INTRODUCTION.

TABLE No. 1.

Acres of land in farms, and cash value.

STATES.	IMPROVED.	UNIMPROVED.	CASH VALUE.
	Acres.	*Acres.*	
Alabama	6,385,724	12,718,821	$175,824,622
Arkansas	1,983,313	7,590,393	91,649,773
California	2,468,034	6,262,000	48,726,804
Connecticut	1,830,807	673,457	90,830,005
Delaware	637,065	367,230	31,426,357
Florida	654,213	2,266,015	16,435,727
Georgia	8,062,758	18,587,732	157,072,803
Illinois	13,096,374	7,815,615	408,944,033
Indiana	8,242,183	8,146,109	356,712,175
Iowa	3,792,792	6,277,115	119,899,547
Kansas	405,468	1,372,932	12,258,239
Kentucky	7,644,208	11,519,053	291,496,955
Louisiana	2,707,108	6,591,468	204,789,662
Maine	2,704,133	3,023,538	78,688,525
Maryland	3,002,267	1,833,304	145,973,677
Massachusetts	2,155,512	1,183,212	123,255,948
Michigan	3,476,296	3,554,538	160,836,495
Minnesota	556,250	2,155,718	27,505,922
Mississippi	5,065,755	10,773,929	190,760,367
Missouri	6,246,871	13,737,939	230,632,126
New Hampshire	2,367,034	1,377,591	69,689,761
New Jersey	1,944,441	1,039,084	180,250,338
New York	14,358,403	6,616,555	803,343,593
North Carolina	6,517,284	17,245,685	143,301,065
Ohio	12,625,394	7,846,747	678,132,991
Oregon	896,414	1,164,125	15,200,593
Pennsylvania	10,463,296	6,548,844	662,050,707
Rhode Island	335,128	186,096	19,550,553
South Carolina	4,572,060	11,623,859	139,652,508
Tennessee	6,795,337	13,873,828	271,358,985
Texas	2,650,781	22,693,247	88,101,320
Vermont	2,823,157	1,451,257	94,289,045
Virginia	11,437,821	19,679,215	371,761,661
Wisconsin	3,746,167	4,147,420	131,117,164
Total States	162,649,848	241,943,671	6,631,520,046
TERRITORIES.			
District of Columbia	17,474	16,789	2,989,267
Dakota	2,115	24,333	96,445
Nebraska	118,789	512,425	3,878,326
Nevada	14,132	41,986	302,340
New Mexico	149,274	1,265,635	2,707,386
Utah	77,219	12,692	1,333,355
Washington	81,869	284,287	2,217,842
Total Territories	460,872	2,158,147	13,524,961
Aggregate	163,110,720	244,101,818	6,645,045,007

AGRICULTURE IN THE UNITED STATES.

By the foregoing table it will be perceived that, in 1860, the agricultural area of the country embraced 163,110,720 acres of Improved Land, and 244,101,818 acres of Land Unimproved. In other words, for every two acres of improved land there are three acres of land connected therewith not yet under cultivation; while the gross aggregate of uncultivated territory, fertile and waste, swells to 1,466,969,862 acres.

This fact gives color to the agriculture of the country. Land is abundant and cheap, while labor is scarce and dear. Even in the older-settled States there is much land that can be purchased at extremely low rates; and, by a recent act of Congress known as the Free Homestead law, every citizen of the United States, or any foreigner who shall declare his intention of becoming a citizen, can have a farm of 160 acres without charge. As good land as any in the world is offered to actual settlers on these easy terms.

Under such circumstances it is evident that the *intensive* system of agriculture which is practiced in some older and more densely populated countries, where labor is abundant and the land mostly under cultivation, cannot, as a general rule, be profitably adopted at present in this country. It has been said that American agriculture is half a century behind that of Great Britain. In one sense this is, perhaps, true. Our land is not as thoroughly under-drained, manured, and cultivated as that of England, Scotland, or Belgium; but we can, and do now, produce a bushel of wheat at much less cost than the most scientific farmer of England can by the best approved method of cultivation, *even if he paid nothing for the use of his land.*

We do not contend for a superficial system of agriculture. All that we ask is, that those who censure our farmers for not cultivating and enriching their land more thoroughly, should take into consideration the circumstances which have surrounded us. High farming involves high prices. The system of cultivation and manuring which is profitable in Great Britain would not be remunerative in the State of New York, because labor is higher and produce lower; and the system which is profitable in New York might not be advantageous in Iowa. An artificial manure that could be profitably used on wheat which brings $2 per bushel, might prove a very unprofitable application where wheat is worth only $1 50 or $1 per bushel. In the State of New York, where land is comparatively high and prices good, there are many instances where $20 to $30 per acre have been expended in under-draining, with great profit. But it does not follow that the same expenditure would be advisable in a section where the best of land can be purchased in fee simple for $10 per acre. The same is true of all other improved processes of agriculture. Their adoption is simply a question of profit and loss. Where land is cheap and rich, it will not pay to expend much labor and money in making or in purchasing manure.

But, it may be asked, "Will not the practice of raising crops without manure impoverish the land?" Certainly it will; but our hardy pioneers, having enjoyed the cream of the soil as a reward of their enterprise, go into a yet newer country, cut down the original forests, clear up the land, and raise all the grain they can. The money thus obtained is expended in the construction of roads, houses, barns, schoolhouses, churches, and colleges. Smiling villages and populous cities spring up, and in a few years the comforts, convenience, and even luxury of civilization are enjoyed—all the result of wealth which has been dug from the soil. Admitting that after all this is effected, the land is not so rich as when first cleared, and that more labor has to be expended in its cultivation, nevertheless much good has been accomplished. The fact is, this question of impoverishing the soil is not clearly understood. Much has been written on this subject, both in Europe and America; and a leading English agricultural journal, the Mark Lane Express, says: "It has long been our opinion that the grain-exporting power of the United States was likely rather to diminish than to increase under the ordinary circumstances of the country. This opinion was derived from the statistical notices of the census and of the Patent Office, and confirmed by the statements of Jay, Wells, and other American writers on the subject. These authorities have warned the agriculturists that if an alteration did not take place in the mode of cultivation, the United States would, in a few years, require a large importation of wheat, instead of being able to export to Europe."

This was written in 1861. Since then we have *exported more grain to Europe than during any former period.* The reason assigned for the opinion thus expressed, that the United States would soon become a wheat-importing instead of a wheat-exporting country, is "the scourging and exhaustive system of husbandry now practiced." There is *some* truth in these remarks. Our system of cultivation has been, and is now to some extent, a scourging and an exhaustive one. *It takes more from the soil than it returns;* and the time will come, as it already has in some sections, when wheat cannot be as easily or as cheaply raised as it was when the country was new. But it does not at all follow from this that the United States will cease to grow all the wheat it requires. We will have to manure our land and cultivate it better; but this is nothing more than has been experienced in other countries. We shall farm better as soon as such improvement is perceived to be profitable and necessary.

But what are we to understand by an "exhausted soil?" No phrase is more common in agricultural literature, and none more vague and indefinite. JOHN BENNETT LAWES, than whom there is no higher authority, speaking of his field on which his celebrated wheat experiments were made, says, it was purposely "*exhausted*" before the commencement of the experiments, and in another of his able papers in the *Journal of the Royal Agricultural Society*, he says: "All the experimental fields were selected when they were in a state of agricultural exhaustion." And he tells us what he understands by the term. He says: "The wheat-field after having been manured in the usual way for turnips at the commencement of the previous rotation, had then grown barley, peas, wheat, and oats, without any further manuring, so that when taken for experiment in 1844, it was, as a grain-producer, considerably more exhausted than would ordinarily be the case."

Here we have the highest English agricultural authority speaking of land as "exhausted" after having grown four crops without manure, the previous crop having been manured; and if this is all that is meant by exhaustion of the soil, we must admit that much of the cultivated land in the older parts of the United States has been exhausted. But one plat in Mr. Lawes's wheat-field has produced a crop of wheat *every year* since 1844, averaging about fifteen bushels per acre, and this without one particle of manure. It is clear, therefore, that the land itself was not exhausted, and in speaking of this as an agriculturally exhausted soil, Mr. Lawes simply intended to say that the *manure* which had previously been used was exhausted.

In this sense our farmers are rapidly exhausting their soil. The English farmer manures his land, grows three or four grain crops, and then considers his land exhausted. The American farmer cuts down the forest, burns more or less of the timber on the land, and scatters the ashes on the surface, then turns up the soil as best he may among the stumps, sows his grain and gets good crops. Why? Because the land has *been heavily manured by nature.* The trees and underwood have through their deep roots been drawing up mineral matter from the earth, and the leaves absorb carbonic acid and ammonia from the atmosphere.

Shall he avail himself of this manure, or shall he let it lie dormant? What would be said of the farmer who should give his land a heavy coat of manure and then neglect to raise crops? If it will produce good wheat and other cereals that command the ready cash, is he to be accused of adopting a "scourging and exhaustive system of agriculture" for growing these crops? And yet this is what the American farmer has done. His land was rich, but he was poor and raised those crops which afforded the most immediate profit. We would not be understood as advocating the continued growth of grain crops without manure; our only object is to show the erroneous conclusions to which a misuse of statistical facts may lead, and to vindicate the American farmers from the charge so frequently preferred against them, of recklessly exhausting their soil. We think they have simply exhausted the manure which nature has spread upon their recently cleared fields, and that in doing so to a prudent degree, they were not unwise.

But when this natural manure begins to fail, we must manure the land and vary our system of agriculture. That any of our so-called exhausted land can be speedily restored to its original fertility, we have abundant evidence. All that is necessary, is to cultivate the soil more thoroughly, under-drain where it is wet, sow less grain and more clover and grass, keep more stock, and make more and richer manure, and the farmer is wise who makes the transition from natural to artificial fertility easy and gradual, so as to avoid all sterility.

American agriculture is in a transition state. In the older-settled sections of the country there is much land that has been exhausted of its original fertility. Here the old system of farming, which was simply to raise all the grain that the land would produce, is no longer profitable. But yet some farmers, with that aversion to change for which they are everywhere proverbial, are slow to adopt an intelligent system of rotation and manuring, and cling to their old ways.

One of the ablest agricultural writers of England remarked some time since, that his only hope of seeing any great improvement in agriculture lay in the rising generation. This remark is quite as applicable to American as to English agriculture. We must look to the intelligent young men of our country for any great improvement in its agriculture, and it is a matter on which we may well congratulate ourselves, that even during the present terrible struggle, agricultural education is not neglected. We have two agricultural colleges in active operation, and others in process of organization. Our young men are beginning to realize that agriculture is worthy their highest ambition, and that in no other pursuit will intelligent labor meet with a surer reward.

Farming implements and machinery in use, value of.

STATES.	1860.	STATES.	1860.
Alabama	$7,433,178	Rhode Island	$586,791
Arkansas	4,175,326	South Carolina	6,151,657
California	2,558,506	Tennessee	8,465,792
Connecticut	2,339,481	Texas	6,259,452
Delaware	817,883	Vermont	3,665,955
Florida	900,669	Virginia	9,392,296
Georgia	6,844,387	Wisconsin	5,758,847
Illinois	17,235,472		
Indiana	10,457,897		
Iowa	5,327,033	Total States	245,205,206
Kansas	727,694		
Kentucky	7,474,573		
Louisiana	18,648,225	TERRITORIES.	
Maine	3,298,327		
Maryland	4,010,529	District of Columbia	54,408
Massachusetts	3,894,998	Dakota	15,574
Michigan	5,819,832	Nebraska	205,664
Minnesota	1,018,183	Nevada	11,081
Mississippi	8,826,512	New Mexico	192,917
Missouri	8,711,508	Utah	242,889
New Hampshire	2,683,012	Washington	190,402
New Jersey	5,746,567		
New York	29,166,695		
North Carolina	5,873,942	Total Territories	912,935
Ohio	17,538,832		
Oregon	952,313		
Pennsylvania	22,442,842	Aggregate	$246,118,141

Statistics of agricultural implements produced in the United States during the year ending June 1, 1860.

	No. of establishments.	Capital employed.	Raw material, value of.	Number of hands.		Cost of labor.	Value of product.	Value of product in 1850.
				Male.	Female.			
New England States	213	$1,021,800	$749,530	1,577	1	$534,837	$1,934,924	$1,662,426
Middle States	678	3,972,116	2,026,233	5,113	1	1,634,496	5,791,224	2,471,806
Western States	840	5,807,358	2,526,578	7,606	....	2,529,809	8,707,194	1,923,927
Southern States	241	664,265	310,569	1,095	2	356,232	1,018,913	784,452
Pacific States	10	11,700	12,259	19	....	15,300	35,705	....
Total	1,982	11,477,239	5,625,169	14,810	4	5,070,674	17,487,960	6,842,611
Scythes *	22	667,025	214,037	474	....	174,948	552,753	....
Shovels, spades, hoes, and forks*	53	961,000	865,068	1,183	1	413,540	1,635,676	....
Cotton-gins *	57	758,825	287,488	614	2	266,168	1,152,315	....
Total	132	2,386,850	1,366,593	2,271	3	854,656	3,340,744	....
Aggregate	2,114	13,864,089	6,991,762	17,081	7	5,925,330	20,828,704	....

* Value of, not represented in 1850.

AGRICULTURAL IMPLEMENTS.

PROBABLY no exhibition of our national statistics is more important or satisfactory, than the foregoing tables showing the great increase and present extent of the construction and employment of agricultural implements and machinery.

The high price of labor has stimulated mechanical invention. In no other country are there so many cheap and efficient implements and machines for facilitating the labors of the farm. In older and richer countries we find more expensive machinery, but, as a general rule, it is too complicated and cumbersome for our use. We have been thrown on our own resources, and have no reason to regret it.

Whatever augments the productive capacities of the soil, or increases the profits of labor and capital employed on so large a scale, either in the first production or the subsequent handling of crops, becomes a practical element in the general prosperity. The vast power resident in machinery, even the more simple applications of the mechanical powers, with their modern perfection of detail, gives this creative force, which may be increased almost beyond computation by the use of steam as a prime mover. Thus, every machine or tool which enables one farm-hand to do the work of two, cheapens the product of his labor to every consumer, and relieves one in every two of the population from the duty of providing subsistence, enabling him to engage in other pursuits, either laborious, literary, professional or scientific, practically duplicating at the same time the active capital or the purchasing power of the producer, thus enhancing the comfort of all and stimulating the common enterprise.

When the utility of labor-saving appliances in agriculture shall come to be fully apprehended, and made generally available in the clearing, draining, and tilling of the soil; in the planting, irrigating, cultivating and harvesting of crops, and in their speedy preparation for market, we may regard the occurrence of famine, either from deficiency of labor, as in time of war, or from the contingencies of soil and climate, as practically impossible. Already has the use of improved implements, aided by scientific and practical knowledge in all the processes of the farm, resulted—like the use of machinery in other departments of industry—in such a diversification and increase of the forms of labor, and such a cheapening of its products under ordinary circumstances, that we rarely hear of the unreasoning and jealous violence of farm laborers, who in England, a generation since, wantonly destroyed all the agricultural machinery of a neighborhood, even to the common drills, in the mistaken opinion that its use was an infringement of their rights to labor. Its palpable advantages has disarmed the traditionary prejudice of the husbandman himself, who is fast becoming as progressive as his neighbor. It has lifted much of the drudgery from the shoulders of the country-bred youth, who no longer loses his elastic step and suppleness of limb in the moil of the farm, which he once instinctively shunned as degrading, while he sought the lighter and more or less intellectual pursuits of the city. It has thus tended to elevate the pursuit of agriculture to its proper position in the social scale, as one of dignity and independence, and not one of mere physical toil, to be shared in common with the brute.

It is in the United States especially, where vast areas of improvable and fertile lands invite the labor of a sparse population, that agricultural machinery is capable of effecting its greatest triumphs. Far back in our colonial days the stream of emigration bore the young and adventurous of the Atlantic settlements toward the richer bottoms and prairies of the west. A gradual deterioration of the fertility of the soil of the older States from constant cropping, and the consequent increased labor required with the imperfect implements formerly in use, were sufficient to maintain the yearly exodus. Columns of hardy laborers from Europe have annually sought our shores, and for the most part have as promptly filed off in the same direction in quest of cheap farms, or in the more alluring search for the precious metals. As a consequence, civilization smiles upon the shores of either ocean, and looks down from the mountain summits which separate them. A prosperous and expanding agriculture, with most of the arts which it demands and fosters, has been rapidly extended over a territory of enormous breadth and fertility, which lacks only the labor of adequate cultivation to develope its vast resources in a wealth of cereal production as yet scarcely imagined. The very causes, however, which have opened up this territory to agriculture and the arts have produced and maintained a continued scarcity of labor, and kept its wages at a permanently high price. It is this enormous area of farm lands, and this great dearth of manual labor throughout the Union, that our inventors and mechanics have from an early period been invited to supply with labor-saving contrivances.

Fortunately the people of this country have not been slow to adopt the most efficient substitutes for animal power, and the inventive talent of the nation has found an ample and remunerating field for its exercise in originating and perfecting instruments adapted to all the wants of the farmer and planter. The great staple products of cotton, grain, and hay, have especially demanded the substitution of mechanical for muscular labor, and some of the happiest products of American skill have been the result.

Scarcely less valuable in the aggregate, however, are the numerous minor inventions whereby the labors of the farm and the household have been saved. Implements of this kind make up a large portion of the stock in trade of the makers and venders of agricultural wares. This successful application of the mechanics of agriculture has happily supplemented the rapid displacement of a large amount of rural labor called off by the war, manufactures, and the mines, and has itself in turn been stimulated by the high prices of produce consequent upon increased demand both for home and foreign consumption.

Evidence that this scarcity of labor in the United States has been a principal incitement to the invention and manufacture of agricultural implements is found in a late report of the Commissioner of Patents, who states that "the most striking fact connected with this class is the rapid increase of applications filed. Notwithstanding half a million of our agriculturists have been withdrawn from the farm to engage in military service, still the number of applications for patents on agricultural implements, (exclusive of reapers, bee-hives, horse hay-forks, and horse hay-rakes,) has increased from three hundred and fifty in 1861, to five hundred and two in 1863."* The number of patented inventions belonging to the class of agriculture, previous to 1848, was 2,043, since which time the number has been vastly augmented. In the United States, as in Europe, the principal improvements in agricultural and horticultural implements have been made within the present century. As a branch of manufacture, this class of machinery has been wonderfully extended within the last ten or fifteen

* Introductory report of Commissioner of Patents for 1863, page 21.

years, having received a great impetus from the exhibition in London in 1851—where our own progress in this respect created so much surprise among foreigners—and the several international fairs which have taken place since that time. Throughout Europe and America, until a comparatively recent date, the implements of the farm remained extremely rude, primitive, and inefficient in form. Attention appears to have been first strongly awakened to the value of mechanical aids in farming about the period of the first introduction of agricultural societies.

The Royal Society, established in England in 1660, encouraged improvements in agriculture. But in the transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce, instituted in London in 1753, we trace a still more liberal promotion, and a general interest in agricultural progress. These societies prepared the way for the establishment of purely agricultural associations. The first associated effort made in England to encourage agriculture by specific rewards was in the premiums annually offered by the Society of Arts after the year 1758, for experiments in husbandry, and for improved implements of the farm. The first agricultural society in Great Britain, the Society of Improvers in Scotland, established in 1723, encouraged improvements in tillage, and in farm implements, with such effect that "more corn was grown yearly where corn never grew before than a sixth of all that the kingdom used to produce at any previous time."* About the same time Jethro Tull introduced—along with his system of deep tillage and thorough pulverization of the soil—the use of the horse-hoe, the drill, and other improved utensils, and became the greatest practical improver of agriculture in the last century. He even attempted an automatic threshing-machine, and incurred the usual charge of being a visionary innovator. The profit of drill husbandry was also demonstrated by John Wynn Baker, of Kildare, in Ireland, who in 1766 commenced a series of experiments with a view of systematizing agricultural knowledge by establishing fixed principles of rural economy, and showed by actual experiment that the saving effected by the drill and horse-hoe amounted in fifteen years to the fee-simple of all the tillage lands of the kingdom. He established as a part of his project a manufactory of farm implements, and issued a catalogue of seventy different machines and tools, all new to the agriculturist at that time. Agricultural machines were thenceforth made with more regard to scientific principles.

The earliest agricultural associations in the United States were established in 1785, in South Carolina and Pennsylvania In the first-mentioned State, indeed, nearly a century before, the assembly passed "an act for the better encouragement of the making of engines for the propagating the staples of the colony," which was followed by legislative encouragement to various individuals who improved the machines for pounding and cleaning rice. In 1784 the assembly enacted a regular patent and copyright law, giving to the authors of books and the inventors of useful machinery the exclusive benefit of their productions for fourteen years. The Philadelphia Society for Promoting Agriculture, established in March, 1785, and after a period of inaction revived and incorporated in 1809, through the exertions of the Hon. Richard Peters, awakened much attention to the subject of improved implements and machinery, by means of a judicious system of premiums, and of practical essays. In July, 1809, Mr. Peters proposed to the society "a plan for establishing a manufactory of agricultural instruments, and a warehouse and repository for receiving and vending them." In that paper he states that no manufactory of agricultural implements in general existed in the United States, although the demand was prodigiously great. The proposed manufactory was to produce, under the patronage of the society, every implement of husbandry, both common and extraordinary, in use at home or abroad, if approved on trial; none to be sold without inspection and the stamp of the society's agent. His plan also embraced a collection of models in the manner of the Conservatory of Arts and Trades, established at Paris a few years before. The Massachusetts Society for Promoting Agriculture, incorporated in 1792, labored successfully to promote like improvements. The first statistics of the national industry collected in the following year embraced one small manufactory of hand-rakes, in Berkshire county, Massachusetts, which made annually 1,100 rakes, valued at $1,870. The census of 1820 gave very

* Philps' History of Progress in Great Britain.

meagre information respecting this branch of production. Several small manufactories of ploughs, scythes, axes, shovels, hoes, &c., existed in different States, and one of patent steel pitchforks, in New Haven, Connecticut, turned out about $5,000 worth annually. During the next thirty years the business increased more rapidly, the traditionary prejudices of farmers gradually giving way before the established utility of labor-saving appliances in the cultivation of the vast domain of our national agriculture. The form and finish of ordinary farm tools were much improved, and a few grand inventions were brought forward. In 1833 rice was successfully threshed out in the southern States by animal and steam power. The harvesting of grain by machinery, which had been several times essayed at an earlier period, was the same year attempted at Cincinnati, where the late Obed Hussey cradled wheat as fast as eight persons could bind it.

State and county agricultural societies were, during the same time, organized in nearly every section of the Union where they did not already exist. The system of annual fairs and exhibitions of farm products and machinery instituted by them, and encouraged by public awards of premiums, powerfully stimulated invention, and made our farmers familiar with the best forms of agricultural implements in use at home or abroad. Of like influence, but wider scope, was the American Institute in New York, which has made its influence felt in every department of industry.

The exhibition of the industry of all nations held in London in the year 1851 exerted a vast influence upon the progress of ideas on the subject of mechanical agriculture, as it did upon all other branches of art. The contrasts there presented between the highest results of modern skill and ingenuity exercised upon the implements of husbandry, and the rude models of the plough and other tools to be seen in the Indian department, little improved since the days of the Hebrew prophets, forcibly illustrated the agency of the mechanic and the engineer in the art of subduing nature to the will and service of mankind.

Although the number of implements of each kind exhibited by the United States on that occasion was small, the variety shown was considerable. The general excellence of American ploughs, reapers, churns, scythes, axes, forks and other implements, was acknowledged by the public admission of disinterested judges from all parts of the world, and the particular merits of many by the medals awarded, and by the number of orders received at the time by the manufacturers. The triumph of the American reapers marked a new era in agriculture, and gave a strong impulse to the inventive genius of Europe and America. The emulation awakened among manufacturers by the London exhibition was still further stimulated by the Crystal Palace exhibition, which took place in New York in 1853–'4, when more than one hundred American manufacturers competed for honorable distinction in this department of mechanics.

The influence of these exhibitions of the collective ingenuity of the world upon our own countrymen, in furnishing our mechanics with a standard of comparison by which to measure their own contributions to the world's progress with the most improved implements of the civilized world, and our agriculturists—already familiar with American instruments through our State and local fairs—with a view of the appliances of agriculture in other lands, can scarcely be overrated.

Some of the results are to be seen in the tables before us.

Credit is also due to the United States Agricultural Society for instituting a great national field trial of reapers, mowers, and other implements, held at Syracuse, New York, in 1857, for the purpose of testing practically the relative merits of different machines and rewarding special excellence.

The magnitude of the interests involved in the successful production of a new labor-saving implement for husbandry should alone prove a sufficient spur to inventors and manufacturers. A slight improvement in straw-cutters has enabled its inventor in a western tour of eight months with a model to realize forty thousand dollars. Another has been known to sell a machine to thresh and clean grain, after fifteen months use, for sixty thousand dollars. The McCormick reaper is believed to have yielded its inventor annually a princely income. A single manufacturer has paid the legal representatives of a patentee $117,000 in a single year for the use of a patent-right on an agricultural machine which others were making at the same time by contract with the owner.

From an article upon agricultural implements, published in the annual report of the Department of Agriculture, by the Hon. M. L. Dunlap, of Illinois, we are pleased to see that invention in this branch has not been stationary during the war. Among the principal competitors for public favor in prairie farming, to which his remarks chiefly relate, are the rotary spader with horse-power, which promises to be more effective than the steam-plough with traction engines, the latter having thus far proved a failure in moist or cultivated soils; the steel-clipper plough, with polished cast-steel mold-board; the two-horse cultivator or plough; the iron roller; the hand sowing-machine; reaping and mowing-machines, separate or uncombined; the sulky, wire-tooth horse hay-rake; the horse hay-fork or patent pitchfork; the horse-power thresher with straw-carrier and bagging apparatus attached; the drain-plough; the portable farm mill and the sorghum mill. But the statistics of the eighth census will measure the public appreciation of these and other new productions of American skill, and their influence upon the rural economy of the nation.

The cash value of farms under actual cultivation in the United States in 1850 was $3,271,575,426. Their value had risen in 1860 to $6,645,045,007, an increase of 103 per cent. in ten years. The amount of capital invested in implements and machinery for their cultivation in 1860 was $246,118,141, having in ten years increased $94,530,503, or more than sixty-three per cent. Thus, the fixed capital of the agriculturists in farms, and in farm tools and machinery, both increased in a ratio much more accelerated than that of the population, which during the same time augmented at the rate of only thirty-five and one half per centum. If we suppose the rural population to have increased in the same proportion with the whole, and the productiveness of the soil to have remained unchanged, we shall perceive that an immense increment of productive force accrued to the nation within ten years in the mechanical appliances of agriculture alone. Taking the aggregate number of acres of improved lands in the United States to be, in round numbers, one hundred and sixty-three millions, as shown by the returns, it would thus appear that the average value of farm implements and machinery for each farm of one hundred acres is only about $150, which is probably less than one third the sum that could be so invested with profit, at least in the older settled States. The greatest deficiency in this respect is found in New England, where it is only $1 34 per acre, probably due to the ruggedness of the country. In the middle States the value of machinery employed is $2 07 per acre; in the western States $1 56, and in the southern $1 48 per acre. Notwithstanding the evidence, therefore, of an improvement in the quantity and quality of implements, and inferentially of a better system of farming, there is manifestly room for further improvements in this respect, and ample encouragement to our agricultural machinists to supply the growing demand.

The production of labor-saving machinery, as will be shown by the tables of manufactures, was still going on to the amount of $17,487,960 in 1860, which was likewise an increase of nearly 156 per cent. over the value made in 1850, when it reached the sum of $6,842,611. This was exclusive of all articles made on the farm, which was formerly considerable, but is yearly decreasing as regular manufactories and depots for the sale of farm implements are multiplied, and their cost diminished. It also excludes cotton-gins, scythes, hoes, shovels, spades, forks, and some other articles of hardware, wagons, carts, and wheelbarrows, the value of which amounted to $11,796,941, and might appropriately be added to the above table.

Of the total product in 1860, nearly two millions in value was made in New England, being an increase of about sixteen per cent. upon the returns of 1850.

The middle States increased their production from less than two and a quarter to upward of five and three-quarter millions, or 134.2 per cent. The great States of New York and Pennsylvania returned, the one 333, and the other 260 establishments devoted to this branch of manufacture, and the increase in their product was 172.7 and 85.5 per cent., respectively, over the business of 1850.

In the western States the increase was most extraordinary, the value having augmented from $1,923,927 to $8,707,194, or 352.5 per cent. Their total production was nearly one-half that of the whole Union. Its increase alone was nearly thirty-nine per cent. of the whole, and nearly equalled the total manufacture of the United States in 1850. The States of Ohio and Illinois, together, manufactured to a greater amount than any other two States in the Union, the value amounting in the former to $2,820,626, and in the latter to $2,379,362, and the increase to 405.5 and 212.2 per cent., respectively. Iowa increased its manufacture 1,208.6 and Kentucky 755.4 per cent. over the product of 1850.

In the southern States the aggregate was but little over one million, and the rate of increase nearly thirty per cent. Virginia was the largest manufacturer, but in several there was a falling off from the product of 1850, after excluding cotton-gins, &c., as before mentioned.

The largest amount manufactured in any one county in 1860 was in Stark county, Ohio, in which fifteen establishments produced $900,480, the larger part of which consisted of mowers and reapers, and of threshing-machines and separators, in each of which three factories were employed. The next largest county production in this branch was in Cook county, Illinois, which made to the value of $529,000, chiefly in the city of Chicago. Of that sum, $414,000 was the value of 4,131 reapers and mowers made by a single establishment, the largest in the country. Rensselaer and Cayuga counties, in New York, each produced upward of $400,000 worth of agricultural implements, and a single firm in Canton, Stark county, Ohio, made reapers, mowers, and threshers to the value of $399,000.

From the New England States there is a considerable exportation of agricultural implements to the British provinces, the southern States, and other parts of the world.

That the large rates of increase in this branch indicated by the foregoing figures are not due simply to the increase of population, is shown by the fact that in Illinois, whose rate of increase with so large a population is without a parallel, the increase in value of agricultural implements manufactured in 1860, as compared with 1850, was 212 per cent., while the increase of population during the same period was only 101 per cent. In Ohio the population increased only 18.14 per cent., while its production of agricultural implements was augmented 417.6 per cent.

We subjoin a summary of the progress of invention in relation to a few of the more important instruments of this class, having given in the preliminary report an account of the progress in threshing implements.

THE PLOUGH.—Could the history of this machine, the type and pioneer of all other implements of husbandry, be traced from its origin, it would probably be found that few agricultural utensils have undergone greater modifications, or been more slowly improved than the plough. Originally, nothing more than the rude branch of a tree, with its cleft and curved end sharpened to scratch a furrow for the seed, possibly, as suggested by the ingenious Tull, in imitation of the tillage effected by swine, the instrument appears at this time to have been brought as nearly to perfection as it is possible to attain. The primitive plough, a "mere wedge with a short beam and crooked handle," became in time fitted with a movable share of wood, stone, copper, or iron, wrought to suitable shape, as we find it in the hands of our Saxon ancestors. To this a rude wooden mould-board to turn the furrow was afterward added, and with various improvements in shape, continued in use until near the present time.

What was its form or efficiency in the days when Elisha was summoned from ploughing with twelve yoke of oxen, to assume the mantle and functions of the Hebrew prophet, may not be quite apparent, but the plough was certainly hundreds of years in reaching the imperfect state above described, and was several hundred more in approximating its present improved condition. In the middle of the last century the ploughs of southern Europe had been little improved, and were still destitute of a coulter, as in the old Roman plough of the days of Virgil and Columella. It has received few modifications there down to this time. Even in England, at that period, the plough was an exceedingly rude and cumbersome affair compared with the best now in use. It was no uncommon thing in parts of the island thirty years ago to see from three to five horses in light soils, and in heavy ones sometimes, as many as seven attached to a plough, which turned about three-quarters of an acre per diem. The old

Scotch plough was still worse, and in Scotland, where agricultural machinery is now most perfect, no instance was known of ploughing with less than four horses. The usual number was six horses, or four horses and two oxen, and sometimes as many as ten or twelve were yoked to it, each requiring a driver. William Dawson, soon after 1760, introduced the custom of ploughing with two horses abreast with lines.*

Although the swing-plough is believed to have been the earliest used in Great Britain, one and two wheel ploughs—long used on the continent—were most in favor. Turn-wrest ploughs, drill, drain, and trenching ploughs, and others adapted to different uses, were employed in considerable variety.

A capital improvement in the plough was the invention of the iron mould-board and landside. An approach to this was made by Joseph Foljambre, of Rotherham, England, who in 1720 took out the first patent of the kind recorded. It was for a mould-board and landside of wood sheathed with iron plates, the share and coulter being made of wrought iron with steel edges. One of these patent or Rotherham ploughs—as all similar ones were called for many years—was imported and used for some time with much satisfaction by General Washington, but, becoming worn, our ploughwrights were unable to repair it. The ploughs used in New England early in this century, and more recently in the south, were of similar construction About the year 1740 James Small, of Berwickshire, in Scotland, first introduced the cast-iron mould-board, still using wrought-iron shares. During fifty years he continued to manufacture and improve the Scotch swing-plough, which, since made wholly of iron, has long been regarded as the best in use in England. In 1785 Robert Ransome, of Ipswich, introduced cast-iron shares, and about 1803 made improvements still in use, by making the cutting edges of chilled iron harder than steel, by casting them in moulds upon bars of cold iron. The making of the first iron plough has been attributed to William Allan, a farmer of Lanarkshire, in Scotland, in 1804, but an iron plough was presented to the Society of Arts in London as early as 1773, by a Mr. Brand. The cast-iron plough was introduced soon after. Like most other improvements in rustic machinery, the iron ploughs, though doing much superior work at less than half the expense of the clumsy wooden plough of that date, came tardily into use. It is said that Sir Robert Peel, in 1835, having presented a farmers' club with two iron ploughs of the best construction, found on his next visit the old ploughs with wooden mould-boards again at work; "Sir," said a member, "we tried the iron, and be all of one mind, *that they made the weeds grow.*"† A similar prejudice opposed the introduction of the first cast-iron plough in America, patented in 1797 by Charles Newbold, of New Jersey, who, after spending, as he alleges, $30,000 in trying to get it into use, abandoned the attempt, the farmers declaring that iron ploughs poisoned the soil and prevented the growth of crops.

The plough has received many improvements at the hands of Americans, and has become an article of frequent exportation, while even in Great Britain the ploughs now used are generally made after American models. The year 1617 is mentioned by an early annalist as the "remarkable period of the first introduction of the labor of the plough" in Virginia. In 1625 we find the Dutch colony on the Hudson supplied with "all sorts of seeds, ploughs, and agricultural implements," to which in 1662 was added a first-class wheel-plough, with its pulleys, &c., at a cost of sixty florins. In 1637 the colony of Massachusetts contained but thirty ploughs, and Connecticut probably less than one-third the number. Nevertheless, the same year a resident of Salem was promised an addition of twenty acres to his original grant if he would "set up ploughing." We involuntarily think of the steam-plough when we read that another citizen of that town in the following year was allowed more land because he had "not sufficient ground to maintain a plough" on his farm of 300 acres. Owing to the scarcity of mechanical labor, most of the ploughs and other farm utensils were for a long time made on the farm, with the aid of the nearest smith. The casting of plough-irons was done at nearly every small foundry. Their make was, of course, clumsy and inefficient. Among the kinds still remembered by many was the Cary plough, with clumsy wrought-iron share, wooden landside and standard, and wooden mould-board

* McCulloch's Statistics of British Empire.

† Philps' History of Progress in Great Britain.

plated over with sheet-iron or tin, and with short upright handles, requiring a strong man to guide it. The bar-share plough was another form still remembered by many for its rudely fitted wooden mould-board and coulter, and immense friction from the rough iron bar which formed the landside. The Bull-plough was similar in form, but without a coulter. Even the shovel-plough, not unlike the rude instrument still used by the Chinese, may be remembered by some, and was in common use in the cotton States a few years since. As early as 1765 the London Society of Arts awarded a gold medal to Benjamin Gale, of Killingworth, Connecticut, for a drill-plough, the invention of which was claimed by Benoni Hilliard, of the same place. The first patent taken out after the organization of the United States Patent Office was in June, 1797, by Charles Newbold, of Burlington, New Jersey, for the cast-iron plough already mentioned, which combined the mould-board, share and landside, all in one casting. He afterwards substituted wrought-iron shares, objections having been made to the cast iron probably because not chill-hardened. He did not succeed in getting them into permanent favor, although cast-iron ploughs were advertised for sale in New York in the year 1800, by Peter J. Curtenius, a large iron founder of the city. Newbold was paid one thousand dollars by David Peacock, a fellow-townsman, who, in April, 1807, patented a modification of the iron plough, having the mould-board and landside cast separate, with a wrought-iron steel-edged share attached.

As early as 1798 Mr. Jefferson also exercised his mechanical tastes in improving the mould-board of ploughs, which he afterwards adapted to an improved plough sent him by the Agricultural Society of the Department of the Seine, in France. His son-in-law, Mr. Randolph, whom Mr. Jefferson thought probably the best farmer in Virginia, invented a side-hill plough, adapted for the hilly regions of that State, and designed to turn horizontally, in the same direction, the sides of steep hills, which, in northern Europe, was effected by a shifting mould-board, constituting the variety called turn-wrest ploughs. Colonel Randolph's plough was made with two wings welded to the same bar, with their planes at right angles to each other, so that by turning the bar, adjusted as an axis, either wing could be laid flat on the ground, while the other, standing vertically, served as a mould-board. Mr. Jefferson advocated an adherence to scientific principles in the construction of the plough. Perhaps the first attempt to carry out these suggestions was made by Robert Smith, of Pennsylvania, who, in May, 1800, took out the first patent for the mould-board alone of a plough. It was of cast iron, and of improved form, the principles of which were published by him. In July, 1814, Jethro Wood, of Scipio, New York, was granted a patent for a cast-iron plough having the mould-plate, share, and landside cast in three parts. The mould-plate combined the mechanical principles of the wedge and screw in raising and inverting the furrow-slice. It became the foundation of many patented improvements of later date, and of a handsome competence to the inventor, who, in 1819, received a second patent, which was renewed by act of Congress in 1832.

A series of improvements in the cast-iron ploughs was commenced about 1810 by Josiah Ducher, of New York, which were patented in 1822. Some of them are still retained in use. Two improvements in the cast-iron plough, designed to make it easier of draught, were covered by letters patent issued in April, 1821, to A. L. & E. A. Stevens, of Hoboken, New Jersey. One of these was for hardening the cutting-edges and parts exposed to wear by cold-chilling them. Four other patents on the cast-iron plough were granted the same year. Much credit is also due to Joel Nourse, of Massachusetts, and his partners, for improving and perfecting the cast-iron plough, which was comparatively a rude instrument, in limited demand, as late as 1836, when they commenced the manufacture of agricultural implements at Worcester. The sale of twenty thousand ploughs in a single year by this firm, within twenty years after they commenced business, indicated the increased demand for ploughs, which they were able to supply, of one hundred and fifty different forms and sizes. Among these were *subsoil* ploughs adapted to teams of from one to six horses, the first implement of that kind in the United States having been imported by them in 1840 from Scotland, and subsequently improved by making it more simple, light, and cheap in construction. American hill-side ploughs are now exported to Great Britain. The number of patents granted for ploughs previous to 1830 was 124, and up to 1848 had reached between three and four hundred.

A distinctive feature in American ploughs is their great simplicity, lightness of draught, neatness and cheapness, which is often in striking contrast with those of foreign make. This economy of power attracted attention to two ploughs sent, in 1815, to Robert Barclay, of Bury Hill, near Dorking, in England, by Judge Peters, president of the Philadelphia Society of Agriculture, the seal of which society, by the way, bears as a device a representation of the plough of the date of 1785. The ploughs referred to were made by order of Mr. Peters, to combine the best principles and forms of American ploughs, and when tested in August of that year against the best English ploughs, were found to do the work quite as well and as easily with two horses as the other did with four. American ploughs obtained favor with English farmers for substantially the same characteristics, namely, "extraordinary cheapness and lightness of draught," at the trial of ploughs at Hounslow during the great exhibition in 1851.

In the early part of this century the manufactories of ploughs in the United States were few and small in size. It has since become an important branch of the agricultural implement business. Ploughs were made and exported in considerable quantity at Enfield, Connecticut, previous to 1819. One of the largest establishments in this or any country, devoted chiefly to plough-making, was established in Pittsburg, Pennsylvania, in 1829. In 1836 it made by steam-power one hundred ploughs daily, of patterns adapted largely for the lower Mississippi, and cotton and prairie lands of the south and west. The iron-centre plough, and hill-side revolving beam-plough, were among the valuable modifications originated by the concern which now makes also the steel-ploughs so valued in prairie farming. Another steam-plough factory in Pittsburg made in 1836 about 4,000 ploughs annually, including wood and cast-iron ploughs, and a great variety of other kinds. These two factories, together, made 34,000 ploughs yearly, of the value of $174,000. There are several other extensive and numerous smaller manufactories throughout the country, particularly in the western States, in which plough-making is carried on as a specialty. It forms, however, a branch of the general manufacture of agricultural implements. In the best conducted of these, machinery is extensively employed, and such a division of labor as to secure great speed and perfection of workmanship, as well as a great reduction of the cost. For each size and pattern of plough, the several parts subject to wear are made all alike, so as to fit any plough of that class, and allow it to be readily replaced without the aid of the plough-right. Sulky-ploughs, with a seat for the driver, and gang-ploughs, cutting several furrows at a time, have been introduced, but have not proved generally satisfactory. Rolling or wheel coulters have, in many cases, taken the place of the old standing coulter. Many ploughs now have a hook attached for turning the weeds under the furrow, an important improvement for prairie farms, where weeds, like other vegetation, are luxuriant.

Several attempts were made in 1858, and the following years to introduce steam-ploughs, for which the Illinois Central Railroad Company offered a premium of $3,000. They have been employed with success for several years in Great Britain. English steam-ploughs are operated by stationary engines placed at one side of the field, and draw the plough from one side to the other by means of wire-chains. At other seasons the engines are used in driving threshing-machines and performing other farm labor. Our inventors have employed traction engines of several tons weight, which on hard ground worked satisfactorily, but on cultivated or moist soil were found to bury themselves inextricably in the ground. They appear to have been abandoned for the present.

A more recent machine, which promises to be a valuable one, is the rotary-spader, which, with the power of four horses, spades the ground eight inches deep and three feet wide, at the rate of five or six acres a day. It is rather too costly for small farms, but on large ones may prove valuable, and in time may be adapted to steam-power.

Many improvements have been made in implements for cultivating corn and other hoed crops, among which the horse-hoe or cultivator is exceedingly popular, and in corn-growing districts has nearly supplied the loss of manual labor by the war. The importance of frequently stirring the soil is becoming better understood, and in our dry climate the effects of severe drought may be almost entirely obviated by the use of the cultivator on rich, well-prepared lands.

MOWERS AND REAPERS.

These implements, making so large an item in the manufacture, deserve a brief notice. The great breadth of land devoted to grain in the western country has rendered mechanical appliances for gathering the crop altogether indispensable to the farmer. But contrivances for that purpose have long been in use. Pliny the elder, in the first century of our era, gives us the earliest description of such an instrument in use among the Gauls. It was a large van, or cart, driven through the standing corn by an ox yoked with his head to the machine, which was fitted with projecting teeth upon its edge for tearing off the heads, which dropped into the van. It is supposed to have been in use for several centuries.

The earliest proposal in Great Britain for an implement for harvesting grain was made by the Society of Arts in 1780, when it offered its gold medal for a machine to answer the purpose of mowing or reaping grain, simplicity and cheapness in the construction to be considered as the principal part of its merit. The premium was continued for several years. William Pitt, of Pendeford, soon after invented a reaping-machine, suggested by the description of Pliny and Palladius, and described in Young's Annals of Agriculture for 1787. A second attempt was made in Lincolnshire, in 1793, by another person, whose name does not appear. In November of that year, two men named Cartwright, each invented a machine for mowing and reaping. In 1799 the first English patent was taken out by Joseph Boyce for a reaping-machine, acting on the principle of the common scythe. In the following year, Robert Mears, of Somersetshire, was granted a patent for a reaping-machine propelled on wheels, but worked by hand. In June, 1805, Thomas J. Plucknett, of Kent, received a patent for a reaper having the cutting apparatus suspended beneath and in front of the axle, and the power behind. He took out a second patent in 1807. Mr. Gladstone, of Castle Douglas, in 1806 invented a machine with horizontal gathering-wheel, and the next year Mr. Salmon, in Bedfordshire, brought forward a plan for raking the corn off a platform by means of a vertically-working rake driven by a large crank in the rear of the machine. Messrs. Kerr, of Edinburgh, in 1811 introduced the "conical drum," and in 1815 Mr. Scott employed rakes with a cylindrical drum, and projecting teeth, &c. In 1822, Mr. Ogle, of Alnwich, invented the large reel or rake for lashing the uncut grain towards the knife, as is now done in some English and American reapers. Some others were brought forward previous to 1826, in which year the Rev. Patrick Bell, of Scotland, produced the oldest machine now known to be in use, having a revolving apron or endless web for gathering, accompanied by Ogle's reel in front, which attracted little attention, however, until after the London exhibition in 1851, when he adopted McCormick's cutting apparatus; since which it has been used to some extent. From the closing of the fair in 1851, to the end of 1852, no less than twenty-eight patents were registered in England for inventions relating wholly or in part to reaping and mowing machines. Patents had been previously granted for this class of machines in Russia in 1831, in Austria in 1839, and in Australia in 1845. The last mentioned, introduced at Adelaide, South Australia, by Mr. Ridley, reaped, threshed, and winnowed all at the same time, at the rate of an acre per hour; but its description conforms very nearly to one patented by D. A. Church, of Friendship, New York, in 1841. Whether from intricacy of construction, or other inherent defect, or, as seems more probable, from indifference on the part of the public, none of these instruments came into permanent use, although they provoked the opposition of agricultural laborers.

The first American patent for cutting grain was issued in May, 1803, to Richard French and J. T. Hawkins, of New Jersey. Their machine was propelled on three wheels, one of which extended into the grain. Samuel Adams, of the same State, followed in 1805; J. Comfort, of Bucks county, Pennsylvania, and William P. Claiborne, of King William county, Virginia, in 1811; Peter Gaillard, of Lancaster, Pennsylvania, in 1812, and Peter Baker, of Long Island, New York, in 1814. The next was the machine of Jer. Bailey, of Chester county, Pennsylvania, patented in February, 1822, which was a rotary mowing-machine, having six scythes attached to a shaft. Four other patents were registered previous to 1828, when Samuel Lane, of Hallowell, Maine, patented a machine for cutting, gathering, and threshing grain all at one operation. It does not appear, however, to have been successful. Only one other machine, that of William Manning, of Plainfield, New Jersey, registered in 1831, and having several points of resemblance to some now in use, was patented previous to that of Obed Hussey, of Cincinnati, Ohio, in December, 1833. The first public trial with this instrument was made before the Hamilton County Agricultural Society, near Carthage, July 2, of that year. During the next it was introduced into Illinois and New York; in 1835 into Missouri; in 1837 into Pennsylvania; and in 1838 the inventor established his manufactory at Baltimore. In June, 1834, Cyrus H. McCormick, of Rockbridge county, Virginia, received his first patent for cutting grain of all kinds, by machinery, which was worked in 1831, improved since, proving a source of large profit to the proprietor, as well as a great boon to this country and foreign lands. From that time to the present nearly every year has produced one or more modifications of harvesting-machinery, among which may be mentioned that of Moore & Haskell, of Michigan, patented in June, 1836, which cuts, threshes, and winnows grain at the same time. From the date of this patent to the issue of McCormick's second patent, in 1845, fifteen other machines were registered, including that of W. F. Ketchum, of New York, in 1844, which has since obtained a high reputation. Since 1851, the new machines brought forward have been numerous. In June, 1852, twelve different reaping-machines and several mowers were entered for trial before the Ohio State Board as contestants for the premium, all of them—including McCormick's and Hussey's—possessing nearly equal merits.

The United States Agricultural Society, in 1857, instituted an elaborate trial of reapers, mowers, and implements, which took place at Syracuse, New York, in July of that year, when fifteen mowing-machines, nine reapers, and fourteen combined mowing and reaping machines were entered. Medals and diplomas were awarded to several. Among those entered were Pell's, Manny's, Haines's (Illinois Harvester,) W. A. Woods's, (J. H. Manny's improved,) Seymour & Morgan's, Burrall's, Warder, Brokaw & Childs's, Atkins's, (automaton self-raker,) Moore & Patch's, and C. H. McCormick's, for reaping alone. Mowing-machines were entered by several of the same inventors, and also by Heath, Ketchum, Ball, Aultman & Miller, Hallenbeck, Kirby, Hovey, Allen, and Newcomb, and combined machines by some of the same parties, and by A. H. Caryl, Obed Hussey, J. H. Wright, and Dietz and Dunham.

The whole number of harvesting-machines produced in England and the United States up to that time amounted to 160 different kinds, about 100 of which were American; and in October, 1854, it had reached about 200.

The progress of ideas, or the different channels in which they have run in regard to the mode of action of the cutters of reaping-machines, has been shown by Bennett Woodcroft, esq., of England, in a patent office publication containing illustrations of sixty-nine examples of reapers, including nine American machines. In thirty-one of the number the motion of the knives was rectilinear, and in thirty-three it was circular, while in five the knives were moved by hand. Previous to the introduction of American reapers, the tendency in England was toward a circular action of the cutters; since that time reciprocating motion has been more employed. Although reciprocating and rectilinear motion was used by Salmon, in 1807, only two of the English machines introduced previous to 1862, viz: Ogle's and Bell's, were examples of that kind of motion, and three American, namely, Manning's, Hussey's, and McCormick's, while there were twenty-one of the other kind. Of later examples there were seventeen with reciprocating motion, to eleven with circular.

Diversities have also existed as to the mode of gearing the horse. Pitt's, Boyce's, Plucknett's, and Gladstone's machines were drawn behind the horses; Salmon's, Kerr's, Harke's, and other early English machines, were pushed before the horses, after the manner of the Romans and Gauls. In America both plans have been used, but since 1833 they have usually been placed behind the horses. By recently proposed improvements, horse-power harvesting-machines with four horses will cut twenty acres of grain in a day, at a net cost—including eight dollars for the use of the machine, a driver, two binders, and two hands to shock up—of ninety cents an acre, which harvested by hand would cost

$1 90 per acre. The binding is now done with wire on the large grain-fields of the west, and a machine has lately been invented for performing that part of the labor. There can be little doubt that we shall soon have machines that will cut, gather, and bind up the grain at one operation. American reaping and mowing machines have now been introduced into every civilized country. Their usefulness has been universally acknowledged. In our own land, where labor is so high, and the season so short, they are indispensable. In many sections the labors of sowing and planting the spring crops are quickly followed by haying and harvesting. Corn, beans, potatoes, and other crops require the use of the hoe and cultivator. Summer fallows, for wheat claim attention at this time; and no sooner is the labor of harvesting over, than the American farmer is under the necessity of sowing his winter wheat, which in the northern and western States is sown from one to two months earlier than in England.

The nature of our climate, the character of our crops, the scarcity of labor, and the extent of our agricultural operations, all conspire to increase the introduction and use of these and all other implements and machines that will expedite the labors of the farm.

It is difficult to conceive that American agriculture could have attained its present condition had the invention of reaping and mowing machines been delayed thirty years. The extent to which they are already used is enormous.

The editor of the Genesee Farmer, Rochester, N. Y., has collected directly from the manufacturers the following statistics of the number of reaping and mowing machines made by a few of the leading firms engaged in this important branch subsequent to the returns of the census in 1860.

C. Aultman & Co., Canton, Ohio, made last year (1863) 3,100 "Buckeye" mowing and reaping machines, and this year (1864) 6,000 of the same machines.

Bomberger, Wight & Co., of Dayton, Ohio, have made 1,250 "Ohio Chief" reapers; and Rufus Dutton, who formerly manufactured the same machine, has made 3,156, making 4,306 in all.

Of the "Manny" reaping and mowing machine there have been manufactured in the State of Illinois, up to 1863, about *forty thousand.* In 1864 there have been made of the same machines in Rockford, Illinois, 10,500.

Messrs. Adriance, Platt & Co., of Poughkeepsie, New York, have also made 2,500 "Manny" machines for the New England States. The same parties have also manufactured 1,100 "Buckeye" machines for the New England States, New Jersey, &c.

S. M. Osborne & Co., of Auburn, New York, have made 15,000 of "Kirby's" mower and reaper. The Buffalo Agricultural Machine Works have also made 7,000, and other parties have made 5,000, making 27,000 of these machines that have been manufactured in the United States.

Messrs. Seymour, Morgan & Allen, of Brockport, New York, have made 7,200 of their "New Yorker" and other machines. Messrs. Warder & Childs, of Springfield, Ohio, also manufacture the same machine, and have made about 9,000.

The Messrs. McCormick Brothers have manufactured at their establishment in Chicago over 55,000 of their celebrated reaper—6000 in 1864.

The establishment of Mr. R. L. Howard, of Buffalo, New York, has manufactured 20,000 of the "Ketchum" mowing-machines, and 5,000 reapers and mowers combined, and 3,500 of the "Howard harvesters."

Mr. Walter A. Wood, of Hoosick Falls, New York, has made over 30,000 reaping and mowing machines. In 1858 Mr. Wood sent an agent to England with fifty; the next year he sent two hundred and fifty machines, and since then his sales in great Britain and on the continent of Europe have averaged over 1,000 per annum.

It thus appears that the manufacturers we have named have made two hundred and fourteen thousand and ninety-four mowers and reapers.

We present these facts, obtained directly from the manufacturers, that our readers may form some idea of the magnitude of the reaper and mower business. There are other machines manufactured of which we have not ascertained the number, but we may safely conclude that there have been two hundred and fifty thousand reaping and mowing machines manufactured and in use in the United States; the importance of which may be estimated, when it is considered that a common reaper will cut from ten to twelve acres in a day of twelve hours, and a mower eight to ten acres in the same time.

Another valuable implement for facilitating harvesting operations is the hay-unloading fork, with which, by the aid of a horse, a load of hay can be elevated to the stack or mow in a few minutes. Several varieties of these useful little machines are manufactured, and tens of thousands are already in successful use.

The wooden revolving hay-rake, (invented by Moses Pennock, of Pennsylvania, in 1824, and now well known in all parts of the country,) also greatly lessens the labor of haying. Fine steel-toothed rakes leave less hay on the ground, but for general use on American farms this wooden revolving hay-rake is one of the most simple, useful, and efficient machines yet invented. On large farms, the sulky wire-tooth rake is fast superseding all others. They throw the windrow into heaps or bundles of eighty or one hundred pounds each, ready for cocking or loading. A boy and horse can thus rake and bunch twenty acres a day. The hay-fork, or patent pitch-fork, is another recent improvement of value.

For THRESHING AND CLEANING GRAIN, we have machines which are confessedly unsurpassed. In our preliminary report we gave an outline of the progress of invention in this class of implements.

Nearly all threshing-machines now in use have an apparatus for separating the grain from the straw and chaff, and carrying the straw up on to the stack. This simple apparatus is now so common that it attracts no notice, except from the English or continental visitor, to whom it is a novelty. Many machines have also an apparatus for bagging the grain when clean.

The English threshing-machines, especially those drawn by steam, have a much more finished appearance, but for simplicity and efficiency they are in no way superior to those of American manufacture. In fact, wherever the American threshing-machines have come into direct competition with those of British and European construction, the American machines have proved superior.

SCYTHES.

Although the genius of modern improvement promises ere long to rob haymaking of one element of the picturesque, it has not yet wholly succeeded in banishing the hand-scythe and mower from modern scenery. Tedious and laborious as its use appears, compared with that of the mowing-machine, it is wonderfully effective in comparison with the rude practice of the Mexican of our day, who cuts his grain and hay by handfulls with a common knife. It may not be generally known that the most valuable improvement made upon this implement for centuries was by one of the first iron-workers of Massachusetts, more than two hundred years ago, in the very infancy of the colony. In the year 1646 the general assembly of that province granted to Joseph Jenckes, of Lynn, a native of Hammersmith, in England, and connected with the first iron-works in that colony, the exclusive privilege for fourteen years "to make experience of his abillityes and inventions for making," among other things, of "mills for the making of sithes and other edge-tooles." His patent "for ye more speedy cutting of grasse" was renewed for seven years in May, 1655. The improvement consisted in making the blade longer and thinner, and in strengthening it at the same time, by welding a square bar of iron to the back, as in the modern scythe, thus materially improving upon the old English scythe then in use, which was short, thick, and heavy, like a bush-scythe.*

The introduction of the scythe and axe manufacture into Massachusetts, Connecticut, and Rhode Island, is to be in a great measure ascribed to Hugh Orr, a Scotchman by birth, who came to Massachusetts about 1737, and a year or two after erected at Bridgewater the first trip-hammer probably in the colony. He engaged in the manufacture of scythes and other edge-tools, in which he acquired a wide reputation. His son, Robert Orr, by successful experiments, established the improved manufac-

* Bishop's History of American Manufactures, vol. I, pp. 476, 477.

ture of scythes by the trip-hammer, and also introduced the iron shovel manufacture into the State. As early as 1766, samples of home-made scythes, shovels, spades, hoes, &c., were laid before the Society of Arts, in New York, and approved. They were probably from the manufactory of Keen & Payson, of that neighborhood, whose improved scythes, often called Salem scythes, then claimed to be superior in quality and form to any others. The non-importation and non-intercourse of the revolutionary period, and during the last war with England, encouraged the domestic manufacture of scythes and other articles of hardware, which, before the end of the last century, were made in different parts of New England in considerable quantity. Scythes were made in Plymouth county, Massachusetts, and to the number of two or three hundred dozens annually, at Canton, in Norfolk county, and also at Sutton, in Worcester county, which town had in 1793 seven trip-hammers and five scythe and axe factories. In 1810 there were nine factories in Sutton, and two in Oxford, and in 1814 seven others had been erected in the county, some of which could make 1,000 dozens annually. Scythes were at the same time made in Boston, and in 1803 the manufacture was commenced at Orange, by Levi Thurston, who employed in it the first tilt-hammer in the town. A few years later there were two scythe factories at Colebrook, in Litchfield county, Connecticut, which county in 1820 returned the largest manufacture of scythes of any in the Union. At Southfield, Rhode Island, large numbers of scythes were made at that time for exportation. As early as 1812, the scythe factory of S. & A. Waters, at Amsterdam, in Montgomery county, New York, turned out about 6,000 scythes annually. They were made at many small establishments throughout the Union, along with axes, sickles, and other edge-tools and cutlery, shovels, &c., by the aid of the trip-hammer, and were in good demand. The price in 1820 ranged from twelve dollars to eighteen dollars per dozen.

About the latter date was commenced, at West Fitchburg, Massachusetts, one of the oldest scythe factories now in the country, then owned by F. T. Farwell & Co., which in the hands of its original and later proprietors has originated many improvements in the manufacture, and given reputation to its well-known brand. At a later period, Harris's scythes, extensively manufactured at Pine Plains, in Dutchess county, New York, obtained a high repute, and are said to have been counterfeited in England. The mammoth scythe factory of R. B. Dunn, at North Wayne, in Maine, was a few years ago considered the largest in the world. In 1849 it turned out 12,000 dozens, requiring 450,000 pounds of iron, 75,000 pounds of steel, 1,200 tons of hard coal, 10,000 bushels of charcoal, 100 tons of grindstones, and half a ton of borax. About the same time, the scythe and cast-steel fork manufactory of D. G. Millard, near the village of Clayville, New York, made about 13,000 dozens of scythes and forks annually, by water-power. In 1860 Massachusetts was the largest producer of scythes, returning $168,550 as the aggregate value of the product of ten establishments. Maine ranked second in the value of its scythe manufacture—$129,363 by three factories. In New York, four establishments turned out scythes worth $117,440, and one factory in Rhode Island employed 100 hands, producing to the value of $100,000. The total value of scythes made in 1860 was $552,753, which was the product of twenty-two factories and 474 hands.

SHOVELS, SPADES, HOES, AND FORKS.

These articles, intimately but not all so directly connected as the foregoing with agriculture, in 1860 gave employment, in five States, to forty-three establishments, the value of whose manufacture was $1,452,226. The hands engaged in them numbered 1,015. Upward of one-half the whole value was made in eleven factories in Massachusetts, which, together, employed 578 workmen, and produced an annual value of $777,048, being relatively much the largest concerns in the country. In New York there were twenty-three manufactories, whose product was $307,428, and the number of hands employed 233. Six factories in Pennsylvania employed 177 men, and produced wares to the value of $312,450.

The manufacture of these articles has long been an established industry in Massachusetts and some other States, having been commenced before the Revolution. The shovel manufacture was successfully introduced at an early period at Easton and Bridgewater, in Massachusetts, where the Messrs. Orr, before mentioned, were instrumental in establishing it by the use of the tilt-hammer. In 1788 the iron-plate shovels made at Bridgewater were deemed superior in workmanship to the foreign article which they undersold. The Easton shovel manufactory—commenced on a small scale nearly sixty years ago by the late Oliver Ames—made in 1822 about 2,500 dozen annually. The proprietor in 1827 took out a patent for improvements in the manufacture, which contributed to give his wares a high reputation, and greatly to extend and perfect the business of his establishment. In 1835, Oliver Ames & Sons had large manufactories at Easton, Braintree, and West Bridgewater, which employed nine tilt-hammers, and were capable of making forty dozen spades and shovels per diem, each shovel passing through the hands of twenty different workmen. They now run twenty-six tilt-hammers, and produce two hundred and fifty dozen per diem In 1822 three factories in Plymouth county, Massachusetts, made from one to two thousand dozens each per annum. In 1831, it was estimated that about 5,000 dozens of shovels, worth $35,000, were made in New York State annually. It was computed that Litchfield county, Connecticut, at the same date made shovels and spades to the value of $6,500, hoes worth $7,150, pitchforks to the value of $20,000, and scythes valued at $56,000. A steel shovel and spade factory in Philadelphia consumed annually about fifty tons of American steel. The sheet-iron shovel was patented in 1819, and cast-steel shovels in 1828. The first American patent for improvement in hoes was registered in 1819, and for cast-steel hoes in 1827, by C. Bulkley, of Colchester, Connecticut. But cast-steel hoes were made in Philadelphia by at least two manufacturers in 1823. In Pittsburg, Pennsylvania, where scythes, sickles, hoes, shovels, and other hardware was made in considerable amount previous to 1803, Messrs. Foster & Murray carried on the manufacture by steam-power in 1813. On account of the fall in the price of iron and steel, superior steel hoes were made in Pittsburg in 1831 for about $4 50 per dozen, or one-half the price of iron hoes ten years before. Socket-shovels were made at nearly the same price, which was about one-third their former price. Two large establishments in that place in 1836 made annually about 1,600 dozen steel hoes, 8000, dozen of shovels and spades, 950 dozen steel and other hay and manure forks, and 600 dozen saws. Four establishments in 1857, in addition to nearly half a million dollars' worth of axes, made 32,000 dozen of hoes, worth $208,000, and 11,000 dozen of planters' hoes, worth $94,000, besides picks, mattocks, vices, saws, &c. The Globe Sickle Factory, in the same place, produced a superior article of sickles to a greater value than all the other factories in the United States. The Steel spring pitchfork was introduced by the late Charles Goodyear, by whom it was patented in September, 1831, at which time, and for several years previous, he was engaged with his father, Amasa Goodyear, in the manufacture and sale of hay and manure forks, and other hardware. Their store in Philadelphia is believed to have been the first in the United States for the sale of American hardware exclusively; but the failure of the business during the commercial troubles of that period led the junior Goodyear to abandon it for the new manufacture of India-rubber goods, with which his name will be ever associated in the annals of industry.

A firm in Philadelphia now manufactures eyeless or solid axes, hoes, picks, shovels, &c. The instrument is made solid, while the handle with which it is to be worked has upon the end an iron socket through which the pick, &c., is put, and kept in its place by an iron wedge. The handle does not become loose, and will answer for any number of tools of the same size, and the blow is rendered more effectual. Many of these tools have been exported to California, where they are prized by the miners.

There can be no doubt that our agricultural tools, such as hoes, forks, rakes, &c., are in most respects superior to those in common use in Europe. An English gentleman, who has spent some time in this country, says: "For lightness and finish, combined with strength and durability, American forks and hoes are superior to all others."

Dr. Hoyt, alluding to the great international exhibition in London, in 1861, says: "Among the minor implements of agriculture, we were both surprised and gratified to find a collection of American forks and hoes. The exhibitor was a sensible English dealer, who, discovering the superiority of this class of American implements as compared with articles of the same description manufactured in his own country, has for years been importing and selling them to his customers. On being asked why English manufacturers did not make them, he replied: 'We can't do it; have been trying ever since the great exhibition of 1851, but somehow don't succeed. It is a mortifying admission to make, but it is nevertheless true, that you Yankees have a knack of doing some things which we have not the skill to imitate.'"

COTTON-GINS.

Although cotton-gins are made by a few establishments in the northern States, their manufacture is principally a southern one, and amounted in 1860 to the value of $1,077,315, which was the product of fifty-five establishments, all but three of them southern. Alabama is the largest manufacturer of machinery for cleaning cotton, having sixteen factories, employing 178 hands, and producing gins to the value of $434,805. Georgia ranks next, having twelve establishments, whose product exceeded a quarter of a million. The manufactories of cotton-gins in Mississippi are relatively the largest, three factories employing seventy hands, and returning an aggregate product of $131,900. In Texas, where the first cotton-gin was erected about 1823, there are four manufactories of gins. Many of these machines are made in northern machine-shops, along with other cotton machinery, from which they are inseparable in the general estimate of value.

The history of the cotton-gin furnishes one of the most remarkable examples on record of the power of a single labor-saving machine to influence the social and industrial interests, not merely of a single nation, but in a great measure of the civilized world. The simple mechanism of the saw-gin invented by Whitney enabled one farm-hand to separate the seed from 300 pounds of cotton fibre in a day, instead of one pound, as he had been able to do by hand. Its introduction at the particular period when the completion of the brilliant series of inventions for carding, spinning, and weaving cotton had created a demand for the raw material, at once directed into a new and profitable channel the agriculture of the south, and at the same time furnished the manufacturing industry of Europe and America with one of the most valuable staples, and the shipping and commercial interests of the world with an enormous trade in its raw and manufactured products. The increase in the growth and exportation of raw cotton which followed has no parallel in the annals of industry, save in the wonderful development of its manufacture in England and the United States. The effects of this growth of the husbandry and manufacture of cotton in increasing national wealth, in furnishing employment to labor and capital, and in increasing the comfort of all classes, can scarcely be conceived in all its magnitude.

In 1792, the year preceding the introduction of the saw-gin, the amount of cotton exported from the United States was only 138,328 pounds, and the total domestic consumption was about five and a half millions of pounds. During the next year there were exported nearly half a million pounds; in 1794, 1,601,700 pounds; in 1795, 5,276,300 pounds; and in 1800, 17,789,803 pounds.* In 1860 the production of ginned cotton in the southern States amounted to 5,198,077 bales of 400 pounds each, or 2,079,230,800 pounds, which was more than seven-eighths of the total production of cotton throughout the world. The quantity exported in that year was 1,765,115,735 pounds, equivalent to 4,412,789 bales of 400 pounds each. To prepare this large amount of cotton for market by the primitive methods would have been utterly impracticable. Not only is the labor of the planter facilitated and cheapened by the use of the machine, but the cotton is much better cleaned than by the old methods, which left it unsuitable for the finer fabrics.

Although the earliest mode of separating cotton from the seed, and the one chiefly practiced in the cotton States previous to the invention of the saw-gin, was to separate the seed with the fingers; yet mechanical contrivances for that purpose have been long in use, having been chiefly borrowed from

* Woodbury's Treasury Report, 1835-'36.

India, the cradle of the cotton culture and manufacture. In that country the practice of beating out the seed was long in use. A more effectual modification of the same method, employed for centuries in eastern countries, and very early introduced into Georgia, which took the lead in cotton husbandry, was the bow-string operation. It consisted in the employment of a long bow fitted with a multitude of strings, which being vibrated by the blows of a wooden mallet while in contact with a bunch of cotton, shook the seed and dust from the mass. Hence upland or short staple cotton became known in commerce as "bowed cotton." A form of the roller-gin appears also to have been used in India in early times, as mentioned by Nearchus, and consisted of two rollers of teak-wood fluted longitudinally, and revolving nearly in contact. In 1728 we find mention of "little machines, which being played by the motion of a wheel, the cotton falls on one side, and the seed on the other, and thus they are separated."

About the year 1742, M. Dubreuil, a wealthy planter of New Orleans, invented a cotton-gin which was so far successful as to give quite an impulse to the cotton culture in Louisiana, but nearly forty years later the colonial authorities in Paris recommended the importation of machinery from India for cleaning the seed.

Early in the Revolution, Kinzey Borden, of St. Paul's Parish, South Carolina, constructed a roller-gin, believed to have been the first ever used in that State for cleaning the long staple and silky cotton, of which he was one of the first cultivators. It consisted of pieces of burnished iron gun-barrels secured by screws to wooden rollers turned by wooden cranks, like a steel corn-mill. A Mr. Bisset, of Georgia, in 1788, contrived a gin having two rollers revolving in opposite directions, operated by a boy or girl at each, by which five pounds of cleaned cotton was made per diem. Nothing but hand-gins, resembling the cotton hand-mills of India, were yet known in the south, although foot or treadle gins appear to have been in use at this date in Philadelphia and vicinity, some cotton being then raised in New Jersey, Maryland, and Delaware. A great improvement in the treadle gin was made about the year 1790, by Joseph Eve, of Providence, Rhode Island, then residing in the Bahamas, and was patented by him in 1803. It was a double gin, with two pairs of rollers placed obliquely one above the other, and by adding iron teeth and pulleys, was made by a little assistance to feed itself. It could be worked either by horse or water power. Mr. Pottle, of Georgia, substituted two single rollers for the double ones, and produced a gin very popular in that State for some time. The present form of foot or treadle gin was first introduced into Georgia from the Bahamas, in 1796. It was improved in 1820 by Mr. Harvie, of Berbice, who obtained a patent, and afterwards by another person, who obtained a patent in the United States for making the rollers hollow, to prevent them from becoming hot while revolving. Other improvements on the roller-gin were patented in 1823, and subsequent years by Eleazer Carver, of Bridgewater, Massachusetts, who in 1807 commenced the manufacture of saw and roller gins in Mississippi and Louisiana, then a new country without saw-mills—of which he erected one of the first in these territories—or any machinery for manufacturing the several parts. The Whittemores, of West Cambridge, also secured patents for improvements on the roller-gin, which was in some respects superior to all others, but was found to injure the staple, and was abandoned. Other modifications of these machines were introduced by Birney, Simpson, Nicholson, Farris, Logan, Stevens, McCarthy, and others, several of which were popular in their day, and preferred in certain sections of the cotton States. The machines of Farris and Logan were improvements upon Eve's mechanism, and at a recent period were still used to some extent with steam-power. Jesse Reed, of Massachusetts, inventor of the tack-machine, patented cotton-gins in 1826 and 1827, the latter for cleaning Sea Island cotton, and the eminent American inventors, Jacob Perkins and Isaiah Jennings, each labored in this field. The roller-gin is especially adapted for cleaning the long staple or Sea Island cotton, the long, silky, delicate fibre of which is injured by the saw-gin. In the original machines, a pair of rollers worked by one hand would make about twenty-five pounds of clean cotton in a day. A recent improvement by Mr. Chichester, of New York, consisting of a fluted roller of polished steel, and one of vulcanized rubber, &c., is said to clean 300 pounds per diem, without crushing a seed. The Parkhurst roller-gin, though costly, is deemed a superior machine in Alabama and other cotton districts. The Louisiana cylinder-gin for short staple cotton, made by Jenks, of Bridesburg, Philadelphia, is also much esteemed for completely removing all extraneous matters without injury to the fibre. But as the Upland short staple, or black-seed cotton, was the first variety cultivated in the south, a means of removing the seed from its tenacious envelope was early sought, and happily supplied by the genius of Eli Whitney, a native of Worcester county, Massachusetts, under the patronage of the widow of General Greene, of Georgia, and her husband, Mr. Miller. Whitney's saw-gin, patented in March, 1794, was the first cotton-cleaning machine recorded in the United States Patent Office. Its appearance produced intense excitement, and numerous infringements of his patent rights, which involved him in expensive and vexatious lawsuits, and finally drove him into other enterprises, in which his ingenuity achieved reputation and success. In 1796 Whitney and partner had thirty machines in operation in Georgia by animal or water power, and in December, 1801, the legislature of South Carolina purchased the right for that State at a cost of $50,000, and threw it open to the public. One of the early invasions of the patent was by Hogden Holmes, of Georgia, who also patented a saw-gin in 1796. Two other Georgians the same year took out patents for saw-gins, and in 1803 another was taken for a saw-gin by G. F. Saltonstall, of North Carolina. Among other improvements on gins made by Mr. Carver, before mentioned, who had long experience in their manufacture, was the grate patented by him in 1823, which being placed where the seed is arrested and the fibre taken from it by the saw, prevented clogging, and the delay of cleaning the saw, &c. In 1837 he patented an improvement in ribs for saw-gins. Mr. McCarthy in 1840 connected a vibrating saw to the roller-gin, adapting it for cleaning both green and black seed cotton. This machine it was thought would supersede Whitney's, the fibre cleaned by it having brought three cents per pound more in the Mobile market than that cleaned by the latter.

The manufacture of cotton-gins has long formed a branch of business in the machine-shops of the northern and middle States, and an independent business in several southern cities. One of the earliest and most extensive of these concerns was that of Samuel Griswold, at Clinton, Georgia. In 1833 the business was commenced in Autauga county, Alabama, by Daniel Pratt, a native of New Hampshire, who had learned the business with Mr. Griswold. He there manufactured cotton-gins of superior quality for the neighboring southwestern States, including many for Texas, and even New Mexico, and acquired reputation and fortune in supplying the great demand, which required a branch house in New Orleans. His large accumulations were employed in erecting saw and planing mills, one of the first flouring-mills in Alabama, grist-mills, large cotton and cotton-gin factories, and other factories and tenements, forming the flourishing village of Prattville, where in 1851 he employed 200 hands, and made annually about 600 gins. He had manufactured since 1833 upwards of 8,000 cotton-gins. In 1846 he received from the University of Alabama the honorary degree of *master in the mechanic arts*, for the intelligent and benevolent exercise of his mechanical ingenuity and ample means.

We have thus very briefly, as compared with the importance of the subject, given a sketch of the rise and progress of the manufacture and introduction of some of the most important implements connected with husbandry. To some it might seem a subject better discussed in the volume on manufactures; but believing it to be one of special interest to agriculturists, we have not hesitated respecting the propriety of incorporating the facts in a volume prepared especially for the farmers of the country, with whose tastes and progress we feel a deep interest, and whose advantages in late years we can appreciate from experience. We hope we may be pardoned for referring in a public work to our personal experience in stating that, as recently as 1849, when we relieved ourselves of the cultivation of a farm in Pennsylvania to take charge of the census, nearly all the operations of agriculture, except that of threshing the grain, were performed by manual labor; and the number of workmen to be provided for, especially during the period of harvest, rendered several months of the year a season of family solicitude and drudgery. On the same farm the crops of the past year were sown and gathered in a much shorter time, in better condition, with one-fourth the number of laborers—the grain being cut by machinery, and the grass mown, loaded on the wagon, and transferred therefrom to mow by means of mechanical appliances. The effects of such changes upon the character of the rural population of our country will soon manifest themselves by their elevating influences.

WHEAT.

Bushels of wheat produced in 1860.

STATES.	BUSHELS.	STATES.	BUSHELS.
Alabama	1, 218, 444	Oregon	826, 776
Arkansas	957, 601	Pennsylvania	13, 042, 165
California	5, 928, 470	Rhode Island	1, 131
Connecticut	52, 401	South Carolina	1, 285, 631
Delaware	912, 941	Tennessee	5, 459, 268
Florida	2, 808	Texas	1, 478, 345
Georgia	2, 544, 913	Vermont	437, 037
Illinois	23, 837, 023	Virginia	13, 130, 977
Indiana	16, 848, 267	Wisconsin	15, 657, 458
Iowa	8, 449, 403		
Kansas	194, 173	Total, States	172, 034, 301
Kentucky	7, 394, 809		
Louisiana	32, 208	TERRITORIES.	
Maine	233, 876		
Maryland	6, 103, 480	District of Columbia	12, 760
Massachusetts	119, 783	Dakota	945
Michigan	8, 336, 368	Nebraska	147, 867
Minnesota	2, 186, 993	Nevada	3, 631
Mississippi	587, 925	New Mexico	434, 309
Missouri	4, 227, 586	Utah	384, 892
New Hampshire	238, 965	Washington	86, 219
New Jersey	1, 763, 218		
New York	8, 681, 105	Total, Territories	1, 070, 623
North Carolina	4, 743, 706		
Ohio	15, 119, 047	Aggregate	173, 104, 924

STATES IN THE ORDER OF THEIR WHEAT PRODUCT IN 1850 AND IN 1860.

The census of 1850 showed that Pennsylvania produced more wheat in 1849 than any other State in the Union, 15,367,691 bushels. Ohio ranked second, producing 14,487,351; New York stood third on the list, 13,121,498; Virginia came next, 11,212,616; Illinois stood fifth, 9,414,575; Indiana, sixth, 6,214,458; Michigan, seventh, 4,925,889; Maryland, eighth, 4,494,680; Wisconsin, ninth, 4,286,131; Missouri, tenth, 2,981,652; Kentucky, eleventh, 2,142,822; North Carolina, twelfth, 2,130,102; Tennessee, thirteenth, 1,619,386; New Jersey, fourteenth, 1,601,190; Iowa, fifteenth, 1,530,581; Georgia, sixteenth, 1,088,534; South Carolina, seventeenth, 1,066,277; Vermont, eighteenth, 535,955; Delaware, nineteenth, 482,511; Maine, twentieth, 296,259; Alabama, twenty-first, 294,044; Oregon, twenty-second, 211,943; Arkansas, twenty-third, 199,639; New Hampshire, twenty-fourth, 185,658; Mississippi, twenty-fifth, 137,990; Connecticut, twenty-sixth, 41,762; Texas, twenty-seventh, 41,729; Massachusetts, twenty-eighth, 31,211; California, twenty-ninth, 17,228; Minnesota, thirtieth, 1,401; Florida, thirty-first, 1,027; Louisiana, thirty-second, 417; Rhode Island, thirty-third, 49 bushels; Kansas, no report.

The census of 1860 (crop of 1859) placed Illinois, which was fifth in 1850, at the head of the list in 1860—23,837,023 bushels.

Indiana, which was sixth in 1850, was second in 1860—16,848,267.

Wisconsin, which was ninth in 1850, was third in 1860—15,657,458.

Ohio, which was second in 1850, drops to fourth in 1860—15,119,047, though showing an actual increase of 631,696 bushels.

Virginia shows an increase in the last decade of 1,918,361 bushels, but nevertheless stands fifth in 1860, instead of fourth, as in 1850.

Pennsylvania, which stood first in 1850, is now sixth, with an actual decrease of 2,325,526 bushels and 10,794,858 less than Illinois.

New York stands seventh—8,681,105 bushels. In 1850 she stood third, producing 13,121,498, showing a decrease in ten years of 4,440,393 bushels.

Iowa, which was fifteenth in 1850, now stands eighth, producing 8,449,403 bushels, against 1,530,581 in 1850, showing an increase of 6,918,822.

Michigan, which was seventh, is now ninth, though the produce of wheat has nearly doubled. In 1850 it was 4,925,889 bushels; in 1860—8,336,368.

Kentucky, which was eleventh in 1850, is now tenth—7,394,809 bushels—showing an increase of 5,251,987.

Maryland, which was eighth in 1850, falls to the eleventh in 1860—6,103,480 bushels—though showing an increase of 1,608,800.

California, which was twenty-ninth in 1850, is now the twelfth wheat-producing State in the Union. In 1850 she produced but 17,228, while in 1860 she produced 5,928,470 bushels, being nearly as much as Indiana (which stood sixth) produced in 1850.

Tennessee, again, as in 1850, stands thirteenth, producing, however, 5,459,268, against 1,619,386 bushels in 1850.

North Carolina, which was twelfth in 1850, now ranks only as fourteenth, producing, however, 4,743,706 bushels, being an increase of 2,613,604.

Missouri, which was tenth in 1850, is now fifteenth, producing 4,227,586 bushels, showing an increase, however, of 1,245,934.

Georgia, in 1860, stands sixteenth, as in 1850, in order, producing 2,544,913, against 1,088,534 bushels in 1850.

Minnesota, which was thirtieth in 1850, now occupies the seventeenth rank, having increased the produce of wheat from 1,401 bushels in 1850 to 2,186,993 in 1860.

New Jersey, which was fourteenth in 1850, is now eighteenth, with a product of 1,763,218 bushels, showing an increase of only 162,028 in ten years.

Texas, which was twenty-seventh in 1850, is now nineteenth, producing 1,478,345, against 41,729 bushels in 1850.

South Carolina, which was seventeenth in 1850, is now twentieth, producing 1,285,631 bushels in 1860, against 1,066,277 in 1850.

Alabama is again twenty-first, as in 1850, producing 1,218,444 bushels in 1860, or 924,400 more than in 1850.

Arkansas is now, as in 1850, twenty-second, producing 957,601 bushels, being an increase of 757,962 in ten years.

Delaware, which in 1850 was nineteenth, stands now twenty-third, producing 912,941 bushels, against 482,511 in 1850.

Oregon, which stood twenty-second in 1850, is now twenty-fourth, producing 826,776 bushels in 1860, against 211,943 in 1850.

Mississippi is again twenty-fifth, as in 1850, producing 587,925 bushels, against 137,990 in 1850.

Vermont, which was eighteenth in 1850, is now twenty-sixth, producing only 437,037 bushels, against 535,955 in 1850, or a decrease of 98,918 bushels in ten years.

New Hampshire, which was twenty-fourth in 1850, is now twenty-seventh, producing 238,965 bushels in 1860, against 185,658 in 1850, or an increase of 53,307 bushels in ten years.

Maine, which was twentieth in 1850, is now twenty-eighth, producing 233,876 bushels in 1860, against 296,259 in 1850, or a decrease of 62,383 bushels.

Kansas, which was unreported in 1850, now stands twenty-ninth, producing 194,173 bushels, taking the same relative rank occupied by California in 1850, but which stands twelfth in 1860.

Massachusetts, which was twenty-eighth in 1850, is now thirtieth, producing 119,783 bushels, against 31,211 in 1850, showing an increase of 88,572.

Connecticut, which was twenty-sixth in 1850, is now thirty-first, producing 52,401 bushels, against 41,762 in 1850, showing an increase of 10,639.

Louisiana continues thirty-second, as in 1850, though producing 32,208 bushels, against 417 in 1850.

Florida, which was thirty-first in 1850, is now thirty-third, producing 2,808 bushels in 1860, against 1,027 in 1850.

Rhode Island, which was thirty-third, is now thirty-fourth, producing 1,131 bushels in 1860, against 49 in 1850.

PRODUCTION OF WHEAT IN PROPORTION TO POPULATION.

In 1850, the United States and Territories, with a population of 23,191,876, exclusive of Indian tribes, produced 100,485,944 bushels of wheat, or 4.33 bushels to each inhabitant.

In 1860, with a population, exclusive of Indian tribes, of 31,443,322, there were 173,104,924 bushels of wheat produced, or 5.50 bushels to each inhabitant, showing an increase of one bushel and one sixth to each inhabitant, or an increase in proportion to population of over twenty-five per cent.

The New England States, with a population of 2,728,116 in 1850, produced 1,090,894 bushels, or only thirteen quarts to each inhabitant. In 1860, with a population of 3,135,283, the New England States produced 1,083,193 bushels, or about eleven quarts and a half to each inhabitant.

The middle States, (New York, Pennsylvania, New Jersey, Maryland, and Delaware,) in 1850, with a population of 6,573,301, produced 35,066,570 bushels, or five and one-third bushels to each inhabitant. The same States in 1860, with a population of 8,258,150, produced 30,502,909 bushels, or about three and two-thirds to each inhabitant.

The western States, (Ohio, Michigan, Wisconsin, Illinois, Iowa, Missouri, Minnesota, Kentucky, Indiana, and Kansas,) in 1850, with a population of 6,379,723, produced 46,076,318 bushels, or seven and a quarter to each inhabitant. The same States in 1860, with a population of 10,218,722, produced 102,251,127 bushels, or ten to each inhabitant.

The southern States, (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and Texas,) in 1850, with a population of 7,349,472, produced 17,795,761 bushels, or nearly two and a half to each inhabitant. The same States in 1860, with a population of 9,103,332, produced 31,441,826 bushels, or three and a half to each inhabitant.

The fifteen slaveholding States, in 1850, with a population of 9,698,487, produced 27,897,426 bushels, nearly three to each inhabitant. The same States in 1860, with a population of 12,112,683, produced 50,080,642 bushels of wheat, or a little over four to each inhabitant.

The non-slaveholding States and Territories, in 1850, with a population of 14,492,389, produced 72,588,518 bushels, or five to each inhabitant.

The same States and Territories in 1860, with a population of 19,330,639, produced 123,024,282 bushels of wheat, or about six and one-third bushels to each inhabitant.

To recapitulate: The production of wheat in the whole United States and Territories was four and one-third bushels in 1850 to each inhabitant, and in 1860 five and a half bushels to each inhabitant.

In the New England States the production of wheat in 1850 was thirteen quarts to each inhabitant, and in 1860 only eleven quarts.

In the middle States the production of wheat in 1850 was five and one-third bushels to each inhabitant, and in 1860 three and three-fourths bushels.

In the western States the production of wheat in 1850 was seven and a quarter bushels, and in 1860 nine and three-fourths bushels, to each inhabitant.

In the southern States the production of wheat in 1850 was two and a half bushels, and in 1860 three and a half bushels, to each inhabitant.

In the entire slaveholding States the production of wheat in 1850 was three bushels, and in 1860 four bushels, to each inhabitant.

In the free States and Territories the production of wheat in 1850 was five bushels, and in 1860 six and a quarter bushels, to each inhabitant.

Taking the country as a whole, therefore, there has been a gratifying increase in the production of wheat as compared with population; an increase of one bushel to each inhabitant, or about twenty-five per cent.

In the western States the increase in proportion to population has been, as was to be expected, much larger than in any other section—an increase of two and a half bushels to each inhabitant, or an actual increase of over thirty-three per cent.

In the slaveholding States, taken as a whole, the increase was one bushel to each inhabitant, against one and a quarter bushels increase in the free States. The increase per cent., however, is greater in the slave States than in the free States, being thirty-three per cent. in the former, against twenty-five per cent. in the latter. The production of wheat in proportion to the population was much lower in 1850 in the slaveholding than in the free States.

In New England the production of wheat, little as it was in 1850, is even less in 1860. It was only thirteen quarts to each inhabitant in 1850, and in 1860 about eleven and a half quarts.

New England is almost entirely dependent upon the western States for breadstuffs. That wheat can be grown in the New England States there is abundant evidence. Wheat forms the principal bread-food of a large portion of all civilized nations, and has a wider range of habitat than any other cereal. There is scarcely a soil in which it cannot be grown, at least occasionally. We have seen as good wheat produced in Connecticut as in western New York or in Ohio.

It has been said that the reason why New England produces so little wheat is on account of the exhaustion of the soil. We believe the soil proper is as rich to-day in New England as it ever was, and that it can be made highly productive has been proved in repeated instances. The soil of New England, however, never was well adapted to the production of wheat. John Adams, of Quincy, Massachusetts, in a letter written to Elkanah Watson, in 1812, says: "Full fifty-five years have I observed, inquired, read, and tried experiments to raise wheat in New England. *The result is total despair*."

In another letter to the same gentleman, written about the same time, he alludes to the experiments of Josiah Quincy with Siberian wheat as follows:

"He (Mr. Quincy) succeeded very well; had a fine crop, which suffered nothing from the Hessian fly, mildew, blasting, or weevil. Enthusiasm was excited in the neighborhood; all the seed he could spare was purchased at a high price for sowing. My wife purchased some bushels; others more. Quincy himself sowed the greatest part of all he had. Expectations were high that it would become the staple of New England. *The next year we all failed;* every plant of it blasted, and seed, labor, and all were totally lost."

"Notwithstanding all this," he further says, "I have no doubt wheat may be raised in Massachusetts as well as anywhere else; but the land must be under proper cultivation, particularly manured abundantly, the seed sown so early that it may be forward and vigorous enough to bear the winter, and start early enough in the spring to shoot the grain and ear forward before the season of insects. But this process, which *I know has succeeded*, and will succeed, is expensive, and the wheat will not procure a price equal to the labor."

There is here nothing to indicate that the soil of New England was ever very well adapted to the production of wheat, and that it has been exhausted by tillage. The reason so little wheat is raised in those States is simply, as Mr. Adams says, "it will not procure a price equal to the labor." Other crops pay better.

In the middle States the production of wheat is also less in 1860 than in 1850 by some four and a half millions of bushels, while during the same period the population increased over one and a half million.

There are several causes which conspire to produce this result. Competition with the west, and consequent low prices, is one cause; want of capital to admit of a higher system of farming generally, another.

Agriculture in the middle States is in a transition state. We have abstracted from the soil nearly all the accumulated organic matter derived from natural sources, and have not yet fully realized the necessity of enriching the soil by the application of manure. Farmers have been proverbially slow to adopt new ideas and practices. Many continue to grow wheat in the same manner, and with as little preparation, as when the country was new, and the soil abounded in available plant-food. They fail to get as good crops as formerly; but too many persevere in the old way, hoping for better success, and of course are disappointed.

In the middle States we must make more manure, and cultivate our land better, before we can reasonably expect to grow good crops of wheat. There are many farmers who understand this, and are doing their utmost to enrich their land, but the majority put in their wheat without any manure whatever, and obtain small crops in consequence. Others, discouraged with their failures to obtain remunerative crops, have abandoned wheat culture altogether, or greatly reduced the number of acres sown.

The advent of the midge is another reason for the falling off in the production of wheat in the middle States. This insect, according to the late Dr. Thaddeus W. Harris, first made its appearance in the United States in the northern portion of Vermont, and on the borders of Lower Canada, about the year 1828, though he adds in a foot-note that Mr. Jewitt states that "its first appearance in western Vermont occurred in 1820." From these places its ravages have gradually extended in various directions from year to year. In 1834 it appeared in Maine, which State it traversed in an easterly course at the rate of twenty or thirty miles a year. Dr. Fitch, the able entomologist to the New York State Agricultural Society, in his sixth report on the "noxious and other insects of the State of New York," gives a most interesting and instructive account of the habits and ravages of this the greatest of all the pests which has infested the wheat-crop. He thinks that this insect was originally brought from Great Britain to Quebec when lying in its larvæ state in some unthrashed wheat, and that it extended itself from thence along the St. Lawrence and Chambly (Sorel) rivers, and thus reached Vermont. All accounts agree in representing it as having overspread the surrounding country from the northwestern portion of Vermont.

In Washington county, New York, the larvæ, or little yellow worms of this insect, were found in the wheat in 1830, and in 1832 they had so multiplied as to completely destroy the crop in many fields. Previous to the arrival of this insect a considerable quantity of wheat was annually sent to market from that county, but at no time since (1860) has it been able to grow more than a small fraction of the amount needed for its own consumption.

Two years later the midge was progressing on its way south, through the adjoining counties of Rensselaer and Saratoga, devastating the wheat-fields in the same manner as in Washington county.

In 1834, the midge having advanced eastward across Vermont and New Hampshire, began to show itself in the State of Maine; and in the opposite direction it had become so numerous around Montreal as to seriously injure the crop.

In 1835 and 1836, over all the territory to which it had extended, and where wheat continued to be sown, it was so extremely destructive that further attempts to cultivate this grain were abandoned.

In 1849 and 1850, the midge having advanced up the St. Lawrence river to Lake Ontario, made its appearance in the counties along the north side of the lake, in Canada, travelling westward, it is said, at the rate of about nine miles each year. At the same time it was making similar progress on the opposite side of the lake, into the great grain-growing district of western New York, which it seems also to have approached at the same time from the Mohawk valley and central New York. It was quite injurious on the borders of Seneca lake in 1849 and 1850.

The late General James S. Wadsworth, of Genesee, New York, states that the midge was seen in the Genesee valley in 1854, more in 1855, and in 1856 it destroyed from one-half to two-thirds of the crop on the uplands, and nearly all on the flats. In 1857 it was still worse, taking over two-thirds of the crop.

The secretary of the New York State Agricultural Society, from statistics gathered for the year 1854, concluded that at the lowest estimate the injury done the wheat-crop in that year in the State of New York exceeded fifteen millions of dollars; or, if estimated at the price to which wheat afterwards advanced, to over twenty millions of dollars.

In Pennsylvania the midge seems to have attracted the attention of wheat-growers earlier than in western New York. In the Patent Office report for 1852, James Thornton, jr., of Byberry, Philadelphia county, Pennsylvania, says: "Mediterranean wheat is universally sown, its early maturity being proof against the grain-worm, (a very destructive insect that feeds upon the grain whilst in a milky state.") And in the Patent Office report for 1853, Mr. F. J. Cope, of Hemphill, Westmoreland county, Pennsylvania, under date of November 8, 1852, says: "The wheat crop of this section was materially injured the past season by an insect not inaptly called the 'milk weevil,' from the fact that its depredations are committed on the growing crop while the grain is in the milky state. The injury has been almost entirely confined to the 'white' varieties, the Mediterranean escaping altogether. The grub (frequently four and five to each grain) is of an orange color, about one-eighth of an inch long. My entire crop was destroyed by it. There seems to be no remedy for it; and we must avoid risks by abandoning, at least for a while, those varieties which seem to be its special favorites."

There can be no doubt whatever that the insect alluded to is the midge. Since that time it has been but too well known to the wheat-growers of Pennsylvania.

The injury done the wheat-crop by this insect, is of itself sufficient to account for the diminution in the yield. The damage was greater in New York than in Pennsylvania, and the falling off in the crop from 1850 to 1860 is also greater in the former State than in the latter. In Pennsylvania the amount of wheat in 1850 was 15,367,691 bushels, and in 1860, 13,045,231 bushels, or a decrease of about fifteen per cent.; while in New York, in the same period, the decrease was from 13,121,498 bushels in 1850, to 8,681,100 in 1860, a decrease of about forty-four per cent.

In the other middle States, New Jersey, Delaware, and Maryland, the production of wheat was greater in 1860 than in 1850.

In these States the midge has done very little injury, owing, it is thought, to the warmer climate. The great deficiency in the production of wheat in the middle States lies wholly with New York and Pennsylvania, and is due principally to the advent of the wheat-midge since the census of 1850 was taken. It is believed that the midge is not now as destructive as it was in 1859, to the production of which year the census returns apply. The wheat crop of the following year (1860) was comparatively uninjured by the midge, and had the census been taken in that year, the deficiency would not have appeared as great as it now stands. When the midge appears among the wheat in a given section, it does comparatively small damage the first year, and consequently attracts little attention. The second year it spreads rapidly, and the third and fourth years, if the season is favorable to its operations, it destroys a large portion of the crop; wheat-growers become alarmed, and after a few futile attempts to raise wheat, are so discouraged as to abandon, in a good degree, all efforts to grow it. This was especially the case in western New York. In the county of Monroe, which in 1845 raised more wheat than any other county in the State, and more than all the New England States, the midge proved so destructive in 1855 and 1856, that the members of agricultural societies held meetings to discuss the propriety of abandoning wheat culture. Spring crops and winter barley took the place of wheat, and many farmers who formerly produced a large quantity of wheat, raised little more than enough for their own consumption. There can be no doubt that farmers in this justly celebrated wheat section had been in the habit of sowing too much of their land to this grain. It was not uncommon to grow wheat every other year on the same land. The result was, as might have been foreseen, the land soon lost its primitive fertility, and became comparatively impoverished. Large crops of clover were grown by the aid of gypsum, (sulphate of lime,) and ploughed under as a manure for the wheat crop, and this in a measure restored the fertility of the soil. There can be little doubt, however, that ploughing under such large crops of clover for so many years increased to a deleterious degree the amount of carbonaceous matter in the soil, and this, as is well known, has a tendency to retard the ripening of the crop, as well as to increase to an injurious extent the growth of straw.

When the midge made its appearance, it found everything in the most favorable condition for its rapid propagation. The wheat-growers were entirely unprepared for such an enemy, and it swept through the country like an epidemic.

No wonder there was a wide-spread conviction that wheat culture must be abandoned. They knew little of the habits of this minute insect, and were unable to offer it any resistance.

The midge was, however, no new thing. It had been known in England for a century, and had at different periods proved very destructive. Farmers there, however, did not abandon wheat culture, neither will they do so in this country. They can, with proper care, raise wheat even in seasons when the midge would otherwise prove most destructive.

How are the ravages of the midge to be avoided? The means necessary to avoid the ravages of the wheat-midge are in themselves very simple, and yet they embrace every process of our agriculture.

Wheat is the most profitable of all our ordinary crops, provided the land and climate are suitable, and the yield good.

It should be the aim of the wheat-grower so to conduct all his operations that they shall tend to enrich and prepare his land for the production of the crop. His system of rotation, of feeding stock, and manuring, should have primary reference to this grain. The great error in American agriculture has been the seeding of too much land in wheat, the result of which practice is seen in small and diminishing crops. The time has come when we can no longer sow wheat on the same land every other year with success.

The wheat-grower will appreciate the necessity of introducing other crops for the purpose of preparing and enriching his land, and on fewer acres, to obtain a greater product.

The two substances most likely to be deficient in the majority of soils for the growth of wheat are ammonia and phosphoric acid.

From the fact that about one-half of the ash of wheat, barley, oats, rye, and Indian corn consists of phosphoric acid, it is usual to speak of the cereals as particularly exhaustive of the phosphoric acid in the soil; and it is undoubtedly true that the growth and exportation of cereals from the farm tend very materially to impoverish the soil of phosphoric acid. But it does not follow from this, *that when a soil falls off in its capacity to produce the cereals, it is owing, necessarily, to a deficiency of phosphoric acid.* We believe, in fact, that, with the exception, perhaps, of some portions of the grain-growing districts of the south, this is seldom the case. It has been clearly proved that a soil requires more available phosphoric acid to produce an average crop of turnips than to produce an average crop of wheat. The same, it is believed, is true of clover, beans, peas, vetches, and probably other leguminous plants So that it follows, that so long as a soil produces good crops of clover, or peas, or beans, there is no deficiency of phosphoric acid in the soil, so far, at least, as the production of the cereals is concerned.

When by a continued course of cropping with the cereals the phosphoric acid becomes deficient—not exhausted—the crops of clover and other leguminous plants will first fall off; and if the farmer, after this, goes on impoverishing his soil by sowing the cereals, he must be content to do it with very poor results. Nature protects herself, and the farmer's capital will be exhausted long before he has so exhausted the soil of phosphoric acid, that a good farmer might not render the same soil highly productive, and that, too, without the application of a single atom of phosphoric acid.

It is true that it is often the cheaper method of renovating such soils by the direct purchase of bones, guanos, or other manures which contain large quantities of phosphoric acid; or, what is sometimes cheaper still, by the purchase and consumption of oil-cake, cotton-seed cake, &c. *As long as we can obtain good crops of clover, we need not apprehend any deficiency of phosphoric acid.* Under such circumstances there is little hope that an application of phosphoric acid to any of the cereals would be attended with any great benefit.

Now, all agree that phosphoric acid is more likely to be deficient than any other ash-constituent of plants; and if the above argument is correct—and it is sustained by many well-known facts—it follows that, in the majority of cases, there is no necessity for the direct application of mineral manures to the cereals. *But the cereals need manure of some kind*, the average yield being not half what it should be.

We have shown that so long as we can grow good crops of clover, the soil contains in an available condition a sufficient quantity of *mineral* plant-food for the production of the largest crops of wheat. We do not, therefore, need a direct application of mineral manures. But we need manure of some kind. We must, therefore, look among the organic manures for the particular ingredient which is required.

Organic manures are divided into two classes, carbonaceous and nitrogenous. It must therefore be a carbonaceous or a nitrogenous manure, or both, that we need to enrich our land for wheat and other cereals.

It might easily be shown that we do not need carbonaceous matter for the growth of wheat. On soils, as we shall presently show, where we have been in the habit of ploughing in clover, there can be little doubt that carbonaceous matter is in excess; and on all soils, if it was carbonaceous matter that was needed, nothing would be easier than to supply it in abundance, and at a cheap rate. If it is not carbonaceous matter that we need, it *must be nitrogenous matter*.

Organized nitrogen in decaying ultimately forms ammonia, and it is in this state, or as nitric acid, that it is generally taken up by plants. In speaking of nitrogenous matter, therefore, it will be more convenient to speak of it as ammonia. In enriching the soil for wheat and other cereals, the main object should be to get ammonia.

We know of no system of culture, or of manuring for the cereals, which experience proves beneficial, that does not, either directly or indirectly, furnish ammonia to the soil, either by eliminating it from the organic matter in the soil, or by increasing the capacity of the soil for abstracting it from the air, or dews, or rain, or by growing those plants which have this power, or by the direct application of ammonia in manure. We cannot increase the growth of the cereals without increasing in some way the supply of ammonia. We are well aware that neither the cereals nor other plants will grow unless the soil contains all their ash-constituents in sufficient quantity and in available condition. But there is no practicable and economical method of supplying the requisite quantity of ammonia which does not, at the same time, furnish these ash-constituents in quantity fully equal to the demand of the increased growth of the cereals caused by the application of the ammonia.

This assertion is based on the experiments of Messrs. Lawes and Gilbert, confirmed as they are by the experience of practical farmers.

Mr. Lawes has devoted a large part of his home-farm at Rothamsted, England, for the last twenty-two years to experimental purposes. One field of fifteen acres has been devoted to experiments of different fertilizing substances on wheat—wheat having been annually sown on the same land for over twenty years. Another field has been devoted in the same way to experiments on turnips; another to experiments on peas, beans, and tares; another to experiments on clover, and another to experiments on barley alone, and in rotation with other crops. On the wheat-field it was found that none of the manures used increased the yield of wheat to any material extent, unless they contained ammonia. Potash, soda, superphosphate of lime, magnesia, the ash of fifteen tons of barn-yard manure, the ash of wheat-straw, alkaline silicates—in short, none of the ash-constituents of plants had any effect. But wherever ammonia was used there was obtained an increased yield, and, within certain limits, the increase of wheat was in proportion to the quantity of ammonia supplied.

But here a new and important fact was brought to light. Though the increase of wheat was in proportion to the quantity of ammonia supplied, in no single case out of many hundreds of experiments which have been made during the last twenty years, was as much ammonia (or, rather, nitrogen) obtained in the increase of the wheat and straw as was furnished to the soil in manure.

There was evidently a loss of ammonia by the growth of wheat. Professor Way has advanced the hypothesis that the large quantity of silica found in the straw of wheat and other grains is taken up by the roots of the plants as an ammonia-silicate—the silica being deposited on the straw, and the ammonia evaporated into the atmosphere. This may or may not be the true explanation; but that there is, *practically*, a great loss of ammonia by the growth of wheat there can be no doubt. The same, it is believed, is true of barley, oats, rye, and Indian corn, as well as of herds-grass, rep-top, rye-grass, and other grasses grown for fodder. We rest this belief on the indications of experiments, and on the experience of practical farmers, and not on Way's hypothesis in regard to the absorption of silica as an ammonia-silicate.

But if that hypothesis is correct, it follows, as a matter of course, that the plants we have named, and all others having silicious stems and stalks, belong to this class, and their growth involves a great loss of ammonia to the farm.

On the other hand, Mr. Lawes's experiments on clover, beans, peas, and tares, indicate that there is no loss of ammonia during the growth of these plants. If we apply fifty pounds of ammonia to a crop of wheat, (which is equal to three hundred weight of the best Peruvian guano,) the increased growth of the wheat and straw will not give us back more than twenty or twenty-five pounds of ammonia; the remaining twenty-five or thirty pounds has been evaporated into the atmosphere. If, on the other hand, we apply fifty pounds of ammonia to clover or other leguminous plants, or to turnips, it is all, or nearly all, retained. There is little or no loss.

Ammonia, or nitrogen, exists in all soils, but usually in a condition unavailable to plants except in small quantity. If it existed in an available condition, it would long ago have been washed away; but it lies there inert and insoluble. *It is rendered active and available by tillage.* Hence the advantages of summer fallows on clay soils. Such soils frequently abound in nitrogen and other elements of plants, but they are in an insoluble condition. The soil is so compact that light, heat and air—the three grand agents of decomposition—are excluded, and it is only by tillage—by stirring the soil, by exposing it to the sun, and letting in the air—that these inert substances can be rendered available as food for plants.

On light and sandy soils, which admit the air more readily, there is not that accumulation of organic matter and other food of plants which exists in the clays, and consequently mere tillage is not so beneficial.

Ammonia and nitric acid (which probably has the same effect as ammonia) exist in the atmosphere. A well-pulverized soil, especially of a somewhat clayey nature, attracts ammonia from the air and retains it. And here we may allude to one of the most important discoveries which have been made in scientific agriculture during the past ten years. Professor Way, at the time chemist to the Royal Agricultural Society of England, made a series of investigations on what has since been called the "absorptive powers of soils," which resulted in throwing new light on the processes of vegetable nutrition, and opening up a new field for future investigations, which have since been made, in regard to the manner in which plants take up food from the soil through their roots. In the course of these investigations he found that ordinary soils possessed the power of separating from solution in water the different earthy and alkaline substances presented to them in manure. Thus, when solutions of salts of ammonia, of potash, magnesia, &c., were made to filter slowly through a bed of dry soil five or six inches deep, arranged in some suitable vessel, it was observed that the liquid which ran through no longer contained any of the ammonia or other salt employed. The soil had, in some form or other, retained the alkaline substance, while the water in which it was previously dissolved passed through.

Further, this power of the soil was found not to extend to the whole salt of ammonia or potash, but only to the alkali itself. If, for instance, sulphate of ammonia was the compound used in the experiments, the ammonia would be removed from solution, but the filtered liquid would contain sulphuric acid in abundance, not in the free or uncombined form, but united to lime; instead of sulphate of ammonia, we should find sulphate of lime in the solution; and this result was obtained, whatever the acid or the salt experimented upon might be. It was found, moreover, that the process of filtration was by no means necessary; by the mere mixing of an alkaline solution with a proper quantity of soil, as by shaking them together in a bottle, and allowing the soil to subside, the same result was obtained. The action, therefore, was in no way referable to any physical law brought into operation by the process of filtration.

It was also found that the combination between the soil and the alkaline substance was rapid, if not instantaneous, partaking, therefore, of the nature of the ordinary union between an acid and an alkali.

In the course of these experiments several different soils were operated upon, and it was found that all soils capable of profitable cultivation possessed the property in question in a greater or less degree. Pure sand, it was found, did not possess this property. The organic matter of the soil, it was proved, had nothing to do with it. The addition of carbonate of lime to a soil did not increase its absorptive power, and, indeed, it was found that a soil in which carbonate of lime did not exist possessed in a high degree the power of removing ammonia or potash from solution.

To what, then, is the power of soils to arrest ammonia, potash, magnesia, phosphoric acid, &c., owing? The above experiments lead to the conclusion that it is due to the clay which they contain. In the language of Professor Way, however, "It still remained to be considered, whether the whole clay took any active part in these changes, or whether there existed in clay some chemical compound in small quantity to which the action was due. This question was to be decided by the extent to which clay was able to unite with ammonia or other alkaline basis, and it soon became evident that the idea of the clay, as a whole, being the cause of the absorptive property was inconsistent with all the ascertained laws of chemical combination."

After a series of experiments, Professor Way came to the conclusion that there is in clays a peculiar class of double silicates to which the absorptive properties of soils are due. He found that the double silicate of alumina and lime, or soda, whether found naturally in soils or produced artificially, would be decomposed when a salt of ammonia, or potash, &c., was mixed with it, the ammonia or potash taking the place of the lime or soda. Professor Way's "discovery," then, is, not that soils have "absorptive properties" that have long been known, but that they absorb ammonia, potash, phosphoric acid, &c., by virtue of the double silicate of alumina and soda, or lime, &c., which they contain.

Soils are also found to have the power of absorbing ammonia, or rather carbonate of ammonia, from the air.

"It has long been known," says Professor Way, "that soils acquire fertility by exposure to the influence of the atmosphere, hence one of the uses of fallows. * * * * I find that clay is so greedy of ammonia, that if air charged with carbonate of ammonia, so as to be highly pungent, is passed through a tube filled with small fragments of dry clay, *every particle of gas is arrested.*"

This power of the soil to absorb ammonia is also due to the double silicates. But there is this remarkable difference, that while either the lime, soda, or potash silicate is capable of removing the ammonia from solution, the lime silicate alone has the power of absorbing it from the air.

We have not the space to enter into the details of these investigations, or to point out their bearing on practical agriculture. Suffice it to say that a well-cultivated soil has the power of absorbing from the atmosphere a considerable quantity of ammonia. We will suppose that the soil, by the decomposition of its organic matter, and its power of attracting ammonia from the atmosphere, and from rain and dew, receives annually fifty pounds of ammonia. If we grow a crop of wheat, barley, oats, rye, or Indian corn, from twenty to thirty pounds of this ammonia is evaporated into the atmosphere during the growth of the plants, and is lost to the farm. If, on the other hand, we grow clover, beans, peas, tares, or turnips, the whole of this fifty pounds is organized in the crop, provided there is sufficient available mineral matter in the soil; and if the crop is ploughed under, or consumed by animals on the farm, the whole fifty pounds of ammonia, or nearly so, will be retained for the use of the subsequent cereal crops.

We have not space to dwell on this important difference in the two classes of plants here designated, one of which (clover, &c.,) retains all the ammonia received from the soil and the atmosphere, while the other class (the cereals) dissipate it into the atmosphere during their growth. A correct application of this fact forms the key to good farming.

We must grow more green crops and a less breadth of cereals.

M. Leonce de Lavergne, an eminent French writer, in his work on the Rural Economy of England, Scotland, and Ireland, deduces the same law from his observations of the astonishing results of the English system of rotation, though without offering any satisfactory explanation of its *rationale.* Speaking of England, he says: "That small country, which is no larger than a fourth of France, alone produces one hundred and four millions of bushels of wheat, forty-eighty millions of barley, and ninety millions of oats. If France produced in the same ratio, her yield would be four hundred millions of bushels of wheat, five hundred and sixty millions of bushels of barley, oats, and other grain, equal to at least *double* her present productions; and we ought to obtain more, considering the nature of our soil and climate, both much more favorable to cereals than the soil and climate of England. These facts verify this agricultural law, that, to reap largely of cereals, it is better to reduce than to extend the breadth of land sown, and that by giving the greatest space to the forage crops, not only is a greater quantity of butcher's meat, milk, and wool obtained, but a larger production of grain. France will achieve similar results when she has covered her immense fallows with root and forage crops, and reduced the breadth of her cereals by several millions of hectares."

This is true. English farmers, guided by close observation and experience, have slowly worked out an admirable system of rotation, and now scientific investigations have elucidated the principles upon which it is founded. *We* may not be able at present to pursue generally the same system of rotation in this country, but the *principles* are as applicable here as there, and, if adopted, will produce the same beneficial results.

The application of *plaster*, *ashes*, *superphosphate of lime*, and other mineral manures, has rarely any great effect on the growth of the cereals; but *superphosphate of lime* has an almost magical effect on turnips, and plaster usually increases the growth of clover, so that these mineral manures, when applied to these crops, may be rendered, indirectly, of great benefit to the cereals.

An English farmer once said to the writer, "Insure me a good crop of turnips, and I will insure you a good crop of barley, and of every other crop in the rotation." Of so much value do British farmers consider the turnip crop as a means of enriching the soil for the growth of the cereal grains, that they spend more money in preparing the soil for turnips than for any other crop, frequently fifty dollars per acre. The turnip crop has justly been termed the "sheet anchor" of British agriculture. It enables the farmer to keep an immense stock of sheep and cattle, and thus enrich the soil; the ammonia which turnips obtain from the soil, the rain, and the atmosphere being retained and left on the farm for the use of the following cereal crops. In the Norfolk or four-course system of rotation, one-fourth of the arable land is sown to turnips, followed by barley, seeded with clover. It then lies one or two years in clover, followed by wheat at one furrow. After the wheat, turnips again follow, and so on as before. Latterly, by the use of *superphosphate* and *guano* for turnips, and by feeding large quantities of oil-cake and other purchased cattle food, the land has become so rich that many farmers have thought it necessary to introduce an extra grain crop into the rotation, in order to reduce the soil. But hitherto the rule has been never to take two grain crops in succession.

How different from this is the practice of some of our American farmers! Corn, barley, and wheat often follow each other in succession; then seed down with timothy, red-top, or some other exhausting grass; take off all the hay and then renew the process. To call this a "rotation of crops" is absurd We might as well grow a crop of Indian corn every year.

We must alternate the cereals with crops of clover, peas, beans, tares, and other leguminous plants, or turnips; feed them out on the farm, and carefully save and return the manure to the soil.

In determining which crop to raise for feeding on the farm, we must not merely ask the simple question, "Which crop will afford the most nutritious matter?" but, "Which will ultimately be most profitable, taking into consideration the effect of its growth on the soil, its value as food, and the value of the manure made by its consumption on the farm?" All will admit that to grow wheat to be fed to animals for the purpose of enriching the farm as the primary object would be a wasteful practice, no matter how low a price it brought in market; and to grow barley, oats, rye, and Indian corn for the same object is wasteful also, though perhaps in a less degree.

In order to enrich the soil for the growth of the cereals, therefore, we must grow those plants which do not dissipate ammonia. We must feed them on the farm to stock; and if we use any grain, or purchased cattle food, it should be such, other things being equal, as contains the most nitrogen for the value of the manure; the quantity of ammonia it contains will be in proportion to the richness of the food in nitrogen. Many farmers think manure is manure, no matter how it is produced. *If the elements which make rich manure are not in the food they will not be found in the manure, however carefully it is preserved or composted.*

Horses fed on herdsgrass and oats might do more work, but their droppings would not be as valuable as though they were fed on clover-hay and peas, for the reason that peas contain twice as much nitrogen as oats, and the clover much more than the herdsgrass.

In determining which food to use, both these facts must be taken into consideration. In regard to feeding sheep, however, there is no drawback to the use of clover. Sheep do better on clover-hay than on any other, and it would be the height of folly to grow herdsgrass, rye, grass, or red-top, or any of the natural grasses, for the purpose of feeding sheep. Clover impoverishes the soil less than the grasses; it contains more nitrogen, is at least equally fattening, and makes richer manure. The same may be said of peas and beans, as compared to oats, barley, rye, or corn. They impoverish the soil less, contain twice as much nitrogen, are equally fattening when judiciously used, and afford much more valuable manure. The same is true of oil-cake. It is quite as fattening as corn, and makes far better manure.

Whatever we do in raising crops, in fattening stock or purchasing cattle foods, let our object be to accumulate ammonia for the growth of the cereals, and their yield will be soon greatly augmented.

To avoid the midge, it is essential to get wheat in early. To attain this result, the land must be naturally or artificially drained. This is the first requisite, without which all others will fail. The best of tillage, manures, culture, and seed will be of little avail if the soil requires under-draining.

Other things being equal, wheat will be at least ten days earlier on land that is thoroughly under-drained than on that which needs draining; and it is a well-known fact, that if we could get our wheat into flower ten days earlier than usual we should avoid the midge.

Early sowing of late years has been very generally adopted as a means of getting wheat earlier; but in sowing too early there is danger from the Hessian fly. This insect deposits its eggs in the young wheat in autumn, and early-sown wheat is more liable to injury than that which is sown later. In the wheat-growing section of New York the time for sowing winter wheat is from the first to the twentieth of September. Formerly it was sown as late as the twenty-fifth of September, or, in some instances, as late as the first of October; but, since the advent of the midge, such late sowing has been abandoned. If the land is in high condition and well drained, from the tenth to the twentieth of September is, perhaps, the best time to seed. Sown at this time, we stand a fair chance of steering between the two great pests of the wheat-grower. If we sow earlier, we run additional risk from the Hessian fly; and if later, the midge will almost certainly destroy the crop.

The land being well drained, enriched, and properly prepared in good season, the next important point is the variety of wheat to sow. To avoid the midge, it must come into flower early. The variety most extensively grown in New York and Pennsylvania since the advent of the midge is the Mediterranean. It is a red wheat, originally of inferior quality, but much improved of late years by sowing in good early-wheat soil. Of white wheat the Soules is most extensively grown. It is, with the exception of the Boughton wheat, one of the earliest white varieties yet generally introduced. The Boughton wheat is extensively grown in Maryland and Virginia. It is from two to three weeks earlier than the Soules, and has been introduced into New York in the hope that its early maturity will protect it from the midge. This subject of getting an early variety of white wheat is attracting much attention, and there can be little doubt we shall be able to obtain a variety that will be early enough to escape the midge.

Wheat-growing in the west.—The increased production of wheat in the western States in proportion to population has been most gratifying. Greatly as the means of transportation have increased, they have not kept pace with the increase in production. The navigation of the Mississippi becoming closed as a result of the present civil war, it was impossible to transport the large crops of the west to the Atlantic markets. Freight rose to such an extent that it cost more than *five times* as much to transport a bushel of wheat from Iowa to New York as the farmer received for it. The crops were sold at prices ruinous to the producer.

As the war continued, however, and as our western army advanced south, a demand for agricultural produce was created which gave buoyancy to prices, and at the present time (1864) the western farmer obtains nearly as much for his produce as the farmers of the middle States.

The effect on wheat, however, has been less marked than on oats, corn, hay, and other articles largely consumed by the army. The price of wheat is relatively lower than that of any other produce. So long as we continue to export wheat to Europe, the price will be regulated by the foreign markets, and the cost of sending it there. The bountiful wheat-harvest of 1863 in Great Britain and France, reduced prices so low that English farmers found wheat one of the cheapest grains they could feed to their stock. Had it not been for the high premium on gold, the price of wheat in this country, and especially at the west, would have been less than the cost of production; as it is, the advance in gold has served to increase prices in the west much more in proportion than in the eastern and middle States. For instance, if a bushel of American wheat sells at $1 25 in London, and the cost of sending it from Iowa is $1, the Iowa farmer, with gold at par, receives only twenty-five cents a bushel for the wheat.

Should gold continue at $2 50, (the price at the present writing,) though the wheat still brings only $1 25 per bushel in London, and the cost of sending it there should be $1 a bushel, as before, the Iowa farmer would receive $2 12 per bushel for his wheat, instead of twenty-five cents, as would be the case if gold was at par. The wheat is sold for gold, and $1 25 in gold sells for $3 12 in legal money. Deduct $1 as the expense of sending it to London, and we have $2 12 as the price which wheat should bring in Iowa. In other words, the premium on gold increases the price of wheat in Iowa *eight-fold.*

On the same basis, the farmer in New York, whose wheat costs only twenty-five cents a bushel to ship to London, would receive, with gold at par, $1 a bushel; and with gold at $2 50, as before, he would receive $2 87.

The premium on gold, which advances the price of wheat eight-fold in Iowa, increases it less than three-fold in New York. In other words, the *increase* in the price of wheat caused by the premium on gold is more than twice as great in the west as in the eastern and middle States.

These figures are not intended to represent the actual cost of sending wheat to Europe, but are used merely to illustrate the effect on prices of the present premium on gold. There can be no doubt that the western farmer obtains a relatively higher price for his produce, owing to the premium on gold, than the eastern farmer.

Of course any conclusions based on the present anomalous condition of affairs will be unsatisfactory. When we return to a specie basis, it would seem that the present high prices of produce in the west, being caused by the premium on gold, must rapidly fall.

For some time before the war our western farmers were beginning to complain that wheat-growing was not profitable—that the cost of transportation left them barely enough to meet the cost of production—and it was argued wisely, as we think, that it would be more profitable to grow less wheat, and raise more cattle, pork, wool, &c., the cost of transporting which, in proportion to value, is much less than that of a more bulky produce.

When things return to their natural channel, there can be little doubt that the west will find it more profitable to produce meat and wool, than to grow wheat. It was so for some years previous to the war, and will be so again when the war ends.

In the mean time the demand for wheat and other grain, induced partly by the increased consumption caused by the war, and the decreased production caused by the abstraction of labor employed in the mechanic arts and the military service, will for some years, probably, keep prices high enough to make wheat-growing at the west exceedingly profitable. The time must be expected, however, when the western farmer will again find the cost of sending wheat to the eastern cities and to Europe, so high as to leave him barely margin enough to pay the cost of production.

The western farmer for a year or two has been receiving high prices for his produce. He would do well fully to understand the causes which have led to this result. They are by no means permanent, and as long as we continue to export breadstuffs to Europe, and prices remain there as they are at present, nothing but a high premium on gold would enable us to command high prices for breadstuffs. When we return to specie payments, if we have a large surplus of wheat to export, it is vain to expect, as a general rule, anything like present prices in the west.

The rapidity with which manufactures have increased in the west, as well as at the east, render it highly probable that in future there will be a much greater home demand for agricultural products of all kinds, than existed for a few years previous to the war. Some of the largest coal-fields in the world exist in the western States, while iron and other metals are found there in great abundance. Everything is favorable for building up a great manufacturing interest. Whatever may be the result of the war in other respects, it seems certain that the price of manufactured articles must also continue high. The interest on our national debt, and the increased yearly expenses of the government, will require heavy duties on foreign manufactures; and this, in addition to the heavy expenses of transportation, will give the manufacturers in the west all the protection that can be desired. The discovery and development of the immense mineral resources of our western Territories, and their astonishing richness in gold, silver, and other metals, also favor the idea that in a few years the centre of population will be found in the west, whither it has been marching with steady progress, rather than in the Atlantic States. Most of the produce which is now sent east at such a great expense will be consumed at home, and the farmers of the interior will thus obtain a more equable market at fair remunerative prices.

There is, perhaps, no one fact which gives a clearer idea of the great growth of the west, and the increase of its products, than the amount of grain which is shipped each year from Chicago. In 1838 seventy-eight bushels of wheat comprised the total exports from what has since become the greatest grain market in the world. In 1839 it was 3,678 bushels; in 1840, 10,000 bushels; in 1841, 40,000 bushels; in 1842, 586,907 bushels; in 1845 it first reached a million bushels; in 1847 over 2,000,000 bushels. In 1851 and 1852 it again fell off to less than a million bushels; but in 1853 again rose to 1,680,998 bushels. In 1854 it was 2,744,860 bushels. In 1855, 7,110,270 bushels; in 1856, 9,419,365 bushels; in 1857, 10,783,292 bushels; in 1858, 10,759,359 bushels; in 1860, 16,054,379 bushels; in 1861, 22,913,830 bushels; in 1862, 22,902,765 bushels; and in 1863, 17,925,336 bushels of wheat.

Our official tables show that there were 173,104,924 bushels of wheat raised in the United States in the year 1859. In that year we exported to Great Britain only 295,248 bushels of wheat. In other words, out of every thousand bushels produced, we exported to Great Britain less than one and three-fourths bushels. In 1860 our exports of wheat amounted to 11,995,080 bushels, or, assuming that no more was raised that year than in 1859, over seventy bushels in each one thousand produced. In 1861 and 1862 the exports were even still greater—greater by far than ever before known, being 20,061,952 and 29,798,160 respectively—falling down in 1863 to 16,069,664. The closing of the Mississippi, and the loss of the southern trade, caused by the rebellion, together with the comparative failure of the wheat crop in Great Britain, accounts for this large increase in our foreign exports.

There can be no doubt that the west, directly or indirectly, is the source of all the wheat that is exported from the United States, and this in addition to supplying New England with breadstuffs. Under these circumstances, or such as are likely to exist, shall we continue to export wheat?

This question has been raised both in Europe and in this country. The question is not whether the western States can raise more than enough for home consumption. There can be no doubt on this point. But New England and the middle States are increasing in population, while their production of wheat is declining. Can the west supply this increased demand and growing deficiency of the New England and middle States, besides supplying the rapidly increasing home demand, and have a surplus left to export to foreign countries? Had the country continued united and prosperous, had the west continued to develop her rich agricultural resources with the rapidity of the last ten years, there can be little doubt that we should have continued for a considerable time at least to export wheat; but, with the increased demand caused by the war, with the abstraction of labor from agricultural pursuits, and the stimulus given to manufactures, it is a question not so easily answered, whether we shall, for a few years to come, continue to produce a surplus. Much depends on the middle States, to the productiveness whereof very slight improvement in our system of agriculture would add greatly.

There is no reason why the middle States should not raise wheat as abundantly as in past years. While the aggregate production of wheat has greatly decreased, there are farmers in every county who, by a judicious system of cultivation, raise as much wheat as at any former period. Let this improved system of farming become general, and the middle States would soon become large exporters of wheat, unless the stimulus given to manufactures shall greatly increase the home demand. Farmers are now receiving better prices for their produce than at any former period, and this is favorable to the introduction of improved systems of cultivation. With prices as low as they have ruled from 1850 to 1860, it was not clear whether farmers in the middle States could afford to underdrain, manure, and cultivate their land to that extent which is necessary for the production of large crops. This has been done in individual cases with much profit, but still the great majority of farmers could not see their way clear in expending so much capital, and, indeed, it must be confessed that it is not easy to show how *high farming* can be made profitable with low prices. All this for the present, however, is now changed. Prices have increased to a figure never before reached in this country. Everything that the farmer can raise, is in demand at rates which are highly remunerative. This demand and high prices cannot fail to stimulate farmers to put forth every energy to increase their crops. A higher system of culture will be introduced, and, when once adopted and found profitable, will be continued, even though prices should fall to the old standard.

There can be little doubt that the war is destined to make great changes in our agriculture. Farming never was so remunerative as at the present time. Hitherto, while the profits have been generally steady and sure, they have not been large, and the best talent of the country found greater attraction in other pursuits.

As a people we have been distinguished for our material prosperity. "Labor is wealth," and this has poured in upon us from every country in Europe. This labor, directed by men of superior education and enterprise, has developed the vast resources of the country to an extent without a parallel in history. We had enjoyed a long period of peace. The expenses of the government were but little, people were active, industrious, intelligent, and enterprising. No wonder we became wealthy. But did our gains favor agricultural improvement? We think not, materially. Being rich, with none of those social distinctions which in Europe are kept up at such great cost, our wealth has been expended in luxuries. The result was, that those who contributed to our pleasures and the gratification of our tastes were more in demand and received a higher compensation than those who furnished the mere necessaries of life. The war will, in the end, make us poorer and more economical, and the time must sooner or later arrive when we shall have less to spend in mere luxuries; and those who furnish the necessaries of life will receive a higher consideration and better compensation. The importance of agriculture will be realized, and will attract the best minds of the country, and vast improvements rapidly follow, succeeded by enlarged production. This great change, however, will not be brought about at once. It will require time to introduce an improved system of agriculture and to materially increase the productiveness of our farms.

In the mean time, it is highly probable that our exportation of breadstuffs to Europe will be materially lessened, unless a European war should greatly enhance prices. It is, however, to an increased home consumption that we look for those higher prices that will give that stimulus to American agriculture it has hitherto needed. As long as we continue to export wheat, no matter to how small an extent, the price in Europe will regulate the price in this country.

The price obtained in England for the 295,241 bushels of wheat which we exported in 1859 determined the price of our whole crop of over 173,000,000 of bushels raised that year. The price of the one and three-fourths bushel exported fixed the price of the thousand bushels consumed at home. If, for a few years, the price of grain in this country is determined not by what it will bring when shipped to Europe, but by the price at which Europe can furnish it to us here, and if we are compelled to forego some of the European luxuries which have of late years absorbed such a large proportion of our wealth, it will be no great misfortune to us as a people.

For the following remarks on wheat culture in California we are indebted to ex-Governor Downey to whom we are under great obligations for other important statements:

"Thus far in our history the wheat crop is next in importance to our product of the precious metals; yielding an abundant supply for home consumption, and a large surplus for exportation. All of our valleys north of the Salinas plains, in Monterey county, are admirably adapted to the production of this great staple, yielding from 30 to 60 bushels to the acre, and generally exempt from all diseases that affect and annoy the farmer in the Atlantic and Mississippi States. Our virgin soil as yet requires neither fallowing nor manuring, but year after year yields from the same field its heaps of golden grain. From the bay of Monterey to the head of Russian river, an extent of 250 miles, is one vast wheat field. Barley and oats are produced in great abundance, but their export demand is limited. The wild oats, which is fully as luxuriant as the cultivated, is one of our most important grasses, and, cut while the grain is in its lactescent condition, is considered the best hay in the world. From the 10th of May until the 1st of November the farmer expects no rain. He therefore cuts, threshes, and sacks on the same field, and houses in a sound and perfect condition, rendering it perfectly safe for the mill or the longest voyage."

THE QUALITY OF OUR WHEAT.

High quality in wheat can only be obtained where there is sufficient heat in summer for its perfect elaboration. There is nothing that will take the place of sunshine. In this respect the climate of the United States is far better for the production of wheat of high quality, than that of Great Britain.

The best wheat years in England are the dryest and hottest. The year 1863, with its great heat, was the best wheat season ever known in England. The crop was never before so large, or the quality so good. The heat of the summer months approximated closely to that of this country. With "high farming" there is nothing which the English wheat-grower dreads so much as a cold, moist summer. Could he be always sure of an American summer he could calculate on obtaining an average yield of not less than forty bushels per acre, and of the highest quality. But should he make his land rich enough to produce a heavy crop in a dry season, and a cool, moist summer should ensue, his wheat would be all laid and not yield half a crop. So far as the summer climate is concerned, therefore, the American wheat-grower has everything that he can desire. Ours is the climate for "high farming."

The severity of the winters, and cold, late, wet springs, followed suddenly by dry, hot summers, are the chief drawbacks to our American climate; but their injurious effects can easily be guarded against. All that we need is *good farming*. The land must be drained, well cultivated, properly enriched, and sown with a variety that matures early, and the result will be all that can be desired. In moist lands, especially, the roots of grain which are not well protected by a healthy growth in autumn are very sure, by the upheaving of the ground, to be broken and exposed to a killing cold in winter. This is inevitable in long-cultivated and moist lands. In new soils, rendered light and porous by the remains of vegetable matter, late sowing often results differently. Underdraining will lengthen the season at least two weeks in autumn and spring. The land will be drier and warmer in spring and fall, and cooler and more moist during the summer months. The wheat, on thoroughly underdrained, well-cultivated, and enriched land, will make a strong, healthy growth in autumn, and thus be enabled to protect itself against the rigors of our severest winters; while it will come forward rapidly during the cool spring months, and by the time that dry, hot weather sets in the plants will be so far advanced, and so full of sap, that all that is needed is for the crop to mature. It is at this point that we need sufficient sunshine to elaborate the juices of the plant and give us heat of high quality; and it is just here that the American climate is so far superior to that of Great Britain. It is seldom, indeed, that we have not sun enough to mature the heaviest crops when the soil and culture are adapted to the wheat plant.

While it is true that the American farmer is highly favored in regard to climate, it must be acknowledged that the average quality of our wheat is by no means what it should be. In New York, Pennsylvania, and Ohio, the midge has driven out of cultivation some of the best varieties of white wheat, and their place has been occupied by the red Mediterranean wheat, which, though earlier, is of inferior quality. The means which we have recommended to avoid the midge, would enable us to grow better varieties, as well as to improve their quality.

In the western States the quality of the wheat has greatly improved; but yet it is by no means what it should be. More care in cleaning the seed, better cultivation, and less slovenly harvesting, threshing, and cleaning, would add greatly to the quality of the western wheat crop, as well as to the profits of the grower. The census returns do not show, separately, the amount of winter and spring wheat. In many sections of the west, spring wheat is now much more extensively grown than winter wheat, and the quality is, of course, inferior to the best samples of the latter. Much can be done, and is doing, to improve the quality of our spring wheat, but the same efforts would give us winter wheat of much greater excellence. With a better system of cultivation at the west, winter wheat will take the place of the spring variety.

In concluding this article, it may not be out of place to suggest, that if any persons should be disposed, from what we have written respecting the consumption of wheat, to draw parallels with the individual consumption in other countries, they should not overlook the extensive use made of maize (Indian corn) by some portions of our people with whom wheat is a secondary consideration as an article of diet.

INDIAN CORN.

Bushels of Indian corn produced in 1860.

STATES.	BUSHELS.	STATES.	BUSHELS.
Alabama	33, 226, 282	Pennsylvania	28, 196, 821
Arkansas	17, 823, 588	Rhode Island	461, 497
California	510, 708	South Carolina	15, 065, 606
Connecticut	2, 059, 835	Tennessee	52, 089, 926
Delaware	3, 892, 337	Texas	16, 500, 702
Florida	2, 834, 391	Vermont	1, 525, 411
Georgia	30, 776, 293	Virginia	38, 319, 999
Illinois	115, 174, 777	Wisconsin	7, 517, 300
Indiana	71, 588, 919		
Iowa	42, 410, 686	Total States	836, 404, 593
Kansas	6, 150, 727		
Kentucky	64, 043, 633		
Louisiana	16, 853, 745	TERRITORIES.	
Maine	1, 546, 071		
Maryland	13, 444, 922	District of Columbia	80, 840
Massachusetts	2, 157, 063	Dakotah	20, 269
Michigan	12, 444, 676	Nebraska	1, 482, 080
Minnesota	2, 941, 952	Nevada	460
Mississippi	29, 057, 682	New Mexico	709, 304
Missouri	72, 802, 157	Utah	90, 482
New Hampshire	1, 414, 628	Washington	4, 712
New Jersey	9, 723, 336		
New York	20, 061, 049	Total Territories	2, 388, 147
North Carolina	30, 078, 564		
Ohio	73, 543, 190	Aggregate	838, 792, 740
Oregon	76, 122		

The production of Indian corn in the United States and Territories, according to the census of 1860, was 838,792,740 bushels. It is difficult to fully realize the magnitude of these figures, which we can only appreciate by contemplating them in connexion with the aggregate production of our other great staples. With this object, we here introduce a table showing the production of wheat, rye, oats, barley, buckwheat, peas and beans, in 1850 and in 1860, as compared with the production of Indian corn.

Wheat, rye, oats, barley, buckwheat, peas and beans, raised in the United States and Territories in 1850 *and* 1860, *as compared with Indian corn.*

	1850.		1860.	
Wheat	100, 485, 944	bushels.	173, 104, 924	bushels.
Rye	14, 188, 813	"	21, 101, 380	"
Oats	146, 584, 179	"	172, 643, 185	"
Barley	5, 167, 015	"	15, 825, 898	"
Buckwheat	8, 956, 912	"	17, 571, 818	"
Peas and beans	9, 219, 901	"	15, 061, 995	"
Total	284, 602, 764	"	415, 309, 200	"
Indian corn	592, 071, 104	"	838, 792, 740	"

It will be seen from the above table that we raise nearly five bushels of Indian corn to one of wheat, and more than *double the aggregate* production of wheat, rye, oats, barley, buckwheat, peas, and beans. Such was also the case in 1850. It will be seen, however, that less wheat was raised in 1850 *in proportion to Indian corn* than in 1860. In other words, vastly as the production of Indian corn has increased in ten years, the production of wheat has increased in still greater proportion.

We produce more bushels of oats than of wheat, but in proportion to Indian corn the increase is not as great in 1860, as compared with 1850, as in the case of wheat.

The production of no other grain has increased so much in the last ten years as barley. It will be seen that we produce *three* times as much in 1860 as in 1850, while the production of Indian corn has not quite doubled.

Buckwheat, peas, and beans have also greatly increased, but only a fraction more than Indian corn.

The principal corn-growing States are: Illinois, Missouri, Ohio, Indiana, Kentucky, Tennessee, Iowa, Virginia, Alabama, Georgia, North Carolina, Mississippi, Pennsylvania, and New York.

The following table shows the production of Indian corn in these States in 1860, 1850, and 1840

Production of Indian corn in the principal corn-growing States in 1860, 1850, *and* 1840.

States.	1860.	1850.	1840.
Illinois	115,174,777	57,646,984	22,634,211
Missouri	72,892,157	36,214,537	17,332,524
Ohio	73,543,190	59,078,695	33,668,144
Indiana	71,588,919	52,964,363	28,155,887
Kentucky	64,043,633	58,672,591	39,847,120
Tennessee	52,089,926	52,276,223	44,986,188
Iowa	42,410,686	8,656,799	1,406,241
Virginia	38,319,999	35,254,319	34,577,591
Alabama	33,226,282	28,754,048	20,947,004
Georgia	30,776,293	30,080,099	20,905,122
North Carolina	30,078,564	27,941,051	23,893,763
Mississippi	29,057,682	22,446,552	13,161,237
Pennsylvania	28,196,821	19,835,214	14,240,022
New York	20,061,049	17,858,400	10,972,286

Tennessee was the greatest corn-producing State in 1840, Ohio in 1850, and Illinois in 1860.

Kentucky was the second greatest corn-producing State in 1840, and also in 1850, while she yielded the honor to Ohio in 1860.

Virginia stood third as a corn-producing State in 1840, Illinois in 1850, and Missouri in 1860.

Ohio stood fourth in 1840, Indiana in 1850, and again in 1860.

Indiana stood fifth in 1840, Tennessee in 1850, and Kentucky in 1860.

North Carolina stood sixth in 1840, Virginia in 1850, and Tennessee in 1860.

Illinois produces nearly one-seventh of all the corn raised in the States and Territories.

The six States of Illinois, Missouri, Ohio, Indiana, Kentucky, and Tennessee, produced, in 1860, 449,332,502 bushels of Indian corn, or more than half the entire production of the United States and Territories.

It will be observed from the above table that Iowa has increased her production of Indian corn during the last twenty and ten years, more than any other of the great corn-growing States. In twenty years she has increased from less than one and a half million bushels to more than forty-one million bushels. This young State produces nearly half as much corn as all New England and the middle States.

The following table shows the production of Indian corn in the New England States, together with the number of inhabitants, in the years 1860, 1850, and 1840 :

Indian corn in the New England States in 1860, 1850, *and* 1840, *together with the population.*

States.	Bushels of Indian corn.			Population.		
	1860.	1850.	1840.	1860.	1850.	1840.
Connecticut	2,059,835	1,935,043	1,500,441	460,147	370,792	309,978
Maine	1,546,071	1,750,056	950,528	628,279	583,169	516,793
Massachusetts	2,157,063	2,345,490	1,809,192	1,231,066	994,514	737,699
New Hampshire	1,414,628	1,573,670	1,162,572	326,073	317,976	284,574
Rhode Island	461,497	539,201	450,498	174,620	147,545	108,830
Vermont	1,525,411	2,032,396	1,119,678	315,098	314,120	291,948
Total	9,164,505	10,175,856	6,992,909	3,135,283	2,728,116	3,234,822

It will be seen that in the last ten years the production of Indian corn has decreased in Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. This is accounted for, in part, by the fact that the year 1859, to which the census of crops applies, was unusually dry, and the crops in New England suffered considerably. It must be confessed, however, that the figures, making all due allowance for the drought, do not place the agriculture of New England in a favorable light.

The following table shows the production of Indian corn in the middle States, together with the number of inhabitants in the years 1860, 1850, and 1840.

States.	Bushels of Indian corn.			Population.		
	1860.	1850.	1840.	1860.	1850.	1840.
New York	20,061,049	17,858,400	10,972,286	3,880,735	3,097,394	2,428,951
Pennsylvania	28,196,821	19,835,214	14,240,022	2,906,115	2,311,786	1,724,033
New Jersey	9,723,336	8,759,704	4,361,975	672,035	489,555	373,306
Delaware	3,892,337	3,145,542	2,099,359	112,216	91,532	78,085
Maryland	13,444,922	10,749,858	8,233,086	687,049	583,034	470,019
District of Columbia	80,840	65,230	39,485	75,080	51,687	43,712
Total	75,399,305	61,413,948	39,916,213	8,333,230	6,624,988	5,118,076

The production of corn in the middle States increased over twenty millions of bushels from 1840 to 1850, and nearly fourteen millions from 1850 to 1860. When we consider that the production of wheat during the last ten years in the middle States has fallen off very materially, this increase in Indian corn is not more than might have been expected.

The following table shows the production of Indian corn in the southern States, together with the number of inhabitants in the years 1860, 1850, and 1840:

States.	Bushels of Indian corn.			Population.		
	1860.	1850.	1840.	1860.	1850.	1840.
Virginia	38,319,999	35,254,319	34,577,591	1,596,318	1,421,661	1,239,797
North Carolina	30,078,564	27,941,051	23,893,763	992,622	869,039	753,419
South Carolina	15,065,606	16,271,454	14,722,805	703,708	668,507	594,398
Georgia	30,776,293	30,080,099	20,905,122	1,057,286	906,185	691,392
Alabama	33,226,282	28,754,048	20,947,004	964,201	771,623	590,756
Louisiana	16,853,745	10,266,373	5,952,912	708,002	517,762	352,411
Texas	16,500,702	6,028,876	....	604,218	212,592	....
Mississippi	29,057,682	22,446,552	13,161,237	791,305	606,526	375,651
Arkansas	17,823,588	8,893,939	4,846,632	435,450	209,897	97,574
Tennessee	52,089,926	52,276,223	44,986,188	1,109,801	1,002,717	829,210
Florida	2,834,391	1,996,809	898,974	140,425	87,445	54,477
Total	282,626,778	238,209,743	184,892,228	9,103,333	7,273,954	5,579,085

Both Tennessee and South Carolina produced less corn in 1860 than in 1850; while Georgia, though showing a slight increase, remains almost stationary. Texas, which was unreported in 1840, gave six million bushels in 1850, and sixteen and a half million in 1860. Arkansas nearly doubled her production of Indian corn from 1840 to 1850, and again from 1850 to 1860. Louisiana also shows a rapid increase—nearly six million bushels. The total increase in the southern States from 1840 to 1850 is a little over fifty-three million bushels of Indian corn, and from 1850 to 1860 less than forty-two and a half million bushels.

The following table shows the production of Indian corn in the western States, together with the number of inhabitants in the years 1860, 1850, and 1840:

States.	Bushels of Indian corn.			Population.		
	1860.	1850.	1840.	1860.	1850.	1840.
Ohio	73,543,190	59,078,695	33,666,144	2,339,511	1,980,329	1,519,467
Indiana	71,588,919	52,964,363	28,155,887	1,350,428	988,416	685,866
Michigan	12,444,676	5,641,420	2,277,039	749,113	397,654	212,267
Illinois	115,174,777	57,646,984	22,634,211	1,711,951	851,470	476,183
Wisconsin	7,517,300	1,988,979	379,359	775,881	305,391	30,945
Minnesota	2,941,952	16,725	....	172,123	6,077	....
Iowa	42,410,686	8,656,799	1,406,241	674,913	192,214	43,112
Missouri	72,892,157	36,214,537	17,332,524	1,182,012	682,044	383,702
Kentucky	64,043,633	58,672,591	39,847,120	1,155,684	982,405	779,828
Kansas	6,150,727	....	....	107,206	....	....
Nebraska	1,482,080	....	....	28,841	....	....
Total	470,190,097	280,881,093	145,700,525	10,247,663	6,386,000	4,131,370

The above table is worthy of careful study. It shows at a glance the unparalleled rapidity with which the agricultural resources of the western States are being developed.

Kansas has advanced more rapidly than any other State, having neither crops nor population in 1850. The production of Indian corn has grown up to over five and a half million bushels in 1860.

Minnesota presents also another instance of rapid increase In 1850 her return of Indian corn was only 16,725 bushels. While in 1860 her product is given at nearly three million bushels, or over one hundred and seventy-eight times as much as in 1850.

Nebraska, which was unreported in 1850, produced nearly 1½ million bushels of Indian corn in 1860, as before stated.

Iowa makes exhibit of remarkable increase in the production of Indian corn. From less than one and a half million bushels in 1840, she has increased to over forty-two million bushels in 1860.

The following table shows the production of Indian corn in the Pacific States, together with the number of inhabitants in the years 1860, 1850, and 1840:

States and Territories.	Bushels of Indian corn.			Population.		
	1860.	1850.	1840.	1860.	1850.	1840.
California	510,708	12,236	....	365,439	92,597	....
Oregon	76,122	2,918	....	52,465	13,294	....
New Mexico	709,304	365,411	....	83,009	61,547	....
Washington	4,712	....	....	11,168	....	....
Utah	90,482	9,899	....	40,273	11,380	....
Total	1,391,328	390,464	....	552,354	178,818	....

In the production of Indian corn, as in all other evidences of material prosperity, California presents a conspicuous instance of rapid increase. From 12,236 bushels in 1850, she produces 510,708 bushels of Indian corn in 1860, or over *forty times* as much as in 1850. This is by no means equal to the ratio of increase in Minnesota—only, in fact, one-fourth as great; but it shows, nevertheless, that the golden State is rapidly developing her agricultural resources.

The following table shows the production of Indian corn in the New England, middle, western, southern, and Pacific States in the years 1860, 1850, and 1840, together with the number of inhabitants:

States.	BUSHELS OF INDIAN CORN.			POPULATION.		
	1860.	1850.	1840.	1860.	1850.	1840.
Western	470, 190, 097	280, 881, 093	145, 700, 525	10, 247, 663	6, 386, 000	4, 131, 370
Southern	282, 626, 778	238, 209, 743	184, 892, 228	9, 103, 333	7, 273, 954	5, 579, 085
Middle	75, 399, 309	61, 413, 948	39, 916, 913	8, 333, 230	6, 624, 988	5, 118, 076
New England	9, 164, 505	10, 175, 856	6, 992, 909	3, 135, 283	2, 728, 116	2, 234, 822
Pacific	1, 391, 328	390, 464	....	552, 254	178, 818	....
Total	838, 772, 017	592, 071, 104	317, 531, 875	31, 443, 322	23, 191, 876	17, 069, 453

The following table shows the number of bushels of Indian corn produced in the different sections of the United States to each inhabitant, in the years 1860, 1850, and 1840:

	1860.	1850	1840.
New England States	2.90	3.70	3.02
Middle States	9.04	9.11	7.79
Southern States	30.83	32.76	33.13
Pacific States	2.55	2.18	.....
Western States	45.27	44.14	35.33
The United States and Territories	26.12	26.04	22.11

In the New England States the production of corn increased over three million bushels from 1840 to 1850, but *decreased* over a million bushels from 1850 to 1860. *In proportion to population* there was also a slight increase from 1840 to 1850; but a decrease of nearly one bushel to each inhabitant from 1850 to 1860. With the exception of the Pacific States, the New England States, in proportion to population, produce far less Indian corn than any other section in 1860—less than three bushels to each inhabitant.

The middle States have nearly doubled their production of Indian corn since 1840. From 1840 to 1850 the increase was from nearly forty millions to over sixty-one millions of bushels; and in 1860 to over sixty-five millions of bushels.

In proportion to population, the middle States show a slight decrease in the production of Indian corn since the census of 1850, but a decided increase from 1840 to 1850. These States now produce about nine bushels of Indian corn to each inhabitant, or more than three times as much as the New England States.

We have no means of knowing the actual increase in the number of acres planted to Indian corn but it is hardly probable that they have increased more than the increase in the production of this grain. The increase in the population is due mainly to the growth of the cities and villages rather than to an increase in the number of persons engaged in the cultivation of the soil. The table, however, is interesting in reference to our ability to sustain a rapidly increasing population.

Indian corn is probably the best crop for such an object. In the case of an individual farmer we are apt to judge of the character of his farming from the appearance and product of his corn crop; and what is true of an individual is no less true of a nation. If the average yield of Indian corn is increasing, it is pretty good evidence that our general system of agriculture is improving. For this reason the tables here presented are pre-eminently worthy of study.

In the New England States, as we have shown, the aggregate crop of Indian corn in 1860 was less than in 1850.

In the middle States there has been a steady increase from 1840 to 1850, and from 1850 to 1860; but from 1850 to 1860 this increase in the corn crop has barely kept pace with the increase in population.

In the southern States there has also been a steady increase in the amount of Indian corn produced in 1840, 1850, and 1860. The increase in 1850, as compared with 1840, was about fifty-three million bushels; and from 1850 to 1860 a little less than forty-two and a half millions.

The increase of the corn crop in the southern States, however, has not kept pace with the increase in population. There were produced in 1840 a little over thirty-three bushels to an inhabitant; in 1850, thirty-two and three-fourths bushels, and in 1860 less than thirty-one bushels to each person.

The southern States, it will be seen, produce, in proportion to population, *ten* times as much corn as the New England States, and over three times as much as the middle States.

In the western States the aggregate production of Indian corn was, in round numbers, 145,000,000 bushels in 1840, 280,000,000 bushels in 1850, and 470,000,000 bushels in 1860; while the population, in round numbers, was 4,000,000 in 1840, 6,000,000 in 1850, and 10,000,000 in 1860.

The western States are the only section of the country (except the Pacific States) in which the production of Indian corn has steadily increased in greater proportion than the population. In 1840 the western States produced 35 bushels to each inhabitant; 44 bushels in 1850, and 45 bushels to each person in 1860.

This result is owing, in a good degree, to the increased facilities of transportation, and still more to the improved processes of culture which have followed the introduction of improved implements and machines. In no other section have farmers manifested a greater promptitude to avail themselves of the labors of the inventor and mechanic, and the result is shown in the above table. In no country in the world is there a finer field for the introduction of mechanical appliances for the culture of the soil than on the rich prairies of the western States. It was here that the reaper first found its way into general use; and what is true of the reaper is equally true of nearly all other agricultural machinery. The steam-plough, introduced the present year from England, will here, if anywhere, be speedily employed to pulverize the soil and prepare it for a crop.

Taking the country as a whole, the production of Indian corn to each inhabitant was 22 bushels in 1840, 26 bushels in 1850, and a little over 26 bushels in 1860. The census of 1850 showed an increase of four bushels to each inhabitant, while the last census shows that the production of Indian corn, taking the country as a whole, fully keeps pace with the increase in population.

Illinois not only produces the largest aggregate amount of Indian corn, but also produces more in proportion to population than any other State. She produced 67 bushels of corn to each inhabitant in 1850, and also in 1860, and 47 bushels in 1840.

Iowa comes next. She produced 32 bushels of corn to each inhabitant in 1840, 45 bushels in 1850, and 60 bushels in 1860.

The next highest is Kansas. She produced 52 bushels of corn to each inhabitant in 1860.

Indiana succeeds, with 41 bushels to each inhabitant in 1840, 50 bushels in 1850, and 51 bushels in 1860.

Tennessee stands next. She produced 42 bushels of corn to each person in 1860. This, however, is far less than she produced in 1850 and in 1840. In 1850 she produced 52 bushels of corn to each person, and in 1840, 54 bushels.

CULTURE OF INDIAN CORN.

Little need be said on this subject. Throughout the great western States, the price of Indian corn has usually, till within a year past, been so low that little money or labor could be expended profitably in manuring or cultivating the corn crop. There are millions of acres that seem as though they were formed to produce this magnificent American cereal at the least cost of time and labor. A loose, moist, but not *wet*, fertile soil, with abundance of sunshine, is what is needed for the growth of large crops of Indian corn. The rich bottom lands of the west and southwest are the finest lands in the world for this grain. There are instances where it has been grown annually on such lands for over fifty years without any sensible diminution in the yield either of grain or stalks.

The ease with which Indian corn can be grown, is, perhaps, one reason why there have been so few investigations in regard to the requirements of this important plant. We know something of the best fertilizers of wheat, barley, beans, peas, turnips, and grass, but how few have made investigations respecting the special demands of Indian corn. To increase a crop of wheat from 15 to 25 bushels per acre, we know with considerable certainty the quantity of certain constituents of manure that will be needed; but who can say the same in regard to Indian corn? If a soil without manure yields 30 bushels of Indian corn per acre, who can tell how much ammonia, phosphoric acid, potash, and other elements of plant food, are required to enable it to produce 60 bushels per acre.

In the hope of ascertaining something in regard to this subject, the New York State Agricultural Society offer a standing prize for experiments on this culture. As the subject is one of great importance to the farmers of the whole country, it will be interesting to give the rules laid down for conducting these experiments, and we cannot but hope that farmers in other States will make similar experiments, so that before another census is taken, we shall not have to confess our ignorance in regard to the peculiar manurial requirements of the most important crop of American agriculture.

The following is the plan of experiments suggested: The executive committee of the New York State Agricultural Society, deeming it of great importance to ascertain the manure best adapted to Indian corn, one of the most important crops of this country, propose to award premiums for the best conducted and most satisfactory experiments with the manures hereinafter named.

It is desired that the field upon which the experiment is made, should have been under cultivation for a considerable time; and if it has not been manured, and has been impoverished by continued cultivation of cereal crops, it will be the most acceptable. It is very important to ascertain the amount of phosphoric acid, sulphuric acid, potash, soda, lime, &c., required in the soil for the proper growth of Indian corn.

The *mechanical* condition of the field must be carefully attended to, and all *parts* of the field to be as much alike as possible. *One-fourth* of an acre for each plot, and *two* of these to be without manure of any kind. It is believed that this is as small a quantity of land as will secure reliable results, and it is of the utmost importance that the field experiments should be satisfactory.

Plate or money premium $75.

No. 1. The following preparations to be tried, each of the numbers representing one-fourth of an acre:

1. Without manure.
2. 4 tons of well-decomposed barn yard manure.
3. 4 tons of green manure from barn yard.
4. 100 pounds sulphate of lime.
5. 100 pounds sulphate of ammonia.
6. 100 pounds of superphosphate of lime.
7. 75 pounds of pearl-ash.
8. 50 pounds of soda-ash.
9. 25 pounds of sulphate of magnesia.
10. 50 pounds of sulphate of lime.

11. 75 pounds of pearlash, 50 pounds of soda-ash, 25 pounds of sulphate of lime, and 25 pounds of sulphate of magnesia.
12. As No. 11, with 100 pounds of sulphate of ammonia.
13. As No. 11, with 100 pounds of superphosphate of lime.
14. As No. 11, with 100 pounds of sulphate of ammonia, and 100 pounds of superphosphate of lime.
15. As No. 11, with 50 pounds of sulphate of ammonia.
16. 50 pounds of sulphate of ammonia.
17. 60 pounds of superphosphate of lime.
18. 4 tons of barn yard manure, 50 pounds each of sulphate of ammonia, superphosphate of lime, pearl-ash, soda-ash, sulphate of magnesia, and sulphate of lime.
19. Without manure.

If potash, soda-ash, and magnesia cannot be readily obtained, unleached hard-wood ashes may be substituted for them.

The *superphosphate of lime* should be made from calcined bones, and should be placed in direct contact with the seed. The sulphate of ammonia should be applied in the hill, with a little soil intervening between it and the seed. The pearlash or soda-ash must not be mixed with the superphosphate or sulphate of ammonia before sowing. The other substances can be applied as convenience or custom dictates.

Superphosphate of lime from calcined bones, ground quite fine before admixture with acid, may be made as follows: Grind the calcined bones very fine; then to 100 pounds of bone-dust add 75 pounds of water, and mix thoroughly; then add 100 pounds of "brown or chamber" sulphuric acid and mix completely, and repeat the process until the quantity required is made. (Such a superphosphate can be sown with the smallest seeds without fear of injuring the germinating principle.)

Hitherto the only experiment that has been made in reference to this prize was conducted by JOSEPH HARRIS, near Rochester, New York. The society awarded him the prize, although the precise conditions of the experiments were not adhered to. As the first, and indeed the only experiments of the kind ever made in this country, we need offer no apology for embodying them in this report.

The soil on which the experiments were made is a light sandy loam. It has been under cultivation for upwards of twenty years, and, so far as could be ascertained, had never been manured. It had been somewhat impoverished by the growth of cereal crops, and it was thought that for this reason, and on account of its light texture and active character, which would cause the manures to act immediately, it was well adapted to the purpose of showing the effect of different manurial substances on the corn crop. The land was a clover sod, two years old, pastured the previous summer. It was ploughed early in the spring and harrowed till in excellent condition. The corn was planted May 23, in hills three and one-half feet apart each way. Each experiment was made on the one-tenth of an acre, and consisted of four rows, with one row between each plot, without any manure. The manures were applied in the hill immediately before the seed was planted. With the superphosphate of lime, and with plaster, (gypsum, or *sulphate of lime,*) the seed was placed directly on top of the manure. The ashes were dropped in the hill and covered with soil, upon which the seed was planted, that it should not come in contact with the ashes. Guano and sulphate of ammonia were treated in the same way. On the plots where ashes and guano or ashes and sulphate of ammonia were both used, the ashes were first put in the hill and covered with soil, and the guano or sulphate of ammonia placed above, and also covered with soil before the seed was planted. The ashes and superphosphate of lime were treated in the same way. It is well known that unleached ashes, mixed either with guano, sulphate of ammonia, or superphosphate of lime, mutually decompose each other, setting free the ammonia of the guano and sulphate of ammonia, and converting the soluble phosphate of the superphosphate of lime into the insoluble form in which it existed before treatment with sulphuric acid. All the plots were planted on the same day, and the manures weighed and applied under Mr. Harris's immediate supervision. Everything was done that seemed necessary to secure accuracy.

The following table gives the results of the experiments:

Table showing the results of experiments on Indian corn near Rochester, New York.

Number of the plots.	Descriptions of manure and quantities applied per acre.	Bushels of ears of sound corn per acre.	Bushels of ears of soft corn per acre.	Total number of bushels of ears of corn per acre.	Increase per acre of ears of sound corn.	Increase per acre of ears of soft corn.	Total increase per acre of ears of corn.
1	No manure	60	7	67	....	....	....
2	100 pounds plaster, gypsum, or *sulphate of lime*	70	8	78	10	1	11
3	400 pounds unleached wood-ashes and 100 pounds plaster, (mixed)	68	10	78	8	3	11
4	150 pounds sulphate of ammonia	90	15	105	30	8	38
5	300 pounds superphosphate of lime	70	8	78	10	1	11
6	150 pounds sulphate of ammonia and 300 pounds superphosphate of lime, (mixed)	85	5	90	25	....	23
7	400 pounds unleached wood-ashes, (uncertain)	60	12	72	....	5	5
8	150 pounds sulphate of ammonia and 400 pounds unleached wood-ashes, (sown separately)	87	10	97	27	3	30
9	300 pounds superphosphate of lime, 150 pounds sulphate of ammonia, and 400 pounds unleached wood-ashes	100	8	108	40	1	41
10	400 pounds unleached wood-ashes	60	8	68	....	1	1
11	100 pounds plaster, 400 pounds unleached wood-ashes, 300 pounds superphosphate of lime, and 200 pounds Peruvian guano	95	10	105	35	3	38
12	75 pounds sulphate of ammonia	78	10	88	18	3	21
13	200 pounds Peruvian guano	88	13	101	28	6	34
14	400 pounds unleached wood-ashes, 100 pounds plaster, and 500 pounds Peruvian guano	111	14	125	51	7	58

The superphosphate of lime was formed especially for these experiments, and was a pure mineral manure of superior quality, made from calcined bones; it cost about two and a half cents per pound. The sulphate of ammonia was a good commercial article obtained from London at a cost of about seven cents per pound. The ashes were made from beech and hard maple *(acer saccharinum)* wood, and were sifted through a fine sieve before being weighed. The guano was the best Peruvian, costing about three cents per pound. It was crushed and sifted before using. In sowing the ashes on plot 7 an error occurred in their application, and for the purpose of checking the result, it was deemed advisable to repeat the experiment on plot 10.

On plot 5, with 300 pounds of superphosphate of lime per acre, the plants came up first, and exhibited a healthy, dark-green appearance, which they retained for some time. This result was not anticipated, though it is well known that superphosphate of lime has the effect of stimulating the germination of turnip-seed, and the early growth of the plants to an astonishing degree; yet, as it has no such effect on wheat, it seemed probable that it would not produce this effect on Indian corn, which in chemical composition is very similar to wheat. The result shows how uncertain are all speculations in regard to the manurial requirements of plants. This immediate effect of superphosphate of lime on corn was so marked that the men (who were at the time of planting somewhat inclined to be skeptical in regard to the value of such small doses of manure) declared that "superphosphate beats all creation for corn." The difference in favor of superphosphate at the time of hoeing, was very perceptible even at some distance.

Although every precaution deemed necessary was taken to prevent the manures from mixing in the hill, or from injuring the seed, yet it was found that those plots dressed with ashes and guano, or with ashes and sulphate of ammonia, were injured to some extent. Shortly after the corn was planted heavy rain set in and washed the sulphate of ammonia and guano down into the ashes, and mutual decomposition took place, with more or less loss of ammonia. In addition to this loss of ammonia these manures came up to the surface of the ground in the form of an excrescence so hard that the plants could with difficulty penetrate through it. This is a fact which should be borne in mind in instituting future experiments. It would have been better, undoubtedly, to have sown these manures broadcast, except for the difficulty of sowing them evenly by hand on so narrow a plot without risk of having some part of the manures blown upon the adjoining plots.

It will be seen by examining the table, that, although the superphosphate of lime had a good effect during the early stages of the growth of the plants, yet the increase of product did not come up to these early indications. On plot 5, with 300 pounds of superphosphate of lime per acre, the yield is precisely the same as on plot 2, with 100 pounds of plaster *(sulphate of lime)* per acre. Now, superphosphate of lime is composed, necessarily, of soluble phosphate of lime and plaster, or sulphate of lime formed from a combination of the sulphuric acid employed in the manufacture of superphosphate with the lime of the bones. In the 300 pounds of superphosphate of lime sown on plot 5 there would be about 100 pounds of plaster, and as the effect of this dressing is no greater than was obtained from the 100 pounds plaster sown on plot 2, it follows that the good effect of the superphosphate of lime was due to the plaster which it contained.

Again, on plot 4, with 150 pounds of sulphate of ammonia per acre, we have ninety bushels of ears of sound corn, and fifteen bushels of ears of soft corn ("nubbins") per acre, or a total increase over the plot without manure, of thirty-eight bushels. Now, the sulphate of ammonia contains no phosphate of lime, and the fact that such a manure gives a considerable increase of crop confirms the conclusion arrived at from a comparison of the results on plots 2 and 5, that the increase from the superphosphate of lime is not due to the phosphate of lime which it contains, unless we are to conclude that the sulphate of ammonia rendered the phosphate of lime in the soil more readily soluble, and thus furnished an increased quantity in an available form for assimilation by the plants—a conclusion which the results with superphosphate alone, on plot 5, and with superphosphate and sulphate of ammonia combined, on plot 6, do not sustain.

On plot 12 half the quantity of sulphate of ammonia was used as on plot 4, and the increase is a little more than half what it is where double the quantity was used.

Again, on plot 13, 200 pounds of Peruvian guano per acre gives nearly as great an increase of sound corn as the 150 pounds of sulphate of ammonia. Now, 200 pounds of Peruvian guano contains nearly as much ammonia as 150 pounds sulphate of ammonia, and the increase in both cases is evidently due to the ammonia of these manures. The 200 pounds of Peruvian guano contained about 50 pounds of phosphate of lime; but as the sulphate of ammonia, which contains no phosphate of lime, gives as great an increase as the guano, it follows that the phosphate of lime in the guano had little if any effect—a result precisely similar to that obtained with superphosphate of lime.

We may conclude, therefore, that on this soil, which had never been manured, and which had been cultivated for many years with the *ceralia*—or, in other words, with crops which remove a large quantity of phosphate of lime from the soil—the phosphate of lime, relatively to the ammonia, is not deficient. If such were not the case, an application of soluble phosphate of lime would have given an increase of crop, which we have shown was not the case in any one of the experiments.

Plot 10, with 400 pounds of unbleached wood-ashes per acre, produces the same quantity of *sound corn*, with an extra bushel of "nubbins" per acre, as plot 1, without any manure at all; ashes, therefore, applied alone, may be said to have had no effect whatever. On plot 3, 400 pounds of ashes, and 100 pounds of plaster, give the same total number of bushels per acre as plot 2, with 100 pounds plaster alone. Plot 8, with 400 pounds of ashes and 150 pounds sulphate of ammonia, yields three bushels of sound corn and five bushels of "nubbins" per acre *less* than plot 4, with 150 pounds sulphate of ammonia alone. This result may be ascribed to the fact previously alluded to—the ashes dissipated some of the ammonia.

Plot 11, with 100 pounds of plaster, 400 pounds ashes, 300 pounds of superphosphate of lime, and 200 pounds Peruvian guano, (which contains about as much ammonia as 150 pounds sulphate of ammonia,) produced precisely the same total number of bushels per acre as plot 4, with 150 pounds sulphate of ammonia alone, and but four bushels more per acre than plot 13, with 200 pounds Peruvian guano alone. It is evident, from these results, that neither ashes nor phosphates had much effect on Indian corn on this impoverished soil.

Plot 14 received the largest dressing of ammonia, (500 pounds of Peruvian guano,) and produced much the largest crop, though the increase is not so great in proportion to the guano as where smaller quantities were used.

The manure which produced the most profitable result was the 100 pounds of plaster on plot 2. The 200 pounds of Peruvian guano on plot 13, and which cost about $6, gave an increase of fourteen bushels of shelled corn and six bushels of "nubbins." The superphosphate of lime, although a very superior article, and estimated at cost price, in no case paid for itself. The same is true of the ashes.

But the object of the experiment was not so much to ascertain what manures will pay, as to ascertain, if possible, what constituents of manures are required in greatest quantity for the maximum production of corn. All our agricultural plants are composed of the same elements; the only difference being in the relative proportions in which they exist in the plants. Thus, wheat and turnips contain precisely the same elements, but the ash of wheat contains five times as much phosphoric acid as the ash of turnips; while the turnips contain much more potash than wheat. This fact being ascertained by chemical analysis, it was supposed that wheat required a manure relatively richer in phosphoric acid than was required for turnips. This is certainly a plausible deduction; but careful and numerous experiments have incontrovertibly proved that such is not the case; in fact, that an ordinary crop of turnips requires more phosphoric acid, in an available condition in the soil, than an ordinary crop of wheat. From this fact, and several others of a similar character, the conclusion is irresistible, that the chemical composition of a plant—the relative proportion in which the several elements exist in the plant—is not a certain indication of the manurial requirements of the plant; or, in other words, it does not follow that because a plant contains a relatively larger proportion of any particular element, that the soil or manure best adapted for the growth of this plant must contain a relatively larger proportion of this element.

Wheat, rye, barley, oats, and Indian corn all contain a relatively large quantity of phosphate of lime; but it is not safe to conclude from this, that a soil or manure best adapted for their maximum growth must also contain a relatively large quantity of phosphate of lime. It is known positively, from numerous experiments, that such is not the case with wheat; and it is, therefore, at least doubtful whether such is true of Indian corn. On the other hand, we know, from repeated experiments, that wheat requires a large quantity of ammonia for its maximum growth; and as Indian corn is nearly identical in composition to wheat, it is somewhat probable that it requires food similar in composition. This, however, is merely a deduction—never a safe rule in agriculture. We cannot obtain positive knowledge in regard to the requirements of plants, except from actual experiments. Numerous experiments have been made in this country with guano and superphosphate of lime; but the superphosphates used were commercial articles, containing more or less ammonia; and if they are of any benefit to those crops to which they are applied, it is a matter of uncertainty whether the beneficial effect of the application is due to the soluble phosphate of lime or to the ammonia. On the other hand, guano contains both ammonia and phosphate, and we are equally at a loss to determine whether the effect is attributable to the ammonia or phosphate, or both. In order, therefore, to determine satisfactorily which of the several ingredients of plants is required in greatest proportion for the maximum growth of any particular crop, we must apply the ingredients separately, or in such definite compounds as will enable us to determine to what particular element or compounds the beneficial effect is to be ascribed. It was for this reason that sulphate of ammonia and a purely mineral superphosphate of lime were used in the above experiments. No one would think of using sulphate of ammonia at its present price as an ordinary manure, for the reason that the same quantity of ammonia can be obtained in other substances, such as barn-yard manure, Peruvian guano, &c., at a much cheaper rate. But these manures contain ALL the elements of plants, and we cannot know whether the effect produced by them is due to the ammonia, phosphates, or any other ingredient. For the purpose of experiment, therefore, we must use a manure that furnishes ammonia without any admixture of phosphates, potash, soda, lime, magnesia, &c., even though it cost much more than we could obtain the same amount of ammonia for in other manures. These remarks are made in order to correct a very common opinion, that if experiments do not *pay* they are useless. The ultimate object, indeed, is to ascertain the most profitable method of manuring; but the *means* of obtaining this information cannot, in all cases, be profitable.

Similar experiments to those made on Indian corn were made on soil of a similar character on about an acre of sorghum or Chinese sugar-cane. We have not space to give the results in detail at this time, and allude to them merely to mention one very important fact—*the superphosphate of lime had a very marked effect.* This manure was applied in the hill on one plot (the twentieth of an acre) at the rate of 400 pounds per acre, and the plants on this plot came up first, and outgrew all the others from the start, and ultimately attained the height of about ten feet, while on the plot receiving no manure the plants were not five feet high. This is a result entirely different from what Mr. Harris expected. He supposed, from the fact that superphosphate of lime had no effect on wheat, that it would probably have little effect on corn, or on the sugar-cane, or other *ceralia;* and that as ammonia is so beneficial for wheat, it would probably be beneficial for corn and sugar-cane. The above experiment indicates that such is the case in regard to Indian corn, so far as the production of grain is concerned, though, as we have stated, it is not true in reference to the early growth of the plants. The superphosphate of lime on Indian corn stimulated the growth of the plants in a very decided manner at first—so much so that Mr. Harris was led to suppose for some time that it would give the largest crops, but at harvest it was found that it produced no more corn than plaster. These results seem to indicate that superphosphate of lime stimulates the growth of stalks and leaves, and has little effect in increasing the production of seed. In raising Indian corn for fodder, or for soiling purposes, superphosphate of lime may be beneficial as well as in growing the sorghum for sugar-making purposes, or for fodder, though perhaps not for seed.

In addition to the experiments given above, Mr. Harris made the same season, on an adjoining field, another set of experiments on Indian corn, the results of which are interesting.

The land on which these experiments were made, was of a somewhat firmer texture than that on which the other set of experiments was made. It is situated about a mile from the barn-yard, and on this account had seldom if ever been manured. It had been cultivated for many years with ordinary farm crops. It was ploughed early in the spring, and harrowed until quite mellow. The corn was planted May 30. Each experiment occupied *one-tenth of an acre,* consisting of four rows three and a half feet apart, and the same distance between the hills in the rows, with one row without manure between each experimental plot.

The manure was applied in the hill in the same manner as in the first set of experiments.

The barn-yard manure was well rotted, and consisted principally of cow-dung, with a little horse-dung. Twenty two-horse wagon-loads of this was applied per acre, and each load would probably weigh about one ton. It was put in the hill and covered with soil, and the seed then planted on the top.

The following table gives the results of the experiments:

Table showing the results of experiments on Indian corn near Rochester, New York.

Number of the plots.	Descriptions of manure and quantities applied per acre.	Bushels of ears of sound corn per acre.	Bushels of ears of soft corn per acre.	Total number of bushels of ears of corn per acre.	Increase ears of sound corn per acre over unmanured plot.	Increase ears of soft corn per acre over unmanured plot.	Total increase of ears of corn per acre.
1	No manure	75	12	87	....	....	....
2	20 loads barn-yard manure	82½	10	92½	7½	....	5½
3	150 pounds sulphate of ammonia	85	30	115	10	18	28
4	300 pounds superphosphate of lime	88	10	98	13	....	11
5	400 pounds Peruvian guano	90	30	120	15	18	33
6	400 pounds of "cancerine," or fish manure	85	20	105	10	8	18

As before stated, the land was of a stronger nature than that on which the first set of experiments was made, and it was evidently in better condition, as the plot having no manure produced twenty bushels of ears of corn per acre more than the plot without manure in the other field.

On plot 4, 300 pounds of superphosphate of lime gives a total increase of eleven bushels of ears of corn per acre over the unmanured plot, agreeing exactly with the increase obtained from the same quantity of the same manure on plot 5, in the first set of experiments.

Plot 3, dressed with 150 pounds of sulphate of ammonia per acre, gives a total increase of 28 bushels of ears of corn per acre over the unmanured plot, and an increase of 22½ bushels of ears per acre over plot 2, which received twenty loads of good, well-rotted barn-yard dung per acre.

Plot 5, with 400 pounds of Peruvian guano per acre, gives the best crop of this series, viz: an increase of 33 bushels of ears of corn per acre over the unmanured plot, and 27½ over the plot manured with twenty loads of barn-yard dung. The 400 pounds of "cancerine," an artificial manure made in New Jersey, from fish, gives a total increase of 18 bushels of ears per acre over the unmanured plot, and 12½ bushels more than that manured with barn-yard dung; though 5 bushels of ears of sound corn and 10 bushels of "nubbins" per acre *less* than the same quantity of Peruvian guano.

At the present price of Indian corn, artificial manures can be used with considerable profit, but the main dependence of the farmer must still be on barn-yard manure. The light, concentrated fertilizers should be used as auxiliaries to barn-yard manure. In this way they will prove of great advantage. Anything which increases the crop of Indian corn increases the means of making more manure, and that of a better quality.

The great bulk of our farmers, however, will still rely on natural sources for their manure; and, happily, there are comparatively few soils on which Indian corn will not produce a fair return if the soil is thoroughly cultivated. With our improved horsehoes and cultivators, there is no excuse for those farmers who neglect to keep their corn land mellow and entirely free from weeds. When this is done, we can, in ordinary seasons, and on the majority of soils, be sure of a good crop of Indian corn. It must be confessed, however, that there are too many farmers who fail to practice this thorough cultivation. One of the greatest advantages of the corn crop is, that, being planted in rows at from three to four feet apart, the horsehoe can be used to clean the land. In this respect Indian corn is a "fallow crop;" and it is much to be regretted that so many farmers neglect to avail themselves of this means of cleaning their land. They would find that the repeated stirring of the soil would not only destroy the weeds, but would make the soil moister in dry weather, and increase its fertility by developing the plant-food locked up in the land. Thorough cultivation alone, would double the average yield of Indian corn in the United States, besides leaving the land cleaner and in much better condition for future crops.

RYE.

Bushels of rye produced in 1860.

STATES.	BUSHELS.	STATES.	BUSHELS.
Alabama	72, 457	Pennsylvania	5, 474, 788
Arkansas	78, 092	Rhode Island	28, 259
California	52, 140	South Carolina	89, 091
Connecticut	618, 702	Tennessee	257, 989
Delaware	27, 209	Texas	111, 860
Florida	21, 306	Vermont	139, 271
Georgia	115, 532	Virginia	944, 330
Illinois	951, 281	Wisconsin	888, 544
Indiana	463, 495		
Iowa	183, 022	Total, States	21, 088, 970
Kansas	3, 833		
Kentucky	1, 055, 260		
Louisiana	36, 065	TERRITORIES.	
Maine	123, 287		
Maryland	518, 901	District of Columbia	6, 919
Massachusetts	388, 085	Dakota	700
Michigan	514, 129	Nebraska	2, 495
Minnesota	121, 411	Nevada	98
Mississippi	39, 474	New Mexico	1, 300
Missouri	293, 262	Utah	754
New Hampshire	128, 247	Washington	144
New Jersey	1, 439, 497		
New York	4, 786, 905	Total, Territories	12, 410
North Carolina	436, 856		
Ohio	683, 686	Aggregate	21, 101, 380
Oregon	2, 704		

The amount of rye produced in the United States in 1840 was 18,645,567 bushels; in 1850, 14,188,813 bushels; and in 1860, 21,101,380 bushels.

Pennsylvania and New York are the largest producers of rye. These two States produce nearly as much rye as all the other States and Territories together. New Jersey also produces largely, raising nearly as much rye as wheat. It is a crop well adapted for light sandy soils, and in the neighborhood of large cities is a profitable crop, not so much, however, for the grain as for the straw.

The following table shows the amount of rye raised in the New England States in 1860, as compared with 1850:

	1860.	1850.
Connecticut	618, 702	600, 893
Maine	123, 287	102, 916
Massachusetts	388, 085	481, 021
New Hampshire	128, 247	183, 117
Rhode Island	28, 259	26, 409
Vermont	139, 271	176, 233
	1, 425, 851	1, 570, 589

The production of rye in the New England States, has fallen off somewhat since 1850, and yet more since 1840. They continue, however, to raise more rye than wheat. In 1860 the New England States produced only 1,077,285 bushels of wheat, against 1,425,851 bushels of rye.

The following table shows the amount of rye raised in the middle States in 1860, as compared with 1850:

	1860.	1850.
New York	4, 786, 905	4, 148, 182
New Jersey	1, 439, 497	1, 255, 578
Pennsylvania	5, 474, 788	4, 805, 160
Maryland	518, 901	226, 014
Delaware	27, 209	8, 066
District of Columbia	6, 919	5, 509
	12, 254, 219	10, 448, 509

The production of rye has increased in all the middle States. It has increased more than threefold in Delaware, and more than double in Maryland. It is, however, a small crop in these States. Pennsylvania, New York, and New Jersey produce nearly all the rye raised in the middle States.

The following table shows the amount of rye raised in the western States in 1860, as compared with 1850:

	1860.	1850.
Ohio	683, 686	425, 918
Indiana	463, 495	78, 792
Michigan	514, 129	105, 871
Illinois	951, 281	83, 364
Wisconsin	888, 544	81, 253
Iowa	183, 022	19, 916
Missouri	293, 262	44, 268
Kentucky	1, 055, 260	415, 073
Kansas	3, 833	......
Nebraska	2, 495	......
Minnesota	121, 411	125
	5, 160, 418	1, 254, 580

There is a marked increase in the production of rye in all the western States. In the aggregate there is four times as much rye raised in the western States as in 1850. Rye, however, is not an important crop in the west. Pennsylvania alone produces more rye than all the western States.

The following table shows the amount of rye raised in the southern States in 1860, as compared with 1850:

	1860.	1850.
Virginia	944, 330	458, 930
North Carolina	436, 856	229, 563
South Carolina	89, 091	43, 790
Georgia	115, 532	53, 750
Alabama	72, 457	17, 261
Louisiana	36, 065	475
Texas	111, 860	3, 108
Mississippi	39, 474	9, 606
Arkansas	78, 092	8, 047
Tennessee	257, 989	89, 137
Florida	21, 306	1, 152
	2, 203, 052	1, 014, 819

The production of rye in the southern States, it will be seen, has doubled since 1850. Virginia and North Carolina are, by far, the largest producers of rye in the southern States, though there it is by no means an important crop.

The following table shows the amount of rye raised in the Pacific States in 1860, as compared with 1850:

	1860.	1850.
California	52,140	....
Oregon	2,704	106
New Mexico	1,300	....
Washington	144	....
Utah	754	210
	57,042	316

California produces nearly all the rye grown in the Pacific States, though there it is not extensively cultivated.

The following table shows the amount of rye raised in the different sections of the United States in 1850 and in 1860, in proportion to the population:

	1860.	1850.
New England States	0.42	0.57
Western States	0.49	0.19
Middle States	1.47	1.57
Southern States	0.27	0.13
Pacific States	0.10	0.001
United States	0.66	0.64

Much more rye than wheat is raised in New England, and the crop has increased, as we have before shown from 1850 to 1860, but, as the above table shows, it has hardly kept pace with the increase in population. There is nearly half a bushel of rye raised in the New England States to each inhabitant. The western States also raise about half a bushel of rye to each person. There is nearly three times as much rye raised in the western States to each inhabitant as was raised in 1850.

The middle States produce about one and a half bushel of rye to each inhabitant. There is, however, a slight falling off in proportion to population since 1850.

In the States and Territories there were sixty-four hundredths of a bushel of rye raised to each inhabitant in 1850, and sixty-six hundredths in 1860, showing a slight increase in proportion to population.

CULTURE OF RYE.

Of all the bread-plants, rye will succeed best on the driest and poorest soils. It will grow where wheat, barley, oats, and Indian corn would fail. With the aid of a little manure it can be grown year after year on the same soil. It is exceedingly grateful for manure, and its application to this crop is quite profitable, especially in localities where the straw is in demand.

Rye can be sown either earlier or later than winter wheat. In sections where corn cannot be harvested in time to sow winter wheat, rye is frequently substituted after Indian corn.

In England and in France, on the light soils where wheat alone is rather an uncertain crop, it is common to sow rye with the wheat—say half a bushel of rye to two bushels of wheat. Large crops are thus produced, and the farmers use the mixture, when ground and bolted, for domestic use. It is called "monk corn." In Germany, under the name of "meslin," in France, "meteil," the same mixture is extensively used. There is no sweeter bread than that made of these mixed grains, and its long retention of moisture would render it valuable and popular as an army bread.

Production of wheat, rye, and corn, in proportion to population.—It may be well here to group together the principal bread-crops of the United States for the years 1850 and 1860, to facilitat parisons respecting the aggregate product of these cereals. In 1850 the United States, with a population of 23,191,876, exclusive of Indian tribes, produced 100,485,944 bushels of wheat, or 4.33 to each inhabitant; 14,188,813 bushels of rye, or 0.61 to each inhabitant; and 592,071,104 bushels of corn, or 25.53 to each inhabitant.

In 1860, with a population, exclusive of Indian tribes, of 31,443,321, there were 173,104,924 bushels of wheat produced, or 5.50 to each inhabitant, showing an increase of one bushel and one-sixth to each inhabitant, or an increase, in proportion to population, of twenty-seven per cent. Of rye there were 21,101,380 bushels produced, or 0.67 to each inhabitant, showing an increase of 0.06 to each inhabitant, or an increase, in proportion to population, of about ten per cent. Of corn there were 838,792,740 bushels produced, or 26.73 to each inhabitant, showing an increase of 1.20 to each inhabitant, or an increase, in proportion to population, of 4.7 per cent.

The aggregate product of wheat, rye, and corn produced in the United States in 1850 was 706,745,861 bushels, or 30.47 to each inhabitant. In 1860 the aggregate product of wheat, rye, and corn was 1,032,999,044 bushels, or 32.90 to each inhabitant; an increase, in proportion to population, of 7.97 per cent.

The New England States, with a population of 2,728,116 in 1850, produced 1,090,894 bushels of wheat, or only thirteen quarts to each inhabitant. In 1860, with a population of 3,135,283, the New England States produced 1,083,193 bushels, or about eleven quarts and a half to each inhabitant, showing a decrease, in proportion to population, of 34.7 per cent. Of rye, the New England States produced in 1850 1,570,589 bushels, or 0.539 to each inhabitant.

In 1860 they produced 1,425,851 bushels, or 0.455 to each inhabitant, being a decrease, in proportion to population, of 18.46 per cent. The same States in 1850 produced 10,175,856 bushels of corn, or 3.73 to each inhabitant. In 1860 they produced 9,164,505 bushels of corn, or 2.92 to each inhabitant; a decrease, in proportion to population, of 27.74 per cent.

The aggregate of wheat, rye, and corn produced in the New England States in 1850 was 12,837,339 bushels, or 4.73 to each inhabitant. In 1860 the aggregate of wheat, rye, and corn produced was 11,673,549 bushels, or 3.72 to each inhabitant, showing a decrease, in proportion to population, of twenty-seven per cent.

The middle States, New York, New Jersey, Pennsylvania, Delaware, and Maryland, in 1850, with a population of 6,573,301, produced 35,067,570 bushels of wheat, or 5.33 to each inhabitant. The same States, in 1860, with a population of 8,258,150, produced 30,502,909 bushels, or 3.69 to each inhabitant; a decrease, in proportion to population, of 44.4 per cent. Of rye, these States, in 1850, produced 10,443,000 bushels, or 1.58 to each inhabitant. In 1860 the product was 12,247,300 bushels, or 1.48 to each inhabitant, being a decrease of 6.7 per cent. in proportion to population. Of corn there were produced in 1850 60,348,718 bushels, or 9.18 to each inhabitant. In 1860 there were produced 75,318,465 bushels, or 9.12 to each inhabitant; a decrease, in proportion to population, of 0.65 per cent. The aggregate of wheat, rye, and corn produced in the middle States in 1850 was 105.859,288 bushels, or 16.1 to each inhabitant. In 1860 the aggregate product was 118,068,674 bushels, or 14.29 to each inhabitant; a decrease, in proportion to population, of 12.6 per cent.

The western States, Ohio, Michigan, Wisconsin, Minnesota, Iowa, Kansas, Missouri, Kentucky, Indiana, and Illinois, in 1850, with a population of 6,379,723, produced 46,076,318 bushels of wheat, or 7.22 to each inhabitant. The same States, in 1860, with a population of 10,218,722, produced 102,251,127 bushels, or 10 to each inhabitant; an increase, in proportion to population, of 38.5 per cent. Of rye, the product in 1850 was 1,254,580 bushels, or 0.196 to each inhabitant. In 1860 the product was 5,157,923 bushels, or 0.504 to each inhabitant; being an increase, in proportion to population, of 157 per cent. Of corn, the product in 1850 was 280,881,093 bushels, or 44 to each inhabitant. In 1860 the product was 468,708,017 bushels, or 45.86 to each inhabitant; an increase, in proportion to population, of 4 per cent. The aggregate of wheat, rye, and corn produced in 1850 was 328,211,991 bushels, or 51.4 to each inhabitant. In 1860 the aggregate was 576,117,067 bushels, or 56.36 to each inhabitant; an increase, in proportion to population, of 9.63 per cent.