PROGRESS OF AGRICULTURE IN THE UNITED STATES.

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CRUDE BEGINNINGS BY INDIANS.

Indians carried on agriculture in a primitive and very limited way in the region now embraced in the United States before the country was inhabited by the white race, and to their crude agriculture they joined the harvesting of the wild products of nature.

SOME CROPS AND METHODS OF CULTIVATING AND GATHERING.

INDIAN CORN.—The farming practiced on the eastern side of North America by the Indians was to burn off the forest, scrape up the top soil into little hills, and, if corn was to be raised, to plant the seed therein. Indian corn, or maize, was indigenous, and the Indians raised it from time immemorial. Women did the work, and the only implements employed were their fingers, a pointed stick for planting, and a clam shell or the scapula of an animal for a hoe. At the time of harvest the ears of corn were stored in a cache, or were hung up to dry, held together by the braided husks.

TOBACCO.—Tobacco was another plant indigenous to America, and the Indians, who had learned its narcotic property, were in the habit of smoking the leaves after they had been dried.

FOOD AND TEXTILE PLANTS.—The Indians of northern California gathered the seeds of wild plants and roasted them on hot stones, to be ground afterwards into coarse flour by a stone operated in a hollow in a rock. Mojave Indian women planted gourd seeds in the crevices of rocks, and when the gourds were ripe gathered enormous quantities of them. Especially along the whole western coast of North America, Indian women gathered wild hemp, agave, and other textile plants; they dried the leaves or stalks, macerated them in water, extracted the fiber, and spun it on their naked bodies without the use of any implement whatever, and then made fabrics for domestic use.

WILD RICE.—Throughout the Great Lake country the Indian women beat the heads of the wild rice plants while holding them over their canoes; having fanned the chaff away by using a large tray, they ground the rice in a mortar and cooked it in much the same way as corn.

WILD CHERRIES AND ROOTS.—The Sioux Indians beat dried wild cherries with buffalo meat to form their winter stock of pemmican. In Oregon and Washington an immense amount of food was gathered from the camass root, and also from the kouse root.

FRUITS, NUTS, ETC.—The Indians gathered the indigenous strawberries, huckleberries, blackberries, raspberries, cranberries, etc., and the chestnuts, butternuts, hickory nuts, walnuts, hazelnuts, and beechnuts. They lived also upon fish and the flesh of deer, bear, buffalo, and other wild animals, both fresh and dried.

BEGINNINGS OF AGRICULTURE BY THE WHITE RACE.

Next the white man came. Poor in the materials of wealth, indeed almost destitute of them, a stranger in a strange land with a strange climate, and beset by native enemies, the white settler had in prospect a simple subsistence upon a few products of a crude agriculture and an insignificant dairy, with such fabrics and other products as might be obtained from a primitive domestic industry. He saw the golden ears of maize strung up in the wigwams of the Indians and learned its value as food; he learned how to plant it, and also the value of putting fish for fertilizer under the seeds.

EARLY COLONIAL CONDITIONS.

Typical references to early colonial conditions are selected from Professor McMaster's "History of the people of the United States;" from Mr. Weeden's "Economic and social history of New England," and from Professor Bruce's "Economic history of Virginia in the seventeenth century."

In Georgia in 1790 the staple was tobacco, cultivated in the simplest manner, with the rudest of tools. Agriculture as we now know it can scarcely be considered to have existed. The plow was little used. The hoe was the implement of industry; made at the plantation smithy, the blade was ill formed and clumsy, and the handle was a sapling with the bark left on. After a succession of crops had exhausted the soil the cows were sometimes penned upon it.

In Virginia the poor whites, who had formerly been indentured servants, were the most lazy, the most idle, the most shiftless, and the most worthless of men. Their huts were scarcely better than negro cabins; the chimneys were of logs, the chinks being filled with clay. The walls had no plaster, the windows had no glass, and the furniture was such as they themselves made. Their grain was thrashed by driving horses over it in the open field; when they ground it, they used a rude pestle and mortar, or placed it in the hollow of one stone and beat it with another.

Each family in New England lived in a state of almost entire independence of other families and of all other communities than the one

in which it lived. Beef or pork, generally salted, salt fish, dried apples, bread made of rye or indian meal, milk, and a very limited variety of vegetables constituted the food throughout the year. The Massachusetts farmer who witnessed the Revolution plowed his ground with a wooden plow, sowed his grain broadcast by hand, and when it was ripe cut it with the scythe and thrashed it on the barn floor with a flail. His house was not painted; his floor was not carpeted. When darkness came on his light was derived from a few candles of home manufacture. The place of furnaces and stoves was supplied by huge cavernous fireplaces which took up one side of the room and, sending half the smoke into the apartment, sent half the heat up the chimney. The farmer and his family wore homespun. If linen was wanted, the flax was sown and weeded, pulled and retted, and broken and swingled, for all of which processes nearly a year was required before the flax was ready for spinning, bleaching on the grass, and making and wearing. If woolens were wanted, sheep were sheared and the wool was dyed and spun and woven at home.

It was almost invariably true of all the settlers that the use and value of manures was little regarded. The barn was sometimes removed to get it out of the way of heaps of manure, because the owner would not go to the expense of removing these accumulations and putting them upon his fields.

In comparison with present conditions, the farmer's life in colonial days was a dreary one, filled with hardships and deprivations, and treading very closely upon the margin of subsistence. Those conditions continued after the Republic had been established, and were not measurably ameliorated until the present century had well advanced—until an improved intelligence, the dissemination of information, and especially the work of the inventor had begun to take effect.

FIRST CROPS.[1]

CEREALS.—The first yield of indian corn, or maize, in any considerable quantity produced in the United States by people of English blood of which we have any authentic record was that of 40 acres in the Jamestown Colony in 1609.[2] Wheat was first sown in Massachusetts on the southern coast as early as 1602, and it was first cultivated in Virginia in 1611. Rye dates back in New England certainly to 1648, and perhaps to 1630, and oats and barley to Gosnold's Colony in 1602.

BUCKWHEAT.—The first cultivation of buckwheat dates back to 1625 or 1626, on Manhattan Island.

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[1] Most of the statements under this head are taken from Eighty Years' Progress of the United States (1861).

[2] Bruce's Economic History of Virginia in the Seventeenth Century, Vol. I, p. 198.

POTATOES.—Plymouth Colony cultivated potatoes as early as 1629.

BEANS.—Beans have the date of 1602 on islands south of Massachusetts, the date of 1644 at Manhattan, and about the same date in Virginia.

FRUITS.—The first apples raised in this country were possibly from trees planted on Governors Island in the harbor of Boston, from which, on October 10, 1639, "ten fair pippins" were brought. Governor Endicott had on his farm in Salem, now Danvers, Mass., in 1640, the first nursery of young fruit trees that was ever planted in this country.

TOBACCO.—The English first saw tobacco cultivated and smoked in clay pipes by the Indians of Virginia in 1585, and the cultivation of tobacco was introduced into the Dutch Colony of New York as early as 1646, when it sold for 40 cents a pound.

FLAX AND HOPS.—Flax was taken to Holland from Manhattan Island as early as 1626. Hemp and flax were raised in Virginia prior to 1648. Hop roots were ordered by the governor of Massachusetts Bay as early as 1628.

SILK.—Silk culture was begun in Louisiana by the Company of the West in 1718. It was introduced into Georgia in 1732. Connecticut began the production of silk in 1760.

SUGAR CANE.—Sugar cane was first introduced into Louisiana in 1751, and the first plantation was established in 1758.

RICE.—The culture of rice was introduced into the colony of Carolina about 1694, the seed being obtained by the governor of the province from a ship from Madagascar.[1]

COTTON.—A pamphlet published in London in 1609 predicts that cotton would grow as well in Virginia as in Italy, and the author of another pamphlet, published in 1620, mentions cotton as a product that may be had in abundance in Virginia; but Bancroft's History of the United States says the first experiment in cotton culture in the Thirteen Colonies was made in Virginia in 1621, when the cotton seeds were planted as an experiment, and their "plentiful coming up" was at that early day a subject of interest in America and England. Cotton wool was listed in that year at 8 pence a pound, which indicates that it may have been grown earlier.[2]

FIRST DOMESTIC ANIMALS.

For many months after the arrival of the Pilgrims at Plymouth they had no beasts of burden; when at last a few cows were brought over they were poorly fed on the coarse wild grasses, and often they

[1] Pitkin's Statistical View of the Commerce of the United States of America (1816), p. 97.

[2] The Cotton Plant; published by the United States Department of Agriculture, pp. 30 and 31.

died from exposure and want of proper food or fell a prey to the wolves or the Indians. Owing to the difficulties and expense of importation, the price was so high as to put them beyond the reach of many even in moderate circumstances. In the colony of Massachusetts Bay a red calf soon came to be cheaper than a black one on account of the greater probability of its being mistaken for a deer and killed by wolves.

CATTLE.—When cows were so high as to sell, in 1636, at from £25 to £30 sterling at Plymouth and oxen at £40 a pair, a quart of new milk could be bought for a penny. The ox of that day was small, ill-shaped, and in every way inferior to the ox of the present time. During the early part of the last century the average gross weight of the neat cattle brought for sale to the Smithfield market was not over 370 pounds.

Dairy cattle were first brought to Virginia in 1611 and to Plymouth in 1624, from the coast of Devonshire. Some of the Virginia cattle were from the black cattle of Spain, and those brought to New York, possibly from the island of Texel on the coast of Holland, were mostly, without doubt, the black and white Dutch cattle. Those on the Delaware were brought from Sweden; those in New Hampshire were the large yellow Danish cattle, and, as the earlier importations were the most extensive that were made for many years, these various stocks were crossed and thus formed the original stock of the country.

The cattle along the northern Atlantic coast fared miserably in winter, having little or no protection from storms and cold and being poorly fed on hay made from overripe swale grass and salt grass cut from the marshes. It was a common opinion in the Virginia Colony that the housing and milking of cows in the winter would kill them.

HORSES.—The first horses taken from Europe to the Western Hemisphere were brought over by Columbus on his second voyage, in 1493. In 1527 forty-two horses were landed in Florida and perished soon after their arrival. The wild horses of the Southwest are probably descendants of the fine Spanish horses abandoned by De Soto on the failure of his expedition. In 1604 a French lawyer brought over horses to Acadia, and these probably laid the foundation of what are now known as Canadian ponies. In 1609 horses were brought to Jamestown, and in 1629 they were introduced into the colony of Massachusetts Bay. Horses were brought to New York in 1625 from Flanders. These importations seem to have been the original stock from which the race of American horses was constituted. But the horses of the United States, as in the case of other farm animals, have been much improved and diversified in special qualities during the last twenty-five years or so by the importation of thoroughbreds from Europe and by well-directed breeding.

SHEEP.—It is probable that the first sheep in this country came to Virginia in 1609 from England. About 1625 some sheep were brought

to New York by the Dutch West India Company from Holland. Sheep were brought into the Plymouth Colony and that of Massachusetts Bay very soon after the settlement.

SWINE.—De Soto probably brought the first swine into this country in 1538 from Cuba, and these were landed in Florida. They were probably descended from some brought over by Columbus in 1493. The Portuguese brought swine into Nova Scotia and Newfoundland as early as 1653. The London Company imported swine into Virginia in 1609. They were introduced into the Plymouth Colony in 1624 by Governor Winslow, and into New Netherlands, now New York, in 1625 by the Dutch West India Company.

TRANSITION TO MORE RECENT CONDITIONS.

Although the early white settlers immensely improved and expanded the agriculture of the Indians, it is nevertheless true that in comparison with the agriculture of the present time that of the previous century and of the earlier half of the present century was crude, wasteful, uneconomical, expensive, laborious, and unscientific. The transition from the old to the new was gradual, but, having in mind long periods of time, it is apparent that American agriculture has had two distinct periods with regard to the characterization above specified. The change has been rapid since the civil war, and the last thirty years or so stand out conspicuously as belonging to a period of development and results, having little similarity to the long preceding period beginning with the eighteenth century and approaching an end about the middle of the present one.

In this paper only a brief mention will be made of some of the causes and opportunities of the agricultural expansion of the country.

EXPANSION OF POPULATION.

The principal opportunity for agricultural expansion was the immense cultivable area of virgin soil awaiting primarily to be despoiled of its fertility, which was subsequently to be partly restored and maintained by means of fertilizers.

The necessity for this expansion was a rapid and permanent growth of sturdy population, derived not merely from a natural increase, but largely from an unprecedented immigration from the peasant laboring classes of Europe—people who had been unable to obtain the ownership of land in a country of primogeniture, as well as people who had failed in other countries where land values were beyond their reach, and who came here with "a land hunger," where they found millions of fertile acres awaiting their acquisition at a cheap price.

The population of this country, according to the census of 1790, was 3,929,214; in 1850 it had increased to 23,191,876; in 1860, to 31,443,321; in 1880, to 50,155,783; in 1890, to 62,622,250; and various

estimates of the population in 1900 place it at a figure somewhat above 75,000,000. Immigrants, who are included in these figures, numbered 143,439 in the ten years 1821–1830; from about 2,500,000 to 3,000,000 in each of the ten-year periods beginning with 1851 and ending with 1880, and 5,246,613 in the ten years 1881–1890. From 1891 to 1899, inclusive, the number was 3,396,011.

THE NONAGRICULTURAL POPULATION.

Since the birth of the nation there must be taken into account also the great and relative increase in the city population, which must derive its subsistence mainly from the agriculture of this country without contributing to agricultural production. The population living in cities and towns of 8,000 or more was 3.35 per cent of the total in 1790, 12.49 in 1850, 22.57 in 1880, 29.20 in 1890, and perhaps is about 35 per cent at the present time, or more than one-third of the entire population.

These percentages do not include the inhabitants of villages, towns, and the smaller cities not engaged in agriculture, who, if included, would swell the percentage above 35.

There has been a further marked increase in the nonagricultural elements of the population. In 1870 the persons 10 years of age and over who were engaged in manufacturing and mechanical industries were 19.61 per cent of the total number of persons of that age having gainful occupations, and this percentage had increased to 22.39 in 1890. It may easily be 25 per cent at the present time.

The number of persons employed in trade and transportation has increased from 9.83 per cent of the total number of persons employed in all occupations in 1870 to 14.63 per cent in 1890.

The percentage for persons engaged in professional services has increased from 2.97 in 1870 to 4.15 in 1890. For domestic and personal service the percentage has increased from 18.48 in 1870 to 19.18 in 1890.

The census group of occupations embraced within agriculture, fisheries, and mining is represented by 49.11 per cent in 1870, or nearly one-half of the persons having gainful occupations, and fell to 39.65 per cent, or about two-fifths, in 1890, and is likely to be hardly more than one-third at the time of the Twelfth Census (1900).

PUBLIC LAND.

While marked increase in the demand for agricultural products for consumption by persons who are in nonagricultural occupations has thus occurred, the Government at the same time has offered to agricultural producers a vast area of land at hardly more than a nominal price. Previous to July 1, 1897, final homestead entries to the number of 529,051 had been made for 70,396,856 acres belonging to the National Government; the number of entries in the following year

was 22,281, covering 3,095,018 acres, and in the year previous to July 1, 1899, the number was 22,218, covering 3,134,149 acres—total to 1899, entries, 573,550; acres, 76,626,023.

During the twenty-two years preceding July 1, 1897, the public and Indian lands disposed of for cash and under the homestead laws, under the timber-culture laws, located with agricultural college and other kinds of scrip, located with military bounty land warrants, and selected by States and railroads embraced 299,961,357 acres; in 1898, 8,453,897 acres; in 1899, 9,182,413 acres—total for twenty-four years, 317,597,667. Some of the States and many railroad companies have been selling land, mostly for farms, amounting in the aggregate to a vast area. The number of sales on credit of tracts of land large enough to be measured by acres, from 1880 to 1889, inclusive, was 60,431 by States and 140,190 by railroads.

CAUSES OF INCREASED PRODUCTION.

While the country has been developing as above indicated, the great nonagricultural populations of European countries have been relatively increasing, and have exhausted in their consumption the farm production of their own countries, especially with respect to the items of wheat, corn, and other cereals, animal and dairy products, and, to the very small extent of cultivation, tobacco and cotton, thus opening up a foreign market, which has in a large degree warranted the expansion of the agriculture of the United States, along with the other causes or opportunities mentioned.

The decided decline in the cost of transportation has also contributed largely to the transformation under consideration.[1]

IMPLEMENTS AND MACHINES.

The most prominent feature in the development of American agriculture is the immense improvement that has taken place in agricultural methods and machines—indeed, the word improvement is not adequate to express the change that has taken place in the methods of agriculture in this country, because the implements and machines are creations rather than improvements, and their mission has been radical and far-reaching. They have reduced the amount of human labor required to produce a given quantity of crops and to cultivate given areas of land, and they have been largely, if not chiefly, instrumental in converting local markets into world markets for the principal cereals, cotton, tobacco, and animal and dairy products.

A technical description of these implements and machines can not be attempted here, and it will be sufficient merely to indicate generally changes in their character and in the results of their work.

[1] The development of transportation facilities in the United States is the subject of another article in this Yearbook.—ED.

Dependence must be placed upon the reader's knowledge of these machines and upon his mechanical mind to understand how and why they have contributed so much to the realization of the present agricultural era.

VEHICLES.—At the beginning of this century carts were used on the farms and chaises on the roads. Stagecoaches were used on the main roads of travel, and a few wagons were found here and there. Carts were more convenient for use with oxen on the farms. For many years discussion was active as to the comparative economy of oxen and horses for farm use, and wagons came in with the increased use of horses and the improvement of the country roads. Buggies and trotting horses grew up together. Light one-horse wagons first appeared in Connecticut about 1830, but it was not until 1840 or later that they became common enough not to attract notice when seen on the roads.[1]

PLOWS.—In 1637 there were but 37 plows in the colony of Massachusetts Bay. Twelve years after the landing of the Pilgrims the farmers around Boston had no plows, and were compelled to break up the ground and prepare for cultivation with their hands and with rude and clumsy hoes and mattocks. It was the custom in that part of the country, even to a much later period, for anyone owning a plow to do the plowing for the inhabitants over a considerable extent of territory. A town often paid a bounty to anyone who would buy and keep in repair a plow for the purpose of going about in this way.[2]

Mr. C. C. Coffin thus mentions the plow that his father used: "I think it was about 12 feet long. I know that it required eight to ten oxen to draw it, one man to ride upon the beam to keep it in the ground, and a man to follow behind with a heavy iron hoe to dig up the baulks."[3]

A writer in the Rhode Island American in 1820 describes the plow generally in use in the Eastern States at that time, known as the Old Colony plow, as follows: "It had a 10-foot beam and 4-foot land side; your furrows stand up like the ribs of a lean horse in the month of March. A lazy plowman may sit on the beam and count every bout of his day's work. Six of these plows cost me on an average, last year, $5 each to keep the shares and coulters fit for work, and the wear of the other parts could not be less than $1 more—$6 per year for each plow."

The first patent for a plow in this country was taken out by Charles Newbold, of New Jersey, in 1797. His was the first cast-iron plow

[1] A Century of Connecticut Agriculture, by Prof. William H. Brewer, Twenty-eighth Annual Report of the Secretary of the Connecticut Board of Agriculture, 1894, p. 49.

[2] Eighty Years' Progress of the United States, p. 27.

[3] Arguments before the Committee on Patents of the Senate and House of Representatives, 1878, p. 272.

ever made, but the farmers in those times entertained great prejudices against it. There was a general idea throughout the country that a cast-iron plow would "poison" the land. Mr. Coffin remembers the first cast-iron plow used in his neighborhood in New Hampshire in 1837 and the assemblage of farmers who objected to it for the reason mentioned. He says that it required from 1797 to 1842 for the inventive genius of this country, together with the observations of farmers and mechanics, to arrive at any just conclusion as to what would be the best form for the plow.

Without mentioning intermediate plows, it will be sufficient to pass on to the Oliver chilled plow, which first appeared in 1870. This was a light, durable plow with a mold board of proper shape to economize draft and suitably turn the furrow, and this plow in a marked degree promoted the economy of plowing. It was stated by Mr. Coffin in 1878 that this invention, if used throughout the United States in the preceding year, would have effected a saving of $45,000,000 to the farmers of the country in the expense of plowing.

And then invention followed invention and improvement followed improvement, until we have sulky plows, gang plows, plows combined with harrow cultivators and with seed drills, side-hill plows, vineyard plows, beet plows, subsoil plows, double land-side plows, and lastly, what has been the aim, and seems to be the end, of plow invention, we have the steam gang plow combined with a seeder and a harrow, which has reduced the time required for human labor (in plowing, sowing, and harrowing) to produce a bushel of wheat, on an average, from 32.8 minutes in 1830 to 2.2 minutes at the present time, and which has reduced the time of animal labor per bushel from 57 to 1½ minutes; at the same time it has reduced the cost of human and animal labor in plowing, seeding, and harrowing per bushel of wheat, from 4 cents to 1 cent.

CORN PLANTERS.—Hundreds of patents have been issued for corn planters. The earlier ones were adjustments to the hoe, which permitted the release of grains of corn when the hoe was struck into the ground; then came the hand planter, and the next step was the horse drill. Next came the idea of marking rows in both directions with a drag. A long beam with pins in it was dragged both ways across the field by horses, and then the farmer would go along with the hand planter and plant the corn at the intersection of the rows. Still, again, followed an improvement, and this was the corn planter which planted two rows at one time with the rows running in both directions. A man sat on the machine, and, at every point where the drag had crossed at right angles, he moved a lever that dropped the corn, which was covered by wheels that turned and pressed down the soil upon the seed. The check rower followed; it was a simple implement, consisting of a wire chain or knotted rope stretching across the field and anchored at both ends. This passed through the machine as it was

driven across the field and dropped some grains of corn every time the knot passed through a slot in the machine. It was only necessary to drive backward and forward all day long until the acres were planted, and then the corn could be cultivated in both directions. Subsequently, numerous check-row planters for corn have been invented with and without fertilizer adjustments, so that several rows of corn may be planted at the same time in places at regular distances apart, permitting cultivation in both directions.

CULTIVATORS.—Cultivators have been the subject of several thousands of patents. The original cultivation of corn and other crops planted in rows was by means of the hoe, but in the course of time a plow was used to loosen the earth and to suppress weeds and grass, being drawn twice between the rows and turning the soil against one or the other. Next a tooth harrow was employed, and this was drawn one way between the rows, and afterwards a cultivator with small double plowshares was used. Then followed the double-shovel cultivator, cutting deep or shallow, as desired, and turning the earth toward two opposite rows at the same time. The implement is now variously made, but it has reduced the economy of cultivation apparently to a minimum; the farmer may now ride while the cultivator is doing its work. He cultivates the rows of his crop in both directions, and the use of the hoe has been nearly, if not entirely, discontinued throughout large agricultural areas.

HARROWS.—Much attention also has been devoted to the invention of implements for harrowing and pulverizing the soil. The farmer no longer drives a brush harrow over his field as of yore, nor does he need to use a tooth harrow, but he has at his command disk harrows, screw pulverizers, smoothing harrows, spring-tooth harrows, and harrows combined with plows and seeders.

CORN HUSKER.—The mechanical corn husker is a machine of recent invention. Previously the husking of corn was done only by hand, and a peg strapped to the hand was often used for opening the husks; but there is now a machine that husks the corn and at the same time cuts the husks, stalks, and blades into feed, the motive power being steam.

CORN HARVESTER.—Again, we have the recent corn-harvesting machine drawn by horses that cuts the cornstalks and binds them into bundles at the same time.

CORNSHELLERS.—The steam cornsheller caused a remarkable change in the time and expense of the shelling of corn. In the olden time corn was shelled by hand, a frying-pan handle or shovel being used, the ears of corn being scraped against it, or perhaps the cob of one ear was used to shell the corn from another. Then came the first machine for shelling corn, a cylinder turned by a crank, by which a

man might shell about 40 bushels in a day. Thousands of patents have been issued for cornshellers, and the culmination of them is the steam-power or horse-power cornsheller, which will shell a bushel a minute, carry off the cobs to a pile or into a wagon, and deliver the corn into sacks or wagons.

SEEDERS.—From the time when wheat was first sown, up to a comparatively recent period, the only method of sowing it was to throw it into the air by the hand. In this way it is impossible to sow evenly, especially if the wind blows with considerable force; and if clover seed is to be sown, the ground must be gone over a second time, while a third time is required if fertilizer is to be distributed. Then, when the harrow comes some of the grains are buried too deeply and some are not covered with earth enough. But not so many years ago inventors set to work to construct mechanical seeders, and the result is an almost complete abandonment of broadcast sowing by hand and the substitution of such seeders. They sow all kinds of grain and seeds at once, with fertilizer if required, and they harrow at the same time. They make the crop more certain. It is the general opinion that the wheat crop is increased one-eighth or more by the use of the mechanical seeders, especially in the case of winter wheat.

MOWERS AND REAPERS.—In 1794 a Scotchman invented what was described as a most marvelous and wonderful machine for cutting grain, doing as much in one day as seven men could do with the sickle. This marvelous machine was only the cradle. The reaper followed, and the first patent for one issued in this country was given to Hussey in 1833. McCormick took out his first patent in 1834, although he had constructed and tested a machine in Virginia in 1831 with some success; but the world heard little of reaping machines until 1845, when 150 of them were built at Cincinnati; by 1846 fully 300 had been built. There was a general trial of mowers and reapers at Geneva, N. Y., in 1852. Nine machines contested, for other inventors had taken out patents. Nineteen years had passed since the first patent had been issued. Out of the nine machines exhibited, not one could start in the grain without backing to get up speed. There was a heavy side draft, the machines were clumsy, and they could not turn easily.

By 1855 about 10,000 mowers and reapers had been built by different makers, nearly all being one-wheeled machines. There was an exhibition of reapers at the French exposition in 1855, in which there was one English, one French, and one American. The French machine did its allotted work in 72 minutes, the English in 66, and the American in 22.

Two years later, in 1857, there was a trial at Syracuse, N. Y., at which nineteen machines contested. Of these, all except three started in the grain without backing to get up speed. There was a trial at Auburn, N. Y., in 1866, at which forty-four different machines were

entered, and of these, forty-two did their work in a satisfactory manner.

The mower and reaper combined cut the grain and left it on the ground bunched up in proper size for a sheaf, subsequently to be bound by hand. The harvester was supposed to be an improvement upon this, because it had a place for one or two men to ride to bind the grain as fast as it was cut; but the self-binder went beyond that and by means of a mechanical attachment did the binding without the aid of human labor. It was not until 1870 that the self-binder was a mechanical success; but that was not the end of invention for constructing machines to harvest wheat.

It remained for the ingenuity of man to construct a combined reaper and thrasher, with which it is necessary only to drive across the wheat field in order to obtain the grain ready for transportation to the elevator or elsewhere.

COTTON GIN.—Without the cotton gin it would be practically impossible to raise and market the cotton crop of this country, which now commonly amounts to 10,000,000 bales and more annually. Before Whitney's invention it is said that the labor of one person was required for about ten hours to pick the seeds from 1½ pounds of cotton lint. At the present time one machine will gin from 1,500 to 7,500 pounds of lint in the same time, the quantity varying according to the size and power of the gin.

INFLUENCE OF PATENT LAWS ON DEVELOPMENT OF AGRICULTURAL MACHINES.

The development and creation of agricultural implements and machines by the inventive genius of this country is one of the most remarkable features of progress of the century. Its history is one of evolution and revolution—a revolution of incalculable consequences to human labor and the production and distribution of wealth, with an immense bearing upon the trend and character of industry, social life, and civilization.

This development has been encouraged by the patent laws of the country, and perhaps nothing could be more tersely expressive of the influence of these laws in promoting mechanical agriculture than a mention of the number of patents that have been granted. Under date of November 17, 1899, the Patent Office reports that patents for agricultural machines had been granted to the number indicated in each of the following classes: Vegetable cutters and crushers, 701; fertilizers, 822; bee culture, 1,038; trees, plants, and flowers, 1,102; care of live stock, 3,749; dairy, 4,632; thrashers, 5,319; harrows and diggers, 5,801; fences, 8,404; seeders and planters, 9,156; harvesters, 12,519; plows, 12,652.

It is no longer necessary for the farmer to cut his wheat with sickle or cradle, nor to rake it and bind it by hand; to cut his cornstalks with a knife and shock the stalks by hand; to thrash his grain with a

flail, nor to drive horses over it to tread it out, nor to scrape the ears of corn against a shovel or the handle of a frying pan. It is no longer necessary for him to dig potatoes, nor to cut his grass with a scythe and to spread it with a pitchfork that it may dry, nor to pitch the hay from the wagon to the haymow in the barn, nor to pick the lint from cotton seed by hand, and so on with numerous operations throughout the whole range of agricultural work.

Mechanical contrivances have largely supplanted human labor in many respects, or have improved the application of labor and increased the product of agriculture, reduced the cost of production, augmented the farmer's gross income, and made his life an easier one than it was before the machine period.

This country has come to be without a peer in the manufacture of agricultural implements and machines, both in quality and number. The manufacturing establishments for producing them in 1890 numbered 910, with a capital of $145,313,997 and 42,544 employees, receiving wages to the amount of $21,811,761, turning out a product valued at $81,271,651. One of these establishments (the largest in the world), making various kinds of mowers and reapers, corn harvesters, corn huskers and shredders, and hayrakes, turned out 187,760 machines in 1898, or, on an average, one in less than a minute for every working day.

AGENCIES FOR AGRICULTURAL EXPERIMENT AND INFORMATION.

Along with the application of invention, have grown up numerous agencies for educating and training the farmer in agriculture, for disseminating information with regard to improvements, and for stimulating among farmers the associative spirit and increasing the benefits to be derived from cooperation.

The first of these agencies, chronologically, consisted of voluntary organizations for the promotion of agricultural interests. These, under various titles, existed in the colonies even before the beginning of this century. We have records of five established during the decade of 1785–1794, in the following States and in the order named: Pennsylvania, South Carolina, New York, Massachusetts, and Connecticut. This method of aid to agriculture has constantly increased during the nineteenth century, and agricultural societies, the name generally applied to them, have multiplied so that at the present day there are probably few counties in the United States where some form of agricultural society does not exist, while all the leading agricultural industries are represented by State, and, in many cases, by national organization.

Many of these voluntary associations receive State aid, and especially is this true of those organized mainly for the purpose of holding annual fairs. About 1,500 such associations are now in existence, extensively distributed throughout the country, but more especially

throughout the North Central and North Atlantic States. Of farmers' clubs, it is sufficient to say their name is legion. Another of these agencies consists of the commissioners of agriculture or boards of agriculture of the different States, and almost every State has some official organization in the interests of agriculture. To these must be added the agricultural colleges and the experiment stations, in which the Federal and State governments cooperate.[1]

Finally, the most important of the agencies referred to is the Department of Agriculture itself, which began as an insignificant division in the Patent Office, Department of the Interior, in 1839, became a Department under a Commissioner in 1862, and in February, 1889, was erected into an Executive Department under a Secretary, who is a member of the Cabinet.

STATISTICS.

AGRICULTURAL CENSUSES.

Important and extensive collections of statistical information with regard to farms and their products have been made by national and State censuses.

The first statistics of agriculture collected by a United States census were obtained in 1840, within limits much narrower than those adopted in the censuses of 1890 and 1900.

At the present time it is the policy of the Census Office to procure an inventory of farm property and products, with detailed statements for acreage, values, quantities, and numbers of live stock, as far as applicable. It is expected that the national census of this year will procure many facts with regard to the farms of this country, which are now supposed to number about 5,000,000. No other country takes such a thorough, extensive, and detailed census of agriculture as does the United States.

The use of the censuses of agriculture might be the subject of extended discussion, but comparatively little can be said here. Not a day passes that the Department of Agriculture does not need to use census statistics of agriculture in many ways and for many purposes, not only in its own routine work of crop estimates and in the preparation and conduct of statistical investigations, but also in response to numerous letters received from residents of the United States and foreign countries.

Some of the States are required by their constitutions, or by legislative enactments, to take censuses, but not all of them comply with the requirement. The most elaborate State census of agriculture is taken by Massachusetts. Among the other States required to take

[1] No attempt is made here to explain even briefly the work of the agricultural colleges and experiment stations as a factor in the development of agriculture, both agricultural education, during this century, and the work of the agricultural experiment stations being treated at length in other papers in this Yearbook.—ED.

censuses are Indiana, Iowa, Kansas, Michigan, Oregon, Oklahoma, and Wisconsin.

Useful agricultural statistics are collected and published also by the boards of agriculture of the several States, notably by the States of Texas and Kansas.

BOARDS OF TRADE AND COTTON EXCHANGES.

At least twenty-five boards of trade publish statistics of the movement, distribution, prices, etc., of agricultural products, and the following is substantially a complete list of the cities in which these boards of trade are situated, the variants of the name being sometimes merchants' exchange, chamber of commerce, produce exchange, or commercial exchange: Baltimore, Md.; Boston, Mass.; Buffalo, N. Y.; Chicago, Ill.; Cincinnati, Ohio; Denver, Colo.; Detroit, Mich.; Duluth, Minn.; Indianapolis, Ind.; Louisville, Ky.; Memphis, Tenn.; Milwaukee, Wis.; New York, N. Y.; Omaha, Nebr.; Peoria, Ill.; Philadelphia, Pa. (commercial exchange and also produce exchange); Portland, Oreg.; Richmond, Va.; St. Louis, Mo.; San Francisco, Cal. (chamber of commerce and also produce exchange); Seattle, Wash.; Toledo, Ohio, and Washington, D. C.

Besides the foregoing boards of trade, there are many in the United States whose object is to stimulate concerted action by manufacturers, merchants, financiers, and persons especially concerned in carrying on the distributive processes. About 800 of these boards of trade have a national association, which speaks powerfully for interests representing many hundreds of millions of dollars of capital, and which substantially represents the class of persons known as middlemen, who distribute the products of the farm. But this national association does not include all of the boards of trade, chambers of commerce, and produce exchanges. These in the aggregate number between 1,300 and 1,400, the largest number among the States being found in New York; second to which stands Pennsylvania; third, Ohio; and, fourth, Massachusetts.

There is a class of these boards of trade especially concerned with cotton, generally known as cotton exchanges, which are associations of middlemen with the object of obtaining information in regard to the condition of the market as influenced by demand, supply, production, available cotton, and, in some cases, of dealing in futures. The cities and towns where these exchanges are situated are as follows: Eufaula, Birmingham, Mobile, Montgomery, and Selma, Ala.; Little Rock and Texarkana, Ark.; Atlanta, Columbus, Rome, Savannah, and Augusta, Ga.; Monroe, New Orleans, and Shreveport, La.; Greenville, Greenwood, Meridian, Natchez, Vicksburg, and Yazoo City, Miss.; St. Louis, Mo.; New York, N. Y.; Newbern, Wilmington, and Raleigh, N. C.; Charleston and Columbia, S. C.; Memphis and Nashville, Tenn.; Galveston, Dallas, Fort Worth, Sherman, Waco, and Houston, Tex.; Norfolk and Portsmouth, and Richmond, Va.

STATISTICS OF DEVELOPMENT.

The progress of American agriculture up to the present time has by no means been thoroughly discussed in this paper, nor is it possible to do so within the limits of a Yearbook article; hence only a few more topics can be mentioned. First, statistics expressing development will be given.

FARMS AND ACREAGE.—The number of farms increased from 1,449,073 in 1850 to 4,564,641 in 1890. During the same time the total farm acreage increased from 293,560,614 to 623,218,619 acres, of which the increase in improved acreage was greater, both absolutely and relatively, than the increase in the unimproved acreage.

INCREASING IMPORTANCE OF MEDIUM-SIZED FARMS.—The average size of farms declined from 203 acres in 1850 to 137 acres in 1890, and it has been established by a thorough statistical analysis that in the more recent years the increase in number of farms has more largely accrued to farms of medium size than to farms of the smaller and larger sizes. Why this should be so is only a matter of conjecture. It may be that the persons who acquire the proprietorship of farms, either as owners or as tenants, have become more able to acquire the possession of medium-sized farms, and so reject or consolidate the smaller farms; it may be also that the larger farms have not been found to be as profitable as medium-sized farms.

The use of machines is an important element in this country's agriculture, and possibly the medium-sized farm as it exists to-day is susceptible of being more economically cultivated and managed than either smaller or larger farms, and among the economic reasons for this the farm machine must be reckoned as highly important. But whatever the explanation may be, the fact remains that the middle-class farmer, according to the tendency disclosed by the census of 1890, is coming more and more to the front among agriculturists.

FARM REAL ESTATE AND MACHINES.—The value of the real estate of farms increased from $3,271,575,426 in 1850 to $13,279,252,649 in 1890. During this period the value of farm implements and machines increased from $151,587,638 to $494,247,467; but these numbers do not adequately represent the increase in the importance of implements and machines, partly because these figures take no account of the vast increase in their efficiency, which has been infinitely greater than the figures express, and in a very large degree because of the much cheaper prices prevailing in 1890.

FARM PRODUCTS.—The censuses have very poorly ascertained the value of farm products, the statements undoubtedly being considerably under the facts. The published statement of the census of 1890 gives the value of farm products as $2,460,107,454, but an estimate made on the production ascertained in the census of 1890 by Mr. J. R. Dodge, former Statistician of the Department of Agriculture, places

the value of farm products in the agricultural year covered by that census at about $3,500,000,000.

FARM ANIMALS have increased as follows, as shown by national censuses: Horses, from 4,336,719 in 1850 to 14,969,467 in 1890; mules and asses, from 559,331 in 1850 to 2,295,532 in 1890; milch cows, from 6,385,094 in 1850 to 16,511,950 in 1890; oxen and other cattle, from 11,393,813 in 1840 to 34,851,622 in 1890; swine, from 26,301,293 in 1840 to 57,409,583 in 1890; sheep, not including spring lambs, from 19,311,374 in 1840 to 35,935,364 in 1890. The wool clip of the census year of 1890 amounted to 165,449,239 pounds. The value of live stock increased during the period 1850–1890 from $544,180,516 to $2,208,767,573.

FARM DAIRY PRODUCTS are thus stated in the census of 1890: Entire number of gallons of milk produced on farms, 5,210,125,567; pounds of butter, 1,024,223,468; pounds of cheese, 18,726,818. It must be remembered that the production of butter and cheese on farms has been largely transferred to creameries, whose products are not included in the foregoing figures, but are included in part in the census statistics of manufactures—only in part, however, because it is known that a very large portion of the creameries and their products were omitted from the census statistics of 1890.

POULTRY.—In 1890 it was reported that the chickens on farms numbered 258,871,125; other fowls, 26,738,315; and that the eggs produced and sold during the census year were 819,722,916 dozen. The poultry statistics, however, probably fall far short of the facts.

CROP PRODUCTION.—Coming now to the production of crops, the following extracts are made from the censuses of 1840 and 1890, to which the figures of the Department of Agriculture for 1899 are added:

Cereals.—Production of indian corn, 377,531,875 bushels in 1840; 2,122,327,547 bushels in 1890; 2,078,143,933 bushels in 1899; and the corn acreage increased from 62,368,504 acres in 1880 to 82,108,587 acres in 1899.

The wheat product was 84,823,272 bushels in 1840; 468,373,968 bushels in 1890; 547,303,846 bushels in 1899; and from 1880 to 1899 the wheat acreage increased from 35,430,333 acres to 44,592,516 acres.

The United States produces more wheat than any other country in the world. A comparison may be made for 1898: Crop of the United States, 675,149,000 bushels; France, 371,881,000 bushels; Austria-Hungary, 170,938,000 bushels; Italy, 133,372,000 bushels; Germany, 115,000,000 bushels; United Kingdom, 77,170,000 bushels; Russia in Europe, 404,836,000 bushels; Russia in Asia, 94,000,000 bushels; total Asiatic production, 421,321,000 bushels; total African production, 44,439,000 bushels; total South American production, 72,000,000 bushels.

The oat product was, in bushels, in 1840, 123,071,341; in 1890,

809,250,666; in 1899, 796,177,713. The oat acreage was 16,144,593 in 1880, and increased to 26,341,380 acres in 1899.

The rye product was 18,645,567 bushels in 1840, 28,421,398 bushels in 1890, and 23,961,741 bushels in 1899, with a decrease of acreage from 1,842,233 acres in 1880 to 1,659,308 acres in 1899.

Cotton.—The cotton crop of 1850 amounted to 2,469,093 bales, and the crop increased decennially up to the census of 1890, and almost without a break annually since that year until the enormous crop of 1898–99, which amounted to 11,189,205 bales of considerably heavier weight than the bales of 1850. The cotton acreage increased from 14,480,019 acres in 1880 to the largest acreage yet attained, in 1898–99, which was 24,967,295. The cotton crop of the United States substantially dominates the world market for cotton, its proportion of the world's crop being from 80 to 85 per cent, and practically having little competition within the lines of its own grades and qualities. The State of Texas alone produces more cotton than any foreign cotton-producing country.

Hay.—The hay production amounted to 10,248,109 tons in 1840; to 66,831,480 tons in 1890, and to 56,655,756 tons in 1899; and the acreage increased from 30,631,054 acres in 1880 to 41,328,462 acres in 1899.

Tobacco.—From 1840 to 1890 the production of tobacco increased from 219,163,319 pounds to 488,256,646 pounds, and the acreage in the latter year was 695,301 acres.

Potatoes.—White potatoes are a crop of extraordinary increase, the bushels in 1850 being 65,797,896; in 1890, 217,546,362, and in 1899, 228,783,232. From 1850 to 1890 the production of sweet potatoes increased from 38,268,148 to 43,950,261 bushels.

AGRICULTURAL EXPORTS.

The development of the agriculture of the United States has much more than kept pace with the enormous immigration, increase of population, increase of domestic consumption for food and manufactured products, and for cattle and other domestic animals. It has furnished besides an enormous surplus for export. Only the exports of the principal products can be given briefly:

WHEAT.—The wheat export was 4,272 bushels in 1823; 4,155,153 bushels in 1860, and 139,432,815 bushels in 1899. During the same time wheat flour was exported to the amount of 756,702 barrels in 1823, 2,611,596 barrels in 1860, and 18,502,690 barrels in 1899.

COTTON.—The exports of raw cotton amounted to 173,723,270 pounds in 1823, to 1,767,686,338 pounds in 1860, and to 3,773,410,293 pounds in 1899. The more recent product, cotton-seed oil, had an export of 50,627,219 gallons in 1899, and the export trade in this product has chiefly grown up since 1889.

HAY AND BARLEY.—The hay export is relatively small, amounting

to only 64,916 tons in 1899. The barley export also is comparatively small, amounting to 2,267,400 bushels in 1899, although it reached its maximum amount of 20,030,301 bushels in 1897.

CORN.—The corn export was 749,034 bushels in 1823; it was 3,314,155 bushels in 1860, and 174,089,094 bushels in 1899. In addition to the unmanufactured corn exports are the exports of corn meal, and these amounted to 791,488 barrels in 1899; but a large portion of the corn product is consumed by domestic animals, the exports of which are mentioned below.

OATS AND RYE.—In 1899 the oat export amounted to 30,309,680 bushels, and the oat-meal export was 58,042,505 pounds. In the same year the rye export was 10,140,876 bushels, and the rye-flour export 4,826 barrels.

ANIMALS AND ANIMAL PRODUCTS.—The following are the exports of farm animals in 1899, the figures representing numbers of animals: Cattle, 389,490; hogs, 33,031; horses, 45,778; mules, 6,755; sheep, 143,286. These numbers have grown during the last twenty-five years from almost nothing.

The exports of beef products amounted to 19,053,800 pounds in 1866, not including preserved meats, and the entire quantity of beef products exported in 1899 was 368,666,638 pounds; in the latter year the beef-tallow exports amounted to 107,361,009 pounds. In 1866 the pork products exported amounted to 97,756,169 pounds, and the number had grown to 1,700,380,357 pounds in 1899. In 1899 the mutton exports amounted to 379,110 pounds.

A large item of export has grown up within a few years under the name of oleo oil, and its export in 1899 aggregated 142,390,492 pounds.

The butter and cheese exports have in late years shown a decline, and in 1899 they amounted, respectively, to 20,247,997 and 38,198,753 pounds.

TOBACCO.—For many years tobacco has been a large item of export, and its quantity has substantially remained constant for twenty-five years or so. The pounds of leaf tobacco exported in 1899 were 272,421,295 and the value of the manufactured tobacco exported in that year was $5,179,012.

WOOL.—The wool export has rarely reached 1,000,000 pounds, although in 1896 it almost equaled 7,000,000 pounds.

The statistics immediately preceding, as well as the others in this paper, express forcibly and comprehensively, although tersely, the agricultural development through which this country has passed up to the present time—a development which has been unparalleled in the history of the world in its rapidity and magnitude.

FERTILIZERS.

The decade 1840–1850 marks an epoch in the history of agriculture. The world was then making rapid strides in applied science.

Railroads were rapidly extending, ocean steam navigation became established, the electric telegraph came into use, and, what was of great importance in connection with agriculture, the chemical theory of manures came to be understood. "Artificial fertilizers," made according to formulas founded on the chemical composition of the ashes of plants, began to be manufactured, and came rapidly into use. The use of nitrate of soda and superphosphate of lime was becoming common. The rapidity of this growth is perhaps best seen in the rise of the use of guano. Samples had come to Europe early in the century; next a few casks came; in 1840, Liebig, the eminent chemist, brought it into notice, and the South American merchants sold a small cargo that year. The next year some 2,000 tons were imported into Great Britain.

The use of commercial fertilizers has progressed from year to year, until, in 1896, 1,894,917 tons were used in the United States, valued at $37,688,869.

The economic advantages of the use of fertilizers are distinctly shown in an investigation conducted by the Division of Statistics of the Department of Agriculture in 1896. This was a unique investigation of comprehensive character, and was applied to the production of cotton.[1]

Along with the increased consumption of commercial fertilizers, there has been a vastly increasing realization by farmers of the value and utility of barnyard and compost manures, especially in the parts of the country where cattle are kept in stables throughout a large portion of the year. While the average production per acre of various crops has not materially increased for many years past, yet farmers know that they not only must not, but can not, rob the soil of its fertility without restoring the elements that go to make plant growth. In some parts of the country, where the fertility of the soil is materially impaired, it is still the custom to let cultivated land lie fallow for sufficient length of time to increase its fertility, but there is also a large extent of country where this is not done, and where, on the contrary, domestic and commercial fertilizers are liberally used.

Speaking in general for the whole country, the net result of the use of fertilizers, so far, has been mainly to preserve the normal fertility and production of the soil, although farmers' experiences have numerously and extensively established the economic desirability of more intensive agriculture.

EVOLUTION OF VARIETIES OF FOODS FROM PRODUCTS.

There is one prominent feature in the agricultural development of the United States that has received little public attention (a feature which alone is worthy of an extended article), and this is the

[1] See Bulletin No. 16, miscellaneous series, Division of Statistics, U. S. Department of Agriculture, The Cost of Cotton Production.

extraordinary multiplication of the varieties of foods into which farm products have been converted by the slaughterhouse, by the packing house, by the cannery, and by the manufacture of health foods. The effect of all this upon the consumption of numerous farm products has been very considerable, and has, to some extent, revolutionized the diet of the people of this country, and presumably of other parts of the civilized world, especially of people living in cities and towns.

EARLY PRACTICES REGARDING FOOD SUPPLY.

One does not need to go back more than a generation to find the meat supply derived from local farmers and butchers. Indeed, among the great mass of the people living outside of the cities and large towns the fresh-meat supply was a matter of neighborhood borrowing; a farmer slaughtered an old cow, perhaps, and distributed some of the quarters or other portions of the carcass among his neighbors, with the expectation that they would return an equivalent when it came their turn to butcher.

Until comparatively recent years the products of the farm were distributed throughout the year for food consumption in a crude and very restricted sense. Apples and green corn were dried in the sun; indian corn was preserved dry in the crib; potatoes, cabbages, and turnips were kept fresh in the cellar; some beef was dried; pork and beef were pickled in brine; squashes and pumpkins were kept for some time after the harvest without rotting, and so on with a few other products of the farm and garden.

CANNING, PRESERVING, AND REFRIGERATING IN RECENT YEARS.

An immense change in the relation of foods to seasons has taken place within recent years. Fresh beef and mutton and pork and poultry preserved by refrigeration can now be had in all parts of the country from the farms and ranches of the Mississippi Valley, to say nothing of the improved local meat supply. Many of the principal garden products now know no season, owing to the canner and the preserver. The peach and the pear, the apricot and the plum, peas and beans, lentils and green corn and tomatoes, and many kinds of berries—and so on through almost the entire list of the fruit and vegetable products of the farm and garden—are now to be had at all times of the year, not always, perhaps, with the flavor they possessed when gathered from their vines and stalks and trees, but yet with much of their original freshness and flavor.

By means of canning and preserving the farmers' market has been enlarged both in time and space until the market for farm and garden products now extends throughout the entire year, not only to remote parts of this country, but to a large portion of the world.

If a list of the different kinds and descriptions of food were to be presented, it would, because of its magnitude, overtax the patience of the reader. An attempt was made several years ago to prepare such

a list for a publisher, and the undertaking had to be abandoned on account of its unexpectedly large proportions and the time, labor, and expense required. In this paper it is proposed merely to give three illustrations of the heterogeneity that has characterized the development of farm products as foods and for other purposes.

BUSINESS OF A PROMINENT PACKING COMPANY.

One of the large Western packing companies with enormous capital and business has been selected to illustrate how the extension of the farmers' market has been promoted and elaborated in recent years. This packing company owns the cars that are used to distribute its products and to collect some of them. It has 500 tank cars for transporting blood and tankage for fertilizers and various animal oils; it has 4,000 cars for transporting dressed beef and 6,500 cars for transporting fruit. From the price lists of this company, sent to its agencies throughout the United States, the following facts are extracted:

The beef carcass is cut into many different parts in various ways, all intended to meet the demands of retailers and consumers, and the different parts so cut, including all of the parts of the animal customarily eaten, number 53. With regard to meat cuttings, the numbers are, pork 29, mutton 12, veal 5; number of boiled hams 6; varieties of sausages 43 and of delicatessen sausage 14—total varieties of sausage 57. The dried salt meats are prepared with 16 different cuttings; the bacon meats with 16.

There are hams of many descriptions, and dried beef, mess pork, mess beef, pickled beef tongue, pork spareribs, mince-meat in packages of numerous sizes, lard, compound lard and lard oil, neat's-foot oil, and tallow oil.

The canned meats include numerous varieties, among which may be mentioned corned beef, pigs' feet, gelatin, boar's head, Oxford sausage, tongue, roast beef, boiled beef, chipped beef, deviled ham, potted ham and tongue, minced ham, chicken, turkey, chile con carne, pork and beans, ox marrow, chicken tamale, and sauerkraut and Vienna sausage, etc.

There are to be mentioned also some of the canned soups, as ox tail, mock turtle, tomato, consommé, chicken, beef, mutton, vegetable, purée of green peas, and so on.

The extracts of beef are liquid and in tablets of various descriptions. The pickled tongues, pork hocks, and pigs' feet are of nine descriptions, and there is poultry of all sorts and fresh eggs and canned eggs, ducks, quails, venison, prairie chickens, pigeons, squabs, and even frogs' legs.

COTTON SEED.

Cotton seed is a very marked instance of a former by-product of the farm which has become of enormous value and of varied uses.

The meats are made into oil cake and oil meal for feeding stuff and for fertilizers; into crude oil, cotton-seed stearin, salad oil, cottolene, miners' oil, and soap, and the oil is exported to Europe and brought back again as olive oil. The hulls may be used for making paper; they are made into bran for cattle food; they are used for fuel, and are an important contribution to the list of fertilizers.

Here is an enormous source of wealth which science has given to the farmers within comparatively recent years. The estimated value of the cotton seed of a 10,000,000-bale crop of cotton (to the planters) is about $30,000,000, and this value is now almost entirely appropriated by them.

DIVERSIFICATION OF DAIRY PRODUCTS.

Only one more instance of the elaboration of the products of the farm need be mentioned to illustrate how varied the farmers' market has become and how minutely his products have been made to create and answer the wants of mankind. The following are the varieties of the dairy products of the United States, as furnished by Maj. H. E. Alvord, chief of the dairy division, Bureau of Animal Industry:

Butter.

Dairy and Creamery: In tubs, boxes, family packages, rolls, and prints.
Imitation Creamery: Ladled, Renovated, or "Process," all melted and rechurned.
Fresh or "Sweet;" that is, unsalted.

Cheese.

I. Hard: (*a*) Domestic varieties:
- Factory Standard, or Cheddar.
- English Dairy.
- Young America.
- Little Favorites. } Differing in size and form rather than in character.
- Picnics. }
- Ponies. }
- Skim cheese.
- Pineapple.
- Sage.

(*b*) Foreign forms, imitated:
- Swiss, or Gruyere.
- Edam.
- Gouda.
- Limburger.
- Munster.
- Brick.

II. Soft:
- Pot cheese, or smearcase.
- Neufchatel.
- Cream.
- Isigny.
- Brie.
- Camembert.
- Potted and prepared cheese, "Club-house," etc.

Milk, etc.

Condensed milk, sweetened.
Condensed milk, plain, or unsweetened.
"Evaporated cream."
Cream, sterilized and canned.
Milk and cream, Pasteurized, "Certified," "Modified," etc.
Koumys, Matzoon, Wheyn, etc.

SOME ECONOMIC RESULTS OF MACHINES.

Much remains to be said with regard to the evolution of agriculture in the United States, but only a brief reference can be made to some of the more important results of the investigation of hand and machine labor and processes as applied to agriculture, with a contrast between farming as it was practiced fifty to seventy years ago and farming as it is now carried on with the advantage of the labor-saving and perfecting implements and machines of the present time as well as with the improvements contributed by the chemist, the "book farmer," and the more enlightened experience of the last half century.[1]

CORN CULTIVATION AND HARVESTING.

Between 1855 and 1894 the following changes took place in the cultivation of corn. The time of human labor required to produce one bushel of corn on an average declined from 4 hours and 34 minutes to 41 minutes, and the cost of the human labor to produce this bushel declined from 35¾ cents to 10½ cents.

In the earlier years the plow and harrow of that period were used; the check rows were marked with the shovel plow; the seed was dropped by hand from a bucket or pouch carried by the farmer and covered with a hoe; the cultivating was done with a shovel plow; knives were used for cutting the stalks from the ground by hand; husking pegs were worn on the hand in husking; the stalks, husks, and blades were cut into fodder with an old-time machine turned by hand, and the corn was shelled by hand, either on a frying-pan handle or on a shovel or by rubbing the cob against the unshelled ears.

A radical change had taken place in 1894. The earth was loosened with a gang plow, and a disk harrow very thoroughly pulverized it. A corn planter drawn by a horse planted the corn, and the top soil was pulverized afterwards with a four-section harrow.

When it came to harvesting the corn, a self-binder drawn by horses cut the stalks and bound them, and the shocks of stalks were then hauled to a machine, which removed the husks from the ears, and in the same process cut the husks and the stalks and the blades into fodder, the power of the machine being supplied by a steam engine.

[1] Report of the United States Department of Labor on Hand and Machine Labor. 1898.

Then came the shelling of the corn, which is one of the marvels of the changes that have been wrought by machines. In this case, the machine operated by steam shelled 1 bushel of corn per minute, while in the old way the labor of one man was required for 100 minutes to do the same work.

WHEAT CULTIVATION AND HARVESTING.

The use of steam as a substitute for horse power in plowing, in harvesting, and in thrashing wheat has not materially contributed to economy, except from a saving due to the elimination of animal power, so the more common power supplied by horses is here selected for the comparison. The years in contrast are 1830 and 1896.

It is one of the marvels of the age that the amount of human labor now required to produce a bushel of wheat from beginning to end is on an average only 10 minutes, whereas, in 1830, the time was 3 hours and 3 minutes. During the interval between these years the cost of the human labor required to produce this bushel of wheat declined from 17¾ cents to 3⅓ cents.

In the contrast thus presented the heavy, clumsy plow of the day was used in 1830; the seed was sown by hand, and was harrowed into the ground by the drawing of bushes over it; the grain was cut with sickles, hauled to a barn, and at some time before the following spring was thrashed with flails; the winnowing was done with a sheet attached to rods, on which the grain was placed with a shovel and then tossed up and down by two men until the wind had blown out the chaff.

In the latter year, on the contrary, the ground was plowed and pulverized in the same operation by a disk plow; the seed was sown with a mechanical seeder drawn by horses; the reaping, thrashing, and sacking of the wheat was done with the combined reaper and thrasher drawn by horses, and then the wheat was ready to haul to the granary.

HAYMAKING.

Hay is the next selection for comparison, the years being 1860 and 1894. When men mowed the grass with scythes, spread it and turned it over for drying with pitchforks, when they raked it into windrows with a hand rake, cocked it with a pitchfork, and baled it with a hand press, the time of human labor required per ton was 35½ hours; but when for this method was substituted a mower, a hay tedder, and a hayrake and hay gatherers and stackers drawn by horses, and a press operated by a horse, the time of human labor was reduced to 11 hours and 34 minutes, while the cost of human labor from the earlier to the later year was reduced from $3.06 to $1.29.

The more noticeable economy in haymaking is in the mowing and curing of the grass. In these two operations the time of human labor declined per ton from 11 hours to 1 hour and 39 minutes, while the cost of the human labor declined from 83⅓ cents to 16¼ cents.

The comparisons might be extended throughout many of the crops produced by the farmer, with a constantly recurring illustration of the saving of human labor and of the diminution of the cost of production by the dimunition of human labor. With regard to animal labor alone it often appears that an increased time is required in production, but where there is an increased cost it is principally due to the increased value of the labor of animals.

SAVING IN THE COST OF PRODUCING CROPS.

The potential saving in the cost of human labor on account of improved implements, machines, and processes, at the rate per bushel or ton, as the case may be, has been computed for seven of the principal crops of 1899; the comparison is between the old-time methods of production, in which hand labor was assisted only by the comparatively rude and inefficient implements of the day and the present time, when hand labor has not only the assistance of highly efficient and perfected implements and machines, but has been considerably displaced by them. The saving in the cost of human labor in cents, per unit of product, permits a very forcible statement of its equivalent in money by means of a computation consisting of the multiplication of the saving per unit into the crop of 1899. The result expresses the potential labor saving in the production of seven crops of that year, and is not an aggregate of the saving of human labor in the cost of producing the crops for all of the years between the earlier and the later ones, during which time this economizing and displacement of human labor has taken place. In the case of the crop of corn, the money measure of the saving of human labor required to produce it in 1899 in the most available economic manner, as compared with its production in the old-time manner, was $523,276,642; wheat, $79,194,867; oats, $52,866,200; rye, $1,408,950; barley, $7,323,480; white potatoes, $7,366,820; hay, $10,034,868.

The total potential saving in the cost of human labor for these seven crops of 1899, owing to the possible utilization of the implements, machines, and methods of the present time, in place of the old-time manner of production, reaches the stupendous amount of $681,471,827 for this one year.

CONCLUSION.

It would be idle to claim that the progress of the agriculture of the United States and its evolution from the primitive scope and conditions in which it was found by the settlers who came from Europe have been set forth adequately, even in its important topics and details, in the foregoing pages, but perhaps enough has been presented to explain in their main features the causes and opportunities which in combination have led to an agricultural production actually too great to be grasped by the human mind.

As great as has been the growth of manufactures, mining, the fisheries, and trade and transportation, all of which tend to draw population from agriculture, yet more than one-third of the population of the country is engaged in agriculture or dependent upon agriculturists. This element in our population has proved to be a strong one. It has been conservative with regard to those things that experience has demonstrated to be good. It has been an industrial element upon which all other elements of the population have needed to depend as the cornerstone of the social and industrial structure.

The agricultural element is the one independent element in our society. Let whatever betide that may, this element has a degree of independence in subsistence and in living that no other element has, and still, as in the past, remains the chief mainstay of the nation.