MAP OF THE UNITED STATES
SHOWING THE RELATION BETWEEN THE PRODUCTION OF BARLEY
IN BUSHELS AND THE AREA OF IMPROVED LAND IN ACRES
Compiled from the Returns of Agriculture at the Tenth Census.
1880.

LEGEND

I Less than ½ bushel per acre of improved land.
II [illegible]
III [illegible]

NOTE.
The absence of color indicates a population of less than 2 to a square mile, being practically an absence of settlement.

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BARLEY.

The acreage and production of barley in the United States amounted, in 1879, to 1,997,717 acres, and the product to 44,113,495 bushels. The production, by states, in the order of their production, is seen in the following table:

TABLE LXVIII.—BARLEY CROP OF 1879 (CENSUS OF 1880).

No.	States.	Acres.	Bushels.	Per cent. of total product.	Cumulative per cent.	No.	States.	Acres.	Bushels.	Per cent. of total product.	Cumulative per cent.
1	California	586,340	12,579,561	28.52	28.52	26	New Hampshire	3,461	77,877	0.18	99.31
2	New York	356,629	7,792,002	17.66	46.18	27	Texas	5,527	72,786	0.17	99.48
3	Wisconsin	204,335	5,043,118	11.43	57.61	28	New Mexico	2,548	50,053	0.11	99.59
4	Iowa	198,861	4,022,588	9.12	66.73	29	Montana	1,323	39,070	0.09	99.68
5	Minnesota	116,020	2,972,965	6.74	73.47	30	Tennessee	2,600	30,019	0.07	99.75
6	Nebraska	115,201	1,744,080	3.96	77.43	31	Georgia	1,439	18,662	0.05	99.80
7	Ohio	57,482	1,707,120	3.87	81.30	32	Rhode Island	715	17,783	0.04	99.84
8	Illinois	55,267	1,229,523	2.79	84.09	33	South Carolina	1,162	16,257	0.04	99.88
9	Michigan	54,506	1,204,316	2.73	86.82	34	Virginia	859	14,223	0.03	99.91
10	Oregon	29,311	920,977	2.09	88.91	35	Connecticut	575	12,286	0.03	99.94
11	Washington	14,080	566,537	1.28	90.19	36	West Virginia	424	9,740	0.02	99.96
12	Nevada	19,399	513,470	1.16	91.35	37	Maryland	226	6,097	0.01	99.97
13	Kentucky	20,080	486,326	1.10	92.45	38	Alabama	511	5,281	0.01	99.98
14	Pennsylvania	23,592	438,100	0.99	93.44	39	New Jersey	240	4,091	0.01	99.99
15	Indiana	16,399	382,835	0.87	94.31	40	North Carolina	230	2,421	0.01	100.00
16	Kansas	23,993	300,273	0.68	94.99	41	Arkansas	157	1,952		
17	Dakota	16,156	277,424	0.63	95.62	42	Delaware	19	523		
18	Idaho	8,291	274,750	0.62	96.24	43	Mississippi	44	348		
19	Vermont	10,552	267,625	0.61	96.85	44	Florida	21	210		
20	Maine	11,106	242,185	0.55	97.40	45	District of Columbia				
21	Arizona	12,404	239,051	0.54	97.94	46	Louisiana				
22	Utah	11,208	217,140	0.49	98.43	47	Wyoming				
23	Missouri	6,472	123,031	0.28	98.71		Total	1,997,717	44,113,495		
24	Colorado	4,112	107,116	0.24	98.95						
25	Massachusetts	3,171	80,128	0.18	99.13						

The table of production shows that California and New York produce 46 per cent. of the total crop. These two leading states are very unlike in their soils, climate, and methods of cultivation, and strikingly illustrate how very unlike conditions may lead to the same commercial result. In California the great production is due to two causes, the first, of course, being that the climate and soil are well adapted to the crop, while the other is that neither climate nor soil is so well adapted to the growth of either oats or corn. From similar causes barley is the chief cereal in Arizona and Nevada. The rapid increase during the last twenty or thirty years in the growth of barley in the northern states east of the Rocky mountains is due to very different causes: first, because of the increased demand occasioned by the increasing consumption of lager-beer and ale; and, second, that it commonly takes the place of wheat as a crop in localities where the Hessian fly renders wheat-growing precarious. This had much to do with stimulating its culture in New York, which state now ranks next to California in its aggregate production. The same cause has operated in Ohio and in Iowa. Soils which will grow good wheat will also grow good barley, and when the Hessian fly or other cause reduces the wheat crop farmers substitute barley. The high price offered for barley, compared with the price of any other coarse grain, as the demand for malting increased, also had much to do with stimulating its growth. There have been times when barley brought a considerably higher price than wheat in the markets, and, as it was less liable to destruction by insects, high prices stimulated the increased culture. The increased German immigration since 1847 has doubtless been another cause of increase of growth.

A precisely similar increase in the growth of barley as wheat-growing decreased has taken place in Great Britain. The breadth of wheat sown has greatly diminished in the British Isles during the last ten years, due mostly to the pressure of American competition, and with this there has been an increase in the breadth sown in barley. During this period the acreage of wheat has decreased in every district into which England is divided (agriculturally), and in every one the acreage of barley has increased. About half the area withdrawn from wheat cultivation has been devoted to barley. (For details of this change in the various districts, see *Craigie on Ten Years' Statistics of British Agriculture* in *Jour. Stat. Soc.*, XLIII, 283, 286, and tables, pp. 309–311.)

There are anomalies in the distribution of barley production in the United States which are quite remarkable. Pennsylvania produces less than half a million bushels, while New York, similar to it in its other products, produces nearly eighteen times as much. Indiana produces less than 383,000 bushels, while the three states of Illinois, Michigan, and Ohio, which surround it on three sides, produce together over 4,000,000 bushels, and each of them produces from three to four and a half times as much as Indiana. These enormous differences in production are not explained by differences of either soil, climate, or markets.

The production of barley in the whole country at the several census enumerations is as follows:

TABLE LXIX.—PRODUCTION OF BARLEY.

Crop year.	Bushels.
1879	44,113,405
1869	29,761,305
1859	15,825,898
1849	5,167,015
1839	4,161,504

The acreage and production of barley for each year since the previous census, as estimated by the United States Department of Agriculture, is as follows:

TABLE LXX.—ACREAGE AND PRODUCTION OF BARLEY.

Year.	Acres.	Bushels.	Year.	Acres.	Bushels.
1880	1,520,057	38,171,802	1874	1,580,626	32,552,500
1879	1,680,700	40,283,100	1873	1,387,106	32,044,491
1878	1,700,400	42,245,630	1872	1,307,082	26,846,400
1877	1,614,654	34,441,400	1871	1,177,666	26,718,500
1876	1,766,511	38,710,500	1870	1,108,024	26,295,400
1875	1,780,902	36,908,600			

The chief production of this crop has always been in a very few states. The following tables show six states leading in production in preceding census years:

TABLE LXXI.—BARLEY CROP OF 1839 (CENSUS OF 1840).

No.	State.	Amount of crop.	Per cent. of total production.	Cumulative per cent.	No.	State.	Amount of crop.	Per cent. of total production.	Cumulative per cent.
		Bushels.					*Bushels.*		
1	New York	2,520,068	61	61	4	Pennsylvania	209,893	5	80
2	Maine	355,161	9	70	5	Massachusetts	165,310	4	84
3	Ohio	212,440	5	75	6	Michigan	127,802	3	87

TABLE LXXII.—BARLEY CROP OF 1849 (CENSUS OF 1850).

No.	State.	Amount of crop.	Per cent. of total production.	Cumulative per cent.	No.	State.	Amount of crop.	Per cent. of total production.	Cumulative per cent.
		Bushels.					*Bushels.*		
1	New York	3,585,059	69	69	4	Pennsylvania	165,584	3	83
2	Ohio	354,358	7	76	5	Maine	151,731	3	86
3	Wisconsin	209,602	4	80	6	Massachusetts	112,385	2	88

TABLE LXXIII.—BARLEY CROP OF 1859 (CENSUS OF 1860).

No.	State.	Amount of crop.	Per cent. of total production.	Cumulative per cent.	No.	State.	Amount of crop.	Per cent. of total production.	Cumulative per cent.
		Bushels.					*Bushels.*		
1	California	4,415,426	28	28	4	Illinois	1,036,338	7	72
2	New York	4,186,668	26	54	5	Maine	802,108	5	77
3	Ohio	1,663,868	11	65	6	Wisconsin	767,307	4	81

TABLE LXXIV.—BARLEY CROP OF 1869 (CENSUS OF 1870).

No.	State.	Amount of crop.	Per cent. of total production.	Cumulative per cent.	No.	State.	Amount of crop.	Per cent. of total production.	Cumulative per cent.
		Bushels.					*Bushels.*		
1	California	8,783,490	30	30	4	Iowa	1,960,779	7	79
2	New York	7,434,021	25	55	5	Ohio	1,715,221	6	76
3	Illinois	2,480,400	8	63	6	Wisconsin	1,645,619	6	82


MAP OF THE
UNITED STATES
SHOWING
THE AVERAGE YIELD OF
BARLEY PER ACRE
Compiled from the Returns of Agriculture at the Tenth Census.
1880.
LEGEND
I Less than 17 bushel per acre
II 17 to 22
III 22 to 27
IV above 27
Areas in white are those of light or no production

CLIMATIC RANGE OF BARLEY.

Barley is successfully cultivated in a wider range of climate than any other cereal. It is the most hardy of all the cereals, and is cultivated farther north, fields of it being found in the Orkney, Shetland, and the Faroe islands to latitude 62°; in western Lapland to latitude 70°, near the North cape; in Russia to the shores of the White sea, above latitude 67°; and in central Siberia farther north than any other grain, and nearly up to the point where all cultivation ceases, potatoes being the only important food-plant ranging farther north in the Old World, and the limit of barley and potatoes forming the line between an agricultural and a pastoral or nomadic life. On the other hand, barley flourishes well in semi-tropical countries, and in this country the state of its greatest production is where the fig, the lemon, and the orange flourish. In Arizona and Nevada more of barley than of any other cereal was grown in the census year.

The tables of distribution according to climatic conditions (Tables XIX, XXIII, pp. 14–16) need no special discussion here farther than to say that the greatest production of barley is with a smaller amount of annual rainfall, and also a smaller amount of rainfall during the growing season, than is found with either of the other cereals, illustrating in another way the curious range of the crop as to climate. Its greatest production is where the rainfall of the growing season is between 15 and 20 inches, the production of each of the other cereals being greatest where the rainfall during the same period is between 20 and 25 inches. Nevertheless, some regions of the United States producing exceptionally good barley are regions of very high rainfall, while the climate of Canada, as also that of northern Europe, where barley is grown of very great excellence, is exceedingly wet, as compared with the drier regions here indicated. A much larger percentage of the crop grows where the rainfall of the growing season is less than 15 inches than of either of our other cereals.

HISTORY OF BARLEY.

The cultivation of barley dates from the remotest antiquity, some writers believing it to be the oldest of cultivated grains. According to Egyptian history, it was used as food for man and his animals and for beer from early days; it was also cultivated by the pre-historic inhabitants of Europe. Three varieties are found in the lake dwellings of Switzerland. Professor Heer tells us that these early varieties are the common two-rowed and two kinds of six-rowed barley.

The grain can be ground into a tolerably white meal, and for a long period it was the chief bread-plant of the nations from which we derived our civilization. It was probably the chief bread-plant of the ancient Hebrews, as it certainly was of the Greeks and Romans. According to Phillips' *History of Cultivated Plants* the meal so highly commended by the Greeks was barley meal. Wheat was more precious, and so barley continued to be the food of the poor, who were not able to procure better, for a long period. Numerous references in ancient history show that it was the principal food of ancient armies, and barley bread continued a common bread with the poor over nearly all of Europe. The use of this grain for bread began to decline with the introduction and wide cultivation of potatoes, and its great consumption in this way has only recently ceased. As one of the results of modern facilities for the transportation of wheat from long distances the commercial importance of the grain now depends on its use for malting, although its local cultivation is sometimes of more importance as a food for animals.

Barley was cultivated by the very earliest settlers in New England for bread, but it proved to be so much inferior to Indian corn in every respect for use by the early colonists that barley bread never appears to have played any considerable part as food in any of the American colonies. It formed an important article of food for domestic animals before oats did, and in portions of the United States it is now largely grown for this use. The great consumption of this grain in the Pacific states is to feed horses, rather than for brewing. Only a very insignificant quantity is used as human food in this country, less than of any other cereal. With the outer hull removed, it is known as "pearled barley", and is used somewhat in domestic cookery, chiefly as an ingredient of soups. An analysis of American pearled barley is given in the table of chemical composition, No. 309 (Table XXV, p. 42).

Considerable quantities of this crop are grown in the Pacific states as a substitute for hay, and it ranks high for this purpose, more "barley hay" being produced in California than of any other kind.

NATURAL HISTORY OF BARLEY.

Barley belongs to the genus *Hordeum*. Whether all the kinds have been derived from a single original species by cultivation, or whether there are three or four species, or even more, is a subject of dispute. Most of the older authors considered that all the varieties of two-rowed barley belonged to one species, four-rowed to another, six-rowed to still another, the naked barleys forming a fourth.

The number of varieties of barley in actual cultivation is comparatively small, and they are ill-defined, being merely designated by the general names of two-rowed, four-rowed, or six-rowed, although some varieties, with more specific names, like the famous Chevalier, have much reputation. The first three classes have the wrinkled husk closely adherent to the grain, and constitute nearly all of the barley grown in this country.

In Great Britain the six-rowed varieties, formerly supposed to constitute a distinct species, are generally known as *bere* and *bigg*, or *big*. They germinate differently in malting, and hence are sold under a special name. In the agricultural returns "barley and bere" are, however, classed together.

In this country, judging from the answers to schedule question No. 131 ("What varieties are most cultivated?"), I infer that of the whole amount the most is of six-rowed, but many of the answers are very indefinite.

The naked varieties are practically unknown in the colder portions of the United States, but are cultivated to some slight extent in California and in the tier of states bordering on Mexico. As a bread-plant the barleys are less nutritious than either wheat or oats, but some of the naked varieties are exceedingly nutritious, one cultivated by the Pueblo Indians at Taos, New Mexico (No. 305 of the tables of chemical composition, p. 42), having a greater percentage of albuminoids than any other cereal in the tables. This barley was grown on irrigated fields by these Indians, and is used by them for bread.

Winter varieties have been sparingly cultivated for a long time, but never to any great amount. I have seen mention of their cultivation in the last century, and here and there they are found still. A few thousand bushels are returned in the last state census of New York, and we occasionally hear of the crop in the northern tier of states all the way from New England to Oregon, but the aggregate is very insignificant, indeed, compared with the product of spring varieties.

CULTIVATION OF BARLEY.

There is nothing in the method of cultivating barley that needs special notice. It is considered by many an uncomfortable crop to harvest. It is handled unbound, and the slippery character of the straw renders it more difficult to manage than oats or other loose grain, but with the forks specially made for its handling some find no difficulty whatever, while other farmers think it especially troublesome to manage.

WEIGHT AND GRADES OF BARLEY.

The commercial weight of barley in the Atlantic states is 48 pounds per bushel; in California, 50 pounds. As it comes to market, much of it weighs less than 48 pounds, because of the awn or "beard" not being broken closely from the grain in thrashing. English buyers notice this peculiarity; indeed, it has long been noticed. Parkinson, in the latter portion of the last century, said that the Americans did not take the beard off so closely as they did in England, and so it measured more. He said that Long Island then produced the best barley, but New England produced much and of good quality, and that 20 bushels per acre was a common crop, but sometimes it was 30 or 40 bushels.

When barley is of under weight, the weight may be increased several pounds per bushel by an extra thrashing of the grain or by a tramping of horses, and this is sometimes practiced. The process not only increases the weight of the grain per bushel, with a very insignificant loss of useless material, but it scours the grain, makes it brighter, and improves its appearance.

CHEMICAL COMPOSITION OF BARLEY.

As will be seen from the tables (p. 42), the chemical composition of barley varies greatly, but no more than that of oats. It has less fiber (or bran) and a larger average percentage of the starchy elements. In albuminoids the percentage in the whole grain is not very different from that of oats, but the food preparations from the two grains are very unlike, the single analysis of pearled barley being much poorer in albuminoids than are the oat-meals. The number of analyses of American barley are entirely too few to base generalizations upon. Perhaps the most striking fact observed in the few analyses made is the wide difference in the composition of barleys nominally alike. Of two specimens of two-rowed barley, No. 303, grown in eastern Massachusetts, has 8.6 per cent. of albuminoids, while No. 307, from central New York, has 14.4 per cent., with a corresponding difference in the amount of carbhydrates. Comparing the albuminoids with each other, the one is to the other as 1 to 1.67—an enormous difference in value for feeding, but probably much less relatively for brewing. In market these would have been graded alike. Both looked of superior quality, and were being sold for seed.

The richness of a naked barley from New Mexico has already been commented upon.

Taken as a whole, the chemical analyses sustain the popular belief that for strength-giving qualities oats are better as a horse-feed than barley.

USE OF BARLEY FOR MALTING.

Beer as a beverage is of very great antiquity. The old Greek, Roman, and Egyptian peoples made it, and in modern times the manufacture of beers and ales has assumed such magnitude that probably no other one manufacture in civilized countries employs so large an amount of capital. During late years the process of brewing has undergone great changes, amounting practically to a revolution, and while this relates primarily to the chemical processes involved, incidental to it is the employment of various other ingredients as a partial substitute for barley malt, largely substances derived from Indian corn (corn meal and glucose, and to a lesser degree other substances); but this has not seriously diminished the demand for barley, which remains the essential ingredient, and upon its quality the character of the beer largely depends.

The process of malting in most, if not all, the countries of Europe is regulated by law, both as to the methods and as to the quantities produced. In this country there is no such regulation. The process essentially is this: The grain is first soaked in water, then allowed to sprout, during which certain chemical changes take place within it, the starchy portions becoming soluble and capable of being extracted by water. When the sprouting has advanced far enough, it is arrested by drying and by heat, and the dried material is "malt". The grades and prices of barley in this country depend entirely upon its malting qualities and the quality it imparts to beer. Varieties that germinate unequally, if mixed, bring a lower price than if sold separately, although the grains may be equally valuable for purposes of food for man and for beast. The brightness of the grain in color is an important character. In portions of California near the coast, where the famous Chevalier barley grows well and yields well, but is somewhat discolored by the fogs from the sea, the grain brings a lower price, although of exceptional plumpness and weight and of superior value for feeding. Accordingly, it is a common practice on many farms in the interior of the state, where the same variety is grown, but where, through difference of climate, the grain is brighter, to sell the entire crop and buy seed from nearer the sea-coast, where it can be got at a lower price, because it is a little off color. This is practiced simply as a matter of economy, the incidental benefit of a change of seed being a secondary consideration.

IMPORTS OF BARLEY.

Barley is the only cereal (save rice) imported to any considerable extent for other use than for seed. While some considerable portion comes into the country for seed, the principal importations are for malting, and chiefly from Canada. The following table, prepared by Mr. J. R. Dodge, shows the imports and value for the last eleven years:

TABLE LXXV.—IMPORTS OF BARLEY INTO THE UNITED STATES.

Year.	Quantity.	Value.
	Bushels.	
1870	6,727,597	$4,750,503
1871	4,866,700	3,678,810
1872	5,505,591	3,403,607
1873	4,244,751	2,902,981
1874	4,801,189	5,801,053
1875	6,255,063	6,297,738
1876	10,285,957	7,887,886
1877	6,702,965	5,099,326
1878	6,764,228	4,105,748
1879	5,720,979	5,402,080
1880	7,135,258	4,537,921

Great Britain imports enormous quantities of barley, and the sources of her supply are an indication of the barley-producing countries of the world. Of late years Turkey usually heads the list; then follow France, Germany, and Russia, with smaller quantities from the northern African states (Algeria, Tripoli, and Tunis), Denmark, Scandinavia, Moldavia, and so on. India also produces a notable quantity. While the cultivation of rye and of buckwheat is actually declining in the world, and of oats relatively declining, the cultivation of barley is doubtless on the increase, and there are many reasons, too, for the belief that its production in America will very greatly increase during the present century.

MISHAPS TO BARLEY.

Barley in this country is not liable to disease, its production being regulated by other causes than the mishaps to the crop. It has its rust and its smut, as other grain has, but is not especially liable to either; in fact, is rather free from them, and is less liable to lodge than either wheat, oats, or rye. It is an uncomfortable grain to harvest, and this causes a prejudice against it on the part of some; but it is, on the whole, a rather sure crop.

INSECTS AFFECTING BARLEY.

ARMY-WORM (*Leucania unipuncta*, Haw.).—See wheat insects.

CHINCH-BUG (*Blissus leucopterus*, Say).—See wheat insects.

GRAIN PLANT-LOUSE (*Siphonophora avenæ*, Fabr.).—See wheat insects.

CUT-WORMS.—See corn insects.

WIRE-WORMS.—See corn insects.

CHLOROPS and OSCINIS, species of.—See Fitch's 2d N. Y. Entomological Report, pp. 297–303.

JOINT-WORM (*Isosoma hordei*, Harris).—See wheat insects. The joint-worm was originally described from barley, and its specific name was taken from the generic name of the plant, *Hordeum*.

ROCKY MOUNTAIN LOCUST (*Caloptenus spretus*, Uhl.).—See wheat insects.

WHEAT MIDGE (*Diplosis tritici*, Kirby).—See wheat insects, and also Glover (Rept. Dept. of Agr., 1872, p. 126).

HESSIAN FLY (*Cecidomyia destructor*, Say).—See wheat insects, and also Glover (Rept. Dept. of Agr., 1872, p. 126).

LOCUSTS OTHER THAN ROCKY MOUNTAIN.—See wheat insects.

INSECTS INJURING STORED BARLEY.—See wheat insects.

RYE.

The acreage of rye in the census year of 1880 amounted to 1,842,303 acres, producing 19,831,595 bushels. The following table gives the data, by states, in the order of their production:

TABLE LXXVI.—RYE CROP OF 1879 (CENSUS OF 1880).

No.	States.	Acres.	Bushels.	Per cent. of total product.	Cumulative per cent.	No.	States.	Acres.	Bushels.	Per cent. of total product.	Cumulative per cent.
1	Pennsylvania	398,465	3,686,021	18.57	18.57	26	Alabama	5,834	28,402	0.14	93.92
2	Illinois	192,198	3,121,785	15.74	34.31	27	South Carolina	7,152	27,049	0.14	99.06
3	New York	244,923	2,634,600	13.28	47.59	28	Maine	2,161	26,398	0.13	99.19
4	Wisconsin	169,692	2,208,513	11.59	59.18	29	Texas	3,326	25,399	0.13	99.32
5	Iowa	102,607	1,518,605	7.66	66.84	30	Dakota	2,385	24,359	0.12	99.44
6	New Jersey	106,025	949,664	4.79	71.63	31	Arkansas	3,290	22,387	0.11	99.55
7	Kentucky	89,417	668,950	3.37	75.00	32	Colorado	1,294	19,465	0.10	99.65
8	Missouri	46,484	535,426	2.70	77.70	33	Oregon	841	13,305	0.07	99.72
9	Nebraska	34,297	424,348	2.14	79 84	34	Rhode Island	1,270	12,997	0.07	99.79
10	Kansas	34,021	413,181	2.08	81.92	35	Utah	1,153	9,605	0.05	99.84
11	Ohio	29,499	389,221	1.96	83.88	36	Washington	518	7,124	0.04	99.88
12	Connecticut	29,704	370,733	1.87	85.75	37	Delaware	773	5,053	0.03	99.91
13	Virginia	48,740	324,431	1.63	87.38	38	Mississippi	806	5,134	0.03	99.94
14	Indiana	25,400	303,105	1.53	88.91	39	Idaho	354	4,341	0.02	99.96
15	Michigan	22,815	294,018	1.49	90.40	40	District of Columbia	301	3,704	0.02	99.98
16	Maryland	32,405	288,067	1.45	91.85	41	Florida	001	2,005	0.01	99.99
17	North Carolina	61,053	285,160	1.44	93.29	42	Louisiana	201	1,013	0.01	100.00
18	Minnesota	13,614	215,245	1.09	94.38	43	Montana	15	430		
19	Massachusetts	21,666	213,716	1.08	95.46	44	New Mexico	17	240		
20	California	20,281	181,681	0.92	96.38	45	Wyoming	6	78		
21	Tennessee	32,493	156,419	0.79	97.17	46	Arizona				
22	West Virginia	17,279	113,181	0.57	97.74	47	Nevada				
23	Georgia	25,854	101,716	0.51	98.25		Total	1,842,303	19,831,595		
24	Vermont	6,319	71,733	0.36	98.61						
25	New Hampshire	3,218	34,038	0.17	98.78						

This cereal has become of very minor importance in the United States as compared with those we have already noticed, and its relative importance as a grain is continually decreasing, as may be seen by the following table:

TABLE LXXVII.—PRODUCTION OF RYE.

Crop year.	Bushels.
1879	19,831,595
1869	16,918,795
1859	15,540,605
1849	14,188,813
1839	18,645,567

The relative decrease in importance of this crop is not, however, so great as these figures indicate, which are merely the returns of grain, the straw not being considered. Its importance as a bread-plant undoubtedly decreases, but for other uses the cultivation of the crop is apparently on the increase. Rye is still extensively used for green-manuring on worn-out and thin soils, and is largely sown as a forage crop, particularly in the South, where its use is on the increase, and the straw has so risen in value in the market that in very many places the grain is but a secondary product, the greatest value being in the straw.

Pennsylvania has at each return been the leading state in total production, now followed by Illinois, but at previous enumerations by New York. Those two states produced 51 per cent. of the entire crop in 1839; in 1849, 63 per cent.; in 1859, 48 per cent.; and in 1869, 36 per cent. These, with Illinois, as will be seen, at the last enumeration produced a little less than half, and, in 1869, fully half of the total crop. The distribution of the crop in these states is very unequal, being in part governed by the soil and in part by the local demand for the straw. Formerly New England produced relatively a vastly larger proportion. In 1850 Connecticut ranked the third, and Massachusetts the fourth state in the order of production. In many of the states there has been a considerable falling off in production during the last decade. This is notably the case in Delaware, Kentucky,


LEGEND
I Less than 10 bushels per acre of improved land
II 10 and 15 " " " " " "
III 15 " " " " " "
NOTE
The absence of color indicates a population of less than 2 to a square mile, being practically an absence of settlement.
MAP OF THE
UNITED STATES
SHOWING THE RELATION BETWEEN THE
PRODUCTION OF RYE
IN BUSHELS AND THE AREA OF IMPROVED LAND IN ACRES
Compiled from the Returns of Agriculture at the Tenth Census.
1880.

Indiana, Virginia, the Carolinas, and in all of the New England states, except Connecticut, where the falling off took place earlier. The increased cultivation of oats in the South for green forage and green-manuring and the spread of other forage plants has had a relative tendency during late years to diminish its cultivation in some portions of those states.

HISTORY OF RYE.

Rye has been known from remote times, and of all our bread-plants it flourishes on the poorest soil and thrives best in inhospitable climates; consequently in all previous ages it has been a crop of vastly more importance to people of our civilization than it is now. Particularly to the people of northern Europe has it been a most precious boon. Flourishing on their poor, sandy soils, and in many countries where wheat was exceedingly uncertain, it was for ages the principal bread-plant in use by the masses of the people. As late as the middle of the present century an eminent agricultural writer states that "rye bread forms the principal sustenance of at least one-third of the population of Europe", this one-third inhabiting the northern half of the continent, barley taking its place in the countries nearer the Mediterranean.

During the whole colonial period, and, indeed, far into the present century, it was the common ingredient of bread for a great many families in this country. Wheat never flourished well in portions of New England, and the same may be said in a lesser degree of parts of the middle states and of a belt of land extending southward along the Appalachian mountains, while over the whole of this very region rye flourished reasonably well. Before the days of railroad transportation, and especially before the opening of the Erie canal, rye bread was the common bread among a large portion of the population of the whole region indicated, in many places, particularly in New England, rye being usually mixed with corn for bread, and "Rye and Indian" was a familiar term in most households east of the Catskills and north of the Delaware. A similar bread of maize and rye is still the common bread of Portugal, the relative proportions of each varying with the year—a good year for rye being usually a poor one for corn, and the composition of the bread varying accordingly.

The manufacture of rye whisky (and, to a less extent, wheat whisky) west of the mountains was an important agricultural industry just after the Revolutionary War. This grain was largely grown in the rougher regions of western Pennsylvania, was distilled on the farm, and the whisky produced was, for a considerable period, the only agricultural product the farmer could profitably transport to the markets east of the mountains, being carried on the backs of animals. The disturbance of this industry led to the famous "whisky rebellion" in the early days of the republic.

With the opening up of transportation routes, and since wheat grown west of the Appalachians has been so abundantly and cheaply transported to the sea-coast, rye as a grain product has steadily declined in relative importance, until in many regions it has about ceased to be grown merely for its grain. So completely has this come about, that in some districts where the previous generation knew it as their chief breadstuff now thousands of families, even the poorest ones, know not even the taste of rye bread.

In the eastern portions of the United States rye derives a larger proportion of its importance from the sale of its straw than does any other cereal, although rye straw is the poorest kind of straw for forage. This straw is in demand in the larger cities for various uses, particularly for packing, and is also extensively used for making certain kinds of paper and pasteboard, for which it is better adapted than the straw of any of the other cereals, and, owing to this demand, the crop is very frequently grown where it would not be if the grain was the chief object sought. Many paper-makers claim that the rye straw produced in southern New England and in New Jersey is better for their purposes than that which is grown west of the Appalachians, and this fact tends to stimulate the culture of the crop in numerous localities. A paper-mill buying it becomes the center of cultivation of the crop, and it is eminently probable that its cultivation could be profitably increased in numerous localities in the United States, but sentiment operates against it. The fact that with previous generations it constituted more largely the bread of the poor, and that at the present time it is recognized that rye will flourish on poorer lands than wheat can be profitably grown upon, have created a sort of prejudice among farmers in many places against it. It is now often looked upon as a hardly creditable crop to grow, as if it indicated a poverty in the soil or in the farmer which he does not wish to have imputed to him or to his land. The common epithet applied to very poor soil, that it is "too poor to grow rye", is but an expression of the feeling, and there is no question but that these influences, even though purely sentimental, diminish the culture of this crop over the whole of the more fertile grain-growing regions of the country, particularly those which have been settled since rye bread has ceased to be a common food. The official report of the late Canadian agricultural commission mentions a similar sentiment as existing in Canada and as operating against the growth of this grain there. Considering all these things, it is probable that its culture as a grain crop will continue relatively to decrease, although it must continue to hold a useful but subordinate place in the agriculture of the country, and its cultivation may possibly increase for other uses than for its grain.

NATURAL HISTORY OF RYE.

What was the native country of rye, what wild plant was the original progenitor of the cultivated varieties, and when and where it was first cultivated, are all unknown. It was cultivated in ancient Egypt, and has been cultivated ever since.

The varieties all belong to the genus *Secale*, and probably constitute but a single species, *S. cereale*, L. It does not break up into varieties so easily as most other cereals do, and this is one reason why botanists are generally agreed that all of its varieties form but one species. In Europe it ripens farther north than wheat, extending in Norway up to latitude 67°, and in Siberia to about 62°. In America it ranges far beyond the northern limits of the United States. The cultivation of rye, as might be inferred from what has been said, follows in this country other conditions than that of climate, but the tables show that it belongs, as a whole, to regions of cooler temperatures and more rain than those which produce the most of our other cereals.

CULTIVATION AND VARIETIES OF RYE.

Rye, like wheat, exists in both winter and spring varieties. The winter varieties, however, are the most commonly cultivated in this country, and both are treated so much like wheat in their cultivation that no special description need be given here.

Little care appears to be taken in regard to its varieties, four or five being commonly reported. By far the larger number of answers given to question 111 of special schedule, "What varieties of rye are cultivated?" were simply "winter", "spring," "black," "white," and "common", but no less than seventeen names of varieties were returned, the most of them, such as "English", "Irish," "Russian," "goose," "blue," "green," "red," and "gray", having but a scanty or even single mention. In answer to the question whether the crop was mostly cultivated for the grain or for the straw (question 112), it appears that in New England, New York, New Jersey, Pennsylvania, and Ohio the straw is the chief object of its cultivation in a majority of cases, the yield being given usually at from one to two tons per acre and the price from $4 to $30 per ton, the most of the answers being from $10 to $20 per ton. In Ohio and farther West the straw is generally sold in bulk, but in New England, New Jersey, Pennsylvania, and portions of New York and Ohio it is sold in bundles. Various special machines have been devised for thrashing the grain so as to leave the straw in a straight condition, that it may be bound into neat bundles. In Indiana, Iowa, Kentucky, Minnesota, Missouri, Nebraska, and Wisconsin, along with states of less production, the grain is the principal object of culture, and in some states there was no report of any marketable value attached to the straw. Illinois, which produces a large quantity, occupies an intermediate position. In some places it is cultivated entirely for the grain; in others more for the straw than for the grain. The yield of straw is given very differently in different sections of the country, ranging from 500 pounds to 4 tons per acre, but as a whole it is returned as greater in the Alleghany mountains and the states east than in the more fertile West.

YIELDS AND GRADES OF RYE.

The average yield of grain for the whole country is $10\frac{7}{10}$ bushels per acre. In Pennsylvania, the state of greatest production, it is considerably less (because the crop there is so often grown for the straw, the grain being but a secondary product), while in Illinois the yield is considerably above the average. Fifteen to twenty bushels per acre is considered a fair crop and 20 to 30 bushels per acre a good crop over most of the country.

The relative yield of grain and straw varies with the soil. For example, in Washington county, New York, where rye is a leading crop and the straw goes to the paper-mills at paying rates, it is stated that, as the crop grows there, a yield of 10 bushels per acre would give about half a ton of straw (56 pounds of grain to 100 of straw), 20 bushels of grain 1,500 of straw (75 pounds of grain to 100 of straw), and 30 bushels a ton of straw (84 pounds of grain to 100 of straw), following the usual rule that the larger the yield of grain the smaller the relative proportion of straw.

Rye varies much in its grades, the grains varying enormously in size, plumpness, and color, and the legal weight varying in the different states. It is usually received at 56 pounds, and this is legalized by statute in more than thirty states; but in Louisiana it is but 32; in California it is 54; and in South Carolina, 60 pounds.

CHEMICAL COMPOSITION OF RYE.

There being but a single previous analysis of American rye, I had some additional ones made (Table XXV, pp. 42–43).

The analysis of the whole grain averaged 10.66 per cent. of albuminoids (12.97 per cent., water free), while the average of wheat is 11.84 per cent. (13.31, water free). The analyses show that rye in the kernel is less nutritious

than wheat, and the difference in their respective flours is still greater. The wheat flours averaged 11.56 per cent. of albuminoids (12.53, water free), while the rye flours averaged only 6.65 per cent. of albuminoids (7.64, water free). On the other hand, rye bran is vastly richer in albuminoids than wheat bran, averaging 14.69 per cent. (16.62, water free), one specimen reaching 16.81 per cent.

These figures are so plain that they scarcely require comment, and they illustrate why fine wheat bread is so much better than fine rye bread, and also why the difference in nutritious qualities between coarse rye bread and fine rye bread is so much greater than between coarse wheat bread and fine wheat bread.

MISHAPS TO RYE.

Rye is usually so free from disease that in Europe it used to be sown among wheat and around wheat-fields, from the idea that it would ward off blight and mildew.

It is, however, subject to one disease of considerable importance, known as ergot, or, in this country, as "spurred" rye. It is caused by a fungus analogous to the smuts (*Claviceps purpurea*), which attacks the kernel; the starch in it is entirely changed, and its place taken by a firm mass; the kernel grows to an extraordinary size, lengthening and protruding from the chaff, the whole becoming of a dark brown or gray color, and very unlike the original kernel in shape, general appearance, and taste. The disease is a specific one, the fungus being produced from spores, as other parasitic fungi are.

Ergot is poisonous, and also has important medicinal properties, acting specifically on the uterus. There are many cases on record on the continent of Europe where gangrenous and other horrible diseases have occurred among very poor people who have eaten rye flour made from poor and badly ergotized grain, and it is believed that some of the cattle distempers of the last century in Switzerland, eastern France, and other portions of Europe were produced by the same cause. This has been made the subject of special investigation from time to time. The injurious effects, however, are not uniform, and there is much conflict of testimony on this whole matter. That ergot is injurious, sometimes poisonous, and often productive of distressing diseases, there is no question; the only question is as to the certainty of such results following its use. Ergot may be found in most rye-fields in this country in small quantities, but rarely occurs in sufficient abundance to materially affect the crop, and our methods of cleaning the grain practically remove it completely.

INSECTS INJURIOUS TO RYE.

ARMY-WORM (*Leucania unipuncta*, Haw.).—See wheat insects.

FALL ARMY-WORM (*Laphygma frugiperda*, Sm. & Abb.).—See wheat insects.

WHEAT-HEAD ARMY-WORM (*Leucania albilinea*, Guenée).—See wheat insects.

CHINCH-BUG (*Blissus leucopterus*, Say).—See wheat insects.

GRAIN PLANT-LOUSE (*Siphonophora avenæ*, Fabr.).—See wheat insects.

CUT-WORMS.—See corn insects.

WIRE-WORMS.—See corn insects.

YELLOW-BELLIED JANUS (*Janus flaviventris*, Fitch), supposed by Fitch to injure rye.—See New York State Entomological Reports, VII, p. 165.

THREE-SPOTTED CEPHUS (*Phylloecus trimaculatis*, Say). Also supposed by Fitch to injure rye (*Ibid*).

THE JOINT-WORM (*Isosoma hordei*, Harris).—See wheat insects. Fitch (7th Rept., p. 163) described a rye-fly under the name of *Eurytoma secalis*, which is probably but a variety of the above.

OSCINIS AND CHLOROPS, species of.—See wheat insects, and Fitch (2d N. Y. Report, pp. 297–303).

ROCKY MOUNTAIN LOCUST (*Caloptenus spretus*, Uhl.).—See wheat insects.

WHEAT MIDGE (*Diplosis tritici*, Kirby).—See wheat insects, and also Glover (Rept. Dept. of Agr., 1872, p. 126).

HESSIAN FLY (*Cecidomyia destructor*, Say).—See wheat insects, and also Glover (Rept. Dept. of Agr., 1872, p. 126).

LOCUSTS OTHER THAN ROCKY MOUNTAIN.—See wheat insects.

INSECTS INJURING STORED RYE.—See wheat insects.

BUCKWHEAT.

The buckwheat crop of 1879 amounted to 11,817,327 bushels, grown on 848,389 acres; a slight increase on the crop of 1869, considered actually, but the amount per head of population is less. The following table gives the more important buckwheat-producing states in the order of their production, with acreage and other data:

TABLE LXXVIII.—BUCKWHEAT CROP OF 1879 (CENSUS OF 1880).

No.	States.	Acres.	Bushels.	Per cent. of total product.	Cumulative per cent.	No.	States.	Acres.	Bushels.	Per cent. of total product.	Cumulative per cent.
1	New York	291,223	4,461,200	37.75	37.75	26	Oregon	372	6,215	0.05	99.83
2	Pennsylvania	438,100	3,593,326	30.41	68.16	27	Delaware	397	5,857	0.05	99.93
3	New Jersey	35,373	466,414	3.95	72.11	28	Dakota	321	2,521	0.02	99.95
4	Michigan	33,948	413,062	3.50	75.61	29	Washington	166	2,498	0.02	99.97
5	Maine	20,135	382,701	3.24	78.85	30	Rhode Island	105	1,254	0.01	99.98
6	Vermont	17,649	356,618	3.02	81.87	31	Arkansas	92	548		
7	Wisconsin	34,117	299,107	2.53	84.40	32	Texas	48	535		
8	West Virginia	30,334	285,298	2.41	86.81	33	Montana	34	437		
9	Ohio	22,130	280,229	2.37	89.18	34	Georgia	58	402		
10	Illinois	16,457	178,859	1.51	90.69	35	Alabama	42	363		
11	Iowa	16,318	166,895	1.41	92.10	36	Colorado	8	110		
12	Connecticut	11,231	137,563	1.16	93.26	37	Arizona				
13	Maryland	10,294	136,667	1.16	94.42	38	District of Columbia				
14	Virginia	16,463	136,004	1.15	95.57	39	Florida			0.02	100.00
15	New Hampshire	4,535	94,090	0.80	96.37	40	Idaho				
16	Indiana	8,846	89,707	0.76	97.13	41	Louisiana				
17	Massachusetts	5,617	67,117	0.57	97.70	42	Mississippi				
18	Missouri	5,403	57,640	0.49	98.19	43	Nevada				
19	North Carolina	5,725	44,668	0.38	98.57	44	New Mexico				
20	Minnesota	3,677	41,756	0.35	98.92	45	South Carolina				
21	Tennessee	4,907	33,434	0.28	99.20	46	Utah				
22	Kansas	2,458	24,421	0.21	99.41	47	Wyoming				
23	California	1,012	22,307	0.19	99.60		Total	848,389	11,817,327		
24	Nebraska	1,666	17,562	0.15	99.75						
25	Kentucky	1,024	9,942	0.08	99.83						

Buckwheat is the least important of our cereals, and is subject to the greatest fluctuations of production, and, as a whole, is continually declining relative to the population, as may be seen in the following table of the crops of the census years:

TABLE LXXIX.—PRODUCTION OF BUCKWHEAT.

Crop year.	Bushels.
1879	11,817,327
1869	9,821,721
1859	17,571,818
1849	8,956,912
1839	7,291,743

DISTRIBUTION OF BUCKWHEAT.

New York and Pennsylvania have been the leading states in buckwheat production for each of the years given in the above table, they having produced 68 per cent. of the crop in 1879, 65 per cent. in 1869, 61 per cent. in 1859, 60 per cent. in 1849, and 59 per cent. in 1839. The portions of these states where the production is largest are in the hilly counties, particularly on the highlands that lie on the divide between the lakes and the Chesapeake and Delaware bays and on the lower mountains and hills that form the outlying ridges of the Appalachian system. In many such places, where a comparatively thin soil is found, it is a somewhat important crop.

It will be noticed that the crop is grown in the cooler parts of the country—in the regions that are hilly or mountainous, and in regions of small farms. New England produces over a million bushels, and the middle states over eight and a half millions, these together producing over 80 per cent. of the crop. The other states lying along the northern border—Ohio, Michigan, and Wisconsin—with the mountainous belt extending down into Maryland, Virginia, and West Virginia, produce a million and a half bushels more, these altogether producing upward of 94 per cent. of the crop of the country. Buckwheat appears again in considerable quantities in Oregon, where the climate and soil are well adapted to it, the fertile soils of the prairie region and the warmer climate of the South being alike unfavorable to its growth.

The table of grain distribution according to altitude (Table XVIII, p. 13) shows that a relatively larger proportion of the crop grows at altitudes above a thousand feet than of either of the other grains, and the tables of


MAP OF THE
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PRODUCTION OF BUCKWHEAT
IN BUSHELS AND THE AREA OF IMPROVED LAND IN ACRES
Compiled from the Returns of Agriculture at the Tenth Census.
1880.
LEGEND
I. Less than 1/10 bushel per acre of improved land
II. 1/10 to 1 " " " " " "
NOTE
The absence of color indicates a population of less than 2 to a square mile being practically an absence of settlement.
PACIFIC OCEAN
ATLANTIC OCEAN
GULF OF MEXICO
BRITISH POSSESSIONS
LAKE SUPERIOR
LAKE ONTARIO
LAKE ERIE
WASHINGTON
OREGON
IDAHO
MONTANA
DAKOTA
WYOMING
NEVADA
UTAH
COLORADO
NEBRASKA
KANSAS
IOWA
MINNESOTA
WISCONSIN
ILLINOIS
MISSOURI
CALIFORNIA
ARIZONA
NEW MEXICO
INDIAN TERRITORY
TEXAS
ARKANSAS
TENNESSEE
KENTUCKY
GEORGIA
NORTH CAROLINA
SOUTH CAROLINA
PENNSYLVANIA
NEW YORK
MEXICO
LOWER CALIFORNIA
PUBLIC LANDS

distribution according to temperature (Tables XIX, XXI, p. 14) show that a relatively larger proportion grows with a lower temperature than any of our other grains, unless it be rye. And so, too, of rainfall (Tables XXII, XXIII, p. 16). Whether considered in respect to annual rainfall or to the summer rainfall, it is most abundantly produced in the moister portions of the United States.

The distribution by latitude shows that three-fifths (59 per cent.) of the crop grows between latitudes 41° and 43°, and upward of four-fifths (80.8 per cent.) between latitudes 40° and 44°. The center of production, then, lies farther north than that of any of our other cereals. It belongs to the cooler and rougher region, with hillsides and thin soils, and on small farms pursuing mixed farming. It does not follow, however, that it belongs to poor regions agriculturally, for over much of the region which produces buckwheat the aggregate value of the total agricultural production, considered per head of population engaged in agriculture or considered relative to the amount of improved land, is as great as in some of the more favored regions for growing wheat and corn. For such a region under consideration the crop is a useful one. Even in the regions of greatest production buckwheat is rarely a staple crop, and it is often grown merely as an adventitious one. The time of sowing extending from the month of May to the middle of August, the most usual time being in the last half of June or the first half of July, it frequently replaces some other crop sown earlier, but which has met with some accident or casualty. For instance, if corn is destroyed by a very late frost, the land is still available for a crop of buckwheat. A particularly late spring or inopportune storms may prevent the planting or sowing of some other intended spring crop, and the farmer, not wishing to lose entirely the use of his land for the summer, puts in buckwheat, and often harvests a profitable crop, where, but for this, there would have been only loss. Again, in the clearing of land from stones or stumps, or in clearing it from weeds, the land may be plowed and tilled late enough in the season to kill the weeds, and a crop of buckwheat then be sown on it, which acts still farther as a weed-exterminator by smothering them, and in this way the crops become incidentally useful. Inasmuch as buckwheat will flourish upon a poor and worn-out soil, it is frequently sown on such lands preliminary to something else. The amount of straw produced is often very large, is very soft and succulent, easily rots, but is useless for forage; so it may be plowed in green, and, making an excellent green manure, much buckwheat is sown for this purpose which does not figure in the census returns. Again, on small farms, and particularly on grain farms, where it is difficult to secure help, or where most of the farm labor is employed by the month, the times of putting in the crop and harvesting it come when there is less pressure of work, and hands may thus be employed at a slack season; and so on through a variety of contingencies this crop plays a useful and a paying part in mixed farming, even though it is not a staple and its yield is capricious.

The yield, perhaps, is more uncertain than that of any of our other cereals, but in good years and under good conditions it is often very large and very profitable. While frequently falling as low as 5 bushels, it also frequently rises above 30, and sometimes to 40 or 50 bushels. In those states which produce the most of the crop 30 bushels per acre is considered a rather large yield, although in favorable years this is not by any means uncommon, and, as a whole, the crop is considered a remunerative one. The states where we find the greatest production are all of them populous states, where there is a large local demand for the grain in the numerous small towns and villages. It is especially esteemed by the farmer for feeding swine and poultry. There is also some buckwheat sown incidental to the making of honey. Although the amount is not large, yet farmers keeping bees have this fact in mind, and in many regions of the United States where the crop is scarcely grown at all for grain, particularly in the tier of states lying just south of the principal production, as in Georgia and Tennessee, it is quite common to find buckwheat-fields sown simply as bee-pastures. The abundance and the fragrance of the flowers peculiarly adapt it to this purpose, and buckwheat honey has a place in most of our markets. All of these considerations taken together, no one of them being very important, make the crop one which will continue to be cultivated, particularly on the small and moderate-sized farms and in the regions adapted to it, and these various uses give it a value greater than the census returns would apparently indicate.

Buckwheat is but sparingly used as a bread-plant in the Old World outside of Russia. It is grown somewhat, and its meal is mixed with others for some of the coarser kinds of bread, particularly in the rougher, mountainous regions of the continent. In England it is sparingly cultivated as a food for poultry and game, particularly for pheasants. But, as a whole, it is everywhere a cereal of minor importance. In the earlier history of this country it had a much greater importance than now. In some of the British provinces it still retains much of that importance. Thirty years ago an eminent Scotch agricultural writer, traveling through those provinces, said that "three-fourths of all the bread consumed" in certain districts "is made of buckwheat. It is chiefly used in the state of thin cakes, called pan-cakes", etc. (*Johnston's Notes on North America*, Edinburgh, 1851, I, p. 69). His remarks regarding the cultivation of buckwheat have a peculiar interest to us at this time, as showing how abundance of production may be considered an evil. He says that the grain is sufficiently nutritious; that those accustomed to its use say that it gives more strength than any other food; that it is very palatable, etc., and continues:

> But the objection to it as a staple food of the people consists in the ease with which it can be raised, the rapidity of its growth, the small quantity of seed it requires, the slovenly and unskillful husbandry which is sufficient in favorable seasons to secure average crops, and the casualties to which the crop is liable from the seasons. It grows on very poor land, from which no other grain crops in remunerative quantity can be obtained, and it is rarely favored with the luxury of manure. Like the potato, therefore, it induces an indolent and slovenly and exhaustive culture; and, supposing the crops fail, the poverty of the land and want of skill in the farmer will render it difficult to replace it by other crops which demand more industry, more skill, and more attention.

The qualities which he here describes, however, render the crop a valuable one, as has already been explained.

These characters gave it a value in colonial days which it has ceased to have. Flourishing on poor soils, especially adapted to hilly and rough regions and to a rigorous climate—its seeding time being so late in the summer that the promise of the other crops could be more or less predicted—it was then an important crop, especially when, from unpropitious seasons, other bread crops seemed likely to fail, and before railroads put the older and rougher states in competition with the more easily tillable regions of the West, and while we were working out the experimental part of our agricultural problem. Down to within fifty or sixty years it was a very important bread-plant over considerable portions of the country; but for a whole generation now the crop has been of diminishing importance, the production decreasing, both relative to the population and to the other cereals, until it is too insignificant in amount to produce any material effect on the bread supply of the country at large. The crop of 1879 amounted to only 11.8 pounds per inhabitant of the whole United States (reckoning 50 pounds per bushel of grain); that of 1869, 12.7 pounds; that of 1859, 27.9 pounds; of 1849, 19.3 pounds; of 1839, 21.4 pounds. Although of so light aggregate value, the loss of the crop would be felt by a large number of people with whom its use for breakfast cakes in winter has been established so long by custom and tradition. Formerly buckwheat cakes and other preparations of its flour in a measure took the place of bread in the poorer wheat regions when other bread crops were unusually short for any cause, but now its use for breakfast cakes is more of the nature of a luxury than of a necessity, and buckwheat cakes have ceased to be cheaper than wheat bread. In our larger cities the flour now sells at retail about as high as good flour does.

NATURAL HISTORY OF BUCKWHEAT.

Buckwheat is a cereal only in the sense that it is a bread-plant. It does not belong to the order of plants known to botanists as *Gramineæ*, but belongs to the order *Polygonaceæ* and the genus *Polygonum*. This is a large genus, embracing at least 150 species, some botanists, indeed, reckoning the number at more than twice that amount, the species being pretty well distributed over the earth, some one or more of them inhabiting nearly every country. They have a great variety of properties and habits, many of them containing an acrid principle, and some being actually poisonous. Our smart-weeds belong to this genus, as do also some of our bind-weeds. All the species have three-cornered seeds, or grains, and many of them contain starch. Many species of this genus grow native and wild in eastern Europe and western and northern Asia, and there originated the two species which together constitute buckwheat. The ordinary varieties cultivated in this country belong to the species *Polygonum fagopyrum*. This is supposed to be a native of Siberia; it has long been cultivated in the eastern countries, and was probably introduced into Europe in the middle ages. Some authors say that it was introduced from the East by the returning Crusaders; others that it was introduced into Spain from Africa by the Moors, and the French name (*Blé sarrassin*, Moorish wheat) is founded on this supposition. Our name, buckwheat, is derived from the German *Buch-weizen* (beech-wheat, the shape of the grains being that of the beech-nut). Another species, *P. Tartaricum*, which originated on the plains of Tartary, is more sparingly cultivated, both in the Old World and here. The first has been the longest cultivated, exists in the largest number of varieties, and constitutes the bulk of the crop in this country; the latter is cultivated in the cooler and more mountainous parts of Europe, because it is hardier and will succeed where the other species fail, and is somewhat grown in New Brunswick, in Nova Scotia, in Canada, and to some extent in Maine. The flour is said to be inferior to that produced from *P. fagopyrum*, and European writers say that it is slightly bitter; but in this country the two species go together in the markets, and most farmers know them merely as different varieties of the same species. Buckwheat, then, is a crop in most favor in regions where the soil is light and where other cereals are particularly liable to damage, and is well adapted to hilly regions and to small farms with mixed cultivation; but it is an uncertain crop. All the varieties flourish best on rather light soils without fresh manure. On too rich soils the straw is liable to be too heavy and soft, and consequently to lodge, and the seed is liable to be blighted.

CHEMICAL COMPOSITION OF BUCKWHEAT.

Inasmuch as there were no recent chemical analyses of American buckwheat, either of the grain, flour, or other food preparations, I have had a few made (Table XXV, p. 43). The proportion of bran is greater than in wheat, but, comparing the flour, we find the albuminoids in considerably smaller amount, as well as exceedingly variable, ranging from about 4 to 8 per cent., the average of wheat flour being over 11 per cent., and the lowest is higher than the best buckwheat flour. The starch is in larger amount, the percentage of oil being about the same, or in the flour a little greater than in the wheat flour. We see from this that the popular belief that buckwheat is less strengthening and more fattening than wheat for either man or beast is founded on a chemical reason. It is probable that the peculiar aroma of well-browned buckwheat cakes is derived from the decomposition by heat of some essential oil which is here classed among the fats.

Such chemical analyses are imperfect in that they only show the aggregate percentages of groups of substances; that is, all the nitrogenous compounds are determined together and classed as albuminoids. Starch, gum, sugar, and similar substances, as carbhydrates, and consequently special compounds or peculiar principles, existing in minute quantities but belonging to one or the other of these classes of chemical substances, may exist

and have great economic interest in any group, and yet be unknown chemically either as to character or the quantity in which they occur in the grain. As previously stated, buckwheat belongs to an order of plants many of whose species have peculiar medicinal principles. It is probable that some such exist in this cultivated grain, affecting its physiological value as food for man. It is a widespread belief that when buckwheat cakes are used as a considerable substitute for bread they cause a feverish condition of the system, which manifests itself in eruptions of the skin, and because of this some medical men condemn buckwheat *in toto* for human food. It is not probable, however, that their sentiments will ever become popular in a land of buckwheat cakes.

The albuminoids of buckwheat, which are analogous to the gluten of wheat in chemical composition, have very different paniferous qualities from the albuminoids of either wheat or rye. While probably equally nutritious so far as they go, they are not so tenacious in their physical character, and a light bread is not readily made from buckwheat flour. With suitable precautions, however, light cakes can be made. In practice it is common to mix the flour of buckwheat with wheat flour. The latter not only make the cakes lighter, but they brown better, and their appearance is improved. Some use Graham flour for this purpose, and in districts where middlings can be obtained they are often used for this purpose.

The fattening qualities of the grain when fed to animals, and especially to poultry and pigs, are universally recognized among farmers and others, and there is a widespread belief that a due proportion of buckwheat stimulates hens to a more fruitful production of eggs.

CULTIVATION AND TREATMENT OF BUCKWHEAT.

A light, dry soil is the best for the crop. The ground, if it is at all rough, is plowed and harrowed before sowing. The seed is then sown broadcast, from two to five pecks to the acre, according to locality, and the crop receives no after treatment. The time of sowing extends from the first of May to the middle of August, according to the locality, the favorite time over most of the region producing nearly all of our buckwheat being in the last half of June. In some districts, however, the early part of July is preferred, this depending upon the altitude and upon the liability of warm weather later in the season blasting the flowers. The flowers appear while the plant is still small, and come on in succession until killed by the frost. The seed also comes to maturity at different times, having grain at every stage of growth at the time when the frost comes. It is usually harvested when the earliest seed is fully ripe, but sometimes, owing to an inopportune warm spell, the earliest flowers are blasted by heat, and in that case a later production of seed constitutes the valuable part of the crop. In any case the crop must stand until it is matured. It is especially liable to injury by frost coming before it is fully ripe. It is cut by either cradle or machine, cured in small conical stooks, and thrashed as soon as it is dry enough. The coarse and very succulent straw is difficult to dry at the time of year when the crop is harvested, and consequently, if stacked, it is liable to heat. The straw is worth little for forage, is not nutritious, and some farmers say it is positively injurious to cattle.

Comparatively little attention has been paid to the special improvement of varieties, largely due to the fact of the small relative importance of the crop. There are, therefore, comparatively few varieties cultivated. In reply to schedule question 139, "What varieties of buckwheat are most grown?" "silver-hull" is returned in a majority of answers from the states where the crop is most important. This is considered the best variety, stays in flower longer than any other, ripens a few days earlier and more uniformly, and yields better, some say "nearly double". Silver-hull, with the indefinite "common", "black," and "gray", constitute nearly all of the answers. The "rough" variety returned a few times from Maine is probably the Tartarian.

Buckwheat is peculiarly exempt from diseases and from ravages by insects. Its principal mishaps are due to climatic causes, excessive drought or heat during growth, or to early frost. For such mishaps there is no remedy.

INSECTS INJURIOUS TO BUCKWHEAT.

Buckwheat is little subject to the attacks of insects; indeed, so great is its immunity that the planting of it is sometimes recommended as a means of driving insects away from fields (*a*).

Nevertheless some insects, especially those which feed indiscriminately upon whatever plants come in their way, feed occasionally upon this plant. Among these are the W-marked cut-worm (*Agrotis clandestina*), the larva of the white-lined morning sphinx (*Deilephila lineata*), the fall army-worm (*Laphygma frugiperda*), and the Rocky Mountain locust (*Caloptenus spretus*), all of which have been treated of previously in the sections on wheat insects or on those injurious to maize.

OTHER CEREALS OCCASIONALLY GROWN.

Here and there in the United States small quantities of other cereals are raised whose names have been already enumerated. Durra has often been introduced, and some thirty or forty years ago it had an extensive trial in the southern states. Here and there it lingered in cultivation in a small way for many years, but it has finally been dropped everywhere east of the drier plains. It has recently again attracted some attention in California, and it is probable that it will ultimately be a crop of some considerable importance in that state, Arizona, New Mexico, and Texas as food for cattle, poultry, and so on. Although it is not at all probable that it will ever rival in amount of production either of the other cereals already grown, it will probably occupy a place in their agriculture similar to that occupied by buckwheat in eastern agriculture.

a Riley, 7th Rept. Ins. Mo., 1875, p. 43.

In southern California large fields of canary grass are seen. I know of no other place in the United States where this is raised as a crop. In Ventura county and other places south of Santa Barbara it is reputed to be of very profitable cultivation.

Then there are various millets raised for forage here and there. In certain localities these are very popular, not only for the hay or straw, but for the seed; but the aggregate amount grown in the United States is the merest trifle compared with the other cereals, and it does not look as though their cultivation would increase. They have been on trial and cultivated here and there since colonial days, and they appear to be, as a whole, no more abundant now than they were a generation ago.

One of the millets, known sometimes as Italian millet, at others as Indian millet (*Sorghum vulgare*), extensively grown in the Old World for its grain, is cultivated in various portions of the United States for a very different purpose. It is the *broom corn*. This use of the material, so far as I have been able to learn, belongs almost entirely to the United States, and appears to have originated here, whether, however, in New England or in eastern New York I do not know; but its greatest cultivation has been in eastern and central New York, the Mohawk valley being especially adapted to it. It has been carefully developed for the brush rather than for the seed, and as its use for brooms requires that it be cut long before it is ripe its seed is of but little importance. It is claimed that if allowed to stand until ripe a large yield of seed is produced, weighing 40, 45, or 50 pounds per bushel, which is very nutritious as a food for swine and cattle, but it is so much inferior to Indian corn as a feed for animals that it will never be extensively cultivated here as a cereal.

Here and there some other one of the different cereals already mentioned may be found cultivated for fancy or as a matter of experiment, but the aggregate product of the whole of them, additional to the six whose cultivation has been spoken of more in detail, would amount to not more than a very few thousand bushels per year. The established cereals have been so long cultivated, are so differentiated into varieties, so adapted to different phases of cultivation and to the various uses to which man applies them, that it seems probable that the number will not be materially increased in cultivation, and, moreover, in our agriculture Indian corn so well fills a part which in other countries is occupied by a number of other plants, either for forage or bread, that it will doubtless continue to exclude various species whose cultivation is practiced elsewhere. The elimination of many of the minor cultivated species from our agriculture is largely due to the specialization of production and of method that has gone along with modern progress.

THE CHIEF FACTORS INVOLVED IN GRAIN PRODUCTION.

Our present enormous grain production is the result of a variety of conditions and factors, no one or two of which will account for all its features, and the relative importance of each would strike different persons quite differently. Hence, writers on the economical, political, and social phases of our agriculture may frame very different arguments by placing different values on these unlike factors. It may be well to enumerate the principal ones before discussing any of them more in detail.

First. A great breadth of fertile land, much of it easily tilled, and especially adapted to grain-raising.

Second. A favorable climate for the growth of crops and for securing the harvest.

Third. Our land laws are such that the sale and transfer of land are governed by the ordinary principles pertaining to other property. A good title is easily secured and easily transferred.

Fourth. Our homestead and pre-emption laws make it possible for any man to acquire land.

Fifth. There are no special privileges carried with the ownership of land, and land has to bear no more than its share of the burdens of taxation, while universal suffrage tends to keep down the taxes.

Sixth. As a result of the above, most of the grain farmers own the land they till, and they are free to till it as they please and to adapt their methods to their own tastes and their own special conditions.

Seventh. There is no peasantry, and agricultural labor is socially respectable.

Eighth. Political liberty, and along with this perfect freedom to form associations and organizations, in order to further the ends of this industry.

Ninth. The race, traditions, and previous history of the people.

Tenth. An enterprising and free agricultural press.

Eleventh. Official departments of agriculture attached to the general and state governments.

Twelfth. The profits of the business are here more widely distributed among the actual workers than is the case in any other department of production: whence special incentives to industry and thrift.

Thirteenth. There is no standing army to draw laborers from the fields, the cost of whose maintenance the land would have to pay.

Fourteenth. Social and intellectual conditions which have led to the wide use of labor-saving machines, and also to an intelligent management of the farms.

Fifteenth. Facilities of transportation.

This by no means exhausts the list; these are simply the more prominent factors, and only a part of them need to be further considered here.

HISTORY OF AGRICULTURE.

Man's first daily necessity is food, and in civilization this is drawn from the soil, either by the growing of crops or by the breeding of domestic animals. In early times, and even yet in most countries of imperfect civilization, these two departments of the art of agriculture have stood in more or less antagonism to each other; but in countries of the highest civilization, and where soil and climate permit, they are so mutually related that neither can be discussed independently of the other.

The art of agriculture is older than history; the science of agriculture is entirely modern. The beginning of the art dates with the beginning of civilization, and the condition, methods, and prosperity of this industry in any country at any time are related to the whole previous history of that country. As it is the most essential of productive industries, so it has been the most conservative, the most adaptive, and the most persistent. It cannot be absolutely killed in any country short of driving out civilization or exterminating the inhabitants. It survives all sorts of political and social change. Revolutions may occur, dynasties change, and even new races occupy the ground, but agriculture endures and perpetuates within itself the methods and traditions of previous generations. The words and the processes in use in this art often tell of times when other dynasties ruled and even other races inhabited the soil. As fossils preserved in the strata tell the geological history of the earth, so in more than one country of the Old World the names, terms, language, and methods of agriculture tell of a previous social and political history or even of a different race-occupation. This industry has therefore its own peculiar history, and while it has grown and developed along with our civilization, its progress has not been parallel with it, or even with that of the general intelligence and culture of the race. In the infancy of civilization it was the most advanced of the industrial arts, but, this infancy passed, it did not grow as most of the others did. For a period of nearly four thousand years, while the race advanced enormously in general culture, and while some of the arts grew from a rude beginning to a higher development than they now have, there was practically no advance in the art of agriculture as a whole, or, if it made any progress at all, it was so very little that it seems as nothing when compared with the progress in the other arts and industries.

This long suppression of growth was due to a variety of causes, the chief of which were the social condition of those who actually tilled the soil, the lack of political liberty, and the systems of land tenure. After a rest, in which the art remained practically stationary for such long ages, it has awakened and grown suddenly to its present condition, this rapid progress being coincident with the rise and growth of the physical sciences and with the extension of political liberty.

Egypt was undoubtedly the cradle of our civilization. Its system of agriculture, although peculiar in itself, gave direction and tone to that of the whole Mediterranean region. The black soil of the Nile delta gave the country its original name, the "Black Country", by which title it was known among its early inhabitants. Modern investigation has probably given us a correct idea of the systems and methods of agriculture which have existed there back to a period two or three thousand years before the Christian era, some Egyptologists say even longer. Under a sort of feudal system of tenure the land was owned by a nobility and tilled by an inferior class, who were sometimes slaves, bought, stolen, or captured in war, and sometimes by a free but socially degraded class. As an abstract principle, labor was glorified, religious rites were performed in special honor of agriculture, and the priests regarded the plow as the most sacred of implements, but the laborer himself was socially despised. On the monuments and in the hieroglyphical writings there is frequent mention of these workers, called the "mob", the "stinking masses", and by similar terms of opprobrium. Such was the condition of the tiller of the soil in Egypt long before Abraham was born, a thousand years before Moses wrote, and this, as a whole, remained his condition, and such continued the sentiment of the better classes toward him, in the most of those portions of the world which gave us our civilization down through the centuries to the time of our own colonial history. During all this long period agriculture had praise and honor enough in the abstract. To own a landed estate, provided one did not till it himself, was an honor, and usually carried with it special political privileges and social preferences, but the actual tillers of the soil were held in social inferiority.

There is no more curious chapter in the history of our civilization than that relating to the differences of sentiment with which this vocation was regarded in the abstract and that with which the workers in it were regarded in practice. The honor which was extended to the art itself and to the product of that art, to the proprietorship of the land, and even to the land itself, to the beast which drew the plow, and even to the plow itself, was not extended to the laboring men, who were the actual producers; and if this art of arts did not improve any faster for so many ages, we need not look farther for an explanation than to the political and social status of the class who were actually employed in the fields.

Early Egyptian sculpture and writings give us a reasonably complete idea of the methods of cultivation in all its details, from the preparing of the soil to the storing of the cleaned grain in the granaries, with numerous and abundant illustrations of the implements used. Between that early date and the middle of the last century the plow remained almost the same, and the same was true of the hoe. With most of the processes and most of the implements there was no essential improvement, except the addition later of a little more iron; and the sickle, which

is often sculptured on the monuments, was identical in shape and manner of use with that used all over Europe down to within the last forty years, and which is still in use in many countries. The same may be said of the methods of thrashing, of cleaning grain, of transporting and storing it, and even of their cattle, which seemed as excellent in shape and form and as carefully bred, and, so far as we can see, of equally good breeds, as those which existed down to the middle of the last century.

The social degradation associated with labor in general and with field labor in particular I consider the most potent factor in this suppression of the development of agriculture. This, combined with the theories which were held about land ownership, the feudal tenure which remained so long in Europe, and the warlike spirit of the times, kept in ignorance the masses who tilled the soil. Their elevation had to precede improved methods and improved tools or implements. It is a law of this vocation that where the laborers are ignorant the tools of the farm must be heavy, clumsy, rude, and ill-adapted to rapid work. This is the universal experience; and, moreover, ignorant field laborers resist innovation and improvement more universally and more strongly than do laborers who work indoors, no matter how intelligently the labor is directed through overseers or managers. A very different rule obtains, as a whole, from that which pertains in manufactures or in the other arts, where ignorant labor may be directed by an intelligent head, and where very ignorant workmen often use the most improved machinery very expertly and very efficiently. On the farm or plantation, where the laborer is not so immediately under the eye of the overseer nor the work susceptible of such artistic comparison, it is different from what it is in manufactories, where many people work under a roof together. We see a phase of this on the larger cotton and sugar plantations in countries where slave labor is used, and where we often find the most improved machinery for the preparation of the crop used along with the rudest and most clumsy implements in the field. In the sugar-house or gin-house the best machines may be successfully and skillfully used, while in the field the most clumsy hoes, carts, and other tools remain. But in such cases, as a matter of fact, such improved machinery as is used is rarely invented amid such surroundings; the inventions come mostly from places where the workmen as well as the overseers are intelligent. In the countries of southern Europe, in Mexico, and in fact everywhere, if we find the agricultural laborers an ignorant and despised class, we also find the art non-progressive and field implements and tools rude, or at least heavy; and if they who cultivate the soil have also the direction of the cultivation, then all the processes are rude. Even with intelligent direction, if the farmers and the laborers belong to a socially inferior class, the country must fail of its greatest possible production, as witness England, where we have the most brilliant example the world has ever seen of a highly developed system of agriculture, in which ignorant labor is directed by a more intelligent class. Now that system is breaking down under the competition with a different one. "American competition" is not merely a competition of land, soil, and climate; it is a competition of the methods and of the men.

In all those countries of Europe with which we are in agricultural competition, and which are buyers of our agricultural products, agriculture is still influenced in a variety of ways by the feudalism of the middle ages. All those countries from which we derive our blood and our civilization passed through the feudal stages. Feudalism at first shaped agriculture in its social and legal aspects and affected it later by its traditions. Because of the principle already spoken of, by which this vocation preserves within itself the history of bygone social sentiment or industrial methods, various traditions and sentiments of feudalism still hamper, modify, and control the vocation, even where the legal aspects have entirely changed. The ancient Egyptian laborer on the soil had few rights which his lord was bound to respect, and this practically remained in Europe until feudalism was destroyed. It was a maxim down to the last century that "between the lord and his tenant there is no judge but God". The tenant could not hold and enjoy the fruits of his labor as of right, and between legal restrictions, social oppression, the tithes of the church, and the taxes of the lords there was little left to the laborer, who had practically little or no incentive to improve his methods, to increase his product, or to aspire to an intellectual culture which his social position forbade him to use to his best advantage. When the legal restraints were removed the social customs and class traditions remained.

It is curious to see in how many ways this social and political repression has affected this vocation. It not only did not foster invention or improvement, but, on the contrary, it actually impeded and prevented the introduction of such improved machines as were devised. It fostered prejudices against all new things connected with agriculture, against new crops as well as new implements. Notice how slowly the American food-plants, Indian corn and potatoes, came into cultivation in Europe. These plants appeared in Europe soon after the first voyage of Columbus, and both were well known and described long before the settlement of any of the colonies of the present United States; yet neither (except potatoes in Ireland and maize in Portugal, for which there were special reasons) obtained a sufficient foothold to be an abundant product of cultivation in Europe until the present century. Indian corn actually spread in cultivation faster among the savages of Africa and the half-barbarous peoples of Asia than in any of the enlightened countries of Europe.

Another way in which this repression of agricultural laborers affected the vocation itself was seen in the fact that it was believed to foster, or at least to produce, pauperism and crime itself, and under the impositions laid upon farm laborers this was very probably true. An eminent writer as late as 1824 showed by statistics that in England the amount of pauperism, vice, and crime was greater among the farm laboring population than among the manufacturing population, and he illustrates his statements with the comparison of six agricultural counties of

England with six manufacturing counties, and comments on the statistical tables which he produces thus: "It appears that in the agricultural counties the proportion of paupers is above 100 per cent., of criminals 60 per cent., and of poor rates 150 per cent. more than in those where manufactures prevail."

Our very language preserves in the meaning of its words many evidences of the social degradation in which the tillers of the soil were formerly held. Philologists tell us that many words which were formerly applied to those who tilled the soil or were connected in some way with farm life, having lost their original meaning, still exist in our language, with now only a low moral or social signification. "*Villein*," in the middle ages, was merely a feudal tenant, and Blackstone describes in detail two sorts of them having different legal status. A "*peasant*", in the same way, was a countryman, and while the term is applied to small farmers in general it has a low social value. "*Boor*" was formerly merely a plowman or peasant, and "*churl*" was "a free tenant-at-will". "*Incivility*" meant merely the awkward behavior seen by city people in their unpolished country or farm acquaintances, and so on through a curious list. The significance of this in the present connection is in the indication it gives of the social contempt in which the class was once held, and it furnishes an explanation why agriculture did not progress faster in Europe, and why it still lags behind the other arts in many parts of the world which boast of a high civilization in other respects. Our own history throws much light upon the causes why agriculture did not advance during so many centuries.

The present aspects of American grain production, its recent rapid growth, and the general aspect of the vocation in this country, are explained by our exceptional social and political history. This industry is perfectly plastic and adaptive, and in any country is molded by the social, political, economical, and physical conditions of that country. In Egypt agriculture very early attained as high a state as those conditions allowed. If it did not advance later, as the other arts did, it was because the political and social conditions which more especially control agriculture continued essentially the same down through the centuries; there could be no farther growth until those political and social factors were changed and farmers were left as free to develop their art as the men of any other class. The American colonies first established this condition and made it a practical fact, and the present aspect of our grain production is the natural and necessary result of our political and social history. It is profitable, therefore, to review our own special agricultural history in this connection.

HISTORY OF AMERICAN AGRICULTURE.

The history of agriculture in the United States, particularly as it is related to grain production, falls naturally into four periods.

The first period is that of our colonial days, extending over about one hundred and sixty or one hundred and seventy years, or from the first settlement down to the American Revolution, and may be called the period of experiment.

The second, beginning with the Declaration of Independence, extends over a period of about fifty years, or to the time when the cast-iron plow came into common use throughout the country. This was the period of awakening, of the formation of agricultural societies, and of the beginning of a science of agriculture.

The third period, of about thirty years, began when the introduction of the cast-iron plow was complete, say about 1825, and extended to the time when the reaper began to come into common use, about 1855. During this period thrashing-machines, which had really been invented long before, became universally used; railroads began to be built and grew to considerable proportions, commercial fertilizers came into use, and advances were made in numerous other directions.

The fourth period began when the reaper became common, and extends to the present time. It includes the introduction into general use of the steam-thrasher, of improved harvesters and reapers, and the farther improvement of many labor-saving machines previously invented, a marked extension in the land transportation of grain by railways, the use of the elevator in handling grain, the ocean transportation of grain by steam, and the greater specialization of agricultural productions.

Each of these epochs or eras in our agricultural history is correlated with political and social events happening here or elsewhere about the same time, which make these dates important ones in the history of the world's material and intellectual progress, the agricultural changes in our country being but phases of a general progress in the industrial arts which has gone along with the growth and development of the physical sciences and the spread of political and religious liberty.

THE FIRST PERIOD.

The settlers of the original thirteen colonies, and most of the immigrants in the earlier days of the republic, came more especially from the middle classes of various countries of Europe, politically and socially representing