Vol. III, pp. 148-150.

methods of farming which this machinery made possible, agriculture passed definitely into the commercial stage in which the products were raised primarily for the market and only incidentally for the use of the farmer and his family.

THE EXTENSION AND DEVELOPMENT OF TRANSPORTATION  
FACILITIES

But the revolution in agriculture would have been impossible had it not been for the marvellous extension and development of the transportation system which made it possible for the agricultural West to dispose of its surplus products in the distant markets of the East and South and of Western Europe. Before 1850 the only avenues for the disposal of these products were the two great waterways of the country: the Mississippi River with its navigable tributaries; and the Great Lakes with their eastern connections, the Welland Canal and the St. Lawrence River and the Erie Canal and the Hudson River. "Although the West possessed these two unrivalled waterways, yet there were but few localities which could choose between the two. . . . To the settler near the lakes, the Eastern route was the only available highway, and to the farmer living near the banks of the Mississippi the river was the only possible route."<sup>18</sup> The early railroads in the Middle West were not regarded as competitors of the waterways but as tributaries to them; for it was believed that the waterways would continue to be the principal avenues of transportation.

The rapid extension of railroads throughout the country after 1850 was destined, however, to effect profound changes in the whole course and conditions of internal trade. In 1850 there were but 9021 miles of railroad in the

<sup>18</sup> Tunell's *The Diversion of the Flour and Grain Traffic from the Great Lakes to the Railroads* in *The Journal of Political Economy*, Vol. V, p. 340.

United States, nearly all of which had been built in the Atlantic seaboard States. In 1860 there were 30,626 miles in operation distributed about equally among the three great sections of the country: the East, the South, and the West. The rate of construction was halted somewhat during the Civil War but immediately after the war the entire country was seized with a mania for railroads. In 1870 there were 52,922 miles of track in use. In 1880 this mileage was increased to 93,922 miles, and finally reached 166,654 miles in 1890 — an increase more than five times that of 1860.<sup>19</sup>

The entire country was spanned with a net work of railroads. The North Central States were well supplied with railway facilities; many new lines were added in the South; thousands of miles of track were built in the Eastern States; and five transcontinental railroads were completed, thus bringing the Pacific Coast States into close economic relations with the Mississippi Valley and the manufacturing-commercial East.<sup>20</sup>

Great improvements accompanied this development in rail transportation among which should be mentioned the reduction of grades and curves, improved drainage and ballasting, better bridges, the introduction of steel rails, the improvement of rolling stock, the adoption of uniform gauges, the consolidation of connecting roads into trunk lines, the construction of terminal facilities, and scientific rate-making. These improvements, in connection with the

<sup>19</sup> These statistics are taken from tables in the *Statistical Abstract of the United States*, 1902, pp. 404, 405.

<sup>20</sup> For a brief historical sketch of transportation in the United States, see Ripley's *Railroads: Rates and Regulation*, Ch. I. See also *Annual Report on the Internal Commerce of the United States* (Bureau of Statistics, Treasury Department, Washington), 1876, maps 1 to 12 inclusive, showing various railroad lines at that time. The succeeding reports for the years 1877 to 1886 inclusive, also contain good maps showing rail routes for this period. The report for 1884 contains a complete railroad map of the United States showing the Pacific railroads in colors.

advantages afforded by rapid transit and reduced risks, tended to increase the value of the railroads as commercial highways so that by the close of the decade of the seventies the railroads had become effective competitors of the waterways in the transportation of western agricultural products to the seaboard.<sup>21</sup> The introduction of the iron steamship on the ocean after 1860 and the formation of combinations between railroad and steamship lines, which made possible the shipment of products on through bills of lading from interior points to the markets of Europe, further increased the importance of the railroads as carriers of western agricultural products.

The development of railway and ocean transportation was accompanied by improvements in the facilities for communication which served to bring all sections of the country and the nations of western Europe into close business relations. Of these the telegraph was the most important agency for the rapid dissemination of information without which the organization and management of the modern commercial system would have been impossible. This was further supplemented by the improvement of the postal system, the growth of newspapers and trade journals, the invention and extension of the telephone system, the organization of produce exchanges, and the modern system of banking and exchange, all of which agencies performed incalculable services in commercial operations.<sup>22</sup>

#### THE GROWTH OF DOMESTIC AND FOREIGN MARKETS

The most distinctive feature of the revolution in agriculture, however, was the growth of domestic and foreign

<sup>21</sup> For a discussion of these improvements, including a consideration of the theory of railroad rates and the rate-making practice, see Ripley's *Railroads: Rates and Regulation*, Chs. II, III, IV, V.

<sup>22</sup> The agencies governing the organization and management of internal trade are discussed in Johnson's *History of Domestic and Foreign Commerce of the United States*, Vol. I, Ch. XVII.

markets. The westward movement of population into the Mississippi Valley, the application of labor-saving machinery to agriculture, and the development of the transportation system made possible that territorial division of labor which enabled each section to devote itself more exclusively to the production of those commodities for which it was best adapted: the East to manufacturing and commerce, the South to the raising of cotton and other staple plantation products, and the West to the production of food. Thus there was developed that economic differentiation and mutual dependence between geographic sections which had already begun to characterize the economic development of the United States during the ante-bellum period,<sup>23</sup> and which became more greatly accentuated after 1860.<sup>24</sup> Each section occupied a position of dependent relationship to the other two sections: the East became to a very large degree dependent upon the food-producing West<sup>25</sup> for the breadstuffs and meat which were needed to furnish its rapidly

<sup>23</sup> Johnson's *History of Domestic and Foreign Commerce of the United States*, Vol. I, Ch. XIV. See also the writer's article on *The Internal Grain Trade of the United States, 1850-1860*, in THE IOWA JOURNAL OF HISTORY AND POLITICS, Vol. XVIII, pp. 94-106.

<sup>24</sup> See Johnson's *History of Domestic and Foreign Commerce of the United States*, Vol. I, Chs. XV, XVI.

<sup>25</sup> New England had by 1860 become almost entirely dependent on western grain. This fact was emphasized by Governor Andrew of Massachusetts in a message to the State legislature in which he said:

"The annual consumption of purchased flour by New England, . . . is something near 3,500,000 barrels, or more than one barrel to each inhabitant. In the year 1862, more than 800,000 barrels of western and northern flour were sold in Boston for domestic consumption, or three-fourths of a barrel for each person in Massachusetts.

"I venture to affirm that the consumption of western agricultural products within the six States of New England, including flour, grain and animal food, used for the support of man and the forage of cattle, swine, and horses, during the year 1863, reached the value of \$50,000,000, the proportion of which taken by Massachusetts exceeded \$20,000,000."—*Eighth Census of the United States*, 1860, Agriculture, p. cxlv.

See also *Report of the Select Committee on Transportation Routes to the Sea-*

growing population with an adequate supply of food-stuffs; while the South continued to purchase large quantities of produce from that section.<sup>26</sup>

But rapidly as the home market expanded, the increase in the volume of production was considerably greater, thus giving rise to an annual product far in excess of the needs of the country, but for which there fortunately existed a growing demand abroad. The development and expansion of the facilities for the transportation and handling of bulky products and the reduction of freight rates<sup>27</sup> transformed the local into the world market, the effect of which was twofold: first, it stimulated the production of food in the great agricultural regions which now had access to the markets of the world; and, second, it subjected the agricultural systems of the western European countries to a severe strain of competition which compelled large numbers of the rural population to abandon farming. As a result, they either migrated to the industrial centers to enlist in the army of wage-earners or emigrated to the New World, by far the greater proportion of them settling in the United States which furnished unequalled opportunities for the making of an independent living. The countries of Europe thus became the natural market for the breadstuffs and live

*board* (Washington, 1874), pp. 12-14. This report shows that in 1872 the Atlantic seaboard States offered a home market for 104,877,000 bushels of western grain of which 41,132,000 bushels were shipped to the New England States and 63,745,000 bushels were sent to the Middle and South Atlantic States.

<sup>26</sup> The Gulf States in 1872 afforded a home market for 33,784,000 bushels of western grain.—*Report of the Committee on Transportation Routes to the Seaboard* (Washington, 1874), p. 13.

<sup>27</sup> The cost of transporting wheat from Chicago to New York by lake and rail was reduced from 25 cents a bushel in 1869 to 8.5 cents a bushel in 1890; while the rate from New York to Liverpool was reduced from 13.4 cents to 4.9 cents a bushel during the same period. The total cost of transporting wheat from Chicago to Liverpool was therefore reduced from 38.4 cents a bushel in 1869 to 13.4 cents in 1890. These statistics are taken from a table in the *Statistical Abstract of the United States*, 1902, p. 416.

stock products, and the cotton and tobacco which entered into the export trade of the United States. The most important market for these commodities was Great Britain which after the repeal of the Corn Laws in 1846 became rapidly transformed from an agricultural into an industrial nation largely dependent on foreign nations for an adequate supply of foodstuffs and raw materials.<sup>28</sup> The nations of continental Europe were second in order of dependence; while the non-European countries of South America, the West Indies, Canada, China, Australia, and South Africa came next. These countries all furnished markets that absorbed the surplus agricultural products which the United States had available for export. Meanwhile Russia, India, Australia, Canada, and Argentina became strong competitors of the United States for this trade.

The chief item entering into the export trade of the United States was the breadstuffs of the West; while cotton occupied second place; and live stock and animal products ranked third. During the Civil War, while the southern market was temporarily closed, wheat and flour exports, already considerable before 1860, were suddenly expanded from 17,213,000 bushels in 1860 to 61,700,000 bushels in 1862 and continued at a high level during the next two years, thereafter declining for a time but advancing again as a consequence of the rapid increase in grain production and the enlargement of European demands for breadstuffs.<sup>29</sup> From 1867 to 1872 wheat and flour exports amounted to an annual average of 35,500,000 bushels, or

<sup>28</sup> For a discussion of this subject, see the writer's article on *The Influence of Wheat and Cotton on Anglo-American Relations during the Civil War* in THE IOWA JOURNAL OF HISTORY AND POLITICS, Vol. XVI, pp. 400-439. See also Ogg's *Economic Development of Modern Europe*, Chs. VIII, XII.

<sup>29</sup> For statistics showing the quantity of wheat and flour exported from the United States from 1830 to 1868, see tables in the *Annual Report of the Commissioner of Agriculture*, 1868, pp. 47, 48.

15.53 per cent of the entire crop; from 1873 to 1878 an annual average of 73,400,000 bushels, or 24.59 per cent of the entire crop, was exported; from 1879 to 1883 this was increased to an annual average of 157,600,000 bushels, or 34.91 per cent of the total crop. Although there was a decrease in the average annual exports after that date, the amount of wheat and flour exported continued at a high level to the end of the century.<sup>30</sup>

While the volume of corn production has been considerably greater than that of wheat, the proportion entering into domestic and foreign commerce has been considerably less. The reasons for this are: first, that corn is not as well adapted to the requirements of commerce as wheat, possessing greater bulk and less value and being more susceptible of injury during transportation; and second, that a very decided prejudice has always existed in the United States and the western countries of Europe against the use of corn as a breadstuff. Even so, however, corn exports showed a rather remarkable increase for this period, increasing from an annual average of 14,200,000 bushels, or 1.54 per cent of the total crop for the period 1867-1872, to 52,800,000 bushels, or 4.51 per cent for the period 1873-1878, and finally reaching 73,400,000 bushels, or 4.90 per cent of the entire crop from 1879-1883. From 1884-1893 there was a decline in the average amount exported; but this was followed by a rapid increase which for the period 1894-1899 amounted to an annual average of 127,400,000 bushels, or 6.56 per cent of the entire crop.<sup>31</sup>

Cotton was a close rival of grain in the list of exports.

<sup>30</sup> These statistics are taken from a table in the *Monthly Summary of Commerce and Finance* (Bureau of Statistics, Treasury Department), January, 1900, p. 1998. See also *Statistical Abstract of the United States*, 1902, p. 345.

<sup>31</sup> These statistics are taken from a table in the *Monthly Summary of Commerce and Finance* (Bureau of Statistics, Treasury Department), January, 1900, p. 1996. See also *Statistical Abstract of the United States*, 1902, p. 344.

While the amount exported during the Civil War decade was decreased from 3,744,000 bales in 1860 to 2,206,000 bales in 1870, the exports quickly regained and finally surpassed their former level, amounting in 1880 to 3,885,000 bales and finally reaching 4,950,000 bales in 1890. The following decade witnessed an even more rapid growth in the production and export of cotton. Throughout the period from 1865 to the close of the century, the annual amount of cotton exported was from 59.2 per cent to 82.5 per cent of the entire cotton crop of the United States.<sup>32</sup>

Live stock and animal products, which heretofore had occupied but a very subordinate position in the foreign trade of the United States, now assumed an important place in the list of exports ranking next to breadstuffs and cotton. The live stock and packing industries produced more than the home market was able to absorb. Consequently, large quantities of beef and pork products were available for the growing demand abroad. The entire export trade in provisions increased from \$54,016,000 in 1865 to \$136,265,000 in 1890, the principal item being pork, the value of which during this period increased from \$26,522,000 to \$85,281,000; while the remainder consisted of beef and dairy products. The value of live stock exports meanwhile increased from \$244,000 to \$47,057,000.<sup>33</sup>

The total value of all agricultural exports of the United States was increased from \$256,561,000 in 1860 to \$361,188,000 in 1870, finally reaching \$685,961,000 by 1880, but

<sup>32</sup> These statistics are taken from a table in Hammond's *The Cotton Industry in Publications of the American Economic Association* (New Series), No. 1, 1897. The table is printed as part of Appendix I. Compare with tables in the *Monthly Summary of Commerce and Finance* (Bureau of Statistics, Treasury Department), March, 1900, pp. 2550, 2553; also *Statistical Abstract of the United States*, 1917, p. 534.

<sup>33</sup> These statistics are taken from a table in the *Monthly Summary of Commerce and Finance* (Bureau of Statistics, Treasury Department), February, 1900, p. 2309.

declining to \$642,751,000 in 1890, and then increasing again to \$835,858,000 in 1900.<sup>34</sup> This rapid expansion in exports enabled the United States by 1880 to become the foremost surplus cereal and live stock producing country in the world — a position which this country had long since attained and continued to hold with reference to cotton and tobacco.

THE DEVELOPMENT OF AGENCIES FOR THE PROMOTION OF  
SCIENTIFIC KNOWLEDGE RELATING TO AGRICULTURE

Of fundamental significance, finally, as a factor in the agrarian revolution was the development of the various agencies for the promotion of scientific knowledge relating to agriculture. While interest in scientific agriculture dates back to the beginning of the national period of our history, this interest was shared by but a comparatively small number of progressive farmers,<sup>35</sup> while the great mass of the rural population followed the rule of tradition, custom, and superstition which prevailed throughout the pioneer period. The reasons for this general reluctance to apply scientific principles to the practice of farming were: first, that it was easier and more economical to acquire and cultivate new land than to institute intensive methods on the older land; second, farmers possessed very meager knowledge as to the proper treatment of soils and plant life, even the most intelligent farmers, including the scientists themselves, knowing very little about such matters; and third, the great majority of farmers were averse to new ideas and methods which they regarded as "book farming" and therefore as entirely impracticable. This attitude is to be explained largely by the fact that the farmers of the pioneer period, accustomed to a life of isolation and separa-

<sup>34</sup> These statistics are taken from the *Statistical Abstract of the United States*, 1902, p. 538.

<sup>35</sup> See, for example, Haworth's *George Washington: Farmer* (Indianapolis, 1915).

tion from their fellowmen, were naturally very independent and extremely individualistic, relying on their own initiative and taking pride in following their own peculiar methods of farming when it would have been easier and less expensive for them to seek and follow the advice and experience of others.<sup>36</sup>

The introduction of scientific agriculture during the second half of the nineteenth century effected a revolution in the methods of farming which in turn had a tremendous influence on the agricultural development of the United States. The reasons for the adoption of scientific methods may be briefly summarized.

1. The rapid disposal of the public domain after 1862 soon brought the nation to the end of the free land era and it was no longer possible to acquire new agricultural lands for nothing, with the result that intensive farming then became necessary.<sup>37</sup>

2. The transformation of agriculture from the pioneer into the commercial stage brought the farmer into closer relations with the business world. The new conditions thus created broadened the farmer's outlook and awakened him to a realization of his educational needs and opportunities. Moreover, this period witnessed the rise of a new generation of farmers who were ready to abandon old methods of

<sup>36</sup> For a study of pioneer agriculture in the United States before 1860, see the writer's *Topical Studies and References on the Economic History of American Agriculture* (McKinley Publishing Company, Philadelphia, 1919), Topics VI, IX, XIV. See also Topic XX on Pioneer Life and Ideals.

<sup>37</sup> "Intensive farming in the strict sense may mean any or all of the following methods:

1. The simple application of more labor in the preparation of the soil and the handling of the crop.

2. The use of more capital in connection with a given quantity of labor, thus enabling the same labor to prepare the soil more thoroughly and care for the crops more efficiently.

3. The application of more scientific methods to the improvement and maintenance of the fertility of the soil".—Carver's *Principles of Rural Economics*, pp. 166, 167.

farming and adopt new ones, once their utility had been demonstrated. Agriculture thus liberated from the fetters of custom and tradition, was prepared to enter upon a new era of scientific development.<sup>38</sup>

3. This led to the establishment of agencies for the promotion of scientific knowledge relating to agriculture. Among these should be mentioned: first, the Federal and State departments of agriculture; second, the agricultural colleges and experiment stations, including rural extension work; third, farmers' organizations; and, fourth, the agricultural press. The limits of this paper will permit only a brief reference to the functions of these agencies in the education of the farmer along scientific and practical lines.<sup>39</sup>

The Federal Government first took an active interest in the promotion of agriculture in 1839, when, on the recommendation of the Commissioner of Patents, an appropriation of \$1000 was made for the "collection of agricultural statistics, investigations for promoting agriculture and rural economy, and the procurement of cuttings and seeds for gratuitous distribution among the farmers".<sup>40</sup> The work was gradually developed by the Patent Office, through its agricultural division, until 1862 when the Department of Agriculture was established. The functions of this Department as defined by law were "to acquire and diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and

<sup>38</sup> For a good brief description of the pioneer self-sufficing agriculture of half a century ago in New England as contrasted with modern commercialized agriculture see Welch's *The Farmer's Changed Condition* in *The Forum*, Vol. X, 1891, pp. 689-700. See also Butterfield's *Chapters in Rural Progress*, Ch. IV, contrasting the new farmer with the old.

<sup>39</sup> See the writer's *Topical Studies and References on the Economic History of American Agriculture* (McKinley Publishing Company, Philadelphia, 1919), Topics XXXI, XXXII, XXXIII.

<sup>40</sup> Poore's *History of the Agriculture of the United States* in the *Annual Report of the Commissioner of Agriculture*, 1866, p. 524.

comprehensive sense of that word, and to acquire, propagate, and distribute among the people new and valuable seeds and plants".<sup>41</sup>

The Department grew slowly at first, owing to inadequate moral and financial support; but as the need for a scientific knowledge relating to agriculture developed, the functions of this department were gradually expanded and the demand for bulletins and reports on many special subjects was increased. By 1889 the Department had finally achieved sufficient dignity to be raised to the rank of a cabinet office. Thereafter the work of this Department was rapidly developed until it became the leading government agency of its kind in the world for the promotion of scientific research relating to all lines of agricultural development, including plant and animal life, crop production, insect pests, trade and commerce, irrigation, statistics, quarantine, and road-making — almost everything, indeed, affecting the interests of those engaged in the raising and marketing of agricultural products. Some idea of the functions of this Department may be gained by reference to the following bureaus into which it has been divided: office of the secretary, weather bureau, animal industry, chemistry, plant industry, forest service, soils, crop estimates, entomology, biological survey, public roads and rural engineering, accounts and disbursements, library, horticulture, markets and rural organization, States relation service, and publications.<sup>42</sup> The Department of Agriculture has always taken an added interest in movements for the education of the farmer, and it has disseminated a very large amount of useful information on subjects relating to agriculture.

<sup>41</sup> *Annual Report of the Commissioner of Agriculture*, 1862, p. 3.

<sup>42</sup> The work of the United States Department of Agriculture is reviewed in the annual reports of the department from 1862 to the present and in the yearbooks from 1894 to the present. See especially the yearbook of the Department for 1899.

Supplementing the United States Department of Agriculture are the State departments, most of which have been established since 1860.<sup>43</sup> The functions of these may be defined in general terms as follows: the collection, publication, and distribution of crop statistics; the holding of State and district fairs; the conducting of farmers' institutes; the enforcement of laws relating to live stock and human foods; the control of insect pests and fungus diseases in orchards, nurseries, and vineyards; the enforcement of quarantine laws against animal diseases; the operation of experimental farms; the distribution of seeds and plants; and the preparation and publication of annual reports, journals, and bulletins.<sup>44</sup>

The same year in which the Federal Department of Agriculture was established marks also the passage of the Land Grant College Act providing for the establishment of colleges of agriculture and mechanic arts.<sup>45</sup> According to the provisions of this law, each State received 30,000 acres of public land for each Representative and Senator to which the State was entitled in Congress under the apportionment of 1860. The interest on the money derived from the sale of this land was to be appropriated for "the endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the

<sup>43</sup> Bailey's *Cyclopedia of American Agriculture*, Vol. IV, pp. 328-339.

<sup>44</sup> The functions of the various State departments of agriculture vary with the different States. In some States the department of agriculture is combined with other departments.

<sup>45</sup> See the writer's article on *The Origin of the Land Grant Act of 1862* in *The Iowa Homestead* (Des Moines), March 11, 1920.

liberal and practical education of the industrial classes in the several pursuits and professions of life."<sup>46</sup>

The Land Grant Act of 1862 was the most important specific enactment ever made for the promotion of scientific knowledge relating to agriculture in the United States. It gave a great stimulus to the movement, already inaugurated before 1860, for the establishment of State supported institutions of learning devoted to "the liberal and practical education of the industrial classes". Many States accepted the conditions of the grant soon after the passage of the Act. By 1887 there were forty-eight institutions in the United States receiving the benefits of this grant.<sup>47</sup>

The land grant colleges underwent a period of slow development during the first twenty-five years of their existence. It was a period of organization and of discussion as to what the character of these institutions should be in order to fulfil the purpose of the act and to meet the needs of "the industrial classes" in the respective States. Courses in the study of the sciences were yet to be developed, teachers in these subjects were to be trained, and the system of elective studies was to be organized; while graduate courses of instruction and research remained to be developed later. It was therefore impossible to develop technical courses in agriculture until the sciences were placed on a sound basis with adequate equipment and well trained teachers in charge of these courses. The most important functions of the land grant colleges during this period were therefore, first, the establishment and perfection of instruction in the natural sciences; and, second, the development of technical courses suited to the needs of farmers and mechanics. At the same time, they gave instruction in a variety of general subjects, thus developing a

<sup>46</sup> Bailey's *Cyclopedia of American Agriculture*, Vol. IV, p. 412.

<sup>47</sup> True's *Education and Research in Agriculture in the United States* in the *Yearbook of the United States Department of Agriculture*, 1894, p. 98.

broader view of what constitutes a liberal education. Finally, they rendered a valuable service in preparing teachers and scientists who later rose to eminence in the work of technical instruction, as well as in scientific and practical investigations.<sup>48</sup>

The natural outgrowth of this development was the experiment station. The first regularly organized experiment station in the United States was established by the State of Connecticut in 1875. Other States followed until by 1887 there were seventeen stations in operation in fourteen States. In that year, Congress passed the Hatch Act providing for the establishment and maintenance of experiment stations as departments of the land grant colleges in all the States and Territories. The experiment station thus became an integral part of the agricultural college; while its work has formed the basis of all instruction relating to the science of agriculture. In addition to this, it has performed a valuable service in the publication and dissemination of bulletins on a variety of subjects of great interest and importance to the farmer.<sup>49</sup>

By 1890, the land grant colleges were beginning to achieve a place of influence and prestige among the better colleges and universities of the country. Since that year these institutions have undergone a rapid growth and development along three clearly defined lines: first, teaching; second, research and experimental work; and, third, extension work. The development of this threefold function has made the land grant college, in coöperation with the United States Department of Agriculture, a powerful factor in the transformation of agriculture from a primitive, pioneer

<sup>48</sup> See True's *Education and Research in Agriculture in the United States* in the *Yearbook of the United States Department of Agriculture*, 1894, pp. 92-99.

<sup>49</sup> True's *Agricultural Experiment Stations in the United States* in the *Yearbook of the United States Department of Agriculture*, 1899, pp. 513-548.

occupation into a modern business organized on a scientific basis.<sup>50</sup>

The rise and growth of farmers' organizations with their social, educational, commercial, and political functions should also be briefly mentioned as one of the important agencies for the diffusion of knowledge relating to the practice of farming. The revolution in agriculture gave rise to complex problems of production, distribution, and exchange which were of fundamental interest and importance to the farmers. As agriculture became more interwoven with the fabric of our national economy, these problems became more and more acute. It was therefore natural that the farmers should follow the example of other economic groups and organize for the promotion of their interests. This period, consequently, witnessed the formation of many organizations which may be divided into two general groups: first, those serving some special end or industry, as, for example, the coöperative creamery associations and the farmers' elevator companies; and second, those which sought to unite the farmers as a class, among which organizations may be mentioned the Granger, Greenback, and Populist movements.<sup>51</sup> These various organizations — local, State, and national — performed a great service in the education of the American farmer. They aided in breaking down the barriers which had heretofore separated the farmers from their fellowmen, developed in the farming population a feeling of class consciousness, taught valuable lessons in coöperation, and finally became an important agency for the dissemination of the new ideas

<sup>50</sup> See, for example, the history of the Iowa State College of Agriculture and Mechanic Arts in Aurner's *History of Education in Iowa*, Vol. IV, pp. 193-311.

<sup>51</sup> See Butterfield's *History of Farmers' Social Organizations* in Bailey's *Cyclopedia of American Agriculture*, Vol. IV, pp. 289-297; and Buck's *The Agrarian Crusade* (The Chronicles of America Series, Vol. XLV).

and methods in farming which were being advanced by the agricultural colleges and experiment stations.

Of inestimable importance, finally, as an agency for the promotion of scientific knowledge relating to agriculture was the agricultural press.<sup>52</sup> It would be difficult, indeed, to estimate the influence of the agricultural press on the development of scientific farming in the United States. From the beginning it has dealt with an infinite variety of subjects; it has been one of the most efficient agencies for the popularization of the results of scientific experiments conducted by the agricultural colleges and experiment stations; and it has accorded much space in its advertising columns to ways and methods of improving the practice of farming. These considerations justify the conclusion that the agricultural press was one of the most significant factors in bringing about the transformation of agriculture from the pioneer into the modern commercial stage.

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<sup>52</sup> For a list of the principal agricultural papers published in the United States during this period, see Buck's *The Granger Movement*, pp. 321-335 (Harvard Historical Series, Vol. XIX).