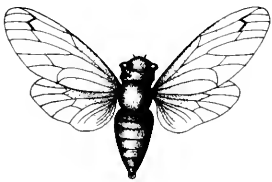
Mr William Newell
College Station
Brazos Co. Texas.



INSERT FOLDOUT HERE

REPORT

OF THE

COMMISSIONER OF AGRICULTURE

OF THE

OPERATIONS OF THE DEPARTMENT

FOR THE

YEAR 1876.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1877.

TABLE OF CONTENTS.

	Page.
Report of the Commissioner, Frederick Watts	7
Report of the Entomologist and Curator of the Museum, Townend Glover	17
Report of the Chemist, William W. McMurtrie	46
Report of the Superintendent of Gardens and Grounds, William Saunders	61
Report of the Botanist, George Vasey	73
Microscopic investigation, Thomas Taylor, Microscopist	74
Report of the Statistician, J. R. Dodge	87
MISCELLANEOUS PAPERS:	
Relations with South America	271
Agriculture in Italy	283
Agriculture in Spain	287
Jute-culture, by Professor Waterhouse	289
Salt and fresh water marsh hay, by A. B. Allen	296
Cattle-feeding in New York, by Prof. E. W. Stewart	299
Fresh meat shipment to Europe	312
Rinderpest	321
Recent inventions for insect destruction	323
Progress of industrial education	326
Digest of State reports	363

ERRATUM.

On page 155, the reported consumption of sugar on the Pacific coast is stated at 30 tons in 1873 and 1874, and 27 tons in 1875. These aggregates should be 30,000 tons and 27,000 tons, respectively.

4

LIST OF ILLUSTRATIONS.

FULL-PAGE ILLUSTRATIONS.

Plate I. Map of the cotton-belt .... Frontispiece.
II. *Pencilium crustaceum* .... facing page.. 74
III. *Aspergillus glaucus* .... facing page.. 74
IV. *Lecythea rosæ* .... facing page.. 76
V. *Ustilago segetum* .... facing page.. 76
VI. *Tilletia caries* .... facing page.. 78
VII. *Polythrincium trifolii* .... facing page.. 78
VIII. *Phylloxera*, four figures .... facing page.. 81
IX. Cotton production before and since the war .... facing page.. 116
X. Agricultural and Mechanical College of Alabama .... facing page.. 326
XI. Agricultural and Mechanical College of Alabama, plan of second story .... facing page.. 327
XII. Missouri State University .... facing page.. 341
XIII. Missouri State University, second floor .... facing page.. 342
XIV. Agricultural and Mechanical College of Texas .... facing page.. 350
XV. West Virginia Agricultural College .... facing page.. 354

OUTLINE ILLUSTRATIONS.

HOMOPTERA.

Page.

FIG. 1. *Cicada pruinosa* 24
2. *C. septendecim* 25
3. *Ortiocerus coquebertii* 27
4. *Fulgora* 27
5. *Phylloscelis atra* 27
6. *Delphax carinata* 27
7. *Oliarius* 28
8. *Amphiscepa bivittata* 28
9. *Ormenis septentrionalis* 28
10. *O. pruinosa* 28
11. *Enchenopa binotata* 28
12. *Telamona ampelopsidis* 29
13. *Entilia concava* 29
14. *E. carinata* 29
15. *Ceresa bubalus* 29
16. *C. diceros* 29
17. *Thelia bimaculata* 30
18. *Similia inornata* 30
19. *Stictocephala inermis* 30
20. *Smilia vau* 30
21. *Archasia galeata* 30
22. *Hoplophora quadrivittata* 30
23. *Cercopis bicincta* 30
24. *Aphrophora quadrangularis* 31

		Page.
FIG.	25. Ravages of *Aphrophora*	31
	26. Larva of *A. parallela*	31
	27. Larva of *A. quadrinotata*	31
	28. *Clastoptera proteus*	31
	29. *C. obtusa*	31
	30. *Proconia undata*	32
	31. *Cœlidea sub-bifasciata*	32
	32. *Aulacizus mollipes*	32
	33. *Erythroneura basalis*	33
	34. *Diedrocephala quadrivittata*	33
	35. *Psylla rhois*	33
	36. *P. pyri*	34
	37. *Aphis mali*	35
	38. *A. avenæ*	36
	39. *A. gossypii*	36
	40. *Lachnus caryæ*	37
	41. *Eriosoma lanigera*	38
	42. *E. imbricata*	39
	43. *E. tesselata*	39
	44. *Rhozobius*	39
	45. *Pemphigus vitifoliæ*	40
	46. *Phylloxera vastatrix*	40
	47. *Aspidiotus gloverii*	41
	48. *A. citricola*	43
	49. *A. conchiformis*	43
	50. *A. Harrisii*	43
	51. *A. pinifoliæ*	44
	52. *Lecanium hesperidum*	44
	53. *L. acericorticis*	44
	54. *Coccus pinicorticis*	45
	55. *Aleurodes*	45
	56. *Dorthesia cataphracta*	45
	57. *Pediculus capitis*	45
	58. *P. vestamenti*	45
	59. *P. pubis*	46
Insect-destroyers, (five figures)		323 to 325

REPORT

OF THE

COMMISSIONER OF AGRICULTURE.

DEPARTMENT OF AGRICULTURE,
Washington, November 1, 1876.

To the President of the United States:

SIR: The celebration of this centennial anniversary of the independence of the United States is especially marked by the exhibition of the products of the earth; thus recognizing the universally-accepted impression that to agricultural science and industry belong the attribute of characterizing the leading feature of the world's improvement. A review of the exhibition which is now in progress brings prominently to view the interest which the world takes in the cultivation of the earth's products and the improvement of their character. All around and everywhere you meet with a sample of the product itself, or the improved implement by which it is cultivated or prepared for consumption. The very walls of the building are decorated with the magnificent products of the farmer, while within those walls the fruits of his labor are beautifully displayed as the evidence of his devotion to the Declaration which secured to him freedom and happiness.

This Department has contributed largely to that exposition in the exhibits which it has made. Statistics, chemistry, botany, microscopy, entomology, and the seed division, are all there to represent the prodigious progress which has been made in this country in the last one hundred years; and I am extremely gratified to be enabled to say that their display has made a lasting impression of the wonderful achievements which have been accomplished in the agriculture of the United States.

This Department has availed itself of the opportunity which this exhibition affords to make exchanges of seeds, plants, and publications with several foreign nations, whereby large additions will be made to our museum and library. This will involve the necessity of an addition to our museum-hall by the erection of a gallery. The original plan of this hall contemplated such an addition when it should be necessary, and the contingency has now arrived when such an improvement is rendered indispensable. The space now covered by the hall occupies 5,000 square feet; the addition of the gallery will add to this 3,000 square feet, and will cost about $2,500, by an estimate which I have caused to be made by a competent architect.

Japan, Sweden, Spain, Portugal, Venezuela, the Australian colonies, and others, have donated a great part of their native products, as grain, roots, fibers, &c., to our museum. The cases for these productions are already provided out of the centennial fund, and were constructed with a view of their being placed in the proposed gallery. The constant work of the entomologist is adding daily to this interesting and valuable collection in our museum; and when it shall have received the donations of which I have spoken from the Centennial Exhibition, it will present such a display as will not be found elsewhere.

At the last session of Congress, out of the sum appropriated for the purchase of seeds I was directed "to expend $2,000, as compensation to some man of approved attainments, who is practically well acquainted with methods of statistical inquiry, and who has evinced an intimate acquaintance with questions relating to the national wants in regard to timber, to prosecute investigations and inquiries with a view of ascertaining the annual amount of consumption, importation, and exportation of timber and other forest products, the probable supply for future wants, the means best adapted to their preservation and renewal, the influence of forests upon climate, and the measures that have been successfully applied in foreign countries, or that may be deemed applicable in this country, for the preservation and restoration or planting of forests, and to report upon the same to the Commissioner of Agriculture, to be by him, in a separate report, transmitted to Congress;" in pursuance of which I have commissioned Franklin B. Hough, of New York, to perform these duties, the discharge of which, as seems to have been contemplated by the act of Congress, will involve an expense for the printing of circulars and their distribution, for which no provision has been made. The sum of $2,000 is certainly quite a meager compensation for the performance of the duties devolved upon the gentleman appointed, without requiring him to pay the expenses which he must necessarily incur in collecting the information, which he will naturally seek from the knowledge of others. There is not such an appropriation for printing made to this Department as would justify me in using any part of it for the purpose of facilitating the inquiries which Mr. Hough may deem it necessary for him to make.

The Statistical Division of the Department, charged with the important duty of presenting the current facts of agricultural production and distribution, both domestic and foreign, has borne an increased burden of labor and responsibility during the present year. With an enlarged field of effort, and increasing efficiency, the demand for information not elsewhere attainable is greater and more persistent, and beyond the limited facilities for adequate supply. The saving to producers and consumers, and the protection against the organized misrepresentations of speculation, through the information furnished by this division, are matters of constant and grateful acknowledgment.

The preparation of the statistical exhibits at the International Exhibition at Philadelphia has added largely to the work of this division. They are intended to present, in compact form and logical arrangement, with such aids to interpretation as are afforded by color and mathematical delineation, some of the main facts which illustrate the progress of settlement, production, and rural improvement of the United States. These exhibits include, first, six large outline-maps of the United States, (17 feet by 12,) representing by tints of coloring the distribution of forest-areas, the comparative value of farm-lands, the rate of wages of farm-labor, and the distribution of cereal and textile crops, and the area in fruit-culture; second, engraved diagrams, ingeniously illustrating the comparative yield of the several States, the effect of fluctuating production upon price and profit, the increase of cereal exportation, and questions of immigration and wages; third, statistics of industrial education, with engravings of college buildings; and, fourth, statistics of farm-animals, with type-specimens in lithographic tint of the principal breeds.

I regret to be obliged to say that the operations of this Department for the coming year, upon which we have entered, have been most severely crippled by the legislation of the last Congress. Our Statistical Division, which I look upon as the most important to the interests of the country, has been almost destroyed for want of an appropriation to supply it. The whole sum appropriated to this division is only $10,000, which is not quite sufficient to pay for the clerical work, leaving nothing for collecting agricultural statistics and compiling and writing matter for monthly, annual, and special reports. In consequence of which, and the want of a sufficient appropriation for printing, the monthly reports cannot be published longer than November, and the articles which make up the annual report cannot be procured at all, unless it be the pleasure of Congress to make a further appropriation.

The Department grounds are yearly becoming more and more a source of deep interest to students in forestry, a subject that is justly attracting the attention of practical as well as scientific men. Comparisons can here be made in regard to the rapidity of growth of the various species, and their adaptability to various purposes and uses. The collection of ligneous plants is constantly receiving additions, and is rapidly approaching completion, so far as known plants are concerned.

Efforts toward introducing the culture of the Chinese tea-plant are still in force, though the great reduction in the appropriation for the support of the garden during the year prevents any further effort in this line at present.

Among recent introductions, the Japan persimmon may be noted as a fruit of much merit. By a long and patient series of seminal productions and careful selections, this fruit has reached great perfection in

Japan, where it is prepared and largely consumed, and exported in a preserved condition similar to that of the ordinary figs of commerce.

Numerous experiments are yearly made in the gardens with seeds and plants received from foreign sources, mainly through the system of exchange. Much information is gained from these tests and trials, and suggestions of value are thus obtained, as well as additions of more or less value in economic plants that are applicable either for fibers, barks, or fruits.

The collection of economic plants is now considered one of the best in the world, and is a constant source of interest as well as profit to visitors, as well as supplying material for the increase of the industrial interests of the country.

Of the work prosecuted by the Chemical Division during the past year, it may be said that the analytical portion, relating to original investigation, has been very much interfered with by the preparation and care of material for exhibition at the International Exposition at Philadelphia. The material for this purpose, collected by the division, consists of soils and fertilizers and of all vegetable substances it was possible to secure, the value of which depends upon their chemical composiion, or the utilization of which involves chemical processes.

Following this idea, the entire collection was divided into—

A. Soils and fertilizers.

B. Vegetable products.

Under these general heads are included the following:

In the first division—

I. Soils taken from different geological formations.

II. Rocks of known composition, with samples of the soils formed from them by disintegration and decomposition.

III. Marls.

1. Calcareous or shell marls.
2. Phosphatic marls.
3. Greensand marls.

IV. Natural fertilizers.

1. Mineral.
2. Vegetable.
3. Animal.

V. The combination of natural fertilizing materials, for the production of so-called commercial or artificial fertilizers.

The second division contains—

I. Cereals and the products resulting from their utilization.

II. Materials illustrating the production of sugar.

III. Products illustrating the process of fermentation of amylaceous and saccharine substances, and the production of alcoholic liquors from the fermented materials by distillation.

IV. Products illustrating the preparation of tobacco for consumption.

V. Tanning and dyeing materials.

VI. Materials illustrating the utilization of wood by dry distillation.

VII. Vegetable products prepared and preserved for food by special methods.

VIII. Products of the American *materia medica*, and the active proximate principles separated from them.

Besides the classes thus enumerated, our collection contains a series of products illustrating the manufacture of butter and cheese.

The fund at the disposal of the division for the purpose of following out this plan was entirely too limited to make the collection complete, but the materials obtained were so arranged as to illustrate as clearly as they would the manner of their utilization. In some cases samples were analyzed, and the results attached to them when exhibited, but this could not be made universal. The analytical work done in this connection constituted the bulk of the work done in the laboratory during the past year. Among the materials analyzed was a series of samples of excrements of bats found in caves distributed through the Southern States. These samples were collected and forwarded by correspondents of the Department, to whom circular-letters, asking for them, had been addressed. Of the number furnished, ten were found to be worthy of analysis, and of value ranging from $10 to $55 per ton, calculated upon the basis of the values of their several constituents generally adopted by analysis of commercial fertilizers.

According to the reports received from our correspondents, the deposits represented by these samples are, some of them, of very great extent. It is, therefore, a matter of considerable interest to southern cultivators, especially of the inland States, where cost of fertilizing materials, depending upon transportation, is such an important item.

We also collected a series of specimens of materials known to be, and many supposed to be, of value for tanning. Of these materials thirteen varieties were obtained, and in all of them the percentage of tannin present was estimated. The work shows our range in the varieties of materials of value in this particular to be much greater than is generally supposed, and also that our national resources in this regard are probably greater than those of any other government.

Our collection contains, further, a series of samples of native wines, contributed by Bush, Son & Meissner, of Bushberg, Mo., which series includes wines manufactured from several new varieties of grapes, believed to have special merit as material for manufacture of wine. The number of samples (all of which were analyzed) obtained from this source amounts to 22. The results of their analyses will be duly published in our reports.

There are still other materials of value, that were obtained while making our collection, well worthy of analysis, the composition of which shall be determined hereafter.

The Microscopical Division of this Department has been principally engaged in preparing a large collection of finely-executed water-color drawings, with the view of showing the character of cryptogamic microscopic fungi, edible and poisonous mushrooms, textile fibers, &c., for the Centennial Exhibition, amounting in all to about six hundred specimens, and now forming part of the Government exhibit, the largest proportion representing the leading types of the genera of microscopic fungi; the results of original investigations upon chemical tests for flax, cotton, ramie, silk, wool, hair, and cellulose; and still another series, illustrating the principal vegetable starches, to the number of about one hundred varieties. These drawings present highly-magnified views of all these microscopic objects, including those most important in economic mycology, especially the fungi commonly known as molds, so destructive to vegetation. The edible and poisonous mushrooms are distinguished in one class of these drawings. The molds of cheese, bread, and jellies are illustrated, and their habits of growth shown, a knowledge of which may often be useful for practical purposes.

Another series of drawings illustrates the action of pear-tree blight, showing the effects of the chemical changes which take place in the interior structure of the tree under the attacks of the fungus to which this disease is due. Black-knot is illustrated in a similar manner, some of the drawings exhibiting it as it appears to the naked eye, while others show in detail its distorted, woody structure. The fungus which produces it is also shown at various stages of its growth.

The fungus *Peronospora infestans*, which causes potato-rot, is illustrated in the various stages of its growth. There is also a series of drawings of its resting spores, recently discovered by Mr. Worthington Smith, of London, so named from the fact that they remain for months in a stationary condition, or, in other words, rest for a long time without germinating.

The importance of the mushroom as an article of diet has never been properly understood in the United States, nor is it generally known how abundant our supply of edible mushrooms is. Many of those popularly supposed to be poisonous are not merely innocuous but highly nutritious, containing as they do many of the elements of animal food. In France, Germany, and Italy, the mushroom forms so important a part of the food of the people, that one distinguished writer has spoken of it as "the manna of the poor." In Transylvania, the oyster-mushroom is so abundant and is so largely used, that tons of it may often be seen in the markets; and in some parts of Germany the Morel mushroom is so popular, that the people, finding it to grow best on a soil treated with wood-ashes, were accustomed to burn down portions of the forest in order to secure favorable spots for its cultivation; a practice which the government ultimately found it necessary to interdict.

Particular pains have been taken to represent the types of the edible mushrooms of this country as fully as possible, a number of collectors having been employed for the purpose in various parts of the United States. Among these may be mentioned Professor Peck, botanist of

New York State, who in that State alone gathered specimens of no less than eighty species of mushrooms, including several new to science. No large collection of well-executed drawings of cryptogamic fungi has heretofore existed in this country, but the Microscopist has supplied the defect in an admirable manner, and has formed a collection which will be of permanent value to mycological science. The drawings, nearly all of which were made from nature, for the special purpose for which they are now used, exhibit a high degree of delicacy and finish.

The work of the Botanical Division of the Department has been steadily prosecuted. Many inquiries have been received from different sections of the country for information respecting the name, properties, and uses of plants which claimed attention either as weeds and pests or as deserving cultivation for agricultural or economic properties. These inquiries have been answered.

Some additions to the herbarium have been received from the survey of Lieut. George M. Wheeler; also a package, through the Smithsonian Institution, from Mr. Karl Keck, of Austria.

Much work has been performed in completing the collection of woods of the United States for the Centennial Exposition, and by this means large quantities of duplicates have been obtained with which to enrich the herbarium and to exchange with foreign governments and scientific societies. The collections from which the greatest material has been obtained are those of Mr. L. F. Ward, from Utah; Mr. G. R. Vasey, from California; Dr. Edwin Palmer, from Arizona and Southern California; Mr. J. G. Lemmon, from the Sierra Nevada Mountains; Mr. A. H. Curtiss, from the Southern Atlantic States; and Mr. John Wolfe, from the Western States. Several sets of duplicate specimens of the woods of the centennial collection have been prepared, and may be disposed of to institutions where they may be of benefit, and where they may be consulted for purposes of study and information, and for foreign exchanges. Among the collections thus obtained are many specimens of cones, fruits, and seeds, which will be of great interest.

The accompanying tabular statement exhibits the quantity and kind of seed issued from the Seed Division of the Department. A mere cursory examination of this table conveys but a faint idea of the value of this division of the Department. But when we consider the value of these seeds, collected from all parts of the world, selected because of their peculiar excellence, and put into the hands of thousands of individuals, who make them the germs from which is to grow a quantity of product that is to characterize the future operations of the farmer and gardener; when we consider how difficult it is for settlers upon the wild lands of the West, who have expended perhaps their last dollar in reaching the spot from whose fertility they hope to live, to get even the poorest of seed, (and this Department will put into their hands that which is choice and excellent,) we may readily imagine that thus seed is "sown in good ground, and will bring forth an hundred-fold."

Tabular statement showing the quantity and kind of seed issued by the Department of Agriculture, under the general appropriation, from July 1, 1875, *to June* 30, 1876, *inclusive.*

Description of seed.	Varieties.	Senators and members.	Agricultural societies.	Statistical correspondents.	Miscellaneous.	Total.
Vegetable .... papers..	337	328, 819	100, 025	151, 390	313, 740	893, 974
Flower .... do....	275	202, 146	170	585	169, 187	372, 083
Herb .... do....	9	10	....	....	223	233
Tree .... do....	16	390	....	52	2, 949	3, 391
FIELD-SEEDS.						
Wheat .... quarts..	7	14, 449	24, 056	18, 506	8, 816	65, 827
Oats .... do....	3	8, 862	19, 964	7, 552	4, 460	40, 838
Barley .... do....	3	5, 130	8, 497	4, 888	762	19, 277
Rye .... do....	2	280	7, 268	42	571	8, 161
Buckwheat .... do....	1	200	3, 384	6, 906	442	10, 932
Corn .... do....	3	3, 478	4, 650	1, 620	1, 710	11, 458
Pease .... do....	1	356	1, 080	1	61	1, 498
Clover .... do....	4	2, 689	70	100	1, 449	4, 308
Grass .... do....	6	6, 542	4, 023	200	4, 377	15, 142
Sugar-beet .... do....	3	2, 000	418	10	271	2, 699
Mangel-wurzel .... do....	3	1, 862	416	4	198	2, 480
Rice .... do....	1	12	....	2	56	70
Sorghum .... do....	1	222	....	2	203	427
Millet .... do....	1	90	....	8	158	256
Broom-corn .... do....	1	188	....	....	85	273
Speltz .... do....	1	152	....	....	460	612
Vetches .... do....	1	22	2	....	11	35
Rape .... half-pints..	1	7	....	....	2	9
Tobacco .... papers..	6	58, 374	50	172	5, 511	64, 107
Opium poppy .... do....	1	25	....	....	253	278
Chufa .... do....	1	271	....	13	193	477
TEXTILES.						
Cotton .... quarts..	4	395	208	2	258	863
Jute .... do....	1	56	....	....	90	146
Hemp .... do....	1	36	....	....	15	51
Flax .... do....	1	103	....	....	....	103
Ramie .... papers..	1	14	....	....	180	194
Grand total	....	637, 180	174, 281	192, 055	516, 691	1, 520, 207

My mind has always been impressed with the idea that some cheaper mode might be devised for putting up the seed for transmission by mail, and the exhibition at the Centennial has presented to me a means of solving this problem. A machine for the construction of a box made of strong paper is there exhibited, which I am quite satisfied will cheapen the putting up of seed one-half, if not more; thus saving to the Government from $5,000 to $7,000 a year, whereby that much of seed will be added to the quantity now distributed. Quart-bags in which the seed is now put up cost about $24.70 a thousand, including material and all labor of putting up the seed; whereas the paper box, which is more convenient and equally safe for transmission by the mails, would cost but about $8.20 per thousand; and the saving on smaller boxes is proportionately great. I propose to purchase this machine at a cost of $5,000.

The Department is careful in its arrangements with seed growers and dealers, from whom it obtains its customary supplies, to secure the best selections and the purest seeds. The result of this care is that, with very rare exceptions, we are enabled to disseminate the very best seeds. Of this we are assured by the uniform testimony of the numerous parties in every part of the country to whom seeds are sent. This testimony is gratifying to the Department, not only as evidence of its faithfulness, but as illustrative of the value of its operations upon the country.

The following table exhibits, in a condensed form, the appropriations made by Congress for this Department, the disbursements, and the balances to be covered into the United States Treasury, for the fiscal year ending June 30, 1876:

Title of appropriation.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Salaries	$77, 180 00	$77, 115 71	$64 29
Collecting statistics	15, 000 00	12, 843 68	*2, 156 32
Purchase and distribution of seeds	65, 000 00	65, 000 00	....
Experimental garden	8, 000 00	7, 966 11	33 89
Museum and herbarium	2, 000 00	1, 993 55	6 45
Furniture, cases, and repairs	3, 300 00	3, 124 23	175 77
Library	1, 250 00	1, 046 84	203 16
Laboratory	1, 300 00	1, 300 00	....
Contingent expenses	12, 100 00	11, 386 91	713 09
Postage	52, 000 00	3, 428 29	48, 571 71
Printing and binding	15, 000 00	14, 427 36	572 64
Improvement of grounds	11, 990 00	11, 990 00	....
Total	264, 120 00	211, 622 68	52, 497 32

* The unexpended balance for collecting statistics will be nearly or quite exhausted in the payment of unsettled bills, to be paid from that appropriation.

Since I have had charge of this Department it has been my special satisfaction to know that its fiscal accounts have been kept with the utmost accuracy and fidelity, and in accordance with the provisions of the law. The absolute pecuniary necessities of the Department to meet the wants of the Statistical Division induced me to claim from the Secretary of the Treasury a proportionate part of the appropriation of $60,000 made by the act of August 15, 1876, to meet the necessities of the several Executive Departments according to the exigencies of the public service. The Secretary, however, being of opinion that Congress intended to limit the amount to be expended "for collecting agricultural statistics and writing matter for monthly and special reports" to the sum appropriated for that purpose, did not, for that reason, think himself justified in complying with my request.

Respectfully submitted, by your obedient servant,

FREDK. WATTS,

Commissioner of Agriculture.

REPORT OF THE ENTOMOLOGIST AND CURATOR OF THE MUSEUM.

SIR: As the Economic Museum, connected with this Department, is a branch of the Entomological Division, it has been principally engaged for the past year—and for several months previous—in the collection, preparation, and arrangement of the series of exhibits illustrating the workings of this branch of the Department at the Centennial Exhibition in Philadelphia. To my assistant, Mr. Charles R. Dodge, was given the supervision of the museum work, and the whole labor of both branches has been performed without the aid of additional force, with the exception that Mr. F. G. Sanborn was employed six months to assist in preparation of the exhibit of entomology.

The report of Mr. Dodge on that portion of the work referring to the Centennial, together with my own report on the *Homoptera*, is respectfully submitted.

TOWNEND GLOVER.

HON. FREDK. WATTS,
Commissioner.

DEPARTMENT OF AGRICULTURE,
February 1, 1877.

SIR: Upon learning your wishes in regard to the manner in which the museum should be represented at the International Exhibition in Philadelphia, three circulars were prepared, and were early sent out to a carefully-selected list of regular correspondents of the Department, in from three to six localities in different portions of the various grain, wool, or cotton growing States, for representative specimens of these products. Each circular so sent was accompanied with bags, labels, and directions for the shipment of specimens, so that no mistakes could occur, and the specimens themselves would not be liable to injury by careless packing. As fast as the samples were received at the Department, they were catalogued and numbered, the accompanying labels carefully filed, and the specimens prepared for exhibition, making, when complete, a collection of over 800 samples of wheat, barley, rye, oats, buckwheat, maize, &c.; 500 specimens of wool, many of the exhibition-jars containing series from different animals of the same flock; and 200 specimens of cotton, both seed and lint.

From the regular collection of the museum and other sources a full series of flax, jute, hemp, ramie, silk, and miscellaneous fibers, including paper-stock, were obtained, to complete the fiber exhibit. A large collection of tobacco was also made, representing a score of States, to which were added about a dozen specimens from the museum, and these, for the sake of uniformity, were pressed into boxes measuring 5 by 15 inches and $2\frac{1}{2}$ inches deep; in all, nearly one hundred.

In addition to the above direct products of the soil and in connection with them, samples of their various manufactures were obtained and exhibited side by side, showing, in the case of the grains, the flours, starches, and fancy food products; with the wools and other fibers, the fabrics manufactured from them, that any one at a glance might see the particular grade of wool or cotton entering into the composition of the fabric, and with the tobacco-samples the product in its prepared state.

The valuable collection of fruit and vegetable models, to which large additions were made, were renamed and mounted on blocks or stands, that they could be better seen and examined. They were then transferred to Philadelphia, where the same plan of arrangement hitherto existing in the museum was followed out, showing the fruit as grown in various States, and illustrating their adaptability to given localities.

The large and valuable series of etchings on copper, comprising upwards of three hundred plates, prepared by yourself in leisure hours during the last twenty years, were transferred from the entomological rooms of the Department to Philadelphia as a portion of the exhibit in entomology, having been renamed up to the latest date from recent check-lists or works of specialists. In this series is illustrated not only the common and well-known forms of our noxious and beneficial insects, but many of the rare and little-known species from the far West, in public and private collections, in all many thousand species. Many of these are figured in all stages, from the egg to the perfect insect, with both sexes, and, in the *Lepidoptera*, with the upper and lower surfaces of the wings. Manuscript notes on the species were placed near at hand for those wishing to make references or desiring to learn more than the simple name of a given insect.

In the collection of economic entomology the usual plan of arrangement (according to classification) was dispensed with, and a plan adopted that was thought to be more purely agricultural and more in the interest of the farmer or fruit-grower. This collection, filling twenty-four cases or drawers, and numbering over 1,100 specimens, comprises the most common forms of injurious and beneficial insects in the United States. The collection is by no means complete, but serves to illustrate the plan of arrangement, which is especially adapted to cabinets of agricultural colleges, State museums, and similar institutions. The cases measure 16 by 21 inches and $2\frac{1}{2}$ inches deep, outside measurement. They are made of whitewood or poplar, $\frac{3}{8}$ inch thick, dovetailed at the corners, with the bottom rabbeted in. The sides are made of two pieces, forming the box proper, about $1\frac{1}{2}$ inches high, and a cover 1 inch, which is grooved on the inner surface near the top (about $\frac{1}{8}$ inch) for the reception of a plate of glass fastened in, when the box is made, with putty. The cover and box, where they fit together, are tongued and grooved, and are held together by brass hooks and eyes on either side.

The plan of arrangement is to show in one group the insect foes of a particular food-plant in the four stages of egg, larva, pupa, and insect, accompanied by specimens exhibiting the mode of injury, and classified according to the portion of the plant injured, as root, stalk, foliage, or fruit, to be followed by the beneficial insects known to destroy a particular species; in short, the idea of such a collection is to be able to show at a glance the entire history of any insect or group of insects affecting any of our food-crops.

In visiting such a collection, we will suppose the farmer, or fruit-grower, or student should desire to see the Colorado potato-beetle. The case devoted to the potato is opened, and he sees a dried specimen of potato-leaf, fastened upon a card-label, covered with little patches of the yellow, golden eggs of this insect; next he observes the larvæ, of various sizes, either in alcohol or prepared by "blowing;" then the pupa is shown to him; and, to complete the story, the male and female of the perfect insect are displayed, some in a state of rest, some with wings expanded, and others in various positions, to show marked portions of the body. Then, if it were possible, a denuded potato-stalk should be shown, to exhibit the method in which they carry on their work of destruction; and, lastly, the army of parasites that help to check their ravages, with samples of chemicals and artificial contrivances in use by man to accomplish the same end, would close the short but instructive lesson. Each card should be labeled with the scientific and common names of the specimen, or with any information necessary to complete the history of the insects.

Should he desire to know what other species are destructive to the potato, in like manner he will learn the history of *Lema triliniata*, *Baridius trinotatus*, and other species. When an insect is a general feeder, it may be shown in the case devoted to two or three only of the plants it is most destructive to, though on the card-label the other plants it feeds upon should be named, or, if found on vegetation generally, the word "omnivorous" explains the fact.

The design of arrangement has not been as fully carried out as could be desired, chiefly for want of specimens, particularly those illustrating the early stages of the insects. The present collection, though, is a commencement, forming the nucleus of what may some day be the full realization of a complete cabinet of economic entomology. In colleges and other institutions, however—as is the case in our own cabinet—such a collection should be accompanied by a working collection, arranged according to families, tribes, genera, and species, in order that the student may familiarize himself with classification while studying the habits of insects in relation to our farm-products.

The groups exhibited in the twenty-four cases exhibited at the Centennial are as follows:

Case A.—Thirty-nine species of insects, destroying, either directly or indirectly, the root, stalk, foliage, or fruit (in the field and in the granary) of Indian corn or maize.

Case B.—Insects destroying (or proving injurious to) wheat, rye, oats, and other cereal crops. Twenty-two species.

Case C.—Insects destroying or injuring cotton. Thirty-three species.

Case D.—Insects destroying or injuring the potato, (*Solanum tuberosum.*) Sixteen species.

Case E.—Insects proving destructive to cucurbitaceous plants, as squashes, melons, &c. Seven species. Insects destroying milkweed. Twenty-five species.

Case F.—Insects destroying cabbage, turnips, &c., or the plants of the kitchen-garden. Twenty-eight species.

Case G.—Insects injuring the grape-vine or its fruit. Thirty-one species.

Case H.—Insects injurious to fruit, fruit-trees, &c. Twenty-six species.

Case I.—Insects destroying or proving injurious to the apple. Twenty-nine species.

Case J.—Insects that annoy the housewife, commonly called "household pests." Forty-one species.

Case K.—Insects aiding in the destruction of forest-trees. Thirty-seven species.

Case L.—Insects destroying the pine. Thirty-nine species.

Case M.—Insects destroying shade-trees. Twenty species.

Case N.—Insects injurious to man, by injuring or destroying the wood of various plants. Twenty-eight species.

Case O.—Gall-insects on oak. Twenty-seven species.

Case P.—Gall-insects of other plants. Forty-four species.

Case Q.—Insects destroying the eggs or young of fishes. Fourteen species. Insects injurious or annoying to bees, to cattle, and to mankind. Thirty species.

Case R.—Objects of insect architecture, with the species employed in producing them. Forty-eight specimens.

Cases S and T.—In these two cases are shown seventy species of the most common forms of our beneficial insects. (These should have been placed in the general collection, after the insects they are known to destroy, but it was decided to group them together for the present.)

Case U.—Thirty-one species of insects beneficial as scavengers by removing filth and carrion.

Cases V and W.—These two cases are devoted to silk-producing insects, and contain about thirty specimens illustrating this industry.

Case X.—In this case are gathered together a few insecticides, so called, and traps or devices for destroying insects.

The birds beneficial and injurious to American agriculture were shown in a case by themselves, labeled, as in the museum, with scientific and common name, and brief facts regarding benefit or injury, as well as suitable marks of distinction on the end of each perch, black to show the evil habits of the bird, and white to show the proportion of good, by their destruction of noxious insects. With many of the specimens the contents of the stomach was exhibited to verify the statements upon the label.

The collection of domestic poultry was made almost complete by the purchase of 80 specimens of fowls, ducks, and pigeons, which were prepared and exhibited with a careful selection from the collection already existing in the museum of the Department, and these, labeled with the name of breeds, formed an interesting exhibit for the farmer or poultry-fancier.

The collections were arranged in sixteen walnut cases, built with the special object of transferment to the gallery of the museum when completed, in order that their great expense should not be lost to the Department, and were allotted a space of 40 by 60 feet. The arrangement of the grand whole is in an ascending series, beginning with the products of the earth, as grains, fruits, tobacco, cotton, wool, and other fibers; next, the insects which prey upon them and blast the hopes of patient labor; and, third, the birds which restore the balance, and render successful production possible by limiting the depredations of the countless hordes of insect spoilers.

Before leaving this subject, it may not be out of place to state that the Department is under obligations to many individuals and firms for aid in making collections for the museum, or for valuable donations of samples which could be procured in no other way, prominent among which may be mentioned:

The Lowell Manufacturing Company, series of samples illustrating manufacture of carpets; the Washington Mills, Lawrence, Massachusetts, a similar series illustrating the manufacture of woolen piece-goods; Chas. A. Stevens & Co., Ware, opera flannels, wool, and manufacture; Amoskeag and Stark Mills, Manchester, N. H., through Mr. Reuben Dodge, samples illustrating cotton and flax manufacture. Various samples of paper-making materials and manufactured paper, to E. Morrison & Co., Washington, D. C.; Holyoke Paper Company, Hadley Falls, Mass.; Askell & Smiths, Canajoharie, N. Y.; Dobler, Mudge & Chapman, and John A. Dushane & Co., Baltimore, Md.; Republic Mills, Springfield, Ohio, and others.

The thanks of the Department are also due to many of its regular correspondents, who aided materially in the success of the exhibition by their prompt response to the call for samples of grains and fibers.

While the Department was enabled by means of the Centennial Exhibition to add largely to its collections of native products of agriculture, far greater benefit was derived from it by the opportunity it presented for the acquisition of rare and not easily-obtained collections of the varied products of the agriculture of foreign countries. Through the earnest endeavors of Professor Baird, of the Smithsonian Institution, and by co-operation with him, the Museum Division has taken advantage of the opportunity presented, which has resulted in the securing of full collections of the products of the soil—direct and indirect—from various portions of the world; many from remote countries, curious and interesting, as illustrating the habits of the people, while exhibiting their agriculture, and all of such value and in such generous quantities, with few exceptions, that, when they are finally classified and arranged in the museum-hall, the display will be most complete.

For the most part the material is given as a donation to the United States for exhibition in its museums, although it is understood that the Department shall reciprocate by sending collections of grains and fibers of our own country, if such collections are desired. Some of the exhibits were presented in their entirety, without condition; from others the Department was allowed to select such specimens as were desirable in quantities sufficient for museum purposes, while with a few the specimens were secured by promise of exchange when the Department is enabled to secure the American collections for the purpose.

From the interesting exhibits of the Australian colonies a full series of grains and fibers were obtained. From Victoria, in addition to grain and wool samples, including thirty-two samples of the fine-wool collection of Hastings, Cunningham & Co., the Department was fortunate in securing a collection of miscellaneous fibers from over forty different species of fiber-producing plants, prepared by William R. Guilefoyle, director of the botanic gardens, Melbourne. This collection also includes fifty specimens of paper prepared from as many species of plants, nearly all of which are represented in the fiber-collection. Among the Victoria wheats secured, one variety weighed 68 pounds to the bushel, and not a few were up to 64 and 67 pounds. In all, several hundred specimens were obtained.

Samples of the remarkable wool exhibits from Queensland were secured, with about forty specimens of miscellaneous fibers, all of different species, with the exception of half a dozen samples of cotton and silk in the raw state. A fine series of sugars was also obtained, with a few samples of grain and tobacco.

The New South Wales donation consisted of a large series of wools, and some few miscellaneous fibers, including silk-cocoons; about twenty specimens of sugar, fifty specimens of grain, arrowroot, starch, flour, &c., and a series of preserved tropical fruits; tobacco, and other miscellaneous products. The South Australian and Tasmanian collections were very similar, numbering about one hundred specimens each.

From New Zealand, the valuable collection of one hundred and nine specimens of New Zealand flax, *Phormium tenax*, was received complete. It illustrates the textile in all stages of manufacture—even as rudely prepared by the natives, who strip the fiber with a shell—and includes articles showing the various uses to which it may be employed, as the manufacture of twine for making nets, coarse twine, small and large ropes, cables, halters, mats, matting, and even a fair quality of coarse flax cloth. A series of fine grains was also received, with about a dozen wool samples, native gum, starch, and miscellaneous products.

The Japanese donation includes one hundred and fifteen specimens of tea in bottles; specimens of tobacco, gums, varnishes, dye-stuffs, flour, starches, and farinaceous products; and a valuable series of preserved fruits in alcohol, among them several varieties of the seedless persimmon, which is used for making wine and for preserving as a delicacy. A few bottles of sauces and wines were also presented. The most valuable acquisition, however, is the complete exhibit illustrating the silk industry of the country, as carried on by the natives, which was given without condition, and includes not only the silk of *Bombyx mori*, but *yama-mai* and other large silk-producing insects. In addition to about thirty samples of raw and spun silk, cocoons, &c., the collection is accompanied by all the implements, baskets, frames, cases, &c., used in feeding and caring for the worms and in preparing the silk; colored plates, with descriptions of each process, accompany each article, which make it not only an interesting but an instructive exhibit. The remainder of the fiber-collection of Japan given to the Department is contained in half a dozen large cases, and consists mainly of cotton and ramie, in various stages of preparation, with a few miscellaneous fibers.

The donations from Egypt include about two hundred varieties of cereals, seeds, &c., and a full series of Egyptian cotton samples. The Orange Free State also presented samples of its grains, as wheat, corn, millet, &c.

The Russian collection is very full and complete. The entire grain-exhibit was turned over to the Department, there being in many cases a bushel of a given variety. Wheat, rye, oats, barley, linseed, cotton-seed, grass-seed, beans, pease, &c., are embraced in this collection, besides samples of nuts and other seeds not enumerated. In the dozen or fifteen varieties of vegetable oils presented are poppy, sunflower, and mustard oil. Twelve samples of beet-root sugar were secured from their fine display, and a few preserved fruits and liquors. The fiber-collection consists of samples of flax, raw and prepared, cotton, silk cocoons and spun silk, and twenty samples of wools sent in the fleece. In addition to these specimens, two large ornamental cases of merino wool, probably two hundred samples, were given entire.

Norway and Sweden presented their complete exhibit of grains and cereals, the latter country also giving about sixty samples of flour and food preparations, including the bread used by the peasants. This bread is made once a year, and is a large, round, flat cake some 10 inches across, made of rye or of wheat flour, and is quite palatable.

The Netherlands presented, without condition, the entire exhibit of the Zeeland Agricultural Society, with a number of miscellaneous exhibits of individual products, as chiccory, liquors, and oils from maize and other grain, medicinal preparations, &c. In addition to these collections, the large exhibit of the Holland Agricultural Society was secured by purchase, the Netherlands Commission offering to become responsible for two-thirds of the amount asked by the society if the Department would pay in cash the remainder, or $50. The collection includes grains, cereals, seeds, fibers, and other products of the soil, and a series of dairy products, and the implements used in the native manufacture of cheese.

From Great Britain the Department received a very full classified collection of over three hundred varieties of wool from all parts of the world, arranged on a portable stand or table, in eight large glass-covered cases, and exhibited by J. L. Bowes & Brother, Liverpool. This collection was in reality presented to the Smithsonian Institution, and is deposited in the museum of the Department by it. Another remarkably fine collection of wool in the fleece was presented by Mr. Odeys, on condition that samples be preserved under glass.

Spain and Portugal each presented several hundred specimens of grains, seeds, nuts, and various agricultural products, together with a small series of fibers, a portion of them from Philippine Isles.

Many of the South American exhibits were given almost unconditionally, and in two or three instances the Department was fortunate in securing the entire exhibit as it stood.

Brazil donated samples of all of its seeds and grains, some nuts, &c., with samples of flour, starch, *mandioca*, *tapioca*, and other native food products; native fibers, many of them curious and interesting, flax, cotton, silk in raw state, &c.; *maté*, cocoa, coffee, sugar, and tobacco—many kinds peculiar to the country—in the leaf and manufactured; wax, gums, oils, dyes, and a large collection of medicinal oils and other preparations, and *materia medica*, principally dried roots, leaves, barks, &c., of medicinal plants.

The agricultural display of Venezuela included thirty varieties of coffee, half as many of cocoa, specimens of grains, seeds, beans, pease, &c.; samples of native miscellaneous fibers, with a few of their manufactures; oils, liquors, and *materia medica;* also a series of fruits preserved in alcohol, in all, several hundred specimens.

A similar collection was also received from the Argentine Republic, much more valuable, however, in regard to its fibers, as it included a full exhibit of the wools of the country in the fleece.

The Chilian collection embraced a representative collection of the cereals and seeds of the country, with some minor products of agriculture; and a like collection from Peru includes, in addition, about forty samples of native wines and liquors.

Coming nearer home, Mexico presents samples of her agricultural products, and these, with a few small collections obtained from exhibits from our own country, complete the list of donations received from the exhibition, at its close, to be placed in our own museum.

In conclusion, I have only to say that when the gallery in contemplation shall have been erected in our Museum Hall, giving an additional space of 3,000 square feet, or 8,000 in all, and when appropriation shall have been made for the proper preparation and display of this valuable mass of material, the work will be commenced at once and pushed to completion.

Much time and labor, however, will have to be expended on the collection in classifying, arranging, and labeling, as samples in duplicate must be prepared from many of the countries for donations to other institutions; a condition required of the Department when the collections were presented. The Smithsonian Institution also desires a small series from each country represented, for exhibition in the Ethnological Hall of its Museum, when the whole shall have been examined and our own series displayed.

As to the advantages accruing to the Department in the possession of the material it has been so fortunate in securing, it is speaking within bounds to say that in fibers alone, in the number of specimens and value of the collection, the Museum is far ahead of any other Museum in this country, and is a rival of the Museums of the Old World, and that an appropriation of $100,000 at any other time would hardly have proved sufficient for bringing together a similar general collection to the one now in the possession of the Department, which has been secured by very limited exchange, and by the simple cost of transportation to Washington.

I am, respectfully,

CHAS. R. DODGE,
Assistant Entomologist.

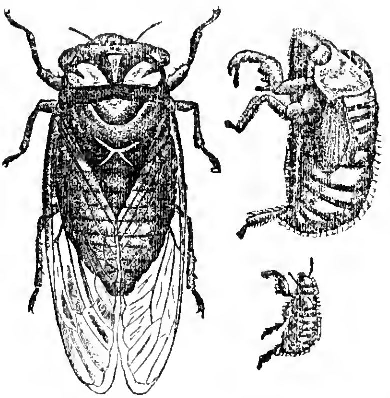
TOWNEND GLOVER,
Entomologist.

HOMOPTERA.

The suborder *Homoptera* of the order *Hemiptera* consists of insects having four membranous deflexed wings, usually lying over the back, like the roof of a house, when the insect is at rest. The anterior pair of wings are usually larger than the posterior pair, generally transparent, and net-veined. The mouth consists of a beak or sucker, which is used to pierce the outer cuticle of plants they frequent, and to suck out the sap in three of the stages of their existence. As larvæ, pupæ, and perfect insect, they are equally active and do much damage, feeding almost entirely upon vegetable substances, and when very numerous, as in the case of the *Aphides* or plant-lice, they do much injury to vegetation by sucking out the sap, thereby weakening the plants, shrubs, or trees they frequent. As no recent reliable catalogue of the *Homoptera* has been published in this country, and only such old works as Amyot and Serville, &c., can be referred to, it has been thought best not to arrange these insects scientifically in this paper, but merely to allude to some of those best known to our farmers, or to such as are particularly distinguished by their destructive habits or singularity of form. This suborder has been very much neglected by our entomologists, who usually take more interest in the study and collection of the *Coleoptera*, (or beetles), and *Lepidoptera*, (butterflies, moths, &c.,) in preference to the smaller and more inconspicuous insects, although the *Homoptera* contain some of the most grotesque and singularly-formed insects we usually meet with, such as *Entilia*, *Telamona*, *Ceresa*, and many others, which will be found described and figured in a later part of this report. We will therefore commence with the *Cicadidæ*, or harvest-flies, incorrectly known in this neighborhood and elsewhere as locusts; the real locust being an orthopterous insect, very closely allied to our common grasshopper.

The harvest-flies are large insects, having a broad, short, transverse head, with large prominent eyes, and broad thorax. The upper wings are rather narrow, membranous, and deflexed over the sides of the body, like the roof of a house. Our most common species in this neighborhood is the *Cicada pruinosa*, which may be heard in summer and autumn at almost any time making its peculiar trilling noise in the shade and forest trees in the grounds of the Smithsonian Institution. These insects are quite large in size, some of them measuring 2 inches or more from the front of the head to the tip of the closed wings. The males alone are musical, hence an old cynical writer observes: "Happy the cicadas' lives, since they all have voiceless wives." The musical apparatus producing the peculiar prolonged trilling chirp or cry made by the male is situated on the under side of the body, on the basal ring of the abdomen, and consists of a pair of large plates, largely covering the anterior part of the body, which, acting like a drum, at the will of the insect produces the prolonged tremulous sound we hear so often in the tops of the trees they inhabit; if the tree on which

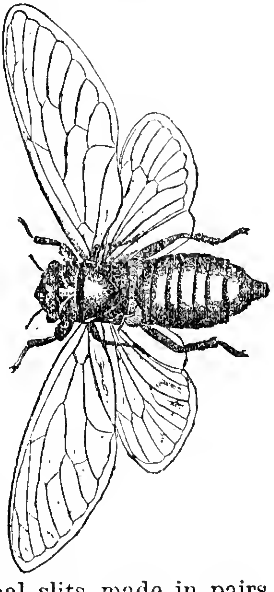
No. 1.



the insect is trilling be slightly struck by the hand, it will stop its musical serenade instantly and remain mute for some time. The perfect insect appears in May and June, and lasts until late in autumn; it is of a green color, shaded with brown. The outer edge of the wings is also green, and when the cicada is young and vigorous, it appears to be covered with a whitish dust or powder, which gradually disappears as the insect grows older. The female deposits her eggs in slits or incisions made in trees or plants, which she cuts with her ovipositor. The eggs remain in these longitudinal incisions for some time, according to the warmth of the season; when hatched by the heat of the sun, the young larvæ drop to the ground, and immediately bury themselves in the soil, feeding upon tender subterranean roots, which they pierce with their beak and then suck out the sap. It is a popular but erroneous idea that the females of this cicada are capable of piercing the skin of mankind and then ejecting a poisonous fluid into the wound, producing violent inflammation and pain. The insect itself is frequently carried off by a large burrowing wasp or hornet, (*Stirus speciosus*,) which forms deep holes or burrows in the earth, where it deposits its egg or eggs in a half-killed cicada, which is intended to form a supply of fresh food for the larva until it changes into the pupa state, when it ceases altogether to feed until it emerges as a perfect wasp or hornet. Last season many specimens of this stirus were brought to the Department, having been caught in the very act of carrying still living harvest flies to their burrows. The manna of druggists is said to be the concrete juice of a species of *Fraxinus*, or ash, in flakes, which is produced by a species of cicada, or, most probably, some other insect of the suborder *Homoptera*. The insects themselves are destroyed in great numbers by hogs, poultry, and various small animals; but as they never appear in such immense numbers as their relatives, the seventeen-year locust, they do very little, if any, damage to the farmer.

Cicada septendecim, or the seventeen-year locust, derives its specific name from the fact that it makes its appearance in certain districts at stated intervals of seventeen years in immense numbers, when the millions of them, swarming on the forest and fruit trees, almost deafen the observer with their trilling calls to the females, and form an abundant feast to the swine, fowls, &c., and wild animals on the land, and, if near a river or lake, to the fishes in the water. They sometimes injure fruit and forest trees by making their longitudinal slits or incisions in the young branches or terminal twigs, in which to deposit their eggs, many of the branches thus injured dying down as far as the injury, and afterward being broken off by high winds and literally almost covering the ground. The perfect insects make their appearance the last of May or beginning of June in immense swarms, and the earth in certain localities is literally honey-combed with the round holes which are made by the insects when issuing from the earth, these holes being bored sometimes through the hardest ground, and sometimes even through well-traveled country roads. After pairing, the females deposit their eggs, from ten to twenty or more, in longitudinal slits, made in pairs,

No. 2.



and penetrating to the pith in the terminal shoots and small branches of oak, apple, and other deciduous trees. These slits are made by the ovipositor of the female. The young larvæ hatch out in about six weeks, fall to the ground, and immediately bury themselves under the earth, where they are said to remain nearly seventeen years in the larvæ state, feeding on succulent roots of trees and shrubs. When about to change into pupæ, the larvæ work their way to the surface of the ground, shed their outer skins, and assume the pupa state, somewhat resembling the perfect insect, but having thick and strong fossorial or digging fore legs, with only wing-cases, and utterly incapable of flight. This pupa state is said to last only a few days, during which the pupa remains near the orifice of its subterranean tunnel. Mr. Rathvon, however, states that in localities which are low and flat, and the drainage is imperfect, they construct galleries of earth, 4 to 6 inches above ground, leaving an orifice for egress even with the surface, in the upper end of which the pupa would be found waiting their appointed time of change. They would then back down below the level of the earth and undergo their transformations in the usual manner. But in all the cases observed when these locusts or harvest-flies abounded near the agricultural college in Maryland, the pupæ were found in somewhat cylindrical holes or burrows, some of them having even burrowed upward through hard gravel roads, as before stated. When ready to change into perfect insects, they crawled out of these holes, made their way as best they could up the neighboring trees, stone fences, and rails, and attached themselves by the strong claws of their feet to some solid rough substance; the skins of the pupæ, hardened, split open down the back and thorax, and the perfect harvest-fly emerged into the open air from the dry old skin, after waiting some time to dry its yet damp wings, it eventually flew away to join its noisy companions on the neighboring trees. In these cases, however, no gallery whatever was made by any of the larvæ observed, but the insects emerged from simple holes in the ground. The situation was high, the soil gravelly, with no swamps in the immediate vicinity. For weeks afterward the trees and fences were literally covered with the dried-up and split skins of the pupæ still clinging to them by means of their strongly-hooked claws, appearing to the casual observer as if they were still alive and in the act of ascending the trees. At the end of the season many of these insects were observed flying about the Maryland woods with only about two-thirds of the abdomen remaining, and that portion perfectly dry and hollow, as if the end had been bitten off by domestic fowls or other birds or broken off by accident; sometimes, however, the hollow portion was partially filled with a brownish powder. On this subject Dr. Leidy, in the Proceedings of the Academy of Natural Sciences in Philadelphia, states that the cicada is liable to be attacked by a peculiar fungus, the posterior portion of the abdomen of the male insects being filled with a green fungus. The abdomen of the infected males was usually inflated, brittle, and totally dead while the insect was yet flying about; when, upon breaking off the hind part of the abdomen, the dust-like spores would fly as if from a small puff-ball. Mr. R. W. Ward, of Ohio, in the American Entomologist, (vol. 1, p. 117,) states that this mold or fungus seems to be a drying up of the membranes of the abdomen, and it is generally of a brown color, dry and brittle. He thinks, likewise, that these males in copulation break off one or more of the posterior joints of the abdomen, and that this "dry-rot" may be the result of the broken membranes. He adds, also, that he never found a perfect male thus affected in the early part of the season. Some naturalists assert that there are two, if not more, varieties of this insect: one appearing at intervals of seventeen years, while another comes every thirteen years. These insects are frequently carried off by the digger-wasps as food for their young, in the same manner as the *Cicada pruinosa* before-mentioned. Madam Meriam states that one species of cicada is very destructive to the coffee-plants in Surinam, but our species do not appear to do much permanent injury, excepting when exceedingly numerous, and then only to the terminal shoots and branches, where the eggs are deposited. The general color of the seventeen-year cicada is of a rich yellow or orange-brown, varied with a darker color; the outside edges of the wings are of a light rich buff or orange brown, by which alone it can be distinguished from its relative *Cicada pruinosa*, which is of a green color, with the edges of its wings also green. It is also much smaller, the figure of the insect No. 2 being taken from an extra large specimen.

Otiocerus coquebertii is a small insect of a somewhat elongated form and having a small projection in front, resembling the lantern of the true fulgora or lantern fly of Surinam, but on a very diminutive scale; it feeds on the wild grape, beech, and oak; it is 0.35 to 0.42 in length, and of a yellowish-white color, with a bright carmine red stripe running longitudinally along each side of its wing, and which stripe is usually forked at its hinder end. This insect is 0.42 in length; it was quite rare near the Maryland college, and was taken by beating among the bushes with a common insect-net. The genus *Otiocerus* is remarkable for possessing long slender cylindrical appendages attached to the base of the antennæ. Another insect of the same genus, *Otiocerus amyottii*, is found on hickory and walnut. As these small insects, however, do very little injury to the farmer, we will not propose remedies, but refer to the remedies for *Tettigonia*, *Erythroneura*, and *Aphis*, which will answer equally well for most of the tree-hoppers should they become very numerous and troublesome.

No. 3.

A small *Fulgora*—*Scolops* (*Fulgora* Say) *sulcipes*—is a most singularly-formed insect; the front part of its head being much prolonged, and projecting upward like a thin curved horn. When dried in a cabinet it is of a light-drab color, and is found among brambles and weeds in meadows. It is not very rare in the neighborhood of the Maryland Agricultural College in July and September, and may readily be taken in a sweep-net; but as it is very active and leaps well, it frequently escapes capture; in length, to the tip of its horn-like prolongation, it measures 0.40.

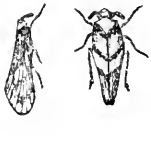
No. 4.

A small homopterous insect, *Phylloscelis atra* (var. *pallescens*) is not uncommon among the brambles and weeds in meadows in Maryland; it is of a singular round or broad oval shape, being about 0.20 in length by 0.13 in breadth; the fore thighs are much thickened, and the hind tibiæ or shanks are quite long and spiney on their outer edges, and are fitted for leaping; it is very active. The color of this insect is black, having two orange-brown stripes on the thorax, two longitudinal stripes of the same color on the outer wings and on the border of the scutel. There is another variety, entirely black, found in the same situations, and the two varieties are frequently taken at the same time when sweeping for other insects.

No. 5.

The genus *Delphax* is here represented by a small insect, *Delphax carinata*, in form somewhat resembling a very small cicada, having wings sloping like a roof, almost transparent, and veined, and bearing three oblique bars of a brown color, meeting at the ridge. It was taken when beating in grass and meadows; length, 0.20; it is likewise found

No. 6.



among young pine trees. Dr. Packard states that another insect of this genus, *Delphax arvensis* of Fitch, is an insect of a pale yellow color, with elytra and wings nearly pellucid, and that it is common in wheat-fields early in June, but he does not state what it feeds upon, or whether it injures the wheat.

Oliarius, n. sp., is a small insect about 0.35 in length, with transparent, broad, strongly-veined wings, having a dark spot about two-thirds of the way down the outer margin. The body is dark green, or almost black, with rings of abdomen tinged with reddish. It was taken among high weeds and brambles, or blackberries, in a meadow near the Maryland Agricultural College, and as its natural history and food are not known, and the insect itself is somewhat rare, it has been figured here, in order to induce young naturalists to observe its habits and make them known to the public.

No. 7.

Amphiscepa (Flata) bivittata is a small insect, 0.30 in length, having its upper wings somewhat broad and rounded, like the wing of the common white butterfly. They are somewhat veined, and rise abruptly from its sides at an acute angle or wedge-form, resembling a very steep roof. There is a broad, lateral, dark-reddish or brown stripe running down the middle of its back. Its general color is pale green, and, when resting on a blade of grass or green leaf, it is scarcely to be distinguished from the substance on which it rests. It is not uncommon in Maryland in grass-meadows and where brambles are abundant.

No. 8.

Ormenis (Poeciloptera) septentrionalis resembles *Amphiscepa bivittata* very much in both form and color, but is much larger, being 0.40 in length to end of wing-covers, and is found in the same situations, being frequently taken with it in the same sweep-net. It also frequents the May-apple (*Podophyllum*) and grape.

No. 9.

Ormenis (Pœciloptera and Flata) pruinosa, the mealy *flata* or frosted tree-hopper, in general form and appearance, resembles the other insects of the genus *flata* before mentioned, being strongly compressed and wedge-shaped. It is about 0.35 in length to edge of wing-covers. Its height is pretty near double its width. It feeds from July to September on the sap of leaves and succulent shoots of various plants, among which may be enumerated rhubarb, gooseberry, plum, privet, grape, &c. The color of the insect itself is plumbeous or dusky bluish, and when young it is covered with white meal-like powder, giving it a hoary appearance. It is very common in Maryland among grass and rank herbage, but does not appear to do any damage to the plants above mentioned.

No. 10.

We will now proceed to insects related to the genus *Membracis*, some of which present most extraordinary and grotesque forms, and which, when resting on small branches or twigs, resemble thorns or excrescences so much that they are frequently passed by unnoticed. We will therefore give some figures to exemplify the singularity of their appearance.

Enchenopa (Membracis) binotata, or the two-spotted leaf-hopper, is a most singularly-formed insect, its thorax having a compressed horn in front extending above the head; when perched upon a dry stalk it has somewhat the appearance of a miniature bird with a long arched neck. It is 0.45 in length to the tip of horn; of a brown or blackish color, and has two pale yellow spots on the edge

No. 11.

of its back. This insect punctures the leaves and extracts the sap from the butternut, hop-tree, and locust; it also is found on weeds. In Maryland it is common on locust, and may sometimes be seen in great numbers arranged in a line on a twig or branch near the body of the tree busily employed in sucking out the sap, which attracts myriads of ants, in the same manner as the so-called honey-dew produced from the anal tubercles of plant-lice.

Telamona ampelopsidis is a curious tree-hopper, about 0.50 in length to the tips of its wings, of a brownish-gray color when dead and dried, and a large and somewhat square hump projecting from its back, which slopes or leans slightly toward the hinder part of its body. As its specific name implies, it is found on the *Ampelopsis*, or Virginia creeper, but also frequents grape-vines, and is rare in Maryland.

No. 12.

Entilia (Membracis) concava is a very small tree-hopper, 0.15 to 0.18 in length, with the ridge of the back somewhat elevated in front so as to form a slight concavity in the middle, or rather before the middle part of the back; the body is marked with dilated punctures. It is of a dark color, and quite inconspicuous in appearance; it is taken on weeds.

No. 13.

Another species, *Entilia (Membracis) carinata*, has the ridge of its back or keel deeply scooped out in a compete semi-circle, so as to make a kind of protuberance in front, separated from a square leaning hump on the ridge of its back by the aforesaid scooped out semi-circle; it is 0.20 in length, and of a brown color, and has been taken on potato-plants, but is quite rare in Maryland.

No. 14.

Ceresa bubalus, or the buffalo tree-hopper, is a very singularly-shaped insect, being broadest in front and shaped something like a beech-nut anteriorly, with a short sharp point at each side jutting out horizontally like the short horns of a bull, and ending also in a sharp point; it forms a kind of triangle on the front part of the insect, and presents a very singular appearance, especially as when viewed from the back; it grows narrower until it ends in a sharp angle at the ends of the wings. The insect is about 0.30 to 0.40 in length, of a green color, and has transparent wings sloping like the roof of a house. This insect is common on a variety of trees in Maryland, apple, peach, grape, and willow, and, when on the locust, generally stations itself in an angle where the leaf-stalk arises from a branch, and where it is almost hidden away. The eggs are deposited in a short curved row, in a series of punctures made by the ovipositor of the female in the bark and sapwood. The larvæ are shaped something like the perfect insects, but are somewhat spiney; as perfect tree-hoppers they are very active, and leap with great agility on being disturbed, and feed on sap of apple and peach trees, willow and grape-vines, and have been accused of injuring the stems of grape-vines by the punctures they make in which to deposit their eggs. The color of the insect being green, it is not very readily distinguished from the leaf itself when in a state of rest.

No. 15.

Ceresa diceros resembles *C. bubalus* very much in outward appearance, but appears to be somewhat smaller, and differs also in being marked with three or more dark brown spots on its upper wings; it is frequently swept up in the same net when beating for other insects on low bushes and in tall herbage or grass. In Maryland it is tolerably common.

No. 16.

Thelia bimaculata, or two-spotted tree-hopper, is 0.45 to 0.50 in length;

No. 17.

♀

it is a brownish triangular insect, shaped like a beech-nut, with a long horn running obliquely forward and upward overhanging the head, compressed and rounded at the end; it has a large, bright yellow or dull gray colored spot on each side. The male differs from the female in the shape and size of its dorsal horn as in the fig. 18, and has been known as another species under the name of *T. acuminata* it has been taken on locust.

No. 18.

Smilia (Membracis) inornata, or the unadorned tree-hopper, resembles *Ceresa bubalus* in size and color, but has no horn-like projections on each side and is uniformly rounded in front and on the back, giving it the appearance of being hump-backed; it is shaped somewhat like a beech-nut, and of a light green color, fading to a light yellow in some specimens; the wings are hyaline or glassy, and deflexed at the sides like a roof; it is 0.35 in length, and found on oak and chesnut in late summer and autumn.

No. 19.

Stictocephala (Smilia) inermis, or the unarmed tree-hopper, resembles *Smilia inornata* in general form, but is more rounded on the back. These insects in late summer and autumn make short straight incisions in the bark of small limbs and twigs of pear and chestnut; the eggs are then deposited in these incisions and hatch out in spring, when the larvæ, pupæ, and perfect insects suck out the sap and thus weaken the trees. The insect is about 0.28 in length, of a uniform pale green color, fading to dirty yellow; when dried the wings are hyaline, and when disturbed it leaps with great agility; it is not uncommon in Maryland, and is frequently taken when sweeping with a net for other insects among grass and weeds and brambles; it has been taken likewise on chinquapin bushes.

No. 20.

Smilia (Membracis) vau, or the V-marked tree-hopper, is found on walnut, hickory, and oak, where it punctures the young branches with its beak, or sucks and drains them of their sap. These insects are about 0.25 in length, with thorax not greatly elevated, but rounded in front, and acutely carinate from before the middle to the posterior tip. These insects are very variable in color, but in dried specimens they are of a dirty yellow, with V-like marks on the back. The thorax forms a high arched crest over the body. The figure is magnified somewhat.

No. 21.

Archasia galeata (*Fab.*) (*Smilia auriculata* of Fitch) is a very singularly-shaped tree-hopper, about 0.35 in length, having a very high rounded back ending posteriorly in a sharp point; its color when dried was of a brownish-yellow and evidently very much faded; it has been taken on prairie *Eupatorium* and *Verbena hastata*.

No. 22.

Hoplophora quadrivittata is a short, thick-set tree-hopper, about 0.35 in length; dried specimens of this insect are of a grayish color, having two short and two longer longitudinal lines of a pinkish color on its back anteriorly; it was taken with a sweep-net among weeds and bushes, and is rare, but frequents oak.

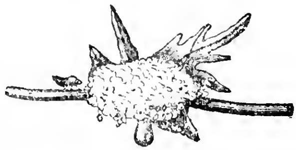
No. 23.

Cercopis bicincta is a very pretty insect, with body sanguineous, (Say,) thorax blackish, a rufous band on the middle wings, or hemelytra blackish, with two yellow or orange bands running across them; it was taken very sparingly when beating with a sweep-net among weeds, grass, and brambles; the insect is about 0.45 in length. Some of the *Cercopidæ* are said to secrete a saccharine substance which is devoured by ants.

Aphrophora (*Cercopis*) *quadrangularis* is a small, broad, quadrangular insect of a light brownish-drab color dried, having a square or rather diamond brown linear mark on its back, and is about 0.35 in length. This insect is also known as the frog or cuckoo spittle-insect, as its larva lives in a kind of foam or froth formed on various plants, shrubs, and trees by the larva sucking the sap from the plant by means of its piercer or sucker, and then ejecting the said sap and discharging it through its body, forming small bubbles like froth or foam, and effectually concealing the larva from its enemies; it lives in security until ready to change into the perfect insect. In Maryland the negroes believe that the small forest horse-flies, so numerous in the woods, are produced from these spots of foam, and it is almost impossible to convince them to the contrary. In Vermont these insects are accused of injuring the crops of hay; it is alsfound on brambles. The larva of a species of *Aphrophora* and the frothy substance produced by it on rag-weed is figured here to show the appearance of the foam as it is formed on the plants.

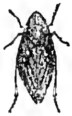
No. 24.

No. 25.



The larva of *Aphrophora* (*Membracis*) *parallela* in June and July forms a spot of white froth upon the bark near the end of the branches of white pine; the perfect insect is 0.50 in length, of a flattened and somewhat oval form, and has its wing-covers deflexed like the roof of a house; it is of a brown color, with blackish punctures on a pale ground, with a smooth whitish line along the back, and a small, smooth whitish spot in the center of each wing-cover; it frequents pine woods, and is very plentiful in Maryland.

No. 26.



The larva of *Aphrophora* (*Membracis*) *quadrinotata*, or the four-spotted spittle-insect, is frequently to be found enveloped in a spot of foam on the branches of the grape-vine; this insect is 0.33 to 0.35 in length, of a flattened form and brownish color; it has a blackish spot or mark near the tip of its wing, another on the outer margin, and a third at the base of the upper wing-covers; as it is found so plentifully sometimes on grape-vines, in all probability it deposits its eggs on or in the branches, which, when hatched out into young larvæ, suck the sap and weaken the growth of the vine. Insects of the genus *Aphrophora* are carried off by a hymenopterous insect, *Gorytis*, to provision its nest and serve as food for its young.

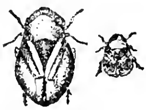
No. 27.

Clastoptera (*Cercopis*) *proteus* is a small insect, very prettily marked with yellow and black, but is somewhat variable in its ornamentations; it is only 0.15 in length, and is found in cranberry and blueberry fields; no special complaints of its noxious habits have been received by the Agricultural Department, although various agricultural papers say it is a great pest to Eastern cranberry-growers, injurious to the cranberry culture. Flooding the fields for a couple of days would effectually remove them. The figure is considerably magnified.

No. 28.

Clastoptera (*Cercopis*) *obtusa*, the obtuse or blunt *Clastoptera* is a small, short, broad, and blunt insect, nearly circular in form; it is 0.25 in length, and of a grayish-brown color in dried specimens, which, when strongly marked, are described as having three brown bands anteriorly and a dark spot near the tip; in the large specimen figured these spots are not shown; it is found on the black alder.

No. 29.

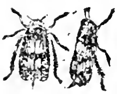


Proconia undata is a tree-hopper, of a brown or blackish color, hav-

No. 30.

ing the head, thorax, and posterior extremity of a lighter and brighter brown color; the head is broad, and blunted in front, and the insect itself is of an elongated form, 0.50 to 0.55 in length, and when young is covered with a bluish powder, which, however, in old insects appears to have been rubbed off. These insects are injurious to the grape-vine, as they are said to puncture the stems of the bunches of grapes, thus causing them to wither and drop off. It also sucks the sap from the branches and deposits its eggs in slits made in the stems in single rows. In certain localities this insect is quite common, and may be taken by sweeping with insect-nets the weeds and bushes in the immediate neighborhood of grape-vines or among weeds and bushes. In the woods they probably frequent the wild grape-vines, and are very common in Maryland on blackberry-bushes.

Cœlidea (Jassus) sub-bifasciata is a tree or leaf hopper, about 0.35 in length, having brownish transparent wings, with two (or more?) broad brown stripes across the wing-covers. It is very active and difficult to capture, except in long sweep-nets brushed through grass and weeds in meadows, but is found on black alder and brambles.

No. 31.


Aulacizus (Tettigonia) mollipes is a long and somewhat narrow leaf-hopper, with a very long triangular head. It is of a green color, and is about 0.35 in length. It is very active, and leaps, like the rest of the genus *Tettigonia*, with great agility, it was taken among weeds and brambles, in meadows, grass, and cypress.

No. 32.

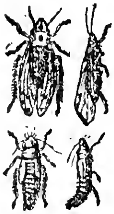

The leaf-hoppers *Tettigonia*, *Erythroneura*, &c., are small leaping insects, very destructive to plants, and especially to the grape-vine, whence they are commonly but erroneously called thrips, which is quite a different insect, and will be found figured under the *Orthoptera*. These insects swarm upon certain plants, and in all their states, as larva, pupa, and imago or perfect insect, are very active and destructive, as they pierce the outer skin of the leaf or bark. They suck the sap until the foliage turns yellow or brown, gradually withering away and dying, leaving the cast-off coats of both larva and pupa adhering to the surface of leaf, (generally on the under side,) resembling small white specks of semi-transparent skin.

Erythroneura (Tettigonia) vitis, or the vine-hopper, is a pretty fair specimen of all the leaf-hoppers; we will, therefore, give a condensed history of their habits and natural history. These insects are supposed to pass the winter in the perfect state, hibernating among fallen leaves and other rubbish. Some naturalists, however, deny this, and say that the eggs for the spring brood are laid during the preceding autumn. However this may be, the young larvæ appear in June, from eggs laid by the females which have survived the winter. The larvæ differ from the parent insects chiefly in not possessing wings, but they are able to leap with great agility when disturbed, and are equally as destructive as the perfect insect, as from the time they are hatched they suck the sap from the leaf and injure the vitality of the plant. In general, they frequent the under side of the leaves, and sometimes appear in such numbers as to be a great annoyance to casual passers by, and so injure the vines as to cause the foliage to turn yellow or brown, and finally to become dry, stiff, and brittle, and fall off. These insects, as before stated, are generally, but erroneously, known to our farmers as thrips. They cast their skins at least three times, leaving their old cast skins like white specks on the leaf, and are very lively, hopping away like fleas when disturbed. They attain maturity in June and July, fresh broods appearing throughout summer and autumn until the end of the season.

When fully grown, the larvæ acquire perfect wings, and are able to fly from vine to vine, where they lay fresh eggs for future generations. The real *Erythroneura vitis*, or grape-leaf hopper, is described as of a pale yellow color, with two blood-red bands and a third dusky band at the apex. The anterior band occupies the base of the thorax, wing-covers, and scutel; the middle band ends in a much narrower, nearly square, spot on the middle of the outer side of the wing-covers; it is 0.13 in length. For the destruction of this insect syringing with strong tobacco-water has been recommended, also dusting with lime, sulphur, hellebore and red pepper, and fumigation with tobacco. Syringing with very dilute carbolic acid and water have also been recommended, but are said not to be of much utility unless applied almost every day. Carrying a lighted torch through the vineyard at night is said to destroy multitudes, as, attracted by the fire, they fly into the flame and are burnt. This should be repeated at short intervals. Spading up the ground in the immediate vicinity of the vines late in the autumn and early in the spring would probably expose the perfect insects to the frost and cold, if it hibernates as before stated. In a green-house or grapery, a large, somewhat shallow vessel, similar to a washing-tub, partially filled with water, might be placed, and a small quantity of oil poured over it so as to form a slight film upon the surface, and a brick placed in the middle of the tub with one end above the level of the water and oil, on which to place a candlestick or lantern, so that at night the candle or lantern might be lighted, and the vines disturbed, when many of the insects, naturally flying around the light, would fall into the tub, and the oil clogging their wings, they could not escape.

Erythroneura (*Tettigonia*) *basalis* is the most numerous species in this vicinity, and differs very much in ornamentation, some of them being very much spotted with red, while others have almost spotless wings and a mere reddish tinge here and there. It is very small, and about 0.05 in length.

No. 33.



Diedrocephala (*Tettigonia*) *quadrivittata* is a very pretty insect, 0.35 in length, and is of a light-green color, with four distinct longitudinal stripes, meeting on apex or edge of the wings. We have taken these insects near grape-vines, but they appear to be more numerous in meadows and amid rank herbage and blackberry-bushes. These figures are magnified.

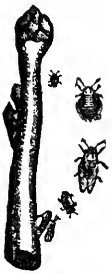
No. 34.

The *Psyllidæ* are small insects, very much like the *Cicada*, or harvest-fly in miniature, having the wings of both sexes deflexed at the sides of the body. As larvæ, pupæ, and perfect insects, they subsist on the juices of plants; the larvæ are flat. A very pretty species, *Psylla rhois*, having deflexed black wings and an orange-yellow thorax, is very common near the Maryland Agricultural College in July and August on the common sumach; it is very small, being only about 0.10 in length. The figure is magnified.

No. 35.

Psylla pyri, or the pear-tree flea-louse, is very injurious to the pear-trees. It is also found on apple-trees, and we have taken them in New York as late as the middle of December sucking out the sap. The pupæ of *Psylla pyri* are very small, of a flat form; the wing-cases are black; the abdomen and body are yellow, barred with black, and the thorax is also yellow, or brownish, spotted or ornamented with black. The perfect insect is about 0.20 to 0.25 in length, and has four transparent wings, which, when the insect is at rest, form an angle over the body like the roof of a house. These wings are hyaline, veined with black veins, and having a blackish spot or mark on the lower side of the upper pair. The larvæ, pupæ, and perfect insects appear to prefer the side of a branch just above a bud or in the axils of the leaf-stalk, and the head is generally hidden under the bud. These insects appear to be gregarious, and fond of herding together in groups of twelve or more. They elaborate and void a sweet clammy substance like honey-dew, derived from the sap of the tree, which, falling on the leaves and limbs below, gather all the dust and dirt, causing the tree to have a very filthy appearance. This so-called honey-dew is generally found on the upper surface of the leaves and branches, and evidently comes from insects feeding directly over or above the clammy places. As it is voided it falls on the leaves below, and is eagerly sought after by ants, which, when a tree is much infested by *Psylla pyri*, may be seen in swarms running up and down the trunk. The same remedies may be recommended for these insects as are mentioned for plant-lice and leaf-hoppers. They are also probably destroyed by chickadees and golden-crested wrens, as we have seen these little birds hanging head downward on a particularly-infested tree in November and even in dead of winter, busily employed in searching every hole and corner for hidden insects. The figure is magnified.

No. 36.

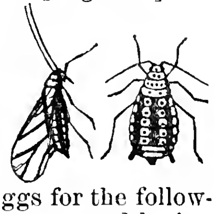


The *Aphides*, or plant-lice, are exceedingly injurious to horticulture, inserting their long beaks into the tender shoots and leaves of plants and then sucking out their sap. These insects are generally of very small size, having antennæ of 5 to 7 joints and a long three-jointed beak, or proboscis, for puncturing plants, and then sucking out the sap. Their bodies are soft, rounded or flask-shaped, and apparently only consist of a skin filled with a liquid; their legs are long and very slender, and many of them have two upright processes or tubercles on the hinder part of the abdomen, from which a sweet gummy substance is occasionally ejected, which is eagerly sought for by ants and other small insects. The wings are generally transparent, and the upper pair are much larger than the lower, and are furnished with strong nerves or veins, which pass outward from the costal or outer marginal vein; these wings are very much deflexed at the side of the body when the insect is at rest. Dr. Burnet states that in early autumn the colonies of plant-lice are composed of both males and females; the female after pairing deposits her eggs and dies. Early in the spring the eggs are hatched, and the young plant-lice puncture the plant, suck the sap, and increase in size, the whole brood consisting of individuals capable of reproducing their species without any connection with a male by a species of gemmation or budding forth. These summer broods are wingless. The second generation and several others pursue the same course, being sexless, or at least without the trace of a male among them, and so on indefinitely until the autumn, when winged individuals are produced, which lay eggs for the spring brood of sexual individuals. Bonnet obtained nine generations and Duval seven by this process of gemmation in one season, and Packard states that *Aphis dianthi*, the plant-louse of the pink, continued to propagate by gemmation without any males for four years, in a constantly-heated room. It has been supposed that the final autumnal set of plant-lice were males and females alone, but Dr. Burnet states that on examining the internal organs of the winged individuals many of them were not females proper, but simply the ordinary gemmiferous or summer form. As there are peculiar plant-lice infesting different plants, the number of species must necessarily be very great.

As before stated, ants are very fond of the sweet gummy substance miscalled honey-dew, which is ejected from the anal tubes of plant-lice, and it has been repeatedly stated on good authority that the ants capture the plant-lice, carry them to their nests, and keep them there, like milch-cows, for the sake of having a good supply of their favorite food near at hand. Dr. Walsh states that *Aphides* feeding on annual plants hibernate in the imago or perfect-insect state. To show the injury done in England by these minute insects, Kirby and Spence long ago stated that their damage to hops alone made the difference of the duty often as much as £200,000 (or in the neighborhood of $1,000,000) per annum, more or less, in proportion as the fly prevailed or otherwise. Happily, however, plant-lice are subject to a great many enemies which materially diminish their numbers. Almost all the lady-birds (*Coccinellidæ*) feed upon them in both larva and perfect state. Minute hymenopterous insects, such as *Aphidius*, &c., lay their eggs in the body of the plant-louse, which, hatching into little grubs, eat out their interior and thus destroy them. (See *Hymenoptera.*) Several plant-bugs, *Nabis ferus*, *Phymata erosa*, *Reduvius raptorius* and *multispinosus*, pierce them with their beak, and suck out their juices. (See *Heteroptera.*) *Syrphus* and *Leucopis*, two-winged flies, also destroy them, (see *Diptera;*) *Chrysopa*, or the lace-wing fly, and *Agrion*, a dragon-fly, (see *Neuroptera*,) feed upon them, and many others, too numerous to mention here, all join in this indiscriminate war upon the helpless but noxious plant-lice. If any person interested in grape-culture will take a single leaf of a grape-vine infested with plant-lice and observe it closely, he will see several individuals differing from the rest, being much swollen and of a grayish-brown color, instead of the usual green, and each having a round hole in the abdomen. This is done by a small hymenopterous or four-winged fly, which deposits its eggs in the body of the doomed plant-louse, which, hatching into a minute grub, devours the inside of its victim, and after changing into a pupa inside the body of the aphis and finally into the perfect fly, cuts its way out into the open air, and emerges through this circular hole in the skin to lay the foundation of new broods of aphis-destroying flies, leaving the empty hard gray skin of its victim still clinging convulsively to the leaf. The number of these empty skins with holes in them on some of the vine leaves will testify how much good this little insect does to the grape-culturist by destroying his enemies. *Aphides* are likewise destroyed by other hymenoptera, *Passalœcus mandibularis*, which stores them up in its cell or nest as food for its young. *Trypoxylon*, *Allotria*, and many of the *Chalcididæ* and other *Hymenoptera* are also benefactors by destroying multitudes of these troublesome plant-lice.

Aphis mali, apple plant-louse. The females deposit their eggs, which are small, oval, and black, on twigs and bark in the autumn; the insect is hatched out the next spring, and feeds upon the sap of the tree. The first broods are all females, which in a short time, without any intercourse with the males, give birth to living young by the procees of gemmation, as before described. These also produce other young ones, which are all females as long as the summer lasts, and it is only in the autumn that males are produced, which, uniting with the females, become the parents of the eggs for the following spring brood, thus bearing living young all the summer, and laying eggs which can withstand the frosts of the winter in autumn for the following spring season, while the parent insects in winter are de-

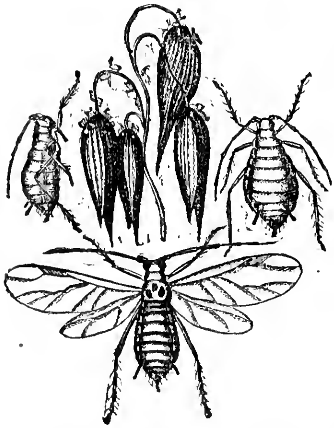
No. 37.
[Magnified.]



stroyed by the wet and cold weather and alternate freezing and thawing. These insects, as larva, pupa, and perfect insect, are found generally on terminal shoots and on the under side of leaves, which become distorted and unhealthy from their repeated attacks. The male is winged, and has a blackish thorax, and is 0.05 to 0.08 in length to the end of abdomen. The female is green, with a row of black marks down each side, and has no wings, and is rather larger than the male. These insects eject a species of honey-dew, or sweet, sticky substance, from two projecting horns or tubercles on each side of the hinder part of the abdomen, which is greedily eaten by ants and other small insects.

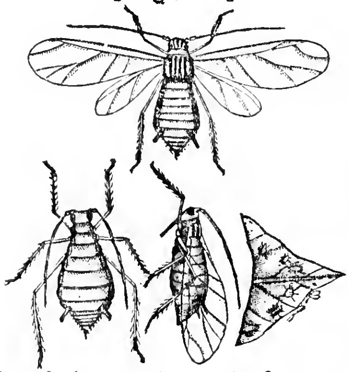
Aphis avenæ, grain or oat-plant louse, does much injury to grain, and especially to oats, but is also found on wheat, rye, and other cereals. Their habits are much the same as the before-mentioned plant-lice, excepting that it is said that although their honey-tubes are well developed, these insects emit no honey, and, in consequence, are not followed by ants. It is also stated that they freeze on the stalks in winter and revive in the spring. The colors of some specimens sent for examination to the Department varied considerably, some of them being of a lively or dull green, while others were of a decidedly brown color. The feet and knees are generally of a darker or nearly black color; length, 0.05.

No. 38.
[Magnified.]



Aphis gossypii, or the cotton-plant louse, is a great nuisance to the planters, especially when the plants are very small, as then they are more liable to succumb to the attacks of these insects, as by sucking out the sap they distort the stems, and in fact frequently kill the plants before they have attained sufficient maturity and strength to withstand their repeated attacks. Their habits are much the same as the rest of the *Aphides*, and their colors vary from green to a decided yellow, striped with black on the upper side of the thorax. A more full description of them may be found in the Patent-Office Agricultural Report for 1855.

No. 39.
[Magnified.]



Aphis persicæ is destructive to the peach-tree. Harris says that larvæ, pupæ, and perfect insects live together in crowds under the leaves, causing them by their punctures to become thickened and curled, forming hollows, with corresponding crispy and reddish swellings above, and finally to fall to the ground. But may not this so-called curl be caused by a fungoid growth or by a sudden change of temperature, as sometimes the *Aphides* are not seen until long after the curl has been observed, and frequently not a single plant-louse is to be found in or on the badly-curled and deformed leaves? We have, moreover, often observed that this so-called curl appeared almost immediately after very cold nights and warm days in the spring, and the leaves were yet very young and tender. These deformed leaves frequently fall off and are replaced by others before the end of the season, but it must necessarily very much injure and weaken the tree to lose its leaves before its natural season for shedding them. Winged individuals of the Harris peach-tree plant-louse are described as black, with the under sides of abdomen dull green; shanks and bases of thighs dull brownish, and the horns or honey-tubes as long as the abdomen. Dr. Fitch considers it different from the peach aphis of England. Colonel Wilkins, of Riverside, near Chestertown, Md., a very extensive peach-grower, last spring wrote to the Department of Agriculture that an aphis or plant-louse similar to those infesting his peach-tree leaves was at work on the roots also, and was killing them by hundreds. Prof. P. R. Uhler, of the Peabody Library in Baltimore, to whom Colonel Wilkins applied, visited the infested peach-orchards, and found the statement to be perfectly correct, and that an underground aphis or plant-louse, not differing from those on the leaves, was doing immense injury to the young trees by sucking out the sap. Professor Uhler also stated that both insects are different from the *Aphis persicæ* above mentioned, and probably is a new species, closely allied to, if not identical with, the *Aphis chrysanthemi* of Europe. The insects on both roots and leaves were about 0.08 in length, with the contour of a broad Florence flask, of a blackish-brown color, and the two varieties could not be distinguished from each other when placed side by side. If these peach plant-lice work under ground on the roots, would it not be advisable to saturate the earth around the trees with hot whale-oil, or soft-soap suds, or dilute carbolic acid? Tobacco or lime water poured around the roots in spring as soon as the frost is out of the ground might destroy the first broods and thus diminish their numbers. Quassia chips, soaked in boiling water, have also been recommended, and perhaps boiling water poured over the roots in the spring might destroy them, but might also injure the tree, although many farmers who have tried the boiling-water process, as recommended for the peach-tree borer, (*Ægeria exitiosa*,) a lepedopterous insect, have reported that the insects were destroyed, while the trees remained uninjured. These experiments, however, were tried in winter, when the trees were torpid. When in greenhouses, plant-lice may be destroyed by tobacco smoke. Syringing the plants with whale-oil, or soft-soap suds strong enough to kill the lice, but not strong enough to injure the plants, is also recommended. Lime-dust sprinkled over the plants in gardens is said to be beneficial; a solution of sal soda is also said to have been used with good effect, and Dr. Packard recommends 30 parts of unrectified cheap petroleum mixed with 100 parts of water to be sprinkled over the plants. As almost every kind of plant has its own peculiar plant-louse—indeed, many species of plant-lice are said to inhabit the same tree, and it is likewise said that if these lice are transplanted to other kinds of plants they will refuse to take nourishment and will die—it will be useless to enumerate more than we have already mentioned, excepting to observe that almost all plant-lice have very much the same habits, sucking the sap from plants, shrubs, and trees, and living either above or under ground, and the number of species cannot be known until a catalogue is made of this genus alone.

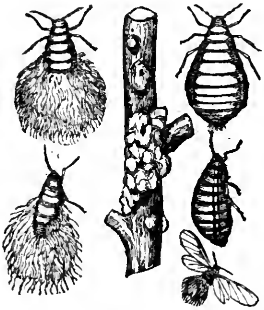
Lachnus caryæ, or hickory aphis, is a large aphis found in clusters on the under side of limbs of hickory, oak, and basswood and walnut, July and August, puncturing the bark and sucking the sap. The insect is 0.25 in length; to tips of the wing, 0.40; and across the wings, 0.72. It is of a black color, coated with a bluish-white powder. The thighs are of a clear tawny red, and the wings are transparent. Dr. Walsh observed on the same tree numerous apterous females, which

No. 40.

lived many days, and laid their eggs in confinement, but died without assuming wings.

Another species, *Lachnus strobi*, or the white-pine aphis, is found on white pine, and sometimes gives the bark of the trees a peculiar black appearance. The eggs are oval-elongate, shining black in color, and are attached in regular rows of from five to twenty, but usually in regular rows of eight, to the thread-like leaves of the white pine in September. The females are wingless.

No. 41.

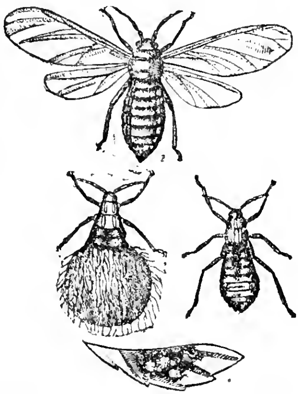


Eriosoma lanigera, or the woolly apple-tree blight. These insects appropriate for their generic name two Greek words, signifying wool and body, the insect being partially enveloped in a cottony or wool-like secretion, furnished from its own body. The eggs are deposited in crotches or cracks of the branches or bark, often at or near the surface of the ground, or on new shoots springing from the parent tree. They are mostly enveloped in a cotton-like substance, the young insects in a fine down, and are hatched out in the spring. As larva, pupa, or perfect insect they are equally injurious, sucking the sap, and, when numerous, do much injury to the trees. These insects are 0.10 to 0.12 in length, and are gregarious, feeding in societies, which, when seen from a short distance, resemble small bunches of cotton adhering to the trunk or branches of the tree. The insect, when denuded of its cottony covering, is egg-shaped, and of a dull reddish-brown color, with blackish head and feet; when undisturbed and feeding on the tree, it has a tuft of white down on the hind part of the body, which is very easily detached when roughly handled. These woolly plant-lice also produce warts or excresences with their powerful beaks, and, when in great numbers on a young tree, cause the leaves to turn yellow, wither, and fall. The young ones are produced alive all summer, but in the fall the females lay eggs which are able to withstand the cold of winter and hatch out into young lice the following spring. Dr. Verrill states that, in Connecticut, in the middle of October, among the wingless neuters, a large number of males and females appear, having well-formed and rather large wings, in other respects closely resembling the rest, and having but little down on their bodies, very plump, and of a black color, the winged females of which are able to fly from tree to tree to deposit the eggs to be hatched out next spring. When the downy covering of these insects is removed by wind or rain, another supply is readily produced, and they are said to be able to withstand a very considerable degree of cold without perishing. These insects have no honey-tubes, but frequently eject drops of a sticky substance from the extremity of their bodies. In order to destroy these pests, it has been recommended to have the insects well scrubbed off with a stiff brush, and the infested parts of the tree immediately afterward well covered with a varnish of shellac. Painting the injured places with a thick coating of whitewash, well mixed withsoft soap or weak glue water, will also destroy the insects, and has been highly recommended. *Eriosoma mali* of Europe is said by C. H. Sorsby, F. R. S., in the Quarterly Journal of Microscopical Science, in an article on the coloring-matter of some of the *Aphides*, to produce a red coloring-matter between cochineal and the hæmoglobin of vertebrate animals.

Eriosoma (*Pemphigus*) *pyri*, or the apple-tree root-louse, sometimes does much injury to apple-trees, &c., by forming galls on the roots, like small potatoes, 2 or 3 inches in diameter, just beneath the ground. Walsh does not think this insect identical with that which is doing so much damage in Europe, either from description or habits. Pouring boiling water over the roots has been recommended as a remedy, but some of our correspondents have complained of their trees being injured by its application. However, it is said that water heated from 120° to 150° will kill the lice without injuring the tree. This remedy may serve among young trees, but large old apple-trees would probably not be benefited by this application. These root-lice are destroyed by several parasites, among which are reported *Ercophilus mali*, a *Chalcis*, (see *Hymenoptera;*) *Pipiria radicum*, a two-winged fly, (see *Diptera*,) &c.

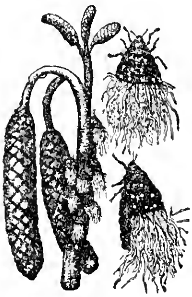
An insect closely allied to *Eriosoma imbricata* is found very abundantly on birch in Maryland in October. These insects cluster together on the twigs, and have the appearance of down or masses of cotton; when disturbed, they present the very singular appearance of many small spots of snow-like wool or down moving up and down by jerks, the hinder parts of the insects being covered with this downy secretion. They are gregarious, and cluster together as close as they can crowd on the ends of the twigs. In the autumn the winged insects appear; the wingless individuals are of a pale or yellow-green color, veined with brown, and are 0.05 to 0.06 in length. This insect, as before stated, resembles the *Eriosoma imbricata*, or beech-tree blight, which is described as "woolly lice infesting the terminal twigs of the beech, and which in the wingless state have the habit of continually wagging their tails up and down." The figures are magnified.

No. 42.



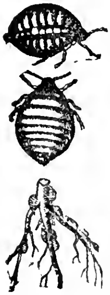
Eriosoma tesselata was found on birch in Maryland, in clusters near the ends of twigs, in the autumn. It is of a black color, with white spots on the fore part of its body, and is covered with a snow white down or wool on its hinder part, like those before described. With its woolly covering, the wingless females measure about 0.15 to 0.20 in length.

No. 43.



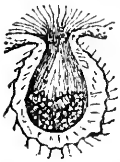
A species of *Rhozobius*, or underground plant-louse, was one season very destructive to the cultivated verbenas in the gardens of the Department of Agriculture, Washington, D. C., clustering in masses on the roots underground, and sucking the sap from the plants, and thereby so weakening them that many died. Most probably, however, had a strong mixture of tobacco and water, or soap-suds, been applied in time to the roots, many of the plants might have been saved; but the cause of the injury being hidden underground, nothing could be seen to indicate that the plant was not in perfect health, until suddenly the leaves turned yellow and the plant died. These insects were about 0.10 to 0.13 in length, of a swollen round form, and apparently bloated almost to bursting. They were of a brown color, and covered with a whitish powder or bloom; no winged individuals were observed among them at any time.

No. 44.



Pemphigus vitifoliæ of Fitch, 1856, (*Dactylosphæra*, Schimer, 1867,)

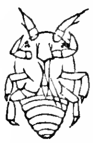
No. 45.



grape-vine-leaf gall-louse. The insect forms galls on the under side of the grape-vine leaves, and although they appear to do comparatively little injury to the vine, they are extremely interesting to vine-growers, as having been said by Professor Riley and other entomologists to be another form of the *Phylloxera vastatrix* or the grape-vine-root gall-louse, so destructive to the vineyards in France and elsewhere. The female of the grape-vine-leaf gall-louse, after fixing herself on the upper side of a leaf, by constant suction and the irritation produced by continued puncture, causes a gall to swell irregularly on the under side, while the upper side gradually becomes downy or hairy and partially closes, forming a little bag on the under side, with a small opening on the upper surface, surrounded with hair-like filaments. In this bag or gall the female lives, and deposits from fifty to some hundreds of small yellow eggs. Dr. Shimer states that there are 500 eggs in one gall, which is doubted by Walsh, who estimates that probably two hundred eggs will be the average number laid by one female. The figure is magnified.

Phylloxera vastatrix, or the grape-vine-root gall-louse, is by many entomologists supposed to be another form of the *Pemphigus vitifoliæ* above mentioned, but that, instead of living above ground and forming hollow bag-like galls on the leaves, it lives underground on the roots, upon which it forms knotty swellings or galls. Mr. Riley, who has paid more attention to the natural history and habits of this insect than any other entomologist in this country, is of the above opinion. The young of the root-inhabiting type (*Phylloxera vastatrix*) are absolutely undistinguishable from those hatched in the leaf-galls, (*Pemphigus vitifoliæ* of Fitch,) and the gravid apterous female differs in no respect from the mother gall-louse. There is, however, a different egg-producing form, which, as it molts, becomes tubercled and more elongate or pear-shaped. Some of these tubercled individuals remain without wings, while others acquire wings. The insect is found on the roots in all stages during the summer months, and in spring, when the sap begins to circulate, eggs are deposited, and the young lice by sucking produce the swellings produced on the roots. The winged lice begin to emerge from the earth as early as July, and the female has only two or three large eggs in her body; and Professor Riley says that her whole duty in life is to fly off and consign her two or three eggs to some grapevine or bud, and that the lice hatching from these eggs constitute the first gall-producing mothers that form the excrescences on the leaves and have a great number of eggs. These insects attack both leaves and roots in the summer at the same time, but the roots appear to be less infested when the leaf-galls are abundant, and may be extremely abundant on the roots when no galls whatever are seen on the leaf. In order to prove the identity of the leaf-gall louse with the root-gall louse of the grape-vine, it is stated that very young gall-lice hatched from the leaf-galls have been transferred to the roots, and by successfully feeding them on roots the smooth-skinned gall-inhabiting type gave birth to the tubercled root-inhabiting type. In our own experience, however, as an experiment, several small vines were placed in a kind of Wardian case, having the roots covered with the swellings and the root-inhabiting type, (*Phylloxera vastatrix.*) Other healthy vines were also potted and placed in juxtaposition to the infested specimens, in order to see if the gall-inhabiting type would make their appearance in the spring on the leaves. The vines wintered safely, and in the spring and summer produced large healthy leaves on which no galls whatever made their ap-

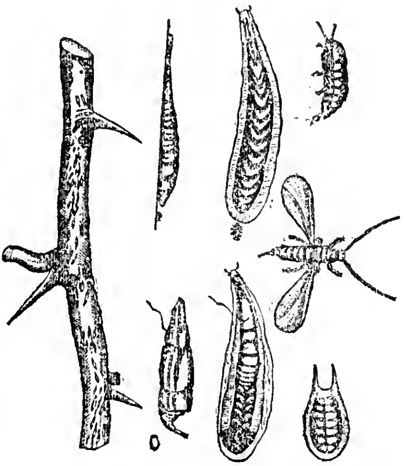
No. 46.



pearance. In the Departmental greenhouse a few of the grape-vines were so much infested with the leaf-gall lice that they had to be cut down; still the other vines in the same house were never troubled with the root-inhabiting insect; and when many dozens of vines, both under glass and under common cultivation in the open air, were closely searched by M. Planchon to prove the existence of the root-louse among the vines, only half a dozen specimens could be procured. We ourselves will not express an opinion on the subject of the identity of the two insects, as we have no opportunity to watch the root-lice in our neighborhood, but will merely state that, although the leaf-gall louse was very plentiful in our gardens one year, not a single root-louse could be found either the same season or the next, and, although much wanted for experiment, not one could be procured excepting by sending to the other States where they were said to abound. The remedies for this root-louse of the grape, recommended by various authorities, are too numerous for a short report like this; but watering the roots with hot soap-suds or tobacco-water has been highly spoken of. Carbolic acid added to the water at the rate of one-half of 1 per cent., poured into holes made with a crow-bar, will permeate the ground and destroy the lice. Sulphuret of calcium dug in around the roots of the vine has also been recommended. M. Gachez, in a recent number of *Comptes Rendus*, states that by planting rows of red maize between the rows of grape-vines the vines are shielded from the ravages of the *Phylloxera*, the insects abandoning the vine-roots for the roots of the maize. Another experimenter reports that he found an effectual remedy in digging a trench four inches deep around his infested vines and throwing in 500 grammes (a little over a pound) of slaked lime, and then whitewashing the vine after having removed the bark; the remedies proposed in the European journals to destroy this insect, however, are too numerous to quote in this report, and as every writer thinks his own remedy the best, and reports it as infallible, nothing can be relied upon until it has been tested by competent persons in this country. Soot, salt, sulpho-cyanide of potassium, lime, and wood-ashes are said to be useful, if applied in proper quantities either above or under ground around the roots of the vines.

Aspidiotus (*Coccus*) *gloverii*, or the mussel-shell orange-scale insect, is found on the orange in Florida, where it does much injury to the orange-trees, sometimes killing whole orange-groves; it is found also on citron and lemon trees, and was found sparingly on a camelia grown under an orange-tree. The female scale (*c*) is from 0.06 to 0.08 in length by 0.02 in breadth, and resembles the upper half of a miniature brown mussel-shell with its flat side downward on the leaf. These scales, when placed singly and not crowded together, are generally straight in form, but when in clusters, they are curved to suit the inequality of the surface or contiguity of the neighboring scales, (*e*.) The insect itself is sheltered under the scale, and is of a soft consistence, resembling a grub, having the body gradually tapering from near the tail to the anterior part,

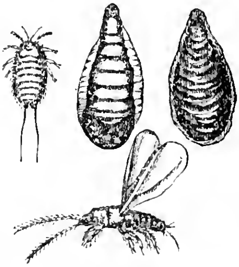
No. 47.



which ends somewhat obtusely. The insect, before it has laid its eggs, is of a rosy pinkish color, and often of a creamy yellowish. From the under side of its breast proceeds a sucker, or trunk, by means of which it extracts the sap which constitutes its food. The female deposits her eggs, which are of a pinkish color, to the number of 20 to 30, in parallel rows, under the scale or outer shell, and decreasing in size gradually as the eggs are deposited, she finally dies and dries up at the small end of the scale. The eggs hatch out in a few days in the same order in which they have been laid, those near the obtuse end of the scale hatching first, when the young escape from under the scale at the posterior rounded end, which at that part is slightly elevated from the leaf in order to afford a means of escape from the parent scale of the young coccus. When very young these insects resemble small mites, for which they frequently have been mistaken. They have six legs, two antennæ, and are devoid of any shield-like covering; they run about for a day or two with rapidity in search of some unoccupied or favorable spot on the leaf or branch in which to insert their suckers to extract the sap from the tree, and it is at this time that they can most readily be destroyed, as, being without any scale or shield-like covering, their tender bodies can readily be reached by any liquid solution, which, when the insect is older and protected by its waxy scale, would otherwise run off without affecting the grub beneath it. After the place is selected the beak is inserted and the insect settled for life, a slight film is formed over its back, (*b*,) and the soft-bodied insect is hidden from view, when it gradually increases in size, assumes a brown color, and grows until it reaches maturity, when, after impregnation by the small midge-like two-winged male, the eggs are fertilized and hatch out into the small mite-like insects before described. The scale covering the male coccus is much smaller than that of the female, and the perfect insect, instead of remaining like the female a soft-bodied grub all its life, finally appears as a very minute fly, having two perfect wings, which it uses to fly abroad and visit the females on neighboring trees. These males are only 0.01 in length and of a pinkish color, have black eyes, and their anal extremity is furnished with a long curved bristle-like appendage. A more full account of this insect may be found in the Patent-Office Agricultural Report for 1850, p. 256. They are destroyed by minute parasitic insects, *Chalcididæ*, (see *Hymenoptera*,) lady-birds, *Coccinellidæ*, (*Coleoptera*,) and several heteropterous insects or plant-bugs, &c. The best method of destroying these insects was found to be by syringing the trees both from above and below with whale-oil or soft-soap suds mixed with a small quantity of Peruvian guano, every three or four days, as soon as the young insects had hatched and were running about on the leaves unprotected by the waxy scale or covering, which they acquire as soon as they fix their beaks in the leaf to settle down for life, and which protects the older ones from the liquid. The guano also, dropping from the leaves on to the ground beneath, fertilizes it, and causes a healthy growth, which is favorable to throwing off the old or dead scales. Many planters who have complained of the inefficacy of this remedy, upon questioning, have acknowledged that they syringed their trees only occasionally, and not at regular intervals of two or three days, thus giving the young naked insects time to form the protecting scale or shield between the syringings and lay the eggs for fresh colonies. Others state that they have carefully followed the directions, and yet see no diminution of the number of scales on the tree. This, however, is because the old dead female scales remain, adhering to the bark and leaves until thrown off by a new and vigorous growth. If such scales be examined they will mostly be found empty. If, however, new small scales should appear, it is because some of the first brood have escaped between the days of applying the remedy, and the syringing should be continued until no young scales appear on the tree.

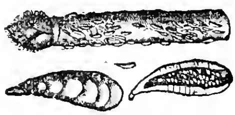
Another scale-insect, *Aspidiotus citricola*, (affinis,) was found on imported lemons in Jacksonville, Fla., 1857. This insect is said to be allied to *Aspidiotus* (*Coccus*) *citricola* of Boisduval, which has been very injurious to the orange in the maritime Alps in Northern Italy. It is much broader than *A. gloverii*, and more of the shape and color of an oyster-shell than of a mussel. It is mentioned merely to apprise orange-growers of its existence, and to warn them to examine all imported fruit well before introducing it on their plantations. It is said to be destroyed by a hymenopterous insect, *Coccophagus*. The figure is magnified.

No. 48.



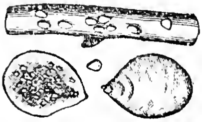
Aspidiotus conchiformis, or the oyster-scale insect of the apple, is exceedingly injurious to the apple and many other fruit-trees—apricot, cherry, crab, currant, pear, plum; it occurs also on lilac. The female lays from 12 to 100 white eggs under the scale. The young, which appear in June, are at first reddish and resemble mites; they run over the twigs and leaves, and, like the orange mussel-shell coccus, in two or three days they fix themselves to one spot and settle for life, and suck the sap of the tree. Harris supposes the shell-like covering is secreted from the surface of the body, and is identical with the flocculent matter which exudes from certain *Aphides*. Dr. Shimer, however, considers the scale to consist of cast skins of larvæ cemented together. The insect under this scale is of a soft consistence, and injures the tree by sucking the sap. The scale itself is oblong, about 0.10 to 0.15 in length, of a brown color, and irregularly ovoid-shaped, like an oyster. These scales are sometimes so much crowded together as to cover the whole surface and cause the bark to appear rough; they are frequently bent in the middle and curved at the smaller end, which is pointed. Mr. Riley, in his report of 1873, has renamed this insect *Mytilaspis pinicorticis*, and given his reasons for so doing. This insect is destroyed by many parasites, among which is a mite, *Acarus malus* of Shimer, (a hymenopterous insect,) *Aphelinus mytelaspides* of Riley, several lady-birds, *Coccinellidæ*, &c. It is found on many fruit-trees, such as the apple, crab, pear, plum, cherry, apricot, &c. The remedy recommended is to scrub the bark with a stiff brush and soap-suds a few days after the trees blossom, as the young are then hatched. Several other remedies have been recommended, such as carbolic acid and water, &c., but none appear to be as effectual as the soap. The figure is magnified.

No. 49.



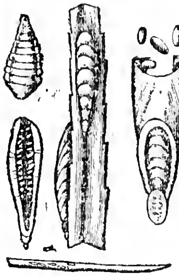
Aspidiotus Harrisii, or the American bark-louse, is indigenous, and does not injure the trees as badly as the *A. conchiformis*, or the imported scale-louse. The scale is about 0.06 to 0.08 in length, of a broad oval form, and pure white in color; the eggs, which are laid under it, are of a red color; it is found on apple, mountain-ash, and pear. The figure is magnified.

No. 50.



Aspidiotus pinifoliæ, or the pine-leaf scale-insect, fixes itself upon the leaves or needles of the white pine, and is abundant on the pine leaves in some parts of Maryland, in the form of minute white elongate scales adhering to the dark-green needle-like leaves; these scales are sometimes crowded together, but usually they are disposed in a row.

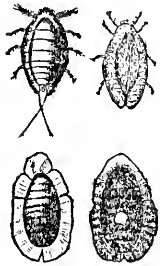
No. 51.



The scale appears externally to be composed of three different oval scales, with their rounded ends overlapping each other. The first scale is very small, and brown in color; the second is about three times the size of the first, and of a lighter color, while the third and last scale is quite large and white. It is 0.10 in length, and the female lays from 28 to 32 oval eggs with rounded ends in the case. These eggs are pinkish in color and crowded together under the scale. When the female has laid all her eggs, she dies and dries up at the smaller end of the case. We have seen the lady-birds (*Coccinella*, in *Coleoptera*) in March and April busily employed in making holes in the cases in order to get at the eggs, which they eagerly devour, besides which, when the trees are agitated by the wind, almost all the unhatched eggs are shaken out of the opening made by the lady-bird and fall on the ground, where they perish. Some persons have supposed this insect to be the adult state of the *Coccus pinicortis*, another insect which appears as a downy patch on the bark of the same tree. The figure is magnified.

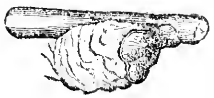
Lecanium hesperidum is another scale-insect, found upon the orange and lemon trees in Florida, but not in as great numbers as the mussel-shell scale-insect first mentioned. It is also not crowded so closely together, but is scattered more sparsely over the leaves. It is shaped like an oval oyster-shell, with a broad flat margin all around the convex part. Anteriorly, it has an indentation on each side, two similar indentations marking the thorax, and one deep notch the posterior portion of the scale. These indentations cross the flattened margin of the scale, and reach the convex and darker part. The very young insects are soft-bodied and yellowish, with six legs and two antennæ. The posterior part is notched, and terminates with two hairs or bristles, which soon disappear. Should this insect increase so as to be injurious, the same remedies can be used as for the other species. The adult scale is about 0.06 to 0.08 in length; color brownish. The figures are magnified.

No. 52.



Lecanium acericorticis, (Fitch, 1859, p. 776.) Maple-bark scale-insect. This insect was found on a silver-maple in the Smithsonian grounds in Washington, and is also found on other maples in the neighborhood. It is very conspicuous from its great size and the snow-white cottony appearance on the twigs and branches. The scale, when mature, is of a brown color and partially covers a mass of snow-white cottony down, which protects the eggs and young bark-lice which are under it. The young insects wander away from the parent scale, and afterward fix themselves to the bark. The males are probably two-winged, somewhat resembling the *Lecanium juglandifex*, as described by Dr. Fitch. *Lecanium acericola*, on maple, and *Lecanium macluræ*, on the osage-orange, are probably only varieties of the same insect. These insects, however, do very little injury, as they are not very abundant.

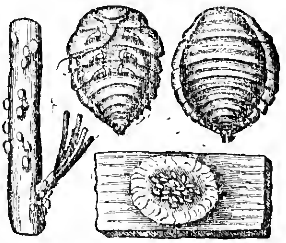
No. 53.



Coccus pinicorticis, or the pine-blight, is sometimes very abundant in the pine woods of Maryland. They frequent the smooth bark around and especially below the axils where the limbs are given out from the main trunk. The injury appears like patches of white flocculent down, which covers minute bark-lice, of a broad, oval, nearly hemispherical, form, about

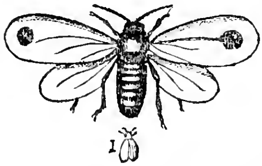
0.01 in length, soft-bodied, blackish in color, and coated over with a mealy powder. This insect was once erroneously supposed to be the preparatory state of the *Aspidiotus pinifoliæ* before mentioned.

No. 54.



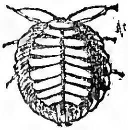
Aleurodes (?) is a minute four-winged insect, one-sixteenth of an inch in length, of a dull white color, and is sometimes found on the apple and crab. *Aleurodes vaporarium*, mentioned by Dr. Packard in the Massachusetts agricultural report for 1870, is 0.04 in length, yellowish-white in color, with snow-white wings. It infests green-houses, and was found also out of doors on tomato-leaves, and is not uncommon at the Agricultural College of Massachusetts on strawberry-plants. The figure is taken from Westwood. A species of *Aleurodes* has been taken on Cornus.

No. 55.



Dorthesia (?) *cataphracta*, a European species figured in Westwood. The males only are provided with wings. The antennæ are long, and nine-jointed, and the abdomen is ovoid, ending in a bushy mass of threads. The female is covered with elongated flakes of a waxy secretion, which, in some species are nearly an inch long. The male insect is terminated by a thick pencil of delicate white setæ. Dr. Fitch mentions a species, *Dorthesia celastri*, which is found on the celastrus.

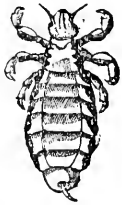
No. 56.



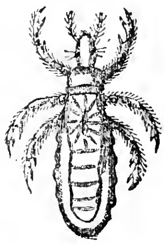
The *Pediculidæ*, or lice, are said by Professor Verrill to be low, degraded *Hemiptera*, destitute of wings, &c. Dr. Packard places them likewise in the *Hemiptera*. Leunis places them after *Coccus* in the *Homoptera*, and therefore we have placed them provisionally at the end of the *Homoptera* until a better place is found for them. They are blood-suckers, and live on mankind and animals, and on mankind certain species attack only certain parts of the body. The figure is magnified.

Pediculus (*humanus*) *capitis*, or the human head-louse, is always found on the head among the hair. The males are smaller than the females; the latter lay about 50 eggs, which adhere to the hair. These insects, after 14 days, are said to be able to propagate their species. They do not attack the smooth and hairless parts of the body, but generally confine themselves to the human head. Another species, *Pediculus vestamenti*, the clothes or body louse, confines itself to the smoother, hairless parts of the body, and hide themselves in dirty garments. They deposit their eggs near the body, in the clothes and in the creases of the linen. There is a third species of louse, *Pediculus pubis*, the crab-louse, or gray-back, which is a much broader square form than the other two species, that has been a great scourge to soldiers in time of war. This insect has been named the crab-louse from its broad crab-like appearance. It is of a grayish color; the head is small, and appears to be united with the broad body without any thorax; it inhabits the hairy part of the body, under the arms or shoulders, in the beard, &c., but appears to avoid the head. These insects pierce deeply into the skin of mankind, and produce an intolerable itching. Mercurial ointment was formerly used to eradicate these pests, but if not rubbed off, or even washed off, as soon as it has effected its purpose, or, if the patient is exposed to the cold and wet, or

No. 57.

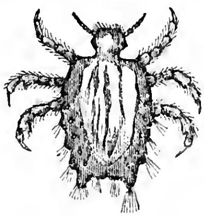


No. 58.



the ointment remains on the skin too long, the mercury is apt to be absorbed into the system, and will, in many cases, produce salivation.

No. 59.



The essential oil of bergamot, or any other essential oil, rubbed into the skin, is said to be an effectual remedy, and not to have any injurious effect whatever, excepting a little smarting when first applied. The seeds of a larkspur, *Delphinium*, sometimes called "slave's-acre," are said to be an effectual remedy for head-lice; but cleanliness is the most effectual preventive, and all the clothes should be scalded before putting on again, as most of these lice frequently hide themselves in the folds of the linen, and are thus carried from one person to another. These figures are magnified.

REPORT OF THE CHEMIST.

SIR: The unfinished investigations mentioned in my last report have been completed, and have afforded results of great value, but the analytical work relating to new investigations has been materially interfered with by the preparation and care of the collection in the late International Exhibition in Philadelphia, and I have, therefore, but little to report.

The investigations that have been completed are as follows:

1. On the extent, composition, and value of certain deposits of bat guano in the Southern States.
2. On the proportion of tannic acid in American tanning materials.
3. On the composition of wines from some new varieties of American grapes.
4. On the presence and amount of oxalic acid in *Mesembryanthemum crystallinum*, and composition of the ash of the same.
5. On the composition of the ash of *Sueda californica.*
6. Analysis of a green sand marl from Maryland.

The collection prepared for the International Exhibition by the division under my charge consisted of specimens of soils, marls, and fertilizers, and of those agricultural and horticultural products the value of which depends upon their chemical composition, and the utilization of which involves chemical processes. It contained not only raw materials, but also specimens from the different stages of the processes of manufacture involved in their utilization, and were so arranged as to illustrate as far as they would the processes in question. The classification of the collection was mentioned in my general report to you, and it is therefore unnecessary to detail it here. The list of the materials will be published in a special catalogue, but I deem it of considerable interest and value to incorporate here a sketch of the American methods of manufacture of cheese, with analyses of the materials and products exhibited, prepared by Prof. G. C. Caldwell, of Cornell University, Ithaca, New York.

The collection for the illustration of the manufacture of the products of the dairy prepared and analyzed at the laboratory of agricultural chemistry in Cornell University at the request of the Department of Agriculture, and placed in its exhibit at the Centennial, consists of samples obtained directly from dealers in dairy supplies, or from factories or private manufacturers of butter or cheese.

It begins naturally with salt, rennet, and annotto—the first being universally used in the manufacture of both butter and cheese, the second always in the manufacture, of cheese, and the last-mentioned substance being very commonly used in coloring both butter and cheese.

In regard to the samples of salt, four of which are of English manufacture and one of American, the chemical analysis serves the useful purpose of showing that the difference between them is very slight, and in practice would appear to amount to nothing at all; and it also shows that the best American is fully equal to the best English product.

	Pure salt calc. from the chlorine.	Lime.	Sulphuric acid.
Syracuse salt	97.74	0.4	0.62
Liverpool salt.. Ashton's	97.71	0.59	0.9
Liverpool salt.. Worthington's	97.65	0.55	0.74
Liverpool salt.. Marshall's	97.99	0.47	0.72
Liverpool salt.. Dean Brothers	97.77	0.52	0.91

Of the annotto, the seed itself, from which the coloring matter is obtained, is shown; this is used by some dairymen directly for the preparation of their coloring matter; then comes the so-called basket annotto, the usual form in which the coloring matter, extracted from the seeds by water, comes to market; there are exhibited also two preparations of annotto made in this country, the annottoine and the golden extract of annotto, both of which are quite free from any injurious ingredient; their use is preferred by many to that of the crude article. As there is no satisfactory method of determining the proportion of coloring matter in this substance, the results of the chemical analysis of its various forms in use among dairymen have little practical value; they do show, however, a very great difference between the three grades of basket-annotto, for that which is richest in organic matter is probably richest in coloring matter.

	Water.	Ash.	Organic matter.
Basket annotto .. No. 1	32.64	10.78	56.58
Basket annotto .. No. 2	22.96	28.83	48.21
Basket annotto .. No. 3	44.18	8.34	47.48
Annottoine	9.13	4.66	86.21

Of rennet, two samples are shown, the domestic and the foreign. There being no known means of estimating with any accuracy the proportion of the coagulating principle of the rennet, no analysis was made of these samples.

While in Europe there is a great number of methods of making cheese, with as great variety in the character of the products, our American dairymen confine themselves to a few methods; in fact, three different types will represent the main bulk of the manufacture at the cheese-factories of this country.

Concerning the most common mode of manufacture, that which yields the so-called whole-milk cheese, made from the whole of the milk, without any skimming, the main details of the process are familiar to all who are interested in the subject. Therefore we simply give below the results of the chemical analysis of several samples obtained from different parts of the country, and represented in the collection:

	Water.	Ash.	Fat.	Caseine, sugar, &c.
New York factory-cheese...... No. 1	31.41	3.53	37.88	27.18
New York factory-cheese...... No. 2	35.68	3.60	35.15	25.57
New York factory-cheese...... No. 3	35.24	3.23	35.68	25.85
New York factory-cheese...... No. 4	33.73	4.05	35.57	26.65
Massachusetts factory-cheese.. No. 1	34.18	3.02	33.92	28.88
Massachusetts factory-cheese.. No. 2	38.5	3.73	31.19	26.58
Maine factory-cheese, Jersey milk	28.11	2.71	41.03	28.15
Wisconsin factory-cheese	35.49	3.34	34.05	26.12

Of the second method of manufacture, that by which the ordinary skim-cheese is produced, the usual proportion of cream being taken from the milk for the manufacture of butter, two varieties are presented. By the one method, and that which is in most common practice, the skimmed milk alone is used for manufacture into cheese;

by the other method, which has been but recently introduced, the buttermilk is added to the skim-milk; the fresh milk is heated to 130° Fahr., cooled to 65°, allowed to stand from twenty-four to forty-eight hours for the cream to rise, and the cream is churned sweet. The results of the analysis of the two kinds of cheese are given below:

	Water.	Ash.	Fat.	Caseine, &c.
Common skim-cheese	42.38	3.63	20.55	33.44
Scalded milk and buttermilk cheese	44.48	4.50	15.22	45.80

While these analyses indicate a larger proportion of fat in the ordinary skim-cheese, there was nevertheless a marked difference in quality in favor of the other; the latter was softer and more salvy, and probably more digestible. It may be said, further, that the proportion of fat in skim-cheeses is not so constant as in whole-milk cheese. Another sample of scalded skim-milk and buttermilk cheese analyzed in this laboratory was found to contain 20 per cent. of fat.

The third important method of cheese making has also been but recently introduced, and the practice of it is as yet confined to a few factories. As in the manufacture of skim-cheese, the butter fat is mostly removed from the milk by skimming; but while the milk is coagulating after the addition of the rennet, as much of a clean animal fat, manufactured from the beef's caul, is most intimately mixed with the forming curd as it will take up; the excess of oil floats on the surface after the coagulation is completed, and is skimmed off; a cheese is thus obtained which, as the anlaysis below shows, is sometimes richer in fat than the ordinary skim-cheese:

	Water.	Ash.	Fat.	Caseine, &c.
Oleomargarine-cheese	40.56	3.98	20.43	36.97

For some unexplained reason the curd will not always take up the same amount of fat, so that its proportion in the cheese is variable; in the case of other analyses of the same kind of cheese made in this laboratory, the proportion of fat has ranged from 18 to 25.9 per cent.

This fat that is added to the curd is sometimes called oleomargarine, and the cheese is hence conveniently distinguished from other kinds by the name given to it above; in respect to quality, it is much superior to the ordinary skim-cheese, although, as in the case of the comparison between the two varieties of skim-cheese already mentioned, the better cheese is not always found to contain the larger proportion of fat.

We have found but one veritable imitation of the styles of cheese so common on the continent of Europe. Limburger cheese is made in one place in the State of New York, somewhat in the same manner as it is made in Europe. The analysis shows that it contains a large proportion of water—43.67 per cent.; and somewhat less than the usual proportion of fat that is found in whole-milk cheese, or about 30 per cent.

The collection further embraces all the several materials used and by-products formed in the three most important methods of cheese making; the fresh milk, curd, whey, and ripe cheese in the whole-milk cheese manufacture. In addition to these, the skim-milk, cream, and buttermilk in the case of the skim-cheese manufacture. The analysis of these substances being not fully completed at this time of writing, they will be communicated hereafter.

In the manufacture of whole-milk cheese, a considerable portion of the fat remains in the whey. In a few cases this fat is collected and made into whey-butter, that brings a fair price in the market; and the removal of this fat does not, it is asserted, lessen the feeding-value of the whey. A sample and an analysis of this butter are presented; but if a chemical analysis is no true test of the quality of a sample of cheese, still less is it so in the case of butter. Two samples of factory-butter and one of butter made from the milk of Jersey cows are also contained in the collection, of which the last mentioned was by far superior to the others in quality; but no such difference is indicated in the results of the analysis given below:

	Water.	Ash.	Fat.	Caseine, &c.
Jersey butter	11.29	3.20	84.76	0.75
Factory-butter	12.36	2.98	83.41	1.25
Factory-butter	8.82	3.43	87.75	
Whey-butter	9.77	1.67	88.56	

A sample of Borden's condensed milk illustrates that important branch of dairy economy. The analysis reveals the large proportion of cane-sugar that is added to the milk in order to get a product that will keep well.

Composition of Borden's condensed milk.

Water	23.6
Ash	1.87
Fat	11.19
Caseine, (by difference)	14.71
Milk-sugar	12.43
Cane-sugar	36.29

Finally, we have to mention, as a by-product of some use, whey-oil, which is prepared from the whey, and is used for oiling the cheese in the curing-room. It melts at a lower temperature than butter made from the same material, and is destitute of the texture and flavor of good butter.

As stated above, though the original investigations made by the division have not been very numerous, the results obtained are of great value on account of the probability of their bringing about an introduction of new industries and the improvement of old ones, more especially in the Southern and Western States, where such an effect will prove most beneficial.

Those of the greatest value in this particular that I have to report are those of the analysis of—

BAT-GUANOS FOUND IN CAVES IN THE SOUTHERN STATES.

I had the honor in a previous report to submit the results of an analysis of a sample of bat excrement taken from a deposit near Huntsville, Ala., and the interest manifested in them, and the reports of other deposits received from time to time, seemed to render it advisable to issue a circular-letter to the regular correspondents of the Department in the South, asking for information concerning the existence of such deposits, with complete descriptions of their location and extent. To these letters we have received replies of a very favorable character, many of them being accompanied by samples of the deposits described, developing the fact that the deposits were not confined to any particular section of the South, but that they exist in many of the States from Virginia to Texas, several of them being of considerable extent. It was believed by many persons before the war, and by officers of the Confederate government during the war, that they would prove to be a valuable source of niter, and were worked for the extraction of this compound. Some of the attempts in this direction proved successful, but very many of them failed ruinously, as might have been expected from the low percentage of nitric acid in some of the samples and its complete absence in others, and, at the close of the war, all enterprise in this direction was abandoned. They will, however, be a profitable source of fertilizing material, since their mechanical condition is favorable to their ready removal and application to the soil. Most of them contain fair percentages of organic nitrogen, while some of them contain both actual ammonia and nitrates. Microscopical examination of the material shows it to consist of the remains of the hard parts of insects in a finely comminuted condition, which are the source of its nitrogenous constituents. Many of these remains are in such a fair state of preservation that the species of insects to which they belong may be determined.

Before proceeding to further descriptions of the samples received by the Department and a statement of their analysis, I will detail some of the information concerning the deposits, as furnished by our correspondents.

Mr. J. Layne, McDowell, Highland County, Virginia, reports caves containing deposits on the lands of the following gentlemen: John T. Armstrong, 2; Samuel Armstrong, 2; Jonathan Lirons, 1; H. C. Jones's property, on Cave Mountain, 2 or more; on property of James Woods, on Jackson's River, 1. Mr. Layne states that from all of these caves large amounts of saltpeter were made during the war, and vast quantities of fertilizing material could be obtained from them at any time.

Mr. R. E. Talbot, Georgetown, Williamson County, Texas, sent samples of deposit, with the following statement: "I inclose a sample of bat-excrement from the cave of William K. Foster, two and a half miles from Georgetown. The amount of the deposit is large, supposed to be hundreds of tons. Many apartments of the cave are filled to the mouth, making it impossible to tell how extensive the cave is, or the amount of excrement in it. For a space of about 100 yards long by 20 yards wide, near the mouth, it is from 6 to 10 feet deep."

Mr. S. B. Thornton, Tuscumbia, Ala., reports "a deposit in a cave three miles west of that place, worked by a gentleman, who considers the deposit worth $20,000. The cave is 80 or 90 feet deep. Material from it has been tried upon corn with very favorable results."

Mr. Hugh J. Brady, Spencer, Tenn., sent a sample taken from an extensive deposit found in a cave, one division of which "measures one mile in length and 50 feet in width. This is the main room. The cave has been surveyed for a distance of three miles. A New York company manufactured saltpeter from the deposit for a number of years, but finally failed." The deposit is believed to be of great value.

Mr. H. Weir, San Antonio, Tex., writes:

I sent you by express, October 26, one can of bat-guano, containing about ten pounds, taken from my cave, about twenty miles northeast of this city. There is a large deposit in this cave, say fifteen or twenty thousand tons, and yearly increasing. I should be pleased to get your analysis of this sample, and will cheerfully give you any further information you may desire with regard to this cave, or others in this section.

Mr. William H. Bayne, postmaster at Batesville, Ark., reports one cave in his vicinity which contains a large deposit of bat-excrement, and is at present the resort of immense numbers of bats.

Mr. P. A. Kendrick, Brierfield, Bibb County, Alabama, reported a cave on Six Mile Creek, in Bibb County, and, in response to a request for a sample of the deposit, sent it, with the following communication:

In reply to your favor of September 9, I would say I have visited the cave in question, and forward by to-day's mail samples of excrement of bats and dirt from the floor of the cave. This material was used by the Confederate government during the war for manufacture of saltpeter. Both the dirt and the excrement are found in large quantities.

The entrance to the cave is 10½ feet high and 20 feet wide. Thirty feet from the entrance the interior is about 15 feet high, and here commences a series of rooms containing the dirt and manure. A tram-road, used by the Confederate government, runs a quarter of a mile into the cave, but beyond this it has never been explored. Its extent is, therefore, unknown. It is in a limestone formation, and situate seven miles from the Selma, Rome and Dalton Railroad, and half a mile from Six Mile Creek.

Mr. J. A. V. Pue writes from Bandera, Texas:

In reply to circular of May 27, 1875, I have the honor to state that there is a bat-cave situated on West Verde Creek, about 8 miles southwest from Bandera, on a survey belonging to Joseph Ney. During the war large quantities of saltpeter were manufactured from it for a time, when it was fired accidentally or designedly. It is now a mass of ashes, from 3 to 5 feet in depth, as far as it has been explored—a distance of about 400 yards. The width of the cave is from 7 to 30 feet. The deposit has never been used for agricultural purposes.

Subsequent to the time of writing the above, Mr. Pue forwarded, by request, to the Department a sample of bat-excrement of fair quality, as is evident from the statement of analysis given below.

Besides the sources already mentioned, we have received specimens from Mr. L. A. Downs, Cave City, Ky., and from Benton County, Arkansas. We have made analyses of eight of the specimens received, and their composition is detailed in the following table:

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Sand, clay, insoluble silicate	1.068	82.29	0.46	2.153	1.885	0.447	62.660	......
Moisture	36.300	2.59	9.17	26.710	44.330	0.425	14.020	9.12
Organic volatile matter	46.77	....	82.18	58.439	47.73	92.745	6.144	......
Alumina and sesquioxide of iron	0.356	8.06	0.17	....	0.463	....	....	......
Phosphoric acid, soluble	0.511	2.02	1.52	0.125	1.833	1.691	....	6.09
Phosphoric acid, insoluble	3.000		0.67	3.866	0.581	0.909	0.711	
Lime	6.428	2.92	1.86	....	0.710	....	....	......
Magnesia	0.666	0.38	0.38	....	Trace.	....	....	......
Sulphuric acid	....	0.61	1.16	....	2.161	....	....	......
Chlorine	....	Trace.	0.38	....	0.202	....	....	......
Nitric acid	....	....	Trace.	....	0.258	....	....	1.69
Potassa	1.590	Trace.	0.67	1.471	0.590	0.763	0.0707	0.47
Soda	0.750	Trace.	Not det	0.425	0.312	0.160	0.152	......
Soluble silica	....	0.41	....	....	....	....	....	......
Organic nitrogen	5.336	....	7.96	0.556	6.000	10.091	0.199	9.18
Ammonia (NH_3) corresponding to organic nitrogen	....	....	....	0.675	7.28	12.253	2.2416	11.15
Actual ammonia	0.528	....	1.24	0.132	2.013	0.472	....	1.18
Undetermined	1.531	....	....	6.511	......	......	....	......

The Roman numerals at the top of the tables represent different samples, as follows:

I. Sample from Brierfield, Ala. Part of the deposit from which it was taken was burned during the war, but this sample represents that portion which remains uninjured.

II. Sample from same deposit representing the remains of the burned portion. It has the appearance of dry, sandy soil.

III. Sample from Bandera, Tex.

IV. Sample from San Antonio, Tex.

V. Sample from Benton County, Arkansas.

VI. Sample from Georgetown, Williamson County, Tex.

VII. Sample from Cave City, Ky.

VIII. Sample from J. A. V. Pue, Bandera, Tex.

These are all very similar in appearance, with the exception of those containing the high proportion of insoluble mineral matter, which are very much like soil. Those containing high proportions of organic matter vary in color from light brown to dark brown, according to the percentage of moisture they contain. As stated before, their physical condition, when air-dried, is excellent, both for handling and for application to the soil, and the analyses given above represent very fairly the average composition of the material, which may be valued at from $15 to $80 per ton, reckoning upon the basis for determination of the value for fertilizers adopted by Dr. Ch. A. Goessmann, inspector of fertilizers for the State of Massachusetts, in his report for 1876. These values compare favorably with those of the fish-products largely manufactured in New England, and even with Peruvian guano, analyses of both of which may be found in the report just alluded to.

Deposits similar to these have also been discovered in Europe, but they are by no means as valuable as those of this country. Thus, according to analyses by Schwarz,* the composition of a deposit near Raab,

* Ding. Polyt. Jour., ccxviii, 215.

in Hungary, is variable, two samples analyzed containing respectively 0.98, 0.84, and 0.70 per cent. nitrogen, and 11.03 and 10.56 per cent. phosphoric acid. A sample from an Italian deposit, analyzed by F. Sestini,* contained 20.799 per cent. volatile matter, (principally organic,) 2.021 per cent. nitrogen, and 1.17 per cent. phosphoric acid. With these facts before us we may readily recognize the importance of the development of these deposits in the South, where fertilizing materials are so much needed and are so costly, and especially is this true when they may be obtained from this source for the mere cost of removal.

AMERICAN TANNING MATERIALS.

Under this head, I propose to submit the results of the analyses of the vegetable substances containing sufficient of tannic acid to make them of value for tanning that were collected and prepared for exhibition in the late International Exhibition in Philadelphia. The list may not comprise all the indigenous products that are of value in this respect, but some of them, at least, have not yet received extended application.

The methods laid down for estimation are numerous, but nearly all of them are liable so many objections as to render their results extremely unsatisfactory, and, in fact, this condition is destined to continue until we have more definite knowledge of the constitution of the varieties of tannic acid found in different plants. In previous estimations we have proceeded by extraction with ether, exhausting the residue obtained from the etheral extract by distillation with water, and determining the amount of tannic acid in the aqueous extract by titrating with a standard solution of potassic permanganate after the addition of a known quantity of potassic sulphindylate. In the estimations in which the present results were obtained this method was abandoned, on account of the difficulty of complete extraction of the tannic acid by means of the ether, too much time being required, and we adopted the method lately described by F. Jean, in the Bulletin de la Société Chimique de Paris, xxv, 511, which depends upon the absorption of iodine by tannic acid in presence of an alkaline carbonate. It consists in titration of the solution containing tannic acid with a standard solution of iodine in potassium iodide, the end of the reaction being determined by placing a drop of the solution under titration on a white paper covered with starch. While this method is open to some objections, one of which is the troublesome character of the end reaction, we consider it on many accounts the most satisfactory that has yet been devised. By this method the proportion of tannic acid found in the various samples respectively is as follows:

	Per cent.
Ground sumac, (mixed,) from Winchester, Va	24.18
Sumac, (*Rhus cotinus*,) Hallsborough, Va	24.08
Sumac, (*Rhus glabra*,) Georgetown, D. C	26.1
Leaves of sweet fern, (*Comptonia asplenifolia*,) from near Boston, Mass	9.42
Leaves of *Polygonum amphibium*, from Nebraska	11.6
Ephedra antisyphilitica, from the table-lands of Arizona and Utah	11.9
Bark of sweet-gum, (*Liquidambar styraciflua*,) from District of Columbia	8.36
Bark of red oak, (*Quercus rubra*,) from Canton, Ill	5.55
Bark of white oak, (*Quercus alba*,) from Canton, Ill	7.85
Crushed quercitron bark, (*Quercus nigra*,) from Winchester, Va	6.47
Bark of *Quercus coccinea*, from Canton, Ill	7.78
Bark of *Quercus macrocarpa*, from Canton, Ill	7.85
Bark of hemlock, (*Abies canadensis*,) Van Ettenville, N. Y	9.5

*Landw. Versuchs-Stationen, xix, 10.

The percentage of tannic acid found in the leaves of *Polygonum amphibium* is very much below that found by Prof. Samuel Aughey, of the University of Nebraska. The sample we examined had been collected over a year, and was the best we could obtain. We hope, however, to be able to secure some fresh specimens in order to make new estimations, since it is possible that on the account stated our results may be low.

AMERICAN WINES.

Our collection for the International Exhibition contained a series of specimens of American wines manufactured and contributed by Messrs. Bush & Son, and Meissner, of Bushberg, Mo., and since the series contained specimens made from all the varieties of grapes usually employed in this country for the purpose, and many made from varieties new to wine manufacture, the results of their analyses are considered of some interest and value. Besides this, the wines being made by the same parties are more likely to be subject to similar conditions in the process of manufacture, and a comparison between them with reference to the value of the grape becomes consequently more reliable.

The names of the new varieties are printed in *italics* in the table.

Name of brand.	Year of vintage.	Composition of wine.				
		Specific gravity.	Alcohol, by volume.	Alcohol, by weight.	Acid,* per cent.	Solids, per cent.
1. American sherry	....	....	17.0	14.23	0.27	6.55
2. Norton's Virginia seedling	....	0.995	12.2	9.85	0.66	2.31
3. *Hermann*	....	0.990	13.9	11.24	0.48	....
4. *Alvey*	1873	....	10.1	8.13	0.78	2.52
5. *Taylor bullet*	1874	0.995	12.4	10.01	0.48	1.73
6. American port	....	1.03	13.1	10.59	0.48	11.30
7. *Martha*	1873	0.995	11.3	9.11	0.43	1.72
8. Missouri claret	1874	0.9975	11.8	9.51	0.72	2.37
9. Herbemont	1874	0.995	11.8	9.51	0.57	2.42
10. Catawba	1874	0.990	12.0	9.69	0.37	1.66
11. Catawba	1875	0.995	11.0	8.87	....	1.53
12. Catawba, sweet	1875	1.015	14.4	11.65	0.40	7.86
13. North Carolina seedling	1874	0.990	13.5	10.92	0.48	1.80
14. *Cynthiana*	1874	0.995	12.8	10.33	0.54	3.15
15. *Goethe*	1873	0.990	11.8	9.51	0.42	1.68
16. Clinton	1874	0.998	13.4	10.83	0.45	3.70
17. Delaware	1874	0.990	13.1	10.59	0.40	2.18
18. Ives seedling	1874	0.995	11.2	9.03	0.54	2.29
19. Norton's Virginia	1873	0.995	12.6	10.17	0.47	2.46
20. Concord	1873	1.000	9.4	7.56	0.60	2.38
21. Concord	1875	0.9975	8.7	6.99	0.48	2.36
22. Concord, white	1874	0.995	12.2	9.85	0.47	1.55

* Calculated as dry tartaric.

MESEMBRYANTHEMUM CRYSTALLINUM.

This plant, which belongs to the natural order *Ficoideæ*, is found growing extensively in marshes on the tide water in the vicinity of San Diego, Cal., has in some sections been used for food, and in the Canary Islands it has been burned for the ashes, which, it was believed, contained a high proportion of potash; on this account they were transported to Spain and sold there to be employed in glass manufacture. As a material for food, it is always used in the young, green state, and necessarily so, since in our analysis of the plant a preliminary examination revealed the presence of a considerable quantity of oxalic acid in the full-grown plant submitted for examination. This quantity was determined, and found to amount to about 13 per cent., reckoned as $H_2C_2O_4, 2H_2O$. For this purpose one estimation was made by treating an aqueous extract of the plant with calcic acetate, in presence of free acetic acid, dissolving the precipitate thus obtained by means of hydrochloric acid, filtering the separated insoluble organic matter, reprecipitating the calcium oxalate in the filtrate by means of ammonic hydrate, and calculation of the percentage of oxalic acid by the usual methods.

In another estimation this method was preceded by the following: The air-dried plant was ground in a drug-mill, macerated for some time in water, the whole placed upon a dialyzer, and submitted to dialysis for three days. To the diffusate thus obtained calcic acetate was added, in presence of free acetic acid as before, and the further estimation made in the usual way. In the first case 13.05 per cent. oxalic acid ($C_2H_2O_4$, $2H_2O$) was found, and in the second case 13.13 per cent.

The estimation of potash and soda to determine the value of the plant as a source of potash gave the results embodied in the following table, which shows also the percentages of crude ash, oxalic acid, and phosphoric acid estimated:

	Per cent.
In total plant:	
Crude ash	36.72
Potash	5.54
Soda	10.1
Crystallized oxalic acid, ($C_2H_2O_4$, $2H_2O$)	13.05
In seed-cases:	
Crude ash	39.62
Potash	7.48
Soda	16.50
Phosphoric acid	0.88

The plant contains a very small amount of sulphuric acid and lime, but a large proportion of chlorine. The alkalies are therefore probably combined with oxalic and phosphoric acids and chlorine. Both the stems and the seeds have a strong saline taste and a peculiar odor, due to an oil soluble in ether.

SUÆDA CALIFORNICA.

Specimens of this plant also have been submitted for analysis with a view to the determination of its value as a source of potash. It grows extensively in the salt marshes of California, and belongs to the natural order *Chenipodiaceæ*. Like many other plants of this order, it contains oxalic acid combined with potash and soda, and in the sample analyzed we have found 2.54 per cent. of this acid corresponding to the formula $C_2H_2O_4$, $2H_2O$.

That the plant has no superior value as a source of potash over that of many other plants will appear from the following results of our analysis of the ash:

	Per cent.
In total plant:	
Crude ash	14.43
Sulphuric acid	0.20
Oxide of iron, &c	0.13
Lime	0.28
Magnesia	0.34
Insoluble silica	0.10
Soluble silica	0.04
Phosphoric acid	0.38
Potash	2.65
Soda	5.58
Chlorine	4.36

GREENSAND MARL.

A sample of greensand marl from the lands of George B. Westcott, near Caulks's Field, Kent County, Maryland, was submitted for analysis by Paymaster Frank C. Cosby, United States Navy, and was found upon analysis to contain—

	Per cent.
Sand and silica	63.96
Potassa	4.4
Phosphoric acid	0.33

showing it to be very inferior in quality to similar material from the deposits in New Jersey, in which the potassa ranges from 3 to 10 per cent. and the phosphoric acid from 0 to 6 per cent.

In addition to the results of our own investigations, I consider it of value to introduce here a brief synopsis of the facts relating to agriculture and agricultural chemistry that have been developed during the past year by investigations made in Europe, as the work has been attended with results of the highest interest and importance in a practical as well as a scientific point of view.

The investigations into the questions of mineral nutrition of plants during the past year have mostly been with particular reference to culture of the beet; but Boehm has made experiments upon the influence of lime salts upon vegetation in general, from the results of which it appears that these compounds are necessary concomitants of the potash salts in the formation of starch and allied products in the vegetable organism. The opinion has been general that the function of potash was directed especially to this end, but the experiments in question have shown that when not associated with lime, or its in absence, they may have an absolutely poisonous influence. Boehm is therefore of the opinion that lime salts are as essential to the formation of starch, and to the change of starch to sugar, &c., in building up the cell-walls which constitute the skeleton of the plant as it is in the animal economy in the metamorphosis of the cartilage of the bones. The notion thus advanced, that the function of potash in the promotion of the formation of sugar in plants is limited, has received confirmation in the results of the investigations of Joulie upon the relation of the elements of fertilizers to the composition of beets, which show that the richness in sugar is favorably affected by phosphoric acid, but is not increased by the alkalies or nitrogen compounds. These latter elements, if applied in moderate quantities, may serve to augment the yield of beets; but if they exist in the soil in excess of the amount required by the crop in normal physiological development, they become injurious to the quality—the alkalies by increasing the saline constituents, and the nitrogenous compounds by increasing the size of the beet and reducing the saccharine constituents. These results agree closely with those of Fremy and Deherain, who have found that the richness in sugar is not affected by different characters of the soil, such as argillaceous, siliceous, or calcareous; that calcic phosphate and potassic nitrate in sterile soils have a favorable effect on the quantity of the product and its richness in sugar, and that excess of nitrogenous manures is injurious. With reference to the nitrogen compounds, Joulie finds that the nitogen of nitric acid is preferable in this connection to that of ammonia, which, in its turn, is more valuable than organic nitrogen. When used in the form of nitrate, the soda compound may replace with advantage the potash compound, and at the same time bring about a reduction of the total alkalies in the products. Stable manures should be used with great care, and do not need any addition of mineral fertilizers. They should be well rotted before application to the crop, or they should be applied sufficiently in advance of planting to insure this condition.

From calculations on the basis deduced from his experiments, the best formula for a fertilizer for beets on very poor soil would be:

	Pounds.
Acid calcic phosphate	160
Sodic nitrate, (Chili saltpeter)	940
Gypsum, (land-plaster)	900

This mixture should be applied at the rate of 1,000 pounds per acre. The quantity may, however, be very materially reduced when applied to soils comparatively fertile, but lacking in constituents necessary for complete nutrition of the crop.

With reference to mineral plant-poisons, a remarkable exception to the rule for the influence of aluminium salts has been observed by Bergstrand in a locality near Westerbotten, in Sweden, where *Rubus articus* was found in a flourishing condition upon a sandy soil containing as high as 3 per cent. of alum. The dry plants yield 4.68 per cent. of ash, containing 12.60 per cent. sulphuric acid and 5 per cent. alumina; but these figures are very much reduced when the percentage of alum in the soil is sufficiently low to admit of the growth of grass and grain. In such case the sulphuric acid of the ash amounts to only 5 per cent.

Eug. Peligot has discovered a veritable plant-poison in the compounds of boracic acid. He has determined that the free acid and its compounds are distinctly poisonous to vegetation, and, when present in the soil in moderate quantity, may cause the death of plants in a very short time.

The contributions to our knowledge of organic and atmospheric nitrogen in their relation to vegetable nutrition have been numerous, and most of them exceedingly valuable. With reference to the compound most favorable for plant-nutrition, Lehman has determined that it varies with the stage of development of the plant, ammonia being more favorable in the early stages, and nitrates during the later, though some plants require nitric acid throughout the entire period of growth for normal development. In the course of his experiments he found that lupines growing in sterile soils have the power of taking up nitrogen from external sources to such an extent that he considers them the cheapest possible source of nitrogen for such sterile soils. Their power in this particular has received a clear and remarkable explanation in the late discoveries of Berthelot, who, by a series of careful and ingenious experiments, has found that the proximate organic constituents of plants, under the influence of the electrical tension always existing between the soil and the atmosphere immediately above it, may combine with atmospheric nitrogen to form compounds which, on decomposition at 300° to 400° C., in presence of soda-lime, are capable of forming ammonia. This explanation of the manner of the absorption and assimilation of atmospheric nitrogen has been the subject of careful and laborious research at the hands of the leaders of chemical science since the study of vegetable nutrition began, and has been supplemented by the results of the late investigations of Boussingault upon the influence of the soil upon the nitrification of nitrogenous organic matters employed as manures, in which he made an extended series of experiments with different substances in admixture with sand, chalk, and garden-soil. As a result of these experiments, he found that the garden-soil determined a formation of the greatest amount of nitrogen and a production of the highest amount of nitric acid, but the lowest amount of ammonia. Between sand and chalk there seems to be little difference with regard to their influence upon the production of nitric acid, but the chalk seems to have the strongest influence in the formation of ammonia. If arranged in the order of their relative value, depending upon this latter influence, they would stand, first, chalk, then sand, and garden-soil last; but, if arranged with reference to the total amount of nitrogen transformed, the order would be, garden-soil, chalk, sand. In case of a chalk-mixture, the proportion transformed varies from 11 to 53 per cent. of the total organic nitrogen, while for the mixture with garden-soil these limits were 30 to 90 per cent.

That this power of garden-soil in the transformation of nitrogenous compounds is resident in the humous substances it contains is apparent from the results of Boussingault's experiments; but it is made more evident by the experiments of Simon in his investigation of the function of *humus* in the soil, from which he concludes that humic acid has the power to appropriate atmospheric nitrogen; that the absorption of atmospheric nitrogen is attended with a liberation of carbonic acid, and that humic acid is insoluble in water free from nitrogen or atmospheric air.

A curious and interesting fact may be noted in the results obtained by Boussingault. In the mixtures with sand and chalk, raw bone was the only material that yielded any appreciable quantity of nitric acid. The bones seem, therefore, to have a special tendency to the function of nitrification; a theory supported by the fact that M. Hervé Magnon found by analysis large quantities of nitric acid in the drainage-waters of the ossuaries of the catacombs of Paris.

With regard to ammonia, Houzeau has discovered a peculiar quality: that when a solution in water is allowed to stand for some time, it completely disappears from the solution. It is well known that it is always present in rain-water; but found in comparatively small quantities in spring and river water, a fact which has always been considered due to absorption by the soil; but M. Houzeau found that it disappeared from solutions under conditions leading to the conclusion that light has in some way an influence in bringing about this result.

While the methods involved in the appropriation and assimilation of atmospheric nitrogen were being made, Gorup-Besanez and Will have developed some important facts in connection with the utilization of combined nitrogen in the interior of the plant. Thus they have succeeded in separating from the seeds of *Cannabis sativa*, (hemp,) and *Linum usitatisimum*, (linseed,) and some kinds of malt, a ferment capable of acting upon fibrin and albumin in a manner similar to pepsin. It is snow-white and pulverulent, and retains its activity for weeks when kept in well-closed vessels. It changes starch-paste into sugar within an hour, and acts rapidly upon fibrine-forming peptones. They also found the same ferment in the sap of different species of Nepenthes, and its action upon animal substances so decided that it has been declared to be a vegetable solution of pepsin.

Passing from the absorption of nitrogen and the formation of nitrogenous compounds, we come to the formation of carbohydrates. Liebig and Rochleder believed that the organic acids (oxalic, tartaric, &c.) form the transition links between atmospheric carbonic acid and the carbohydrates in the economy of plant-growth, while Davy, Sachs, and others hold that the transformation is direct, with no intermediate steps. Baeyer subsequently advanced the theory that when sunlight falls upon chlorophyll in plants well supplied with carbonic acid, the latter seems to suffer the same dissociation as at higher temperatures, liberating oxygen and leaving carbonic oxide combined with chlorophyll, and that in this combination it undergoes further reduction under the influence of the cell-contents, thus entering into the formation of the carbohydrates. Stützer, of Göttingen, has tested these views by careful experiment under various conditions, and has obtained results which show that the views of Liebig and Rochleder are incorrect, and that oxalic acid can enter into the process of nutrition only after previous oxidation to carbonic acid; that this being true for oxalic acid, it will also hold good for the other acids of the carbonyl group; but tartaric acid and the compounds of the alcohol group may be changed directly into the formative material of the plant. The views of Liebig are also in opposition to the results lately obtained by Mayer.

Stützer's experiments with reference to Baeyer's views show that an assimilation of carbon cannot be effected after the manner indicated, and that we must for the present hold on to the old theory, viz., that of the direct change of carbonic acid to the carbohydrates in the plant containing chlorophyll under the influence of light. Whether alcohol may or may not have the function in the plant-nutrition suggested by Stützer, it has at any rate been found in the unfermented juices by Gutzeit, who has succeeded in separating from *Heracleum giganteum*, *Pastinica sativa*, and *Anthriscus cerefolium* small quantities of volatile fluid, which, upon examination, proved to consist of one-third methyl alcohol and two-thirds ethyl alcohol. From examination of fruits in various stages of growth, he concludes that as the process of ripening advances, the ethyl alcohol changes to other compounds, while the methyl alcohol remains constant. This conclusion corresponds to a certain extent with that of Stützer, to the effect that the compounds of the methyl or methylen groups may change to final products in the plant; but since oxygen must first be taken up, these groups are subject to extensive metamorphoses. The results obtained by Gutzeit, showing a variation in the amount of ethyl alcohol in fruit according to the degree of maturity, are confirmed by those of Lechartier and Bellamy, who have found that when deprived of free oxygen, fruits and leaves give off definite quantities of carbonic acid, due to formation of alcohol, according to the stage of ripening; the maximum being reached before complete maturity. With the exception of the horse-chestnut, which gave off 22 cubic centimeters per gram of substance, the limits for fruits and leaves are from 0 to 13.5 cubic centimeters per gram. That this formation of alcohol in fruits, &c., is augmented by absence of oxygen is shown by the results obtained by Missanghi, who observed a formation of alcohol, acetic and formic acids in grapes preserved in an atmosphere of carbonic acid, and showing no indications of decomposition, the flavor of the grapes when taken out being similar to that of fruits preserved in spirit. De Luca's conclusions from his experiments are that saccharine matters of fruits may undergo a change to carbonic acid and alcohol without the presence of alcoholic or acetic ferment. He finds that this change is attended with evolution of nitrogen, and sometimes of hydrogen, and that leaves and flowers act similarly in atmospheres of carbonic acid, hydrogen, or air. Fremy's results lead to totally different conclusions. He placed cherries, which had been carefully washed, in hermetically-sealed tubes, under various conditions, and observed, after a time, a liberation of carbonic acid, with formation of alcohol. On examination with the microscope, he found in their interior germs capable of exciting alcoholic fermentation in sugar-solutions, and he was therefore led to a belief in the spontaneous generation of this ferment. In this belief he is opposed by

Pasteur, and the views of the latter are supported by Struve, who, in the course of an investigation of the gases found in fruits, placed some grapes under water, free from air, under conditions favorable to exhaustion of air, and at the close of the experiment found that the water contained small quantities of alcohol and yeast-cells, but on careful examination of the grapes was unable to find any yeast-cells in their interior. The reliability of Fremy's conclusions are therefore questionable.

As might be inferred from the presence of alcohol found in plants and fruits, the gas they contain generally consists of carbonic acid. Thus Struve has found that when grape-leaves are covered with ether, a liberation of gas takes place, varying in amount with the stage of their development, being most abundant in young leaves. Grapes similarly treated give off no gases, but do so when covered with water and placed under a bell-jar from which the air is subsequently exhausted by means of the pump. The gas liberated was found in each case to consist entirely of carbonic acid.

On analysis of the gas contained in the pod of *Colutea arborescens*, (bladder-nut,) Bender found it to consist of 2.2 carbonic acid, 18.7 per cent. of oxygen, and 79.1 per cent. of nitrogen. These results correspond closely with those obtained by Saintpierre and Magnien, who find, however, that these proportions vary, not only with the time of the season, but also with the time of the day in which the pods were collected. Bender considers that the gas is obtained entirely from external sources by transfusion through the walls of the pods; but the results of the experiments of Saintpierre and Magnien seem to favor their view, that the carbonic acid is due to internal exhalation, and that it subsequently becomes mixed with atmospheric air by transfusion, in accordance with the law of diffusion of gas; that the oxygen of the air thus taken in is absorbed by the green pods in the process of growth. A simultaneous liberation of carbonic acid taking place, the latter being often greater than the absorption of oxygen, and producing distension of the cell-walls of the pod. But it must not be inferred from the results just described that the gases liberated by plants always consist of carbonic acid; for Joseph Boehm has observed that when branches of woody plants were placed in direct sunlight under water freed from air by boiling, a liberation of gases immediately began, and in a short time there was set free an amount greater in volume than that of the twigs under experiment. The last portions were almost pure oxygen. Though he considers this a physiological phenomenon, he does not, for the present, attempt to explain it; but Ad. Mayer, who has also observed the phenomenon, considers it due to the formation of starch under the influence of light, by reduction of acids which have been formed by oxidation of starch in the absence of light. The results of other investigations, as will appear further on, suggest the idea that there may be in such case an oxidation of sugar, since it has been shown by different persons to exist in leaves in considerable quantity. Thus Deherain has detected its presence in the leaves of beets, and from the results of the investigations of Corenwinder it appears to be located principally in the ribs or veins, and that in these parts it amounts to 1.607 per cent. From further experiments he has found the percentage higher in roots having large, well-developed leaves than in those having smaller ones. Joseph Boussingault has also found sugar in the petals of certain flowers, and has estimated the amount present. He divides the sugar found into reducible sugar and invertible sugar. The first may consist of inverted sugar, glucose, levulose, or even inactive sugar, or, what is more probable, a mixture of them all, having the power to reduce cupric oxide.

The invertible sugar consists of saccharose. The limits of the amounts found in the various flowers examined were, for reducing sugar, from 1.27 to 4.88 per cent. of the normal undried substance, and, for invertible sugar, from traces to 2.12 per cent. The average of the amounts found in the leaves collected at the same time as the flowers was 2.2 per cent. After being cut and exposed to the air, the proportion of sugar in the flowers was reduced, which, according to Boussingault, is due to oxidation, with formation of carbonic acid. This action takes place only in the green state, becomes feeble during desiccation, and is inappreciable in the dried product. While for this liberation of carbonic acid or of oxygen reasonable explanations may be found without great difficulty, it will not be as easy to explain the liberation of hydrogen gas by vegetation, which the observations of Pollacci seem to indicate. Thus he found that *Oidium Tuckeri* found on grape-leaves is rapidly destroyed when exposed to the action of sulphureted hydrogen, and he therefore believes that the destruction of this fungus by application of sulphur is due to this gas formed by the action of nascent hydrogen, probably liberated by the leaves and fruit in the process of growth. This action is indicated by the results obtained by washing the leaves which had been treated with pure sulphur with distilled water and testing the washings with lead acetate and silver nitrate. Similar experiments made upon other plants led him to the conclusion that all plants are capable of liberating hydrogen in a nascent condition. Missanghi, however, takes issue with Pollacci in his conclusions, but appears to have misunderstood them. He experimented with a view to the determination of emission of hydrogen in the growth of mildew, and by subjecting the atmosphere surrounding the fungus growing on bread to suitable tests, he was unable to detect the slighest trace. While these results are of value with reference to mildew, they do not seem to conflict with those of Pollacci.

But whatever may be the character and composition of the gases liberated by plants in respiration, Ad. Mayer finds that between this latter function and growth, as determined by experiments made upon small wheat-plants under various conditions, no fixed relation exists. Growth is variable, depending upon very many external conditions, while respiration, the quantity of oxygen, and the character of the plants being similar, is remarkably constant.

From the consideration of these questions we now pass to those of a more technical character, among the most important of which are the conclusions of Soxhlet and Tisserand with reference to manufacture of butter. The former, in a discussion upon the condition of fat in milk, opposes the generally-accepted theory that it exists in globules surrounded by a membrane which it is necessary to break up in the process of churning, or by chemical means, for the production of butter, and believes that it exists in much the same condition as oil in an emulsion with albumin, citing authorities in support of his belief. He considers that in new milk the butter is present in oily drops, as it appears under the microscope; but his experiments show that if the milk is frozen at a temperature of three or four degrees below 0° C., they become solid and remain in this condition after the milk is thawed. It can then be separated by churning, it is said, in two minutes, a result usually requiring eleven minutes; which is a point of great practical importance. The conclusions of Tisserand, who has made an extended series of experiments upon the influence of low temperatures, varying from 0° to 36.0° C., upon milk and the production of butter, are similar to those of Soxhlet; for he finds that it renders the separation of the cream more rapid, increases its volume and the yield of butter, and improves the quality of the skimmed milk, butter, and cheese. These effects increase with a decline of temperature. He therefore considers the practice of warming dairies in winter objectionable, and that the temperature should be kept as low as possible.

Another advance in technical chemistry relating to agriculture that has been recorded is in reference to the purification of sugar. On account of the insolubility of magnesia and its compounds in saccharine liquors, M. M. C. Bernard and L. Ehrmann have made experiments with reference to its suitability for industrial application to defecation of sugar-solutions. When employed for this purpose in the proportion of 0.3 to 0.5 per cent. of the liquor to be operated upon, the defecation was complete and the liquid made clear. They made use of calcined magnesia, the hydrate, carbonate, and phosphate, but give preference to the calcined magnesia. As a result of their experiments, they obtained—

1. A yield in white sugar of the first crystallization 6 to 7 per cent. higher than that generally obtained.

2. A quality of sugar in no way inferior to the fine qualities obtained by the regular methods of manufacture.

They insist that the magnesia forms no combination with the sugar, and may therefore be used in excess with no necessity for treatment with carbonic acid and animal charcoal. It settles to the bottom of the vessel and remains behind on drawing off the liquid.

This *résumé* of the work accomplished in foreign laboratories may not include all the discoveries made during the year within the domain of agricultural chemical science, but it embodies the results of the most important investigations that have been publishud in the regular periodicals, and it may not be devoid of interest to the readers of this report.

In our own laboratory, investigations of an important character other than those the results of which are given in this report have been under way and are in the process of completion, and reports upon them must therefore be withheld for a future occasion.

Very respectfully,

WM. McMURTRIE,
Chemist.

HON. FRED'K WATTS,
Commissioner.

REPORT OF THE SUPERINTENDENT OF GARDENS AND GROUNDS.

SIR: I have the honor to submit the following report:

The improvement of the grounds and the enlargement of the collection of plants in the arboretum is prosecuted from time to time as far as the means available for these purposes will admit.

The herbaceous ground, intended to contain specimens of all native plants not properly admissible in the ligneous collection, has been laid out and is now ready for planting. Special efforts will be required to complete this collection; a large number can be raised from seeds, plants of many species can be procured from commercial sources, and some by exchanges with botanic gardens, but the chief reliance will be upon competent collectors in various parts of the country.

The addition to the grounds of the space formerly occupied by the canal has been filled, drained, and graded to correspond with the general design. This extension will be fully occupied by additional genera to the groups of trees in that section, particularly the willow family, which is now very full, numbering over two hundred species and varieties.

In improving that portion of the grounds formerly occupied by the canal, advantage was taken of the position to construct a small lake, mainly for the purpose of introducing a collection of native water-plants.

The ornamental as well as the picturesque effects of this class of plants are mostly quite neglected in modern landscape-gardening. It is not uncommon to find artificial lakes in parks and pleasure-grounds wholly destitute of this class of vegetation, and although water-surface is seldom uninteresting in scenery, there is no reason why it should not possess all the attractions and sanitary effects which can be imparted by the introduction of suitable flowering-plants.

No flower in the garden border can excel, either in beauty of form or in delicacy of fragrance, the white water-lily, *Nymphæa odorata;* the large cup-shaped yellowish flowers, boldly projected out of the water on long foot-stalks, of the *Nelumbium luteum;* and the less showy blossoms of the yellow pond-lily, *Nuphar advena*, in connection with the massive spread of the large leaves, especially those of the *Nelumbium*, which are frequently 18 inches in diameter, produce an effect equal to the best efforts of the most distinguished artist in that popular formation of "foliage" plants known as "carpet-bedding."

In addition to the water-lilies, various other interesting species of water-plants have been introdued, and are spreading rapidly in the lake. Several of the curiously-horned seeds of the *Trapa natans* were thrown in, and in due time the small triangular-shaped leaves made their appearance on the surface, neatly arranged in roseate form. Several plants of a tropical *Limnocharis* spread rapidly during summer, and produced abundantly of its yellow flowers. The duck-weed, *Lemna*, thrown in a sheltered cove, speedily covered the surface with its diminutive greenery. In deeper water, plants of the eel-grass, *Vallisneria spiralis*, were planted, and in shallow recesses various species were introduced, as, *Potamogetan*, *Calla*, *Pontederia*, *Caltha*, *Acorus*, *Polygonum*, &c. On prominent points, tall, reedy plants will be disposed, such as *Typhas* and *Sparaganiums*, with *Cyperus*, *Juncus*, and smaller growths, as marginal plants to the taller central groups.

A small island was formed, having its surface raised about six inches above the water-level with spagnum, in which various low-growing bog-plants were inserted, such as the pitcher-plant, *Sarracenia purpurea*, the horse-tail grasses, *Equisetums*, with *Habenarias*, and similar low-growing forms that are to be found in woody swamps and wet meadows.

The effective arrangement of water and bog plants in and on the margin of lakes should be as much a subject of artistic study as is the arrangement of trees and shrubs in park scenery. This branch of landscape decoration is wholly neglected, but it is destined to become popular, and it will awaken an interest in an extensive class of plants that are but little known and that possess a characteristic individuality of form and beauty, which, when received in connection with their natural surroundings, cannot fail to recall pleasant associations to the mind, compared to which the landscape-effect produced by a group of flowering shrubs will appear exceedingly tame and uninteresting.

Another feature connected with the lake is the rhododendron island.

On this the soil is raised 18 inches above the level of the water, supported at the sloping sides by a rustic wall of small stones. Plants of the Japan bamboo-cane have been thickly set on the margin, and more sparingly dotted over the surface of the bed, for the purpose of affording a slight shelter and shade to the rhododendrons. These brilliant flowering plants have been found to grow and thrive to perfection in such positions. They are provided with fine hair-like roots that ramify near the surface, and are easily destroyed if the soil becomes dry; hence a soil that is kept equally moist without reaching saturation is favorable to their extension and preservation; the whole secret of rhododendron culture depends upon this condition of the soil; for, although they are natural to shady forests, they become habituated to sunshine and retain their verdure in open sites, provided the roots are constantly supplied with moisture. Surface-evaporation can be retarded by mulching the roots with decaying leaves, grass-cuttings from the lawn, or strawy manure from the barn-yard. The magnificent display of rhododendrons in flower at the International Exposition has created a wide-spread interest in their culture; from comparative obscurity they have suddenly been raised to a popularity which they deservedly merit as regards ornamental effect in pleasure grounds and public parks.

The native azalea is a close family relation of, and associates well with, the rhododendron, requiring similar conditions of soil and position. A portion of the bed is reserved for plants of *Kalmia latifolia*, *Andromeda floribunda*, *Ilex* (*Prinos*) *verticellata*, *Itea virginica*, and *Clethra alnifolia;* the trailing arbutus, the partridge-berry, and others of similar habit are planted as undergrowths.

The interest felt in the introduction of new economic plants for experimental trial leads to constant demands upon the Department for seeds and plants of species not adapted to the climate or locality in which these experiments are proposed to be made. Among those in frequent demand the following are noted, with remarks on their adaptability or fitness for cultivation in this country:

COFFEE.

The successful culture of the coffee-plant, *Coffea arabica*, in any portion of the United States is exceedingly problematical. There is a constant demand for plants for experimental purposes, which the Depart-partment is unable to supply, owing to the difficulty of procuring fresh seed. It is barely possible that in Southern California, or in Southern Florida, localities may be found where it may succeed; but these are the only regions where further experiments in coffee-culture need be made. Authorities on coffee-production very generally coincide in the opinion that it cannot be profitably grown in any climate where the temperature falls as low as 50° F. at any period of the year. It may be presumed, however, that the amount of summer-heat required to mature the berry is a more potent factor in the elements favoring success than is the mere ability of the plant to endure for a brief time a certain degree of cold; for it is well known that culture can extend a controlling influence so far as to render plants better fitted to endure a temporary low temperature without inducing any perceptible injury to their vital forces; but no modification of ordinary cultural appliances can increase the supply of atmospheric heat in a climate so as to exert any favorable influence on its vegetation. Since the introduction of coffee-culture in Liberia, attention has been directed to the superior size of the berry produced in that country. For a time it was supposed to be one of the varieties of

Coffea arabica, of which several are known to exist in Abyssinia and Central Africa; but more recent investigations have placed it as a distinct species, which has been named *Coffea Liberica*. Efforts are now being made to introduce this species into coffee-growing regions, on account of its supposed immunity from the rust, a fungoid disease that has greatly impaired the value of the coffee-crop in some of the best plantations in various parts of the world. This Liberian species is said to be of larger and of more robust growth than any other cultivated kind; whether it will prove to be hardier, or mature its fruit in climates of lower temperature, remains to be seen.

A young plant growing in the Department conservatory fully bears out the above description as to appearance and growth; the leaves are double the size of those of any other species, of which there are several in the collection, and in other respects its distinctive character is quite apparent.

Seeds of this class of plants are not readily procurable through ordinary commercial sources, and looking to the desirability of giving this promising species of coffee a fair experimental test, a sufficient quantity of seeds for this purpose might be obtained directly from Liberia.

Unless under the most carefully-guarded conditions, coffee-seed soon loses its vegetative powers; the only successful method of transporting fresh seed is to pack securely in a tin box, surrounding each seed with dry sand, and hermetically seal the package.

Statements have been freely circulated to the effect that the "coffee-plant grows wild all over California." The latest "coffee-plant" thus eulogized is the *Frangula californica*, a native plant allied to the buckthorn.

INDIA-RUBBER PLANTS.

In the praiseworthy endeavors to introduce new industries into the Southern States, requests are made for economic plants of many kinds that are strictly tropical productions, and among these may be placed the India-rubber-bearing trees.

Various plants afford caoutchouc, the elastic, gummy substance better known as India rubber, but as far as is known it is solely produced by plants of tropical climates. In the East Indies it is collected from *Urceola elastica*; from several species of *Ficus*, mainly from *Ficus elastica*; and from a few other species, natives of the East Indies and western tropical Africa.

South American rubber is also extracted from plants of different genera. The best is said to be obtained from the *Hevea brasiliensis*, a native of the Para forests, considered to be distinct from the *Siphonia elastica*, which furnishes the largest portion of the rubber entering into the commerce of that country. The sand-box tree, *Hura crepitans*, yields a milky juice which is similarly converted into caoutchouc by evaporation. These plants belong to the natural order *Euphorbiaceæ*, a large family of plants, mostly yielding a milky juice, containing acrid and poisonous properties.

Mexican rubber is extracted from a native tree, the *Castilloa elastica*, which grows abundantly near the Gulf coast. This plant is botanically allied to the rubber-producing *Ficus* of the East Indies.

A new elastic gum has recently been produced in Mexico, which is said to be derived from a native herbaceous plant allied to the family of asters. This plant would probably succeed in the Southern States.

These are strictly tropical trees, for which we have no suitable climate; but attention might profitably be directed to the gum-producing

Mesquit tree of Texas, *Algarobia glandulosa*, which yields a non-elastic gum of the nature and possessing all the essential qualities of gum-arabic.

CINCHONAS.

During the past ten years a continuous supply of young plants of several species of cinchona has been maintained by a yearly propagation of young plants equal to the numbers distributed. Plants have been sent to California, and to several of the Southern States, mainly to Florida. The reports that have reached the Department do not indicate success in their culture, owing to adverse climatic influences. Experiments here show that none of the species will stand the slightest frost without injury, and even in the equable atmosphere of the greenhouse their vitality is impaired when the temperature is below 50°. Whether or not the climatic conditions for the growth of cinchonas exist in any portion of the country is a question not yet solved, but, so far as our present knowledge warrants an opinion, further experiments should be confined to the locality of San Diego, Cal., as offering greater promise of success than any other point.

In the recently-formed cinchona-plantations in India the best results are said to be obtained in a warm, equable, and very moist atmosphere, at elevations where the mean yearly temperature indicates 64°; and in those established in St. Helena, the plants flourish well at an elevation of 1,500 feet above sea-level, in rich lands, bathed in moisture, the mean temperature for the year being 60°.

Dr. J. E. Howard, of England, (high authority in everything relating to the cinchona,) in the transactions of the Linnean Society, remarks that "it must be remembered that these are mountain-plants, loving free air and alternate mist and sunshine, while the hot, close atmosphere of the lower valleys is always injurious to their perfection as quinine-producing plants." It is shown in the reports of the Signal-Office that the mean temperature for the year at San Diego is 60°, the highest monthly mean reaching 68° in August, and the lowest monthly mean being that of 53° in January and February. So far as thermometric figures indicate atmospheric temperature, the climate of San Diego corresponds with that of St. Helena, but it is well known that the thermometer alone is not a safe guide in comparisons of this kind; the hygrometrical condition of the atmosphere being of equal, if not of greater, importance as regards vegetable growth. Experience in the culture of several species here confirms the reports that *Cinchona succirubra* is the most robust in growth. This species predominates in artificial plantations on account of its rapid growth.

EUCALYPTUS GLOBULUS.

The interest attached to the Australian blue-gum tree, both in relation to its great rapidity of growth and its reputed hygienic qualities, is increasing, and the demand for plants and definite information regarding their culture and sanitary value continues unabated. There is no special difficulty in propagating the plant. The seeds are small, very similar in size and appearance to those of the onion, and vegetate rapidly when sown in good condition. The young plants are rather delicate at first, but after a few weeks they grow with great rapidity. In the greenhouse they have reached a height of 4 feet in as many months from the seed, and young plants 1 foot in height planted out in May grow from 4 to 6 feet before winter. This applies to plants in rich, moist soil. Those placed in sandy soil, poorer and drier, do not reach such dimensions, but will stand a greater degree of cold. Succulent leaves and branches shrivel when the thermometer falls to 30°, while the more rigidly-matured shoots of the slow-growing plant have survived after being subjected to 12° of frost.

As a forest tree it will not flourish in this country north of the thirty-fifth parallel of latitude, probably it will not succeed even up to this point; but it is unnecessary to experiment with it in higher latitudes, so far as pertains to hardiness. As to the sanitary value of the *Eucalyptus*, evidence is accumulating to show that it has a tendency to lessen malaria and destroy miasmatic poison. This has been largely attributed to the great absorbent power of the roots, but this value would be equally shared by other trees of similarly rapid growth, such as our strong-growing poplars. It is no longer doubted that several species of *Eucalyptus* evaporate with water a volatile oil and a volatile acid, which permeate the atmosphere and contribute to its invigorating and healthy nature and character.

The absence of malarial diseases in Eucalypti forests seems to be well established, and as the planting of useful trees is not likely to be overdone with us, these claims for special recognition are worthy of consideration and encouragement.

Of the genus *Eucalyptus* upward of one hundred species have been described. Growing at different elevations, and embracing in their habitats many degrees of latitude, it is to be expected that some of the species will resist cold better than others. The numerous species possess different properties in the various oils, gums, and dyes which they furnish. The iron-bark gum, the peppermint gum, the stringy-bark gum, the curly gum, the red gum, and the sweet-scented gum, with many others, are all equally worthy of introduction and trial.

EUROPEAN OLIVE.

The introduction of the olive into this country as an object of culture dates back more than one hundred years, and during that time various attempts have been made to revive and extend its culture, which have in turn been abandoned, or at least have failed to maintain a permanent increasing activity in the business. Various reasons may be adduced for this failure. The length of time that elapses between the planting of the trees and the securing of a crop, variously stated as being from eight to twelve years, is so great as to cause olive-culture to give way to that of more immediately remunerative crops. The difficulty in securing a sufficient supply of the most approved varieties, yielding fruits best adapted to the respective uses to which they are applied, has also had a decided influence in retarding olive-culture in this country.

The olive is not a tender plant; it is nearly, if not quite, as hardy as the Chinese tea-plant. In a somewhat sheltered situation, without special protection, both of these plants have been growing for several years in the grounds of the Department, and annually increase in size.

European authorities state that "the olive requires for ripening about one-third more annual heat than the grape, and that the best localities are those where the winter temperature does not fall below 18° F., but that the plant will resist for a short time even 28° of frost; indicated at 4° F. Long-continued droughts, so detrimental to most plants, will affect the olive but slightly. It thrives best on a free, loamy, calcareous soil, but it dislikes clays. Proximity to the sea is favorable to it, and hill-sides are more eligible for its culture than plains."

The olive is one of the oldest cultivated plants of which history makes mention, and during the centuries of its culture it has doubtless run into innumerable varieties, differing widely from the original form, from which selections have been made of those possessing the most highly-valued properties of tree and fruit. It has been stated that the number of distinguished varieties of the olive in Europe is equal to that of the apple in America. It is readily perceived that plants raised from seeds, even if the seeds have been collected from the most esteemed varieties, may not inherit the qualities of the parent plant; and plantations formed of such seedling-plants may produce fruits of inferior value, causing great disappointment and loss.

The following descriptive list of select varieties is taken from a recent treatise on the culture of the olive in Spain, and may therefore be considered to include only the best in cultivation in that country:

Spanish varieties for early maturation, for colder localities.

1. Var. *Promiformis.*—Manzanillo; (French, *Ampoulleau.*)—Fruit above an inch in diameter, spherical, shining black.
2. Var. *Regalis.*—Sevillano; (French, *Pruneau de Catignac.*)—Fruit about an inch in diameter, ovate-spherical, blunt, bluish-black.
3. Var. *Bellotudo* or *Villotuda.*—Fruit about an inch long, egg-shaped; pericarp outside dark red, inside violet.
4. Var. *Redondillo.*—Fruit ovate-spherical, nearly an inch long; pericarp outside bluish black, inside whitish. A rich yielder.
5. Var. *Ovalis.*—Lechin; Picholin; Acquillo; (French, *Saurine.*)—Fruit broad-oval, two-thirds of an inch long. A copious yielder.
6. Var. *Argentata.*—Nevadillo blanco; Doucel; Gorzalena; Moradillo; Ojiblanco; Olivo lucio.—Fruit broad-ovate, an inch long, very blunt, not oblique. Quality and quantity of oil excellent.
7. Var. *Varal blanco.*—(French, *Blanquette.*)—Fruit ovate, globular, three-fourths of an inch long, neither pointed nor oblique, outside blackish-red.
8. Var. *Empeltre.*—Fruit ovate, an inch long, equable. Rich in oil of excellent quality, also one of the best for pickles. Outside violet, inside white.
9. Var. *Racimal.*—(French, *Bouteillan, Boutiniene, Ribien, Rapugette.*)—Fruit violet-colored, globose-ovate, about an inch long, neither pointed nor oblique. Bears regularly also on less fertile soil, and is one of the earliest to ripen.
10. Var. *Varal negro;* Alameno; (French, *Cayon, Nasies.*)—Fruit violet-black, spotted, globose-ovate, nearly an inch long, somewhat pointed. Bears richly.
11. Var. *Colchonudo.*—Fruit spheric, outside red, inside white, one inch in diameter, slightly pointed. Produces a large quantity of good oil.
12. Var. *Ogillo de Liebre.*—Fruit nearly spheric, outside violet-black, about one inch long, somewhat oblique.
13. Var. *Carrasquena.*—(French, *Redouan de Cotignal.*)—Fruit black-red, almost spherical, slightly oblique, about an inch long. Valuable both for oil and preserves.
14. Var. *Hispalensis.*—Gordal; Ocal; Olivo real.—Fruit black-gray, oblique, spherical, measuring fully an inch. Rather a large and quick-

growing tree. Fruit used in the green state for preserves, not used for table-oil.

15. Var. *Verdejo.*—Verdial, (French, *Verdal; Verdan.*)—Fruit black-violet, oblique-spheric, pointed, about one inch long. Furnishes good oil and resists best of all the cold.

Spanish varieties of late maturation, for warmer localities.

16. Var. *maxima.*—Madrileno, Olivo moreal.—Fruit over an inch long, cordate-globose, strongly pointed. Valuable for preserves.

17. Var. *Rostrata.*—Strong and tall plant, very hardy. Fruit black-reddish, over an inch long, oval, much pointed. Good for oil.

18. Var. *Ceratocarpa.*—(French, *Odorant; Luquoise.*)—Fruit fully an inch long, oval, pointed.

19. Var. *Jaraluno.*—Fruit black-gray, over an inch long, egg-shaped, somewhat oblique, gradually pointed. Rich in good oil.

20. Var. *Picudo.*—Fetudilla.—Fruit fully an inch long, egg-shaped, blunt at the base, pointed at the apex, with black-gray pulp. Good both for oil and preserves.

21. Var. *Neradillo negro.*—Fruit egg-shaped, fully an inch long, with turned pointed apex. One of the richest of all varieties in yield, and ripens moderately early.

French varieties merging into the Spanish kinds.

22. Var. *Angulosa.*—Laurine.—For preserves.

23. Var. *Rouget.*—Marvailletto.—Produces a fine oil.

24. Var. *Atrorubens.*—Salierue. Saverne.—Fruit dusted white. Furnishes one of the best of oils.

25. Var. *Variegata.*—Marbee. Pigale. Pigau.—Purple fruit, with white spots.

26. Var. *Le Palma.*—Oil very sweet, sparingly produced.

27. Var. *Atrovirens.*—Pointue. Punchuda.—Fruit large, with good oil.

28. Var. *Rubicans.*—Rougette.—Seed small, yield annual and large.

29. Var. *Alba.*—Olive blanche. Blancane. Vierge.—Productive, but inferior.

30. Var. *Caillet Rogue.*—Figanier.—Tree small. Fruit large, red. Oil good and produced in quantity.

31. Var. *Caillet Blanche.*—Fruit almost white, produced annually and copiously, yielding a superior oil.

32. Var. *Raymet.*—Fruit large, reddish. Oil copious and fine. This variety prefers a flat country.

33. Var. *Cotignac.*—Fruit middle-sized, blunt. Oil obtained in considerable quantity, and of excellent quality.

34.—Var. *Bermillaon.*—Vermilion.—Yields good table-oil. Tree very hardy.

JAPAN PERSIMMONS.

During the past twelve years the Department has made various importations of seeds of the persimmon from Japan, but only in a few cases have they reached here in condition to vegetate. When young the plants suffer to some extent during winter; the points of the branches are injured, but they recover as summer advances, and after the second winter they are perfectly hardy. There is also quite a difference in the seedling-plants, some few remain uninjured from the start, while others suffer to the extent of being killed to the ground. All the young plants have been distributed; a few only having been planted in the grounds some years ago, which are now ten feet and over in height, but have so far given no indications of flowering.

It appears that in Japan the persimmon, like our own orchard fruits, has long been subject to improvement by culture and selection of the best varieties, which are then increased by grafting. The Japanese are now in possession of many fine varieties, differing greatly in size, shape, and quality; some being oblong, like a huge acorn, others are flat, closely resembling both in shape and color a large, red, smooth tomato.

It may therefore be presumed that the plants raised here from seeds would bear the same relation to these improved varieties that seedling-apples do to the finest productions of our orchards, and that efforts should be made to procure a supply of these grafted varieties directly from Japan.

These fruits are worthy of introduction; in Japan they are dried in the sun and preserved in the same manner as figs, which they very much resemble when thus prepared. The fruit is not so astringent as is our native persimmon, *Diospyros Virginiana*.

VANILLA.

The opinion prevails that the vanilla-plant can be successfully cultivated in Florida, and applications for plants and inquiries as to their growth and culture are frequently received.

The vanilla belongs to the family of orchids, and grows wild in Mexico, Peru, Brazil, and other parts of South America. It is also found in Trinidad, Jamaica, and other West India Islands, and it is exceedingly doubtful if the climate of any portion of Florida would prove suitable for its profitable cultivation.

The vanilla is a climbing plant, and is propagated by cuttings inserted near the stems of trees upon which it climbs, adhering to the bark by its fleshy roots.

The best marketable pods are supposed to be produced by the species *Vanilla planifolia*, and the principal supply comes from Vera Cruz.

Assertions have been made that the vanilla-plant grows wild in Florida. In answer to requests for specimens, leaves of *Liatris odoratissima* have been received. This plant has aromatic foliage, and is sometimes used for flavoring cigars and tobacco, and is locally known as wild vanilla, but it has no relation whatever to the vanilla-plant that produces the fragrant pods of that name.

PARAGUAY TEA.

The Paraguay tea-plant, or maté-tree of South America, will not, probably, flourish in any part of this country. It is a species of ilex, or holly, and the prepared leaves form an article of considerable commerce in South America, but has not yet been introduced as an article of diet in any other country. Its consumption is said to be steadily increasing, and it is probable that it may yet become an article of importation here as well as in Europe, if its reputed good qualities are truly reported. The leaves contain theine, the bitter principle of tea and coffee, but in less quantity than is found in either of these well-known beverages, although some analyses have placed it equal to coffee in its stimulating properties.

There are two methods of preparing it for use. For domestic consumption, it is simply dried in the sun, the leaves are then broken up in small fragments and kept dry until used. In this condition it resembles the Chinese tea, and is similarly prepared as an article of food.

For commercial distribution it is mostly reduced to a powdery state; the leaves being dried or scorched by artificial heat until they become sufficiently brittle to be pounded into powder. Maté is prepared by adding boiling water to a small quantity of the powder.

It is asserted that Paraguay tea can be placed in market at rates much below those of coffee, and that it is equal to the latter as a nourishing beverage.

CHINESE TEA-PLANT.

Efforts to popularize the tea-plant are still continued. About 20,000 plants have been distributed during the year. Arrangements had been made for a larger distribution of this plant in the Southern and Southwestern States, but owing to the great reduction made in the appropriation for this division, they had to be abandoned, and the propagation limited to a few thousand only.

The expectation that tea may become a staple article of our productive industries is not diminished. Improved processes of preparation will undoubtedly supersede the expensive hand manipulations that have hitherto prevented successful competition with cheap manual labor, and as the plant becomes more widely known through these yearly distributions, and its hardiness and adaptability to a wide range of climates becomes definitely established, public interest will in time be directed to its cultivation as an article of commercial value.

HEDGE-PLANTS.

The jujube-tree, *Zizyphus vulgaris*, will form a good protective hedge south of the thirty-eighth degree of latitude. It is of rapid growth, thorny branches, and pinnate foliage of a bright, glossy, green color. As a lawn-tree it is exceedingly beautiful, particularly when covered with fruits, which are profusely produced. The cherry-like fruit is of a dull red color when ripe, and is used for economic purposes in some parts of the world, but it is not of much value as an article of food.

The Chinese tea-plant will make a good ornamental evergreen hedge where the climate is favorable to its growth. The periodical clippings required to keep it in proper trim could be saved, dried, and utilized. The experiment is worthy of trial, if for no other purpose than to ascertain whether or not this would prove to be a profitable method of gathering the young shoots and leaves for tea, as seems highly probable from the large surface of uniform growths which frequent clippings would produce.

The evergreen Euonymus, *Euonymus Japonicus*, also forms an admirable ornamental hedge. The plant is easily grown from cuttings' of dense growth naturally, but little care is requisite to keep it in good condition.

PHYLLOXERA VASTATRIX, (THE GRAPE-ROOT LOUSE.)

For several years past considerable attention has been given to the grape-root insect, and the injuries it inflicts upon vineyards, both in this country and in Europe. Its life-history appears to have been thoroughly studied; its curious and somewhat perplexing transformations have been elaborately explained by entomologists of both continents, and its destructive capacities duly chronicled.

Grape-growers possess their full share of that propensity in mankind which is manifested in the tendency to shift responsibilities; and all failures in grape-culture, with but little of hesitation, are freely and willingly attributed to this diminutive insect. Unless we ignore an almost overwhelming amount of clear and direct evidence, it cannot for a moment be doubted that the *Phylloxera* has worked great devastation and caused great losses; but when it is asserted that all failures in grape-culture in this country are traceable to its ravages, it then becomes apparent that the insect is falsely accused, and that the assertion conveys a flagrant error, for which there is no intelligent excuse.

It has been distinctly stated that the failure of the European grape in this country is owing to the ravages of the *Phylloxera*. With as much truth the statement may be made that the failure of the orange-tree on the slopes of the Adirondacks is due to the presence of this insect.

The true cause of the failure of the foreign grape in ordinary field-culture is now so fully understood, that it seems almost superfluous to state that it is solely due to atmospheric influences, as is clearly shown by its successful culture in glass structures in all parts of the country.

In the spring of 1863 a purposely-rude glass structure was erected in the garden of the Department for the purpose of illustrating the cause and effects of mildew on the grape-vine. The appearance of this structure will be best understood by supposing an inclosure made by placing a few glazed sashes against a common board fence. A collection of grapes, comprising both native and foreign varieties, were planted two feet from and parallel with the front of the house. In due time two stems were procured from each plant, one of them being introduced under the glass roof and the other trained to an upright trellis set four feet from the front, fully exposed to the atmosphere. This arrangement was maintained for seven years, during which time the branches under the glass cover remained in perfect health and annually produced crops of well-ripened fruit. On the other side, the branches on the exposed trellis, with the single exception of the Concord, were more or less injured by mildew each season. The Iona branch under cover produced branches so perfect, both in size and quality of fruit, as to suggest a recommendation for its culture under glass, as published on page 25 of the annual report of the Department for the year 1867. The branch of this vine on the exposed trellis never ripened a berry, and after struggling for a few years against mildew, the loss of foliage during summer, and the destruction of unripened wood during winter, it ultimately succumbed.

The foreign varieties, Black Hamburgh, Black Prince, and White Frontignac, shared the same fate, only more rapidly. Among natives, the Rebecca, Maxatawny, and Delaware, on the trellis, occasionally ripened a few branches, accordingly as mildew more or less prevailed, while the protected branches never failed to ripen perfect fruit. Occasionally the position of some of the branches were reversed, the inside branch withdrawn and fastened to the outer trellis, and its place in the house given to the branch it displaced on the trellis, and the result was in all instances alike. These are not isolated experiments. Horticultural literature is replete with corroborative evidence of a similar nature, and if the history of every vineyard in America could be minutely recorded, it would be found that success followed immunity from mildew, (or leaf-blights, as some prefer to term it,) or fungoid diseases in other forms, and that failures as surely followed their presence; and the statement is not presumed to be made that this intermittent action was due to the erratic movements of *Phylloxera*.

Neither will the claim be seriously entertained that this insect exercises an influence in promoting the health of vines when their foliage is protected, either by a glazed or a boarded covering; that the resulting loss of foliage, disease, and weakness, when the covering is removed, is caused by their active presence, and that they again abandon the plant, and permit it to assume health and vigor when the protective cover is replaced; if so, then the much-sought-for and highly-valued remedy for the *Phylloxera* is readily obtained.

The fact that the *Phylloxera* is found on the roots of sickly or dying grape-vines is not to be taken as conclusive evidence that the destruction of the plant is solely the work of the insect, since the presence of insects upon diseased organisms is of common occurrence both in animal and vegetable life.

It is a significant fact that, if we compare the list of varieties said to be least affected by the *Phylloxera* with the list of varieties least subject to mildew, we will find them to be identical.

The sum of the whole matter, then, appears to be this: that when a grape-vine becomes weakened from successive yearly attacks of mildew, destroying the foliage, so that the wood or shoots fail to thoroughly mature their growth, its vitality is so impaired that what little of life remains is easily vanquished by the *Phylloxera*.

It has been recommended to graft the Iona, Delaware, Catawba, and other varieties infested with the root-louse on roots of the Clinton, Oporto, Concord, and other kinds that resist its attacks, as a means of securing immunity from its ravages. It may safely be predicted that the results expected will not be realized. The same causes that rendered the Iona unprofitable on its own roots will render it unprofitable when grafted on the roots of the Clinton; and it would not be at all surprising if the then weakened roots of the usually robust Clinton be found badly infested with the *Phylloxera*.

If this method of grafting had proved successful, our vineyards would be planted with the most esteemed grapes of the world; but the experiment has often been made, and as often failed.

If we look into the history of Europen grape-culture during the past thirty years, we learn that previous to the year 1846 the crops were satisfactory and the wine-producing interest prosperous. In that year the grape-mildew made its appearance near Paris, and soon spread over vineyards in neighboring districts, from whence it traveled with great rapidity over the south of France, Italy, and Hungary. In 1851, it had crossed the Mediterranean, invading Algeria, Syria, and Asia Minor, destroying the wine-commerce, and bringing ruin to the owners of vineyards. In 1852, it appeared in Madeira, and worked such devastation, that in 1856, only 200 pipes of wine were produced as against 14,000 pipes produced in 1850 in that island.

The losses incurred and the destruction occasioned to vineyards by this malady were beyond calculation; thousands of acres were abandoned, and in those not utterly destroyed the vines were weakened by the disease and produced only inferior crops. About the year 1863, it was discovered that the roots of diseased vines were covered with excrescences, and continued observations proved that this malady was increasing with fatal rapidity.

In 1868 a memoir was presented to the French Academy, detailing a new disease, which, the writer thought, was "likely to prove more disastrous than the mildew. This new enemy was an insect, a minute *aphide*, which formed yellow parasitic patches on the roots of the grapevine." This "new enemy" has since received the name of ***Phylloxera vastatrix***.

The warty, knotty processes, now so familiarly known as indicating the presence of *Phylloxera*, are not by any means a modern production. They have long been observed on the roots of grapes; but it is only when the plants are otherwise diseased and their normal vitality impaired that the insects prevail to a fatal extent.

Various kinds of *Aphides* have existed on the roots of plants from time immemorial.

If, as maintained by most entomologists, the leaf-gall-producing insect and the root-louse are identical, it further confirms the accuracy of the foregoing observations and deductions. Among all the varieties of grapes, native or foreign, that have come under observation, I do not recall to mind any one kind that has been so frequently or so severely attacked by the leaf-gall insect as the Clinton. But this variety is so healthy, so exempt from fungoid diseases, that all attempts of the insect to fatally injure its roots are abortive; a result that may be expected of all other varieties so long as they retain a similarly healthy condition.

For the past two years or more my time has been largely devoted to duties devolving upon me as representative of the Department on the board on behalf of United States Executive Departments at the International Exhibition, 1876. These duties have been somewhat arduous, but I have not permitted them to interfere, except when altogether unavoidable, with my daily duties in the Department.

WILLIAM SAUNDERS,
Superintendent of Gardens and Grounds.

Hon. FREDERICK WATTS,
Commissioner.

REPORT OF THE BOTANIST.

SIR: I have the pleasure of presenting the following report of the work of this division during the past year:

A large amount of time and labor has been given to the preparation of the collection of sections and specimens of forest-trees of the United States. This collection constituted a conspicuous feature of the display of this Department in the Government building during the recent Centennial Exposition, and was appreciated and commended by the most intelligent citizens of our country, and was an object of careful study by many of the representatives of foreign countries. It has often been stated that the Government building was one of the most instructive and interesting features of the exhibition, and it is also conceded that this Department contributed its due proportion to that display. A number of scientific men, who had part in the representation of different countries at Philadelphia, made requests to be furnished with duplicate specimens of our forest-woods, and also botanical specimens of our native plants, for the scientific societies of their respective countries. In accordance with these requests, there was prepared and delivered before the close of the Exposition boxes of specimens from the duplicates belonging to this Department for the following countries, viz: for Brazil 2 boxes, for the Argentine Republic 1 box, for Russia 1 box, and for New South Wales 1 box.

More recently a box of specimens has been forwarded through the Smithsonian Institution to the Royal Herbarium at Kew, England, Eight sets of plant duplicates are now being prepared as rapidly as possible for further distribution, a part to colleges in this country, and a part for foreign institutions. The duplicate wood sections are also being prepared for distribution.

Of the very large contributions which were made to the United States by foreign governments represented at Philadelphia, a considerable portion comes to this Department, and will serve not only to greatly enrich our Museum and Herbarium, but there are quantities of some of these objects in duplicates, which, it is understood, are to be divided and prepared for distribution to various museums and institutions of learning in this country. This will involve a large amount of work for this division, but the benefits to be conferred upon the cause of education through this means will be well worthy of the labor and expense.

As a result of the centennial collection of forest-trees, much information has been gained respecting species hitherto imperfectly known, and several species have been obtained which were before unknown to our flora, the particulars of which are given in the Catalogue of the Forest-Trees of the United States, which was published by this Department to accompany and illustrate the collection.

The Herbarium has also been greatly enriched by collections of plants made in connection with the procuring of the forest-tree specimens, and also by the purchase of a large number of rare and new species of the Sierra Nevada Mountain region.

Respectfully,

GEO. VASEY, *Botanist.*

Hon. FREDERICK WATTS, *Commissioner.*

MICROSCOPIC INVESTIGATION.

BY THOMAS TAYLOR, MICROSCOPIST.

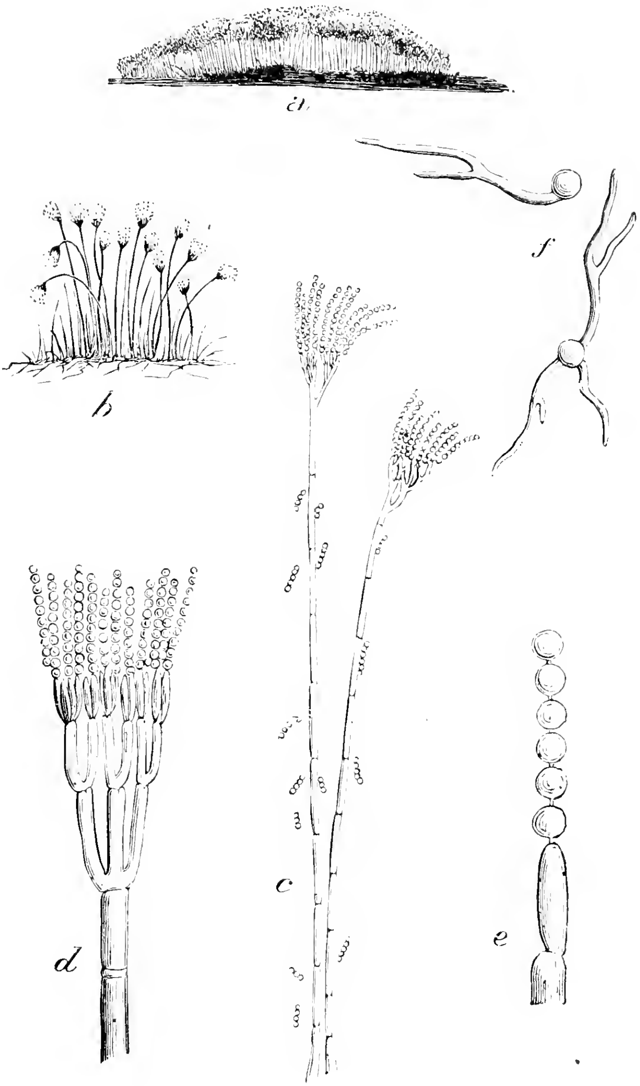
During the past year a large portion of my time was devoted to the preparation of a series of water-color drawings for the Centennial Exhibition, having in view, to a limited extent, the illustration of objects connected with the usual work of the Microscopic Division, a large proportion of which represents the leading types of the genera of microscopic fungi. Another section of the exhibit presents the results of original investigations upon chemical tests for flax, cotton, ramie, silk, wool, hair, and both animal and vegetable cellulose; and still another series illustrating the principal vegetable starches, to the number of about one hundred varieties. These drawings present highly magnified views of these microscopic objects, including those most important in economic mycology, especially the fungi commonly known as molds, so destructive to vegetation. The edible and poisonous mushrooms are distinguished in one class of these drawings.

MUSHROOMS.

The importance of the mushroom as an article of diet has never been properly understood in the United States, nor is it generally known how abundant our supply of edible mushrooms is. Many of those popularly supposed to be poisonous are not merely innoxious, but highly nutritious, containing as they do many of the elements of animal food.

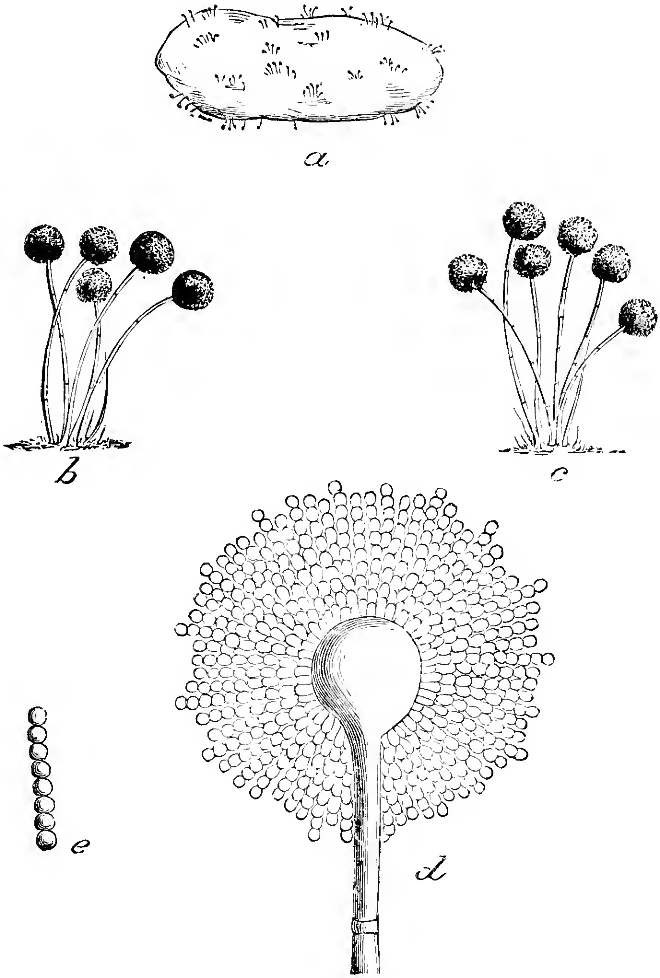
In France, Germany, and Italy the mushroom forms so important a part of the food of the people that one distinguished writer has spoken

HYPHOMYCETES MUCEDINES.



PENICILLIUM crustaceum, Lk.

HYPHOMYCETES MUCEDINES.



ASPERGILLUS glaucus, L.

a.—Nat. size. *b* and *c.*—Threads magnified.
d.—Capitulum in section x 500. *e.*—Spores x 500.

Aspergillus Micheli.—A genus of Mucedines (Hyphomycetous fungi) forming common molds, such as the blue of cheese. I have found frequently on moldy cheese in combination with *Aspergillus*, *Penicillium glaucum*. *Aspergillus* has been found to produce a secondary form of fruit, being that forming the subject of the genus *Eurotium*.

of it as the "manna of the poor." In Transylvania the oyster-mushroom is so abundant, and is so largely used, that tons of it may often be seen in the markets; and in some parts of Germany the Morel-mushroom is so popular, that the people, finding it to grow best on a soil treated with wood-ashes, were accustomed to burn down portions of the forests in order to secure favorable spots for its cultivation; a practice which the government ultimately found it necessary to interdict.

It is hoped that the collection of drawings, which has been made with so much care, will serve to call public attention to the value of the mushroom as an article of food, and at the same time furnish means of discriminating between the poisonous and edible varieties of the plant.

Particular pains have been taken to represent the last-named class of plants as fully as possible, a number of collectors having been employed for the purpose in various parts of the United States. Among these may be mentioned Professor Peck, of New York, who, in that State alone, gathered no less than eighty species of mushrooms, including several which are new to science. The specimens furnished by Professor Peck are admirably copied, and colored to nature. There are also several excellent photographs made from specimens furnished by various collectors, representing different genera and species of the same class of plants.

Another series of drawings illustrates the action of pear-tree blight, showing the effects of the chemical changes which take place in the interior structure of the tree under the attacks of the fungus to which this disease is due. The disease of plum and cherry trees, known as "black-knot," is illustrated in a similar manner, some of the drawings exhibiting it as it appears to the naked eye, while others show in detail its distorted, woody structure. The fungus which produces it is also shown at various stages of its growth.

The fungus *Peronospora infestans*, which causes potato-rot, is illustrated in the various stages of its growth. There is also a series of drawings of its "resting-spores," recently discovered by Prof. Worthington Smith, and so named from the fact that they remain for months in a stationary condition, or, in other words, *rest* for that time without germinating.

There is an interesting series of drawings, representing, as seen through the microscope, the mold of bread, cheese, jellies, &c., and illustrating their habits of growth, a knowledge of which may often be useful in preventing beer or milk from souring and wine or bread from becoming "ropy."

One of the most curious of the cryptogamic plants is the *Protococcus nivalis*, which, we believe, was first found by Captain Parry, during his northern exploration, and to which was given the name of "red snow," from the fact that it gives its own red color to the surface of the snow on which it grows. This singular little plant is represented by several drawings of exquisite finish and color.

The fibers of hemp, flax, jute, ramie, esparto-grass, and Australian flax, as well as wool, silk, calf's-hair, and the hair of the Cashmere and Angora goats, are exhibited as seen through the microscope, both in their natural condition and under various forms of chemical action. In the course of my investigations on this subject, I found a number of new chemical tests by which the presence or absence of certain of these fibers in every fabric may be determined. This series of drawings will, therefore, be of considerable interest to manufacturers of textile fabrics, to dealers in that class of goods, and to the Government, which, besides being an extensive purchaser of clothing for the Army and Navy, is largely interested in determining correctly the materials composing the fabrics which pass through the custom-house.

There are a number of drawings illustrating the methods employed by me in detecting the presence of animal and vegetable starch and cellulose in various parts of the animal economy. The investigations to which these drawings relate are still in progress, but the great majority of the drawings relate to the leading families, orders, and genera of cryptogamic plants or fungi, of which by far the greater number are microscopic in size. The latter are often visible to the naked eye when massed together in large numbers, presenting, in some cases, the appearance of a pigment on the surface of the plants upon which they fasten. In such cases the microscope sometimes reveals millions of spores to the square inch. The ravages of these minute vegetable organisms are incredible in their extent. The potato has at times been threatened almost with extinction. Grasses have been affected by them, and the cereals throughout large districts have at times suffered blights so serious and so often repeated, that the farmer has been almost ready to abandon their cultivation in despair. Fields of hops, vineyards, and orchards have withered under their blighting touch, and in lower latitudes they have assailed coffee-plantations and groves of orange, lemon, and olive trees with equally fatal results. Even the hardy forest-trees have not in all cases escaped their devastating influence, and at the present moment many of the stately maples in the public grounds of our cities are withering under the insidious attacks of these minute destroyers. In short, there is hardly any department of agriculture, horticulture, or forestry that can claim exemption from their ravages; and the importance of a correct knowledge of their characteristics, modes of propagation, and development, and the conditions under which they tend to flourish or decay, can hardly be overestimated. As a contribution toward the dissemination of such knowledge, the collection just described possesses a high practical value.

No large collection of well-executed drawings of cryptogamic plants has heretofore existed in this country; but by the assistance of Dr. M. C. Cooke, of London, and others, I have been able to supply the defect, and have formed a collection which will be of permanent value to mycological science in America. The drawings, nearly all of which were made from nature for the special purpose to which they are now destined, exhibit a high degree of delicacy and finish.

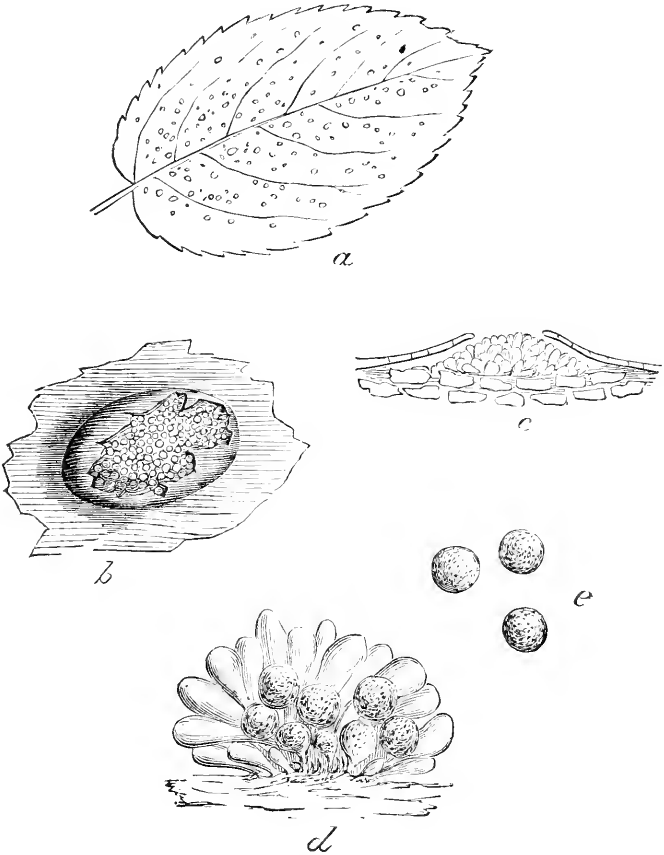
Mushrooms in their composition more nearly resemble flesh than any other vegetable. Dr. Marcet proved that, like animals, they absorb a large quantity of oxygen, and give out in return carbonic acid, hydrogen, or azotic gas. Chemical analysis demonstrates the presence in their structure of the several components of which animal matter is formed, many containing sugar, gum, resin, fungic acid, various salts, albumen, adipocere, and ozmazone, which last "is that principle which gives flavor to meat-gravy," according to Dr. Badham.

Fungi are applicable to other than culinary uses, though their most important use is the gastronomic one. To obviate the difficulty arising from the prejudice against the wholesomeness of any mushroom, Mr. Berkeley recommends a good quantity of bread to be eaten with them. He is of opinion that mushrooms are only indigestible when eaten alone or in imprudent quantity. Of course this remark applies equally to any sort of mushroom, though it is made with reference to the one in familiar use.

As an indirect but very important article of diet, the tiny fungus known as "yeast" stands pre-eminent. It is composed of globular cells,

PLATE IV.

CONIOMYCETES—CŒOMACI.

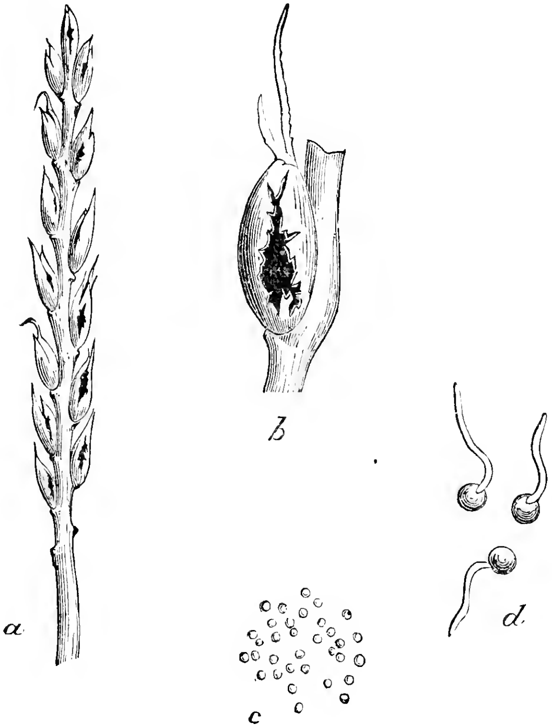


LECYTHEA Rosæ, Lev.

a.—Nat. size. *b*.—Cysts enlarged. *c*.—Section of same. *d*.—Spores and cysts x 500. *e*.—Free spores x 500.

On living Rose Leaves.

CONIOMYCETES—USTILAGINEI.



USTILAGO Segetum.

a.—Nat. size. *b.*—Infected grain enlarged. *c.*—Spores x 500.
d.—Spores germinating further magnified.

On Cereals and Grasses.

which produce other cells with incredible speed, and the interchange of fluids on either side of the membrane is the cause of the fermentation. German yeast is formed of the dried globules.

The *Polyporus betulinus* makes very superior razor-strops, its substance containing minute crystals; the *Polyporus squamosus* is also good for this purpose, if cut from the tree in autumn, then flattened in a press, rubbed carefully with pumice, cut into slices, and each slice fastened to a wooden stretcher. The *Polyporus fomentarius* forms the amadou of commerce, formerly used only as "German tinder," but now applied—by, at any rate, one medical practitioner—in sheets to protect the backs of bed-ridden patients. Gleditsch relates that the poorer inhabitants of Franconia stitch it together and make garments of it. *Polyporus ignarius* is used as snuff in the north of Asia. *Polyporus officinalis* was formerly used as medicine, but is so employed no longer. *Polyporus sulphureus* furnishes a useful dye. *Coprinus atramentarius* may be made into ink. *Amanita muscarius* furnishes poison for vermin, and is an ingredient in some intoxicating liquors. Wood impregnated with the metallic green spawn of the *Peziza* is of great value in the delicate inlaid work known as Tunbridge ware. A small fungus belonging to the *Ascomycetes* class, and known as ergot of rye, furnishes a powerful and useful medicine, though in the hands of the ignorant it is an extremely dangerous poison. Mr. Berkeley suggests that decayed fungus would form good manure. Such being the case, it would be well worth the trouble to let the laborers' children collect them and throw them into a heap, like dead leaves, for leaf-mold; thus even the poisonous species might be utilized.

HOW TO GROW MUSHROOMS.—Having received many communications asking for information in relation to mushroom culture, we append the following descriptive answer from the pen of Mr. William Saunders, Superintendent of the Propagating Gardens of this Department, who has given much practical consideration to the subject. Many persons suppose that there is a great difficulty in cultivating edible mushrooms, and they believe that there is a mysterious secret connected with their propagation known only to a few:

The poisonous properties of many species of fungi, and the difficulty of distinguishing the good from the bad, militate against them, and render it necessary to be cautious in making them an article of food. Nevertheless, mushrooms are very generally esteemed when properly cooked, and are nutritious when used in moderation. Chemically they have more resemblance to flesh than any other vegetable. In some parts of Russia it is said that the peasantry depend on mushrooms and bread for the greater part of their sustenance. They employ about fifty kinds of fungi as food. In Rome there is an inspector of mushrooms, who attends the market as a guarantee for public safety; and, strange to say, our common edible mushroom (*Agaricus campestris*) is interdicted. Specimens of it brought to the fungus market are sent under escort and thrown into the Tiber.

It appears from the remarks of mycologists that the majority of mushrooms are harmless; the poisonous varieties being the exception, the innoxious and esculent the rule. But the difficulty lies in the selection, as we have no definite guide to point out what sorts are, or what are not, poisonous. Even some of the wholesome kinds acquire noxious properties when grown under peculiar circumstances. Soaking in vinegar destroys many of the poisonous qualities, if present. Cooking also removes the deleterious properties from many that would be unsafe to be eaten in a raw state. Various tests have been recommended. The presence of a free acid has been considered a sign of harmlessness. This is found not to be conclusive, as many, good and bad, will redden litmus paper. Cooking them with a silver spoon, under the impression that, if bad, the spoon will change its color, is also an erroneous idea. Selecting by color has also its disadvantages. Many of the most noxious species are of a snowy whiteness, while others of a less tempting color are perfectly harmless; so that great care and experience are requisite to discriminate those that can be eaten with safety.

The *Agaricus campestris*, or common mushroom, is the only species that is generally grown artificially. It is thus botanically described: Stipes (or stalk) two or three inches in length, white, solid, fleshy, furnished with an annular veil, (a thin membraneous substance encircling the stalk.) Pileus (cap, or edible part) fleshy, dry, convex, convexo-plane, white, changing from yellowish to brownish. Gills (thin parallel plates underside of the cap) free, ventricose (swelling unequally on one side) pink, changing to deep purplish brown. Flesh (internal substance) white.

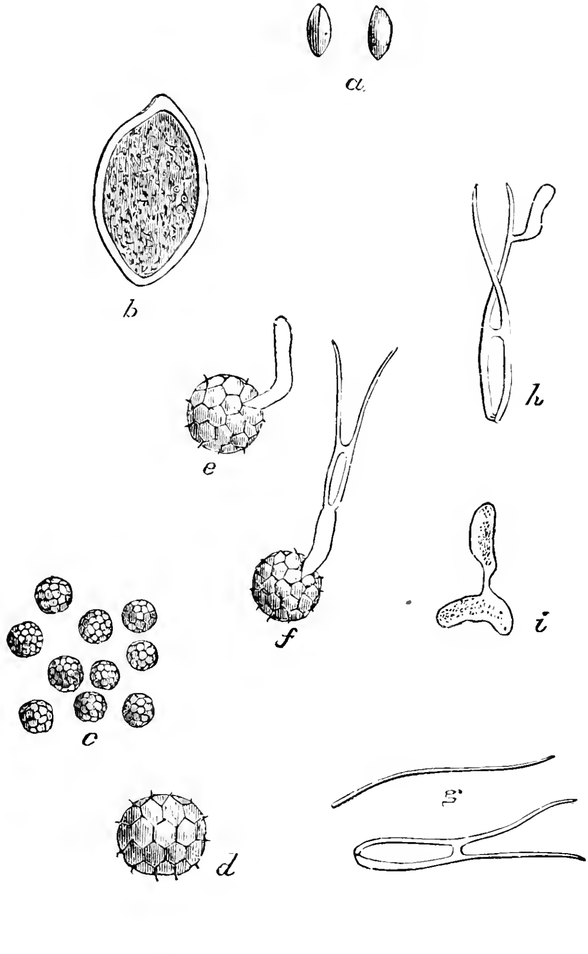
There are several species of the *Agaricus* besides the preceding, and also a few varieties of the *A. campestris*, that are sometimes grown for the table. It is unnecessary to describe them here, as those who purchase spawn need be under little apprehension of receiving a spurious article; at least so far as my experience goes. I have never been disappointed in this respect. So far from there being any difficulty in growing them, I venture to say that not one in fifty who make the attempt will fail. Of course some little attention is requisite, as with everything else artificially circumstanced. A knowledge of the condition under which they are most plentifully found in nature will be of material assistance to the grower. In very dry seasons, mushrooms are most plentiful in low situations, on rather strong soils; on the contrary, should there be much wet, they are more abundant in uplands and drier localities. A continuance of warm, dry weather, followed by slight showers, and a hazy, still atmosphere, brings them most profusely. These considerations are worthy of being kept in mind in their artificial culture. There is no particular season for making a mushroom-bed. In winter it requires to be under cover, and in summer the difficulty lies in keeping it cool and moist. Autumn is perhaps the best season for making a bed out of doors; and, if a constant supply be an object, a bed should be made up in some spare cellar about the beginning of November.

Before entering into the details of management, it may be useful to make a few remarks upon the propagation of spawn. Summer is the best time for performing this operation. Procure some horse-manure; if there is a sprinkling of short litter with it, so much the better; cow-dung and light loamy soil, or road scrapings, in about equal proportions; it is not particularly necessary that they should be in exact quantities. I mention this in passing, as an idea sometimes gets abroad that, unless everything is mathematically adjusted by number or weight, it would be folly to expect a satisfactory result. Wash these ingredients together with water into a thick mortar, and spread it out three inches in thickness in an open shed to dry. As soon as firm enough, cut it with a spade in squares of seven or eight inches, set them on edge, and turn them occasionally to facilitate their drying. When they will admit of being handled with safety, cut with a knife two or three holes, about two inches in diameter, little more than half through the brick, and fill each hole with good spawn, plastering it over with a portion of what was cut out. They should now be left until quite dry. Have ready a quantity of fermenting manure which has been well sweetened by frequent turnings. Spread a layer of this six or eight inches in thickness, and build the bricks on it with the spawned side uppermost, drawing the pile up to a point; then cover the whole with warm manure. A genial warmth of about sixty degrees will be sufficient to cause the spawn to run through the whole of the bricks. When this takes place the process is ended. The brick can be laid aside in a dry place, and the spawn in them will keep good for years.

Mushroom-beds out doors may be made of any material capable of producing a mild heat by fermentation. Stable-manure is best, taking long and short as it comes to hand, and tossing it into a heap to ferment. When it becomes sufficiently heated, turn it over, bringing the rougher portions into the center. This should be repeated until it is well mixed and equally rotted. The object is to bring the whole into an equal state of fermentation without rottenness, to drive off excessive moisture, and subdue the burning heat with the least possible loss of the essential gases. If a third part of old hot-bed manure is mixed with it, it will moderate the heat and give the bed a consistency that it would not otherwise possess. Having it in readiness, choose a spot for making the bed; if under the shade of a tree, so much the better. Mark out the ground four or five feet wide, and of a length to correspond with the quantity of manure. Commence by throwing in a layer of the least decayed portions of the dung; then build the whole up in a rounded ridge three feet high. It must be equally and firmly beat down, that it may produce a mild, equable heat. Pushing in a few stakes at intervals all round and drawing these out occasionally, and at the same time feeling them with the hand, will afford a tolerable estimate of the interior warmth. The heat should never exceed ninety degrees after the bed is put up. If likely to get warmer than this, make holes all over it with a stout stake, and when the heat subsides to between seventy and eighty degrees, it is ready for planting the spawn. Beat the bed evenly all round, and insert the spawn just below the surface, in pieces the size of a hen's egg, twelve inches apart; then cover it over with a layer of strong, loamy soil two inches in thickness, beating it firmly and leaving it quite smooth. To prevent accident from overheating, it should be only partly soiled at first—say, half-way up—covering the whole some days afterward. To prevent the soil from cracking in dry weather, a thin covering of short straw or hay may be thrown over it; very little watering will be necessary. When it is found requisite to moisten the surface, let water pass through a fine rose on the outside of the covering, which is preferable to applying it directly on the

PLATE VI.

CONIOMYCETES—USTILAGINEI.

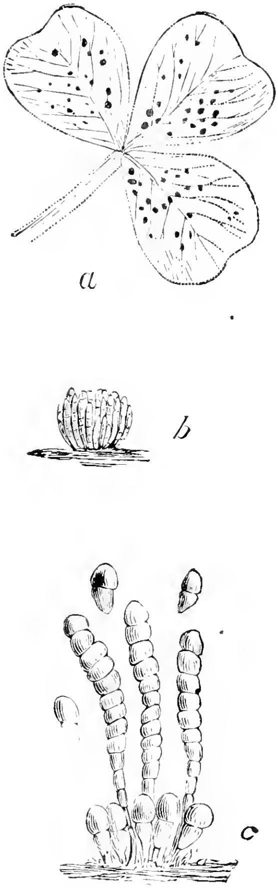


TILLETIA caries, Tul.

a.—Infected grain, nat. size. *b.*—Section of grain enlarged. *c.*—Spores x 500. *d.*—Spore x 1000. *e.*—Germinating Spore. *f.*—Secondary Conjugating Spores. *g.*—Secondary Spores. *h.*—Secondary producing Tertiary Spores. *i.*—Tertiary Spores again germinating.

In kernels of Wheat.

HYPHOMYCETES—DEMATIEI.



POLYTHRINCIUM Trifolii, Kze.

a.—Nat. size. *b.*—Tuft enlarged. *c.*—Threads and Spores x 500.
On living Clover.

bed. Should the bed be made up about the middle of August, mushrooms may be expected toward the end of September, from six weeks to two months after spawning. When the nights become cold, the covering should be increased, and to guard against damp, choose a clear day, occasionally turn off the covering, remove all decaying matter, and when all is dry, cover as before. It will keep in bearing for two months or more, if the interior heat is preserved by additional covering.

Various schemes may be resorted to for obtaining mushrooms in winter. Those who have a greenhouse may make a bed in the furnace-room, if they desire to do so, taking advantage of the heat that escapes from the furnace. A good supply may be had from a bed formed underneath the plant-stage, provided the drippings of water from the pots above be guarded against by boards or water-proof cloth. Portable boxes, three or four feet long, two feet wide, and one in depth, filled with horse-manure, and spawned in autumn, being set in a dry place, will, when soiled over in rotation, and placed in the warm end of a greenhouse, afford a moderate supply. Even good sized flower-pots may be thus prepared, and a few introduced at intervals. The equal temperature of an underground cellar or root-room is very suitable for the growth of this esculent. In such a place mushrooms may be had the whole year from successional beds without much trouble or expense. The best crop I ever saw was in beds on each side of a close shed, with a row of fermenting manure between them. The frequent turning over of the manure filled the place with an agreeable moisture, and obviated the necessity of watering. The ammonia disengaged by this process was also decidedly beneficial. Shelves four feet long and one in width, rising one above another, will be found economical where space is limited. Where an ample and constant supply is desired, it is better to erect a structure on purpose. This need not be a costly affair. A house thirty feet long, ten wide, and ten high to the ridge, built with timber, would not be expensive. Allowing three and a half feet on each side for beds, there would be three feet in the center for a path, underneath which a flue or hot-water pipes should be placed. By having a bed on the surface, there would be space for two tiers of shelves on each side, affording, in all, upward of six hundred square feet of surface for growing the crop. This would be sufficient for a constant supply the whole year Means should be provided in the roof for light and ventilation. Four windows, three feet square each, would be sufficient for this purpose.

The principal material for forming beds in winter or at any season, on shelves, should consist of horse-manure, with a little short litter intermixed. As this is collected, spread it out thinly to dry, turning it over frequently to prevent violent heating. The object is to get it into a dry state without decomposition. When it is in this latter condition, commence making the bed, by throwing in the manure to the depth of three or four inches, and beat it firm with the back of a spade, or, what is more expeditious, with a flat, heavy board, having two handles to work it with. Proceed in this manner until there is a depth of ten inches or so, firmly beaten ; then insert the spawn just below the surface as before. Insert the bulb of a thermometer into the bed, and should the heat rise above eighty degrees, bore holes eight or nine inches apart all over it. When the temperature is about seventy-five degrees, cover the surface with two inches of strong turfy loam, well beaten, leaving the surface smooth and level. The atmospheric temperature may range from fifty to sixty degrees, with proportionate humidity. A sprinkling of short hay laid over the bed will keep it moist Where it is found necessary to moisten the surface, apply the water on the hay, which is preferable to watering directly on the surface of the soil. Pass it through a syringe or fine-rosed watering-pot, observing to use the water a few degrees warmer than the temperature of the house. It is better to give it frequently than too much at a time. If duly attended to, mushrooms will be gathered in six or seven weeks, and keep in bearing for two or three months. An occasional watering with weak, clear manure-water will prolong their duration. In gathering the crop, the mushrooms should be *twisted* up as far as possible without disturbing the young ones around. When cut over, the remaining part of the stem is liable to hurt the others from its decomposition.

Edible fungi.—As it is highly important to be able to distinguish the edible from the poisonous fungi, I herewith submit a list of the former, as tested by one of the highest authorities on this subject, Dr. Curtis, of North Carolina:

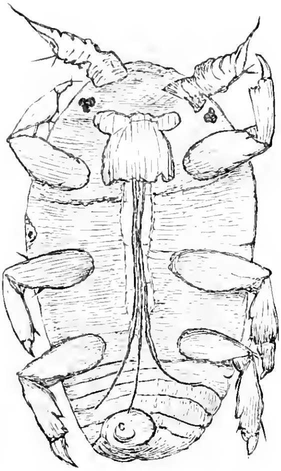
Agaricus, (*Amanita*.)—casareus, strobiliformis, rubescens.
Lepiota.—procerus, rachodes, excoriatus, mastoideus.
Armillaria.—melleus.
Tricholoma.—Russula, frumentaceus, hypopithyus, Columbetta, castus, albellus, consociatus, personatus.
Clitocybe.—nebularis, odorus, giganteus, cespitosus.
Collybia.—radicatus, esculentus.
Pleurotus.—ulmarius, tessulatus, Pometi, glandulosus, ostreatus, salignus.
Volvaria.—bombycinus, speciosus.
Clitopilus.—Prunulus.
Pholiota.—squarrosus, mutabilis.

Psalliota.—campestris, arvensis, amygdalinus, cretaceus, sylvaticus.
Coprinus.—comatus, atramentarius.
Cortinarius.—infractus, violaceus.
Cortinarius.—pholideus, cinnamomeus, castaneus.
Hygrophorus.—chrysodon, eburneus, pratensis.
Lactarius.—torminosus, insulsus, piperatus, deliciosus, volemus, subdulcis.
Russula.—adusta, lepida, virescens.
Russula.—ochroleuca alutacea.
Cantharellus.—cibarius.
Marasmius.—oreades, scorodonius.
Boletus.—luteus, elegans, flavidus, collinitus, granulatus, bovinus, subtomentosus, edulis, versipellis, scaber, castaneus.
Polyporus, (1. *Mesopus.*)—leucomelas, ovinus, poripes.
Merisma.—frondosus, cristatus, confluens, giganteus, sulphureus, berkeleii.
Fistulina.—hepatica.
Hydnum, (1. *Mesopus.*)—imbricatum, subsquamosum, laevigatum, repandum, rufescens.
Merisma.—coralloides, caput-Medusæ.
Sparissis.—crispa, laminosa.
Clavaria, (*Ramaria.*)—flava, botrytis, fastigiata, muscoides, tetragona, cristata, rugosa, uliginea, macropus, subtilis, pyxidata, aurea, formosa.
Tremella.—foliacea, mesenterica.

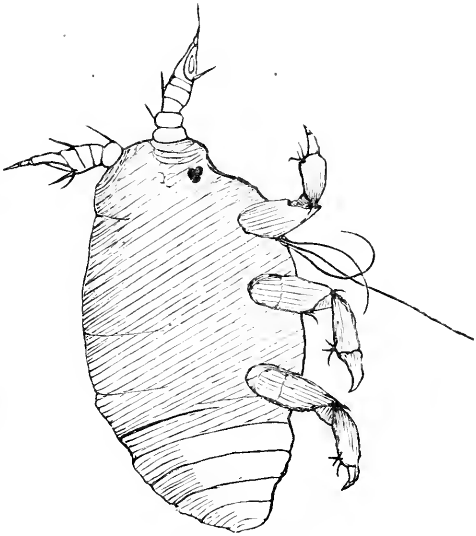
Dr. Curtis says that hill and plain, mountain and valley, woods, fields, and pastures, swarm with a profusion of good nutritious fungi, which are allowed to decay where they spring up, because people do not know how, or are afraid, to use them. "By those of us who know their use, their value was appreciated, as never before, during the late war, when other food, especially meat, was scarce and dear. Then such persons as I have heard express a preference for mushrooms over meat had generally no need to lack grateful food, as it was easily had for the gathering, and within easy distance of their homes, if living in the country. Such was not always the case, however. I remember once, during the gloomy period when there had been a protracted drought, and fleshy fungi were to be found only in damp shaded woods, and but few even there, I was unable to find enough of any one species for a meal, so, gathering of every kind, I brought home thirteen different kinds, had them all cooked togther in one grand *pot pourri*, and made an excellent supper."

"One important use to which several species of fungi can be applied is the manufacture of catsup. For this purpose, not only is the mushroom, *Agaricus campestris*, and the horse-mushroom, *Agaricus arvensis*, available, but also *Agaricus rubescens* is declared to be excellent for the purpose, and a delicious, but pale, extract is to be obtained from *Marasmius orcades.* Other species, as *Coprinus comatus* and *Coprinus atramentarius*, are also available, together with *Fistulina hepatica* and *Morcehella esculenta.* In some districts, when mushrooms are scarce, it is stated that almost any species that will yield a dark juice is without scruple mixed with the common mushroom, and, it should seem, without any bad consequence, except the deterioration of the catsup. There is an extensive manufacture of catsup conducted at Lubbenham, near Market Harborough; but the great difficulty appears to be the prevention of decomposition. Messrs. Perkins receive tons of mushrooms from every part of the kingdom, and they find, even in the same species, an immense difference in the quality and quantity of the produce. The price of mushrooms varies greatly with the season, ranging between one penny and sixpence per pound. Messrs. Perkins are very careful in their selection; but little discrimination is used by country manufacturers on a small scale, who use such doubtful species as *Agaricus lacrymabundus* with *Agaricus spadiceus*, and a host of allied species, which they characterize as nonpareils and champignons. In the eastern counties *Agaricus arvensis* has the preference for catsup."

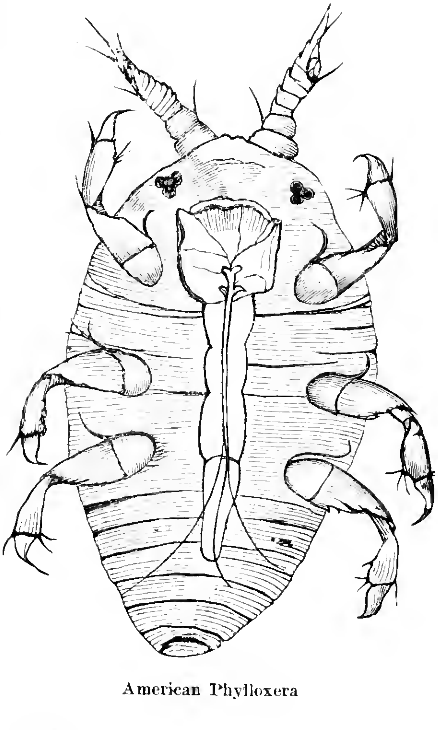
PLATE VIII.



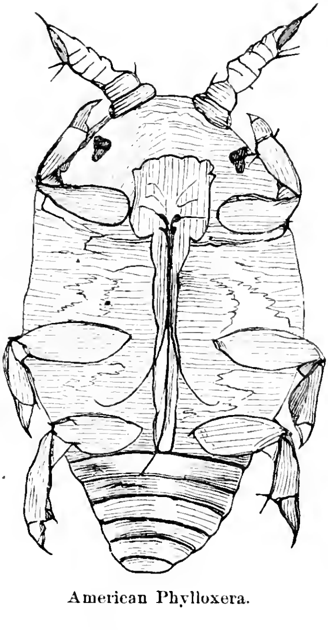
French Phylloxera, slightly distorted.



French Phylloxera, distorted in mounting.



American Phylloxera



American Phylloxera.

MICROSCOPIC CENTENNIAL COLLECTION OF FUNGI.

We propose to publish, from time to time, in the monthly and annual reports of the Department, copies of the water-colored drawings of the centennial collection of microscopic fungi, edible and poisonous mushrooms, textile fibers, &c., comprising the exhibit of the Microscopical Division of this Department. As this collection was made under the supervision of some of the most noted cryptogamists of Europe and America, and represent some of the most common types of fungi, it is believed it will prove of great interest to students of botany generally, and particularly to the instructors of botany in the schools and colleges of agriculture of the United States.

We make our first selection, blue mold, *Penicillium crustaceum*, from a class of common molds which are frequently found on moldy bread and other articles of food, and appear of various colors, blue, green, red, yellow, white, black, &c. Blue mold (*P. glaucum*) is supposed to have intimate relations to fermentation: *a* represents the appearance of this fungus to the naked eye on a piece of bread; *b*, tuft enlarged; *c*, threads enlarged, 420 diameters; *d*, apex $\times$ 620; *e*, chain of spores further magnified; *f*, spores germinating.

CONIOMYCETES USTILAGINEI.—*Ustilaginei* is the name given to a family of Coniomycetes fungi related to the *Uredinei*, generally distinguished by their growing in the interior of the organ (especially the ovaries and anthers) of flowering plants, causing deformity, absorption of the internal tissue, and its replacement by a pulverulent substance consisting of the spores of the fungi. In the earlier stage, the infected organ exhibits either a grumous mass, or an interwoven filamentous mycelium, from which acrogenous spores arise; finally, the mycelium disappears, and a dark-colored (often fetid) powder remains, composed entirely of the spores, which are simple.

Ustilago segetum, a genus of *Ustilaginei*, frequently found on cereals and grasses, forming the blight called *smut* of corn, commonly infesting wheat, oats, barley, and other grasses, filling the ears with a black powder of smooth spores about $\frac{1}{5000}$ of an inch in diameter, in corn sometimes about twice as large in the varieties attacking species of Bromus. The smut of maize, *U. maidis*, has minutely echinate spores $\frac{1}{2500}$ of an inch in diameter. Sedges are infested by *U. olivacea* with olive-colored spores. *U. antherarum*, growing in the anthers of *Caryophyllaceæ*, has violet-colored spores. Many other species are described by Tulasne.*

PHYLLOXERA.

The following letter, accompanied by specimens of the grape *phylloxera* was addressed to the Commissioner of Agriculture by Dr. C. Jaquème, of France:

MARSEILLES, *September* 26, 1876.

To the Commissioner of Agriculture:

SIR: I have the honor to send you, by post, some specimens of the *Phylloxera vastatrix* and some of the grape-roots which have been attacked by that insect; of the ravages of which, in France particularly, you are well aware. It is alleged, I believe unjustly, that we are indebted to your country for this destructive evil, the *Phylloxera* having been brought to this country in the first importation of American vines. By a comparison of our insects with yours, you can judge whether they are the same species. Please send me some specimens of your *Phylloxera*, and give me the particular habits of the insect.

The habits of ours are as follows:

1. During the summer, the wingless females remain about four months upon the roots.

* See Micrographic Dictionary.

2. In October, some of the females, after metamorphosis, taking flight from the ground, ascend to the stems of the vines, where they deposit their eggs.
3. The eggs, which are called winter-eggs, are hatched in the spring.

Yours, &c.,

C. JAQUÈME.

The specimens of *Phylloxera vastatrix* alluded to arrived safely, and I mounted the best of them in balsam. Having good specimens of the American *Phylloxera* on hand, I selected two of them and also two of the foreign species, and had them photographed. The French *Phylloxera* appears to be smaller than the American. The same objective was used for both specimens, and they seem to be identical. Photographs have been forwarded to Dr. C. Jaquème, Marseilles, France. Since the receipt of the specimens no opportunity has occurred to enable me to make any outdoor examination of the habits of the American *Phylloxera*; and, moreover, the grape-vines of this section of our country are seldom injured to any appreciable extent by this insect.

Fig. A represents a top view of the French *Phylloxera vastatrix*, and B a profile of the same; and C and D represent two views of the American *Phylloxera*.

EUCALYPTI.

The preservation of medicinal alkaloids from fermentation is a subject of much interest to the medical fraternity, hence the following inquiry addressed to the Commissioner of Agriculture by Dr. Wm. H. Ross, of this city:

1019 F STREET, N. W.,
Washington, D. C., December 11, 1876.

SIR: My attention having been lately called to the properties of infusions of leaves of *Eucalypti* to preserve medicinal alkaloids from fermentation, I would suggest that this be made a subject of examination by the Microscopist of your Department, with a view to ascertain their general bearings as an antifungoid and deodorizer.

Very respectfully,

WM. H. ROSS, M. D.,
Professor of Materia Medica and Therapeutics, University of Georgetown, D. C.

In consideration of the preceding request, I made a series of experiments with eucalyptol and other essential oils, as follows: Twelve glass jars, each holding one quart, were arranged side by side. In six of them I placed a quantity of the leaves of several species of the *Eucalyptus*, taking care that each jar should contain the leaves of a distinct species. The jars were then filled with pure water. Ground stoppers were used to exclude air and dust from the solution. Each jar was numbered, respectively, from one to six. No. 6 contained leaves of the *Eucalyptus globulus*. Seven other jars, numbering from seven to thirteen, were filled with solutions, and various plant-leaves, as follows: No. 7 contained a solution of sulphate of quinine in the proportion of about 3 per cent. of the alkaloid. In this solution I immersed a foreign grape-leaf. No. 8 contained a grape-leaf and pure water; No. 9, a grape-leaf and pure acetic acid; No. 10, equal parts water; No. 11, a large cinchona-leaf and a weak solution of the essential oil of the *Eucalyptus globulus*, made by immersing a few leaves of that plant in pure water, by which the water became impregnated with the oil. No. 13 contained water, a grape leaf, and about half an ounce of the flowers of sulphur. At the termination of ten days I found that nearly all the plant-leaves had fermented; the exceptions were those contained in numbers 6, 9, 10, 11, and 13. Although eucalyptol oil is very sparingly soluble in water, its weak solutions prove highly antiseptic and deodorizing; and when the amount of albuminoids held in solution is reasonably limited, they are preserved. Solutions of the alkaloids, and some of their medicinal preparations, may, therefore, be prevented from decaying by fermentation when alcohol cannot be used successfully with them.

The foregoing results induced me to extend my experiments to other well-known essential odorous oils, first, to ascertain their relative value as antiseptics and deodorizers; second, whether their oxidizing power is proportional to the strength of their odors; and, third, their immediate chemical action on the soluble alkaline sulphides of potassium and ammonium. For this purpose I arranged a series of test-tubes, about ten inches in length by one in diameter, each of which I filled to within half an inch of the top with water, adding a few drops of an essential odorous oil, combining the mixture as well as could be done by shaking it. All of the essential oils are sparingly soluble in water. In this series of experiments I used the oils of bergamot, spearmint, cloves, caraway, cinnamon, lavender, peppermint, lemon, winter-green, rosemary, origanum, and cajeput. The results demonstrate that several of them decompose the sulphide of potassium quickly, while others, although highly odorous, are slow deodorizers, and do not seem to decompose these sulphides under the conditions stated. Rosemary, pepperment, winter-green, and lavender are of this class.

If concentrated solutions of the oils of pennyroyal, tincture of myrrh, the oil of rose geranium, and oil of horse-mint are combined in separate test-tubes with sulphide of ammonium, it will be found that pennyroyal and myrrh produce a heavier precipitate than either of the other two oils, rose geranium and horse-mint.

The oil of cloves oxidizes quickly the potassium of the sulphide and precipitates sulphur when both solutions are combined in concentrated form, and it also decomposes this sulphide when it is highly diluted; but it exhibits no decomposing properties when combined with the sulphide of ammonium. Concentrated sulphide of potassium and ammonium exhibit but very slight action on cajeput. Origanum decomposes concentrated sulphide of potassium, while it exhibits no reaction on the sulphide of ammonium. Turpentine and eucalyptol oil have a similar action on the concentrated solutions of potassium and ammonium sulphides; but the eucalyptol exhibits a higher precipitating power than turpentine or any other of the essential oils with which I have experimented.

It is generally believed that the atmosphere of pine forests is highly favorable to invalids suffering from pulmonary complaints, and it has been supposed that the oxidation of the oil of turpentine exuded from pine-trees, and of other essential oils, such as the odorous oils of flowers in the air, is attended by the formation of ozone, inasmuch as the oxidized oils and the air in their vicinity exhibit the reaction of ozone with potassium iodide and starch. Kingzett attributes the active properties of the oxidized turpentine-oil to the formation of monohydrated terpene oxide $C^{10}H^{16}OH^{2}O$, which was shown some time ago by Sobrero (Ann. Ch. Pharm., b. xxx, 106) to be formed when turpentine-oil containing water is exposed to the sun's rays in a vessel filled with oxygen, (see page 887, Watt's Chemistry, second supplement,) and it has been shown that the air of the country contains an odoriferous and oxidizing principle which imparts to it a peculiar odor, and the power of bluing iodized red litmus paper; also of decolorizing blue litmus paper without previously reddening it, and of destroying bad odors. This principle is called ozone.*

When a varnish containing commercial turpentine is applied to a

* Ozone is supposed to be oxygen in a positive state, or allotropic form, having acid properties.

bronzed surface, the metallic powder is oxidized by the turpentine. If copper-bronze powder is combined with turpentine, the bronze is first oxidized and ultimately dissolved by it. Since, then, turpentine has an acid reaction on copper bronzed, it will necessarily have a reaction on the alkaline metals. When common oil of turpentine is added to the sulphide of potassium, the potassium is oxidized, and sulphur precipitated. In this way we may be able to explain *in part* the deodorizing action of essential oils on soluble sulphides and gaseous sulphur compounds. To test this, I poured an ounce of turpentine into a transparent glass quart jar, in the atmosphere of which I suspended a sheet of bibulous paper which was saturated with a composition of the iodide of potassium and starch. The mouth of the jar was quickly covered with a sheet of glass to exclude the action of the air. Within ten minutes the paper appeared brown. The turpentine had oxidized the potassium and liberated the iodine, which in turn colored the starch purple; but, to render this fact more apparent, I combined a drop of turpentine with a drop of the composition of iodide of potassium and starch. When the composition became visibly brown to the naked eye, and was placed under a suitable power of the microscope, it was observed that many of the starch granules were stained purple by the iodine. Subsequent experiments with concentrated eucalyptus oil and the starch composition gave similar results. Had these experiments been made in a pine forest or plantation of *Eucalypti*, the liberation of the iodine, and consequent coloration of the starch-paper, would have been attributed to the presence of ozone in the atmosphere. Nearly all the essential oils give similar results when combined directly with the iodide of potassium and starch. Since the preceding experiments were made, I have placed a paper moistened in the starch composition in an inclosed atmosphere of turpentine, placing the jar containing it in a dark closet; but the action of the turpentine vapor seemed to be as powerful in darkness as in the presence of light.

Some suppose that ozone, or active oxygen, is in great abundance in the atmosphere of eucalyptus plantations, and, as a consequence, the poisonous gases of marshy districts in their vicinity are decomposed by it, ozone acting the part of an acid; while others have supposed that such unhealthy regions are purified by the rapid absorption of the marsh-waters, owing to the very great rapidity of the growth of the *Eucalyptus* family. It is not my purpose to discredit the views of those who attribute so much importance to the production of ozone under such conditions, but to remind those who insist that oxidation of the gases of malarial districts, and the consequent improved healthy condition of them, in the presence of the essential oils of the eucalyptus family, or of other odoriferous plants, are not necessarily the result of ozone. Any acid or substance having an acid reaction will oxidize the potassium of iodide of potassium. My experiments demonstrate that eucalyptol, turpentine, benzole, or any of the essential oils will oxidize potassium when it is combined with iodine or sulphur; and we are, therefore, in a position to explain how the favorable changes and purifications of the atmosphere to some extent are affected, independent of the theory of ozone. Turpentine of commerce contains formic and succinic acid, (Löwig;) but turpentine itself is an oxidizable body, as has been shown, and will oxidize some foreign bodies in the atmosphere. Mix turpentine of commerce with caustic potash and suspend in its atmosphere a slip of paper moistened with the starch mixture; after the lapse of twelve hours it will be found that the starch is colorless or tinged yellow, instead of a very dark purple; in this case demonstrating that the presence of an alkalic atmosphere may modify the oxidizing conditions. Place half an ounce of turpentine in a quart jar, and put in the jar a test-tube containing the sulphide of ammonium, which is very volatile, taking care that only the gases of each liquid will come in contact. Suspend in this mixed atmosphere a slip of the starch-paper* and exclude common air. After the lapse of twelve hours it will be found that the test-paper is saturated with the sulphide of ammonium, and no tinge of purple or other indication of free iodine is observed; in this case the atmosphere is highly alkaline.

If to an aqueous solution of iodide of potassium and starch a few drops of commercial turpentine be added, by agitation a purple color will appear, first on the top, but ultimately the entire mass will appear beautifully stained. If a portion of the liquid be examined under a suitable power of the microscope, it will be seen that the starch granules have become swollen and are tinged a blue-purple. The granules have an appearance of partially-boiled starch, and remain suspended for a long period in the liquid. Slips of iodized starch-paper prepared with *very* weak solutions of iodide of potassium, hung in an inclosed atmosphere of turpentine, take a very slight tinge after a lapse of twelve hours. The same changes are observed when other essential oils are used, but when a saturated solution of the iodide of potassium and starch are used instead, a very deep color is quickly obtained. Sometimes the color will approach to blackness, but is in reality a deep purple, as seen under the microscope. When the oil of bergamot is used with the weak solutions, a very slight change is effected; but should a drop of the starch mixture fall into this oil, it will take a very deep stain. Nearly all the essential oils behave in a similar manner under similar conditions. The vapor of benzole, supposed to be chemically pure, does not give any appreciable color to iodized paper; but when droppings of the starch mixture are immersed in the benzole from ten to twenty hours, they become deeply stained brown or purplish. It will be seen that various substances of a very dissimilar character, chemically considered, give acid reaction; and those who favor the ozone theory in eucalyptus, coniferous, and other essential oils, will do well to consider the facts above recited. It is only by a full and faithful consideration of all the facts which relate to the changes and conditions that affect the (ozone) test-paper that a knowledge of its value or worthlessness may be understood.

The fleshy sides of the skins of animals may be preserved from putrefaction by rubbing on them eucalyptus oil. It may also be combined with plaster, and injected into the veins and arteries of animals for the purpose of preservation.

As a result of actual experiment, I find that beef or any animal matter may be preserved by it. I placed two ounces of solid beef in a glass jar with a few drops of this oil, securing the contents from contact with the atmosphere by means of a glass stopper. At the expiration of three months I examined the beef and found it fresh, and on cutting into it the fresh surfaces appeared of a healthy flesh color. I examined the surface, by removing portions of it and placing them in the usual manner under a power of about 350 diameters, but no organic germs of any kind were visible. I next removed the beef from the jar, and exposed it to an atmosphere of about 75° F. Within twenty-four hours afterward the beef dried up, and became very hard, showing no sign of moldiness or putrefaction. In consideration of these facts, I deem it

* Paper dipped in a solution of iodide of potassium and starch.

probable that eucalyptus oil may be safely employed, and with advantage, in cases of humid gangrene, as it certainly will preserve animal matter from decay and deodorize that which is putrescent.

The preceding experiments demonstrate that eucalyptus oil, turpentine, and, indeed, nearly all the essential oils, possess an oxidizing property. To speak in figurative language, they have the power to burn up or decompose some products deleterious to health, which are always present in malarial regions, and are well known as products of animal and vegetable decay.

COMPOSITION OF EUCALYPTOL, $C^{12}H^{20}O$, (Colez. Ann. Ch. Pharm., cliv, 372.)—The Sanatarian Monthly Journal says: This compound is contained in large quantity in the volatile oil of *Eucalyptus globulus*, a tree indigenous in Tasmania and much cultivated in the southwest of Europe. The crude oil contains also a number of products with boiling points between 188° and 190°, and above 200°; the eucalyptol is contained in the portion which passes over between 170° and 178°, from which it may be obtained pure by contact, first, with solid potassium hydrate, then with calcium chloride, and subsequent distillation.

Eucalyptol boils at 175°, has a specific gravity of 0.905 at 8°, and turns the plane of polarization to the right. Its molecular rotary power is +10.42° for a length of 100 millimeters. It is slightly soluble in water, and dissolves completely in alcohol; the dilute solution has an odor of roses. Vapor density, obs.=5.92; calc.=6.22.

Ordinary nitric acid attacks eucalyptol, forming, among other products, an acid probably analogous to camphoric acid. Strong sulphuric acid blackens eucalyptol, and water separates from the product a tarry body, which yields by distillation a volatile hydrocarbon.

Eucalyptol heated with phosphoric anhydride parts with water, and yields eucalyptene, $C^{12}H^{18}$, (vapor-density=5.3,) which boils at 165°, and has a specific gravity of 0.836 at 12°. At the same time there is formed another liquid, eucalyptolene, which has the same composition, but boils above 300°. Eucalyptol absorbs a large quantity of dry hydrogen chloride, the liquid first solidifying to a crystalline mass, which, however, afterward liquefies, with separation of water and formation of a body apparently identical with eucalyptene.

Just outside the walls of Rome may be seen the Abbey of the Three Fountains, long since abandoned on account of the unhealthfulness of the locality. In 1868 some French Trappists obtained possession of this place, with the intention of reclaiming the land and rendering the locality tenable. But they suffered severely from the effects of malaria, and in summer were obliged to go every night into the city to sleep. Father Gallos, having learned the qualities of the *Eucalyptus globulus*, determined to test its value in this place. His success has been complete, and the ecclesiastics, as well as the cultivators of the soil, are now enabled to reside permanently on the premises, without any apprehension for their safety. Father Gallos has been complimented for his success by the Agricultural Bureau of Rome, and many of the members of the agricultural committee have visited his plantation to obtain plants and seeds, and testify their appreciation of the benefits he has conferred on the health of the people as well as on agriculture.

REPORT OF THE STATISTICIAN.

SIR: I have the honor to present my twelfth annual report as Statistician of the Department of Agriculture. The period covered by the work of this division has been emphatically an era of statistical progress. The advance of the world in industrial invention and social science has demanded increased activity in statistical investigation, and greater accuracy and breadth in statistical statement. The progress of nations in beneficent legislation and good government has been found dependent upon the work of the statistician. The profit of the tradesman and the thrift of the farmer are greatly affected by the accuracy of the information upon which the business operations of each are based.

The intelligent farmer is beginning to learn that misrepresentation of crop prospects, in the interest of higher prices, meets with but temporary and partial success, followed by revulsion and disaster. As water finds its level, so prices naturally tend to the equilibrium found under the law of supply and demand, which acts as inevitably as the law of gravitation. If a high price is obtained for a time, under a false impression of scarcity, the producer inevitably pays the penalty in prices running to the other extreme, whenever a surplus is accumulated in the hands of the purchaser for consumption. The buyer, with better means of information and a longer purse, oftener defrauds the isolated and needy producer of a portion of the legitimate results of his labor. The truth in its plainest garb subserves best the true interests of consumer and producer, though not the pecuniary advantage of the sharks who would thrive by the plunder of honest labor, making more in an hour than the producer receives for a year's work and investment.

It is conceded that the Government has an interest and a stake in the enlightenment of laborers, agricultural and mechanical, the makers of the wealth and conservers of the prosperity of the country, for their guidance in production in kind and quantity required and for their protection against the pirates of trade. The revenues of the Government, as at present secured, depend upon the ability of the masses to consume the products of native and foreign industry; and the prosperity of the nation is involved in the welfare of the industrial classes. Even monarchical governments see the necessity of aiding industry by technical, agricultural, and industrial education; by commissions for scientific and statistical investigation; in brief, by doing for the producers collectively what they have no means or sufficient inducement for doing individually, or even by organized association. Millions annually are spent for such purposes by France, Austria, Italy, and other European governments. Reports of investigation bearing on the interests of labor are multiplied annually, greatly to the advancement of industry and human happiness.

Recently the subject of international statistics has attracted much attention abroad and among progressive minds in this country. Several sessions of the International Statistical Congress have been held with good results, though a far greater work yet remains to be accomplished. It is of the utmost importance to this Government that a system of international crop reports should be inaugurated, and the prompt exchange of current statistics should be secured. It is my desire that this Department especially should be encouraged to participate in an effort in one, and, if possible, in both of these directions.

It is unfortunate that a higher appreciation of the value of investigation tending to the introduction of new industries into this country, and for the protection of those already established, should not characterize our law-makers. Few of the State legislatures have ever provided a permanent system of statistical inquiry, though more has been accomplished in ten years in that direction than in the entire prior history of State legislation. In some cases, after successful initiation, ignorant majorities have ruthlessly stricken down a system just beginning to work beneficently. A department of agriculture established in Georgia, the first in the cotton States, at the cost of a few thousand dollars per annum, has been the means of saving and producing millions in the inspection of fertilizers and the stimulation of neglected branches of production; yet a majority report of a committee of the legislature has recommended its abolition, though the minority showed that it was putting into the State treasury far more than its cost in fees for inspection of fertilizers.

The provision for statistical investigation in this Department has sometimes been less than that provided by a single State for a similar purpose. It was but $10,000 in 1876, a sum not sufficient for the salaries of a meager clerical force for compilation in the office, when $50,000 was necessary properly to supplement and complete the gratuitous work of the statistical corps worth three times that sum. A moderate increase was obtained for the coming year, on the demand of the House Committee on Agriculture, yet the $15,000 given was far less than the allowance in the infancy of the division, when the requirements of its service were not a fourth as great as at present. A member of the committee from North Carolina, in the discussion, declared "that the amount of information collected by this Department cannot be procured from any other source at a cost ten times as much as asked for by the Committee on Agriculture." An influential member from New York asserted that "every interest in this country can obtain appropriations more readily than the agricultural interest." A Pennsylvania member believed that the increase would be repaid "ten times, probably a hundred times, to the people of the country in the information brought to them." The following statement of the work of this division, made by the Statistician at the unanimous request of the Committee on Agriculture, was ordered to be printed in the Congressional Record, and will convey some idea of the work reasonably required of this branch of the Department service:

In response to the request of your committee for a showing of the inadequacy of the proposed appropriation for the Statistical Division of this Department, allow me to present the following considerations:

The appropriation is for the entire expenses, including clerical service, of this division, the current work of which includes—

1. Statistical investigation in more than twenty-five hundred counties of the United States.
2. The crop-reporting system now including our organized corps of correspondents in seventeen hundred of the principal counties.
3. Investigations for furnishing advanced and practical original material for the annual volume.
4. Record and tabulation of such statistics, with current data from official statistics of States, boards of agriculture, and of trade.
5. Translation and compilation of foreign, official, and other statistics of agriculture.
6. Writing and editing fifteen hundred printed pages, annually, of regular and special reports, and preparing an equivalent of one thousand pages more for industrial, com-

mercial, and other organizations; in all, an annual average of seventy-five hundred manuscript pages.

For this work, at its initiation thirteen years ago, $20,000 was appropriated, in addition to the salary of the Statistician. With the decrease of appropriations, a few years later, as the war-begotten labors of other branches of the civil service declined, the *pro rata* system of reduction was applied to this new work, when its importance and usefulness demanded increase, and the appropriation was cut down to $15,000. Last year it was reduced to $10,000 for all these purposes, when the salaries of the regular force of clerks employed in tabulating and recording amounted to $10,600, leaving nothing for collecting statistics, statistical investigations, or the preparation of material for the annual volume or other work. This staggering blow might have been regarded as a vote of censure, but for the fact that on the day before an appropriation of $130,000 was voted for the printing for congressional distribution of 300,000 copies of the annual, for which no *future* provision was apparently desired. But it was evidently an accident of the conference committee, as it was less than provision made in the House bill, which was enlarged by a Senate amendment.

The appropriation proposed in the present bill, $5,000, if all applied to the collection of statistics, will not give twenty cents for each monthly county return or pay the postage between our county correspondents. If applied to the routine office-work exclusively, it would not pay $2 each per day for the smallest force for its possible accomplishment. If used for investigations and writing for the annual, all other work being discarded, it could not produce a volume worthy an edition of 200,000 copies, or even 10,000. In fact, it would be far better to blot out the $5,000 and the division and its work together, and with it the Department, rather than to degrade and dwarf to utter inefficiency a branch of the service which has possibilities of eminent usefulness and needed protection to both producers and consumers, who have already been saved the plunder of millions by heartless speculators through its instrumentality.

You know well the history of agricultural appropriations; that a hundred dollars has been given in the aid of commerce to every dollar appropriated for the promotion or protection of agriculture. There is no lack of provision for investigation in aid of other industries. One of the geological explorations of the Rocky Mountains in 1876 obtained $75,000; another, $40,000; a third, $25,000, and $40,000 more were given for illustrations of two of them. In the same year the appropriation for the observation and report of storms was $470,000 for the benefit of commerce. There was appropriated for clerical service in compiling commercial statistics during the same year $59,440, and an additional fund of $20,000 for special investigation. There was also as large a sum appropriated for the preparation of a single annual of mining statistics in the same year as was given for all the operations of the Statistical Division. And yet there is no Government publication for which the popular demand is so imperative and public appreciation so marked as for the reports of agriculture.

We have at least the value of $150,000 per annum in gratuitous service of public-spirited citizens. We need $50,000 per annum to supplement this work and render it truly efficient. But for the present year $20,000 is as small a sum as should be given for present purposes.

CROP ESTIMATES OF THE YEAR.

In former times there were attempts at estimates of the quantities produced of principal crops, but they were either futile or so unsatisfactory that they were soon abandoned. The difficulties of the work are sufficient to stagger the determination of any one to make such attempt. The national census, costing millions once in ten years, is more a series of minor estimates than an actual enumeration, so far as crops are concerned; the defective memory of the farmer as to the crops of the previous year, which may never have been actually measured, is the best dependence of the census-taker, when he is too conscientious to take second-hand estimates of neighbors or make draughts upon his imagination for facts.

Yet estimates must be made, and are daily made, even before a crop is half grown, and published as a guide to trade operations, most frequently by those interested in speculation. A traveler rides by rail, through tunnels and cuts and over barren slopes, by night and day, and is ready for the most detailed and accurate of estimates; and the country trader and railroad-agent is equally ambitious and confident. Thousands of such irregular and unsystematic estimates might give an idea of great changes in production, but would be valueless for detailed and particular statement that should even approximate the truth.

What are our facilities for such work? Meager enough in some respects, costing a mere trifle in money, but involving gratuitous work of thousands of earnest men. We have a board of statisticians in each county, trained for the work of comparison with former areas in specific crops, with the normal condition of the plant of each from month to month, and ultimately with the result in quantities produced. These returns are scanned, and any obvious error corrected before recording. The records are made by the counties as reported, summed up and averaged, and such averages corrected by a duplicate record, in which the differences in productive value of the counties is considered. The corrected result stands as an average, not inevitably of the whole State, but of such portion, half or two-thirds, or whatever area is reported of the entire State.

Now, these men are fallible and may err in judgment. If their exact figures are taken, and made to cover unreported areas as well, and their errors are annually piled on errors, the cumulative inaccuracy might become something utterly, if not monstrously, unreliable. What is done next? Here is where all routine arithmetic, all ordinary clerical effort, is found unavailing and worthless. There are now tests to be applied by which errors are eliminated; first, by comparison of results of separate returns made at different times, as changes in acreage tested by returns of quantity produced, rate of yield per acre, etc. When discrepancies are found, they must be reconciled by an investigation of the local circumstances affecting the result, the history of the season in the monthly returns of condition, returns of prices as a valuable indication of increased or decreased supply, the various existing causes of local changes in cropping, and outside data from State or other reports.

In the case of the principal crops in the older and settled States, these methods diligently pursued, with a knowledge of the quality of soils and special cropping of every slope and valley in the United States, it is possible to obtain very satisfactory results. Remarkable accuracy, even in the absence of yearly State reports, has been attained in some notable cases of fluctuating production. Illinois, for instance, promising nearly 250,000,000 bushels of corn in July, was credited with scarcely half that amount in November, 1869. The census of the following year corroborated a deficiency of more than 120,000,000 bushels. The wheat-crop was reported at almost the exact figures given by the census; and the numbers of farm-animals were as near as an independent census by the same marshals would have made it. In the South and distant West, in the shadow of the war and amid the rush of new settlement, similar accuracy was not possible. It is gratifying to know that substantial progress in the direction of accuracy has been made, which, with better facilities in the future, may be materially quickened.

CROPS OF THE PAST YEAR.

Corn.—The crop of 1876 is placed at nearly 1,284,000,000 bushels, only 37,000,000 less than the great crop of 1875. The rate of yield per acre is 25 bushels, which is about 4 bushels per acre less than last year. The acreage of Illinois is placed at 8,920,000 acres, an area about 50 per cent. greater than that of the State of New Hampshire. Iowa and Missouri come next.

The surplus of the crop of 1875 has had an effect in reducing the average price from 42 (in that year) to 37 cents.

Wheat.—The reported deficiency of 36,000,000 bushels of spring-wheat in the Northwest proves on analysis of all the facts to be substantially correct. The yield in New York and Pennsylvania was larger by 8,000,000 bushels than in 1875. A large increase is also found in the South, mainly in Texas. The effect of such increase was to make the crop nearly as large as the medium one of 1875. The figures in the estimates are 289,356,500 bushels. The acreage is estimated at 27,627,021, against 26,381,512 in 1875. The yield per acre is less only 10.4 bushels; in 1875, 11.07. Both of these crops are, therefore, below a medium yield. A good yield would produce, with the present acreage, 330,000,000 bushels. The average price of wheat is $1.037, 3 cents higher than that of the previous year.

Rye.—There is a small increase in the area of rye as well as in the rate of yield. Average yield, 13.8 bushels; price, 66.9 cents per bushel.

Oats.—The acreage of oats was increased nearly a million and a half, but the product is placed at 320,000,000 bushels, 34,000,000 bushels less than in 1875. The price averaged 35 cents, 2 cents more than that of the previous year, notwithstanding the great abundance and low price of corn.

Barley.—No increase in the area of barley is reported; but there was an improvement in the yield, which averaged nearly 22 bushels. Value, 66.4 cents per bushel.

Buckwheat.—The reported area is slightly decreased, as well as the total product, with an increase of average price, which is 72.6 cents.

Potatoes.—A marked change in potato-production is indicated, the crop of 1876 being the poorest for many years; the reduction being from 166,000,000 to 125,000,000 bushels.

Hay.—The hay-crop of 1876 was unusually heavy, amounting to nearly 31,000,000 tons, 10 per cent. larger than that of 1875. The large supply affected the price, which averaged $11.90 per ton, against $12.27 the previous year.

Table showing the product of each principal crop of the several States named, the yield per acre, the total acreage, the average price in each State, and the value of each crop, for 1876.

Products	Quantity produced in 1876.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
MAINE.					
Indian corn .... bushels.	1, 400, 000	31	45, 161	$0 79	$1, 106, 000
Wheat .... do....	296, 000	12	24, 666	1 58	467, 680
Rye .... do....	33, 600	14	2, 400	1 11	37, 296
Oats .... do....	2, 352, 000	23	102, 260	49	1, 152, 480
Barley .... do....	663, 000	18. 5	35, 837	75	497, 250
Buckwheat .... do....	397, 000	22. 5	17, 644	62	246, 140
Potatoes .... do....	5, 868, 000	100	58, 680	63	3, 696, 840
Tobacco .... pounds.	....	....	....	....	....
Hay .... tons.	1, 264, 800	0. 98	1, 290, 612	11 20	14, 165, 760
Total	....	....	1, 577, 260	....	21, 369, 446
NEW HAMPSHIRE.					
Indian corn .... bushels.	2, 029, 000	42	48, 309	79	1, 602, 910
Wheat .... do....	192, 000	15	12, 800	1 55	297, 600
Rye .... do....	47, 000	18	2, 611	1 00	47, 000
Oats .... do....	1, 222, 000	33	37, 030	49	598, 780
Barley .... do....	108, 000	24. 8	4, 354	86	92, 880
Buckwheat .... do....	97, 000	19	5, 105	65	63, 050

Table showing the product of each principal crop, &c., for 1876—Continued.

Products.	Quantity produced in 1876.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
NEW HAMPSHIRE—Continued.					
Potatoes ....bushels.	3,990,000	100	39,900	60	2,394,000
Tobacco ....pounds.	414,000	1,500	276	12	49,680
Hay ....tons.	702,000	90	780,000	12 28	8,620,560
Total	....	....	930,385	....	13,766,460
VERMONT.					
Indian corn ....bushels.	1,892,000	39	48,512	78	1,475,760
Wheat ....do....	421,000	14.7	28,639	1 43	602,030
Rye ....do....	80,000	18.5	4,324	96	76,800
Oats ....do....	4,514,000	37	122,000	42	1,895,880
Barley ....do....	121,000	22.5	5,377	88	106,480
Buckwheat ....do....	399,000	20.6	19,368	64	255,360
Potatoes ....do....	5,265,000	140	37,607	50	2,632,500
Tobacco ....pounds.	....	....	....	....	....
Hay ....tons.	1,060,500	1.00	1,060,500	10 31	10,933,755
Total	....	....	1,326,327	....	17,978,565
MASSACHUSETTS.					
Indian corn ....bushels.	1,150,000	35	32,857	75	862,500
Wheat ....do....	17,500	18	972	1 30	22,750
Rye ....do....	290,500	13.5	21,518	90	261,450
Oats ....do....	490,000	30	16,333	51	249,900
Barley ....do....	55,000	25	2,200	90	49,500
Buckwheat ....do....	54,000	13	4,153	65	35,100
Potatoes ....do....	3,250,000	100	32,500	83	2,697,500
Tobacco ....pounds.	4,650,000	1,640	2,835	09.4	437,100
Hay ....tons.	675,000	1.02	661,764	16 00	10,800,000
Total	....	....	775,132	....	15,415,800
RHODE ISLAND.					
Indian corn ....bushels.	290,000	35	8,285	75	217,500
Wheat ....do....	....	....	....	....	....
Rye ....do....	18,500	12	1,541	90	16,650
Oats ....do....	90,000	27	3,333	60	54,000
Barley ....do....	9,000	19	473	90	8,100
Buckwheat ....do....	....	....	....	....	....
Potatoes ....do....	500,000	65	7,692	1 00	500,000
Tobacco ....pounds.	....	....	....	....	....
Hay ....tons.	115,000	0.80	143,750	20 00	2,300,000
Total	....	....	165,074	....	3,096,250
CONNECTICUT.					
Indian corn ....bushels.	1,850,000	32.5	56,923	74	1,369,000
Wheat ....do....	35,000	14.5	2,413	1 30	45,500
Rye ....do....	360,000	12	30,000	86	309,600
Oats ....do....	1,050,000	24	43,750	48	504,000
Barley ....do....	27,500	25	1,100	92	25,300
Buckwheat ....do....	130,000	15	8,666	80	104,000
Potatoes ....do....	1,700,000	65	26,153	97	1,649,000
Tobacco ....pounds.	7,568,000	1,220	6,203	09.1	688,688
Hay ....tons.	575,000	1.03	558,252	17 50	10,062,500
Total	....	....	733,460	....	14,757,588
NEW YORK.					
Indian corn ....bushels.	21,000,000	30	700,000	68	14,280,000
Wheat ....do....	9,750,000	15	650,000	1 31	12,772,500
Rye ....do....	2,760,000	12	230,000	82	2,263,200
Oats ....do....	40,025,000	28.5	1,404,385	42	16,810,500
Barley ....do....	6,600,000	22	300,000	83	5,478,000
Buckwheat ....do....	3,750,000	14	267,857	74	2,775,000
Potatoes ....do....	23,000,000	55	418,181	80	18,400,000
Tobacco ....pounds.	1,500,000	700	2,142	08.4	126,000
Hay ....tons.	5,600,000	1.15	4,869,565	11 20	62,720,000
Total	....	....	8,842,130	....	135,625,200

Table showing the product of each principal crop, &c., for 1876—Continued.

Products.	Quantity produced in 1876.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
NEW JERSEY.					
Indian corn .... bushels.	9, 400, 000	36	261, 111	$0 56	$5, 264, 000
Wheat .... do....	2, 176, 000	13. 6	160, 000	1 32	2, 872, 320
Rye .... do....	520, 000	13. 5	38, 518	81	421, 200
Oats .... do....	4, 150, 000	26. 5	156, 603	42	1, 743, 000
Barley .... do....	....	....	....	....	....
Buckwheat .... do....	330, 000	11. 5	28, 695	83	273, 900
Potatoes .... do....	2, 100, 000	40	52, 500	1 20	2, 520, 000
Tobacco .... pounds.	....	....	....	....	....
Hay .... tons.	590, 000	1. 20	491, 666	15 90	9, 381, 000
Total	....	....	1, 189, 093	....	22, 475, 420
PENNSYLVANIA.					
Indian corn .... bushels.	42, 250, 000	35	1, 207, 142	55	23, 237, 500
Wheat .... do....	18, 740, 000	13. 2	1, 419, 696	1 25	23, 425, 000
Rye .... do....	3, 240, 000	14	231, 428	74	2, 397, 600
Oats .... do....	33, 150, 000	28. 6	1, 159, 090	35	11, 602, 500
Barley .... do....	560, 000	22	25, 454	85	476, 000
Buckwheat .... do....	2, 100, 000	13. 6	154, 411	74	1, 554, 000
Potatoes .... do....	6, 800, 000	50	136, 000	85	5, 780, 000
Tobacco .... pounds.	13, 200, 000	1, 380	9, 565	09	1, 188, 000
Hay .... tons.	2, 900, 000	1. 23	2, 357, 723	12 16	35, 264, 000
Total	....	....	6, 700, 509	....	104, 924, 600
DELAWARE.					
Indian corn .... bushels.	3, 850, 000	30	128, 333	50	1, 925, 000
Wheat .... do....	920, 000	16	57, 500	1 27	1, 168, 400
Rye .... do....	12, 000	13	923	80	9, 600
Oats .... do....	375, 000	26	14, 423	34	127, 500
Barley .... do....	....	....	....	....	....
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	325, 000	70	4, 642	95	308, 750
Tobacco .... pounds.	....	....	....	....	....
Hay .... tons.	37, 500	1. 18	31, 779	15 00	562, 500
Total	....	....	237, 600	....	4, 101, 750
MARYLAND.					
Indian corn .... bushels.	13, 780, 000	29	475, 172	49	6, 752, 200
Wheat .... do....	6, 000, 000	12. 5	480, 000	1 27	7, 620, 000
Rye .... do....	315, 000	13. 5	23, 333	76	239, 400
Oats .... do....	4, 450, 000	21. 5	206, 976	34	1, 513, 000
Barley .... do....	....	....	....	....	....
Buckwheat .... do....	75, 000	19. 5	3, 846	61	45, 750
Potatoes .... do....	1, 150, 000	64	17, 968	73	839, 500
Tobacco .... pounds.	21, 500, 000	690	31, 159	08	1, 720, 000
Hay .... tons.	237, 000	1. 20	197, 500	14 50	3, 436, 500
Total	....	....	1, 435, 954	....	22, 166, 350
VIRGINIA.					
Indian corn .... bushels.	20, 600, 000	20	1, 030, 000	46	9, 476, 000
Wheat .... do....	7, 875, 000	8. 5	926, 470	1 13	8, 898, 750
Rye .... do....	475, 000	9. 6	49, 479	64	304, 000
Oats .... do....	7, 650, 000	15. 8	484, 177	40	3, 060, 000
Barley .... do....	....	....	....	....	....
Buckwheat .... do....	48, 000	13. 4	3, 582	58	27, 840
Potatoes .... do....	1, 350, 000	64	21, 093	62	837, 000
Tobacco .... pounds.	49, 300, 000	600	82, 166	08	3, 944, 000
Hay .... tons.	256, 000	1. 25	201, 800	13 82	3, 537, 920
Total	....	....	2, 801, 767	....	30, 085, 510
NORTH CAROLINA.					
Indian corn .... bushels.	23, 000, 000	14. 6	1, 575, 342	54	12, 420, 000
Wheat .... do....	3, 600, 000	7. 3	410, 958	1 20	3, 600, 000
Rye .... do....	360, 000	8. 4	42, 857	88	316, 800
Oats .... do....	3, 530, 000	13. 5	261, 481	54	1, 906, 200
Barley .... do....	....	....	....	....	....
Buckwheat .... do....	....	....	....	....	....

Table showing the product of each principal crop, &c., for 1876—Continued.

Products.	Quantity produced in 1876.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
NORTH CAROLINA—Continued.					
Potatoes ....bushels.	850, 000	70	12, 112	64	544, 000
Tobacco ....pounds.	16, 225, 000	550	29, 500	09	1, 460, 250
Hay ....tons.	116, 200	1. 25	92, 960	11 12	1, 292, 144
Total	....	....	2, 425, 240	.....	21, 539, 394
SOUTH CAROLINA.					
Indian corn ....bushels.	9, 700, 000	8. 2	1, 182, 926	78	7, 566, 000
Wheat ....do....	850, 000	8	106, 250	1 66	1, 411, 000
Rye ....co....	44, 000	6. 6	6, 666	1 47	64, 680
Oats ....do....	1, 100, 000	14. 5	75, 862	82	902, 000
Barley ....do....	....	....	....	.....	....
Buckwheat ....do....	....	....	....	.....	....
Potatoes ....do....	104, 000	80	1, 300	93	96, 720
Tobacco ....pounds.	....	....	....	.....	....
Hay ....tons.	24, 000	1. 20	20, 000	16 50	396, 000
Total	....	....	1, 393, 004	.....	10, 436, 400
GEORGIA.					
Indian corn ....bushels.	23, 620, 000	11	2, 147, 272	60	14, 172, 000
Wheat ....do....	2, 840, 000	6	473, 333	1 31	3, 805, 600
Rye ....do....	....	....	....	.....	....
Oats ....do....	5, 700, 000	11. 6	491, 379	68	3, 876, 000
Barley ....do....	....	....	....	.....	....
Buckwheat ....do....	....	....	....	.....	....
Potatoes ....do....	....	....	....	.....	....
Tobacco ....pounds.	....	....	....	.....	....
Hay ....tons.	23, 600	1. 30	18, 153	14 73	347, 628
Total	....	....	3, 130, 137	.....	22, 201, 228
FLORIDA.					
Indian corn ....bushels.	2, 500, 000	10	250, 000	86	2, 150, 000
Wheat ....do....	....	....	....	.....	....
Rye ....do....	....	....	....	.....	....
Oats ....do....	132, 000	13. 5	9, 777	99	130, 680
Barley ....do....	....	....	....	.....	....
Buckwheat ....do....	....	....	....	.....	....
Potatoes ....do....	....	....	....	.....	....
Tobacco ....pounds.	225, 000	700	321	20	45, 000
Hay ....tons.	....	....	....	.....	....
Total	....	....	260, 098	.....	2, 325, 680
ALABAMA.					
Indian corn ....bushols.	26, 215, 000	13	2, 016, 538	48	12, 583, 200
Wheat ....do....	1, 140, 000	6. 5	175, 384	1 23	1, 402, 200
Rye ....do....	....	....	....	.....	....
Oats ....do....	1, 800, 000	14. 1	127, 659	67	1, 206, 000
Barley ....do....	....	....	....	.....	....
Buckwheat ....do....	....	....	....	.....	....
Potatoes ....do....	260, 000	56	4, 642	96	249, 600
Tobacco ....pounds.	....	....	....	.....	....
Hay ....tons.	24, 000	1. 30	18, 461	16 75	402, 000
Total	....	....	2, 342, 684	.....	15, 843, 000
MISSISSIPPI.					
Indian corn ....bushels.	20, 000, 000	15	1, 333, 333	55	11, 000, 000
Wheat ....do....	325, 000	7. 7	42, 207	1 38	448, 500
Rye ....do....	....	....	....	.....	....
Oats ....do....	780, 000	16. 3	47, 852	69	538, 200
Barley ....do....	....	....	....	.....	.....
Buckwheat ....do....	....	....	....	.....	....
Potatoes ....do....	320, 000	80	4, 000	96	307, 200
Tobacco ....pounds.	....	....	....	.....	....
Hay ....tons.	23, 500	1. 35	17, 407	16 31	383, 285
Total	....	....	1, 444, 799	.....	12, 677, 185

Table showing the product of each principal crop, &c., for 1876—Continued.

Products.	Quantity produced in 1876.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
LOUISIANA.					
Indian corn .... bushels.	12,000,000	17.2	697,674	70	8,400,000
Wheat .... do ...	....	....	....	....	....
Rye .... do ...	....	....	....	....	....
Oats .... do ...	....	....	....	....	....
Barley .... do ...	....	....	....	....	....
Buckwheat .... do ...	....	....	....	....	....
Potatoes .... do ...	40,000	72	555	85	34,000
Tobacco .... pounds	....	....	....	....	....
Hay .... tons.	....	....	....	....	....
Total	....	....	698,229	....	8,434,000
TEXAS.					
Indian corn .... bushels	48,000,000	25	1,920,000	50	24,000,000
Wheat .... do ...	4,750,000	13	365,384	1 08	5,130,000
Rye .... do ...	56,000	17.5	3,200	95	53,200
Oats .... do ...	3,650,000	31	117,741	58	2,117,000
Barley .... do ...	80,000	29	2,758	82	65,600
Buckwheat .... do ...	....	....	....	....	....
Potatoes .... do ...	541,000	95	5,726	67	364,480
Tobacco .... pounds.	175,000	745	234	22	38,500
Hay .... tons	80,000	1.38	57,971	11 26	900,800
Total	....	....	2,473,014	....	32,669,580
ARKANSAS.					
Indian corn .... bushels.	21,500,000	24	895,833	39	8,385,000
Wheat .... do ...	1,400,000	8.2	170,731	95	1,330,000
Rye .... do ...	50,000	11	4,545	79	39,500
Oats .... do ...	925,000	20.5	45,121	50	462,500
Barley .... do ...	....	....	....	....	....
Buckwheat .... do ...	....	....	....	....	....
Potatoes .... do ...	450,000	77	5,844	58	261,000
Tobacco .... pounds..	1,980,000	900	2,200	12	237,600
Hay .... tons	23,000	1.40	16,428	13 10	301,300
Total	....	....	1,140,702	....	11,016,900
TENNESSEE.					
Indian corn .... bushels.	54,500,000	24.5	2,224,489	32	17,440,000
Wheat .... do ...	11,260,000	8.3	1,356,626	93	10,471,800
Rye .... do ...	355,000	9	39,444	92	326,600
Oats .... do ...	5,400,000	17.6	306,818	39	2,106,000
Barley .... do ...	80,000	18.5	4,324	90	72,000
Buckwheat .... do ...	97,000	16.4	5,914	83	80,510
Patatoes .... do ...	1,260,000	80	15,750	48	604,800
Tobacco .... pounds.	32,200,000	630	51,111	08	2,576,000
Hay .... tons	165,000	1.36	121,323	13 56	2,237,400
Total	....	....	4,125,799	....	35,915,110
WEST VIRGINIA.					
Indian corn .... bushels.	10,605,000	28.2	376,063	45	4,772,250
Wheat .... do ...	3,377,000	11	307,000	1 11	3,748,470
Rye .... do ...	300,000	12.6	23,809	74	222,000
Oats .... do ...	2,800,000	22.5	124,444	35	980,000
Barley .... do ...	52,000	15.6	3,333	85	44,200
Buckwheat .... do ...	83,000	17.6	4,715	65	53,950
Potatoes .... do ...	1,125,000	66	17,045	52	585,000
Tobacco .... pounds.	2,750,000	640	4,296	08	220,000
Hay .... tons.	265,000	1.30	203,846	10 00	2,650,000
Total	....	....	1,064,551	....	13,275,870
KENTUCKY.					
Indian corn .... bushels	63,300,000	33.5	1,889,552	30	18,990,000
Wheat .... do ...	8,237,000	10	823,700	1 00	8,237,000
Rye .... do ...	1,150,000	11.1	103,603	70	805,000
Oats .... do ...	6,850,000	22	311,363	36	2,466,000
Barley .... da ...	275,000	21.5	12,790	84	231,000

Table showing the product of each principal crop, &c., for 1876—Continued.

Products.	Quantity produced in 1876.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
KENTUCKY—Continued.					
Buckwheat ... bushels.	....	....	....	....	....
Potatoes ... do.	2, 100, 000	82	25, 609	49	1, 029, 000
Tobacco ... pounds.	128, 000, 000	680	188, 235	07	8, 960, 000
Hay ... tons.	363, 000	1. 25	290, 400	10 25	3, 720, 750
Total	....	....	3, 645, 252	....	44, 438, 750
OHIO.					
Indian corn ... bushels.	115, 000, 000	36. 7	3, 133, 514	38	43, 700, 000
Wheat ... do.	21, 750, 000	11. 8	1, 843, 220	1 14	24, 795, 000
Rye ... do.	460, 000	12. 8	35, 937	68	312, 800
Oats ... do.	24, 500, 000	26. 5	924, 528	31	7, 595, 000
Barley ... do.	800, 000	20	40, 000	78	624, 000
Buckwheat ... do.	390, 000	12. 2	31, 967	75	292, 500
Potatoes ... do.	9, 000, 000	70	128, 571	62	5, 580, 000
Tobacco ... pounds.	26, 500, 000	810	32, 716	06. 5	1, 722, 500
Hay ... tons.	1, 950, 000	1. 20	1, 625, 000	8 42	16, 419, 000
Total	....	....	7, 795, 453	....	101, 040, 800
MICHIGAN.					
Indian corn ... bushels.	21, 350, 000	29	736, 206	52	11, 102, 000
Wheat ... do.	15, 170, 000	12	1, 264, 166	1 16	17, 597, 200
Rye ... do.	252, 000	13. 5	18, 666	67	168, 840
Oats ... do.	11, 500, 000	31. 4	366, 242	45	5, 175, 000
Barley ... do.	955, 000	20	47, 750	77	735, 350
Buckwheat ... do.	620, 000	14. 1	43, 971	69	427, 800
Potatoes ... do.	4, 750, 000	55	86, 363	72	3, 420, 000
Tobacco ... pounds.	....	....	....	....	....
Hay ... tons.	1, 375, 000	1. 30	1, 057, 692	10 00	13, 750, 000
Total	....	....	3, 621, 056	....	52, 376, 190
INDIANA.					
Indian corn ... bushels.	99, 000, 000	30	3, 300, 000	34	33, 660, 000
Wheat ... do.	20, 000, 000	11	1, 818, 181	1 02	20, 400, 000
Rye ... do.	520, 000	12. 2	42, 622	71	369, 200
Oats ... do.	13, 270, 000	22. 7	584, 581	31	4, 113, 700
Barley ... do.	400, 000	15. 2	26, 315	79	316, 000
Buckwheat ... do.	160, 000	17. 2	9, 302	76	121, 600
Potatoes ... do.	4, 300, 000	65	66, 153	56	2, 408, 000
Tobacco ... pounds.	16, 500, 000	750	22, 000	05. 7	940, 500
Hay ... tons.	1, 150, 000	1. 25	920, 000	8 57	9, 855, 500
Total	....	....	6, 789, 154	....	72, 184, 500
ILLINOIS.					
Indian corn ... bushels.	223, 000, 000	25	8, 920, 000	31	69, 130, 000
Wheat ... do.	23, 440, 000	9. 3	2, 520, 430	93	21, 799, 200
Rye ... do.	2, 580, 000	16	161, 250	58	1, 496, 400
Oats ... do.	48, 000, 000	20	2, 400, 000	26	12, 480, 000
Barley ... do.	2, 200, 000	17. 7	124, 293	50	1, 100, 000
Buckwheat ... do.	175, 000	14. 8	11, 824	81	141, 750
Potatoes ... do.	9, 450, 000	75	126, 000	61	5, 764, 500
Tobacco ... pounds.	11, 000, 000	760	14, 473	05. 7	627, 000
Hay ... tons	3, 500, 000	1. 40	2, 500, 000	6 68	23, 380, 000
Total	....	....	16, 778, 270	....	135, 918, 850
WISCONSIN.					
Indian corn ... bushels.	27, 000, 000	34	791, 117	41	11, 070, 000
Wheat ... do.	16, 800, 000	9	1, 866, 666	1 01	16, 968, 000
Rye ... do.	1, 330, 000	14	95, 000	63	837, 900
Oats ... do.	21, 700, 000	31	700, 000	30	6, 510, 000
Barley ... do.	1, 800, 000	22	81, 818	65	1, 170, 000
Buckwheat ... do.	425, 000	18	23, 611	61	259, 250
Potatoes ... do.	5, 820, 000	80	72, 750	49	2, 851, 800
Tobacco ... pounds.	3, 300, 000	800	4, 125	66	198, 000
Hay ... tons.	1, 533, 000	1. 40	1, 095, 000	7 75	11, 880, 750
Total	....	....	4, 733, 087	....	51, 745, 700

Table showing the product of each principal crop, &c., for 1876—Continued.

Products.	Quantity produced in 1876.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
MINNESOTA.					
Indian corn .... bushels.	7, 400, 000	25. 4	291, 338	$0 40	$2, 960, 000
Wheat .... do....	16, 000, 000	8. 5	1, 882, 352	90	14, 400, 000
Rye .... do....	111, 000	16	6, 937	61	67, 710
Oats .... do....	12, 000, 000	25	480, 000	37	4, 440, 000
Barley .... do....	1, 520, 000	21. 9	69, 406	63	957, 600
Buckwheat .... do....	47, 800	14. 5	3, 296	66	31, 548
Potatoes .... do....	3, 100, 000	96	32, 291	36	1, 116, 000
Tobacco .... pounds.	....	....	....	....	....
Hay .... tons.	1, 060, 000	1. 40	757, 142	5 00	5, 300, 000
Total	....	....	3, 522, 762	....	29, 272, 858
IOWA.					
Indian corn .... bushels.	142, 500, 000	30	4, 750, 000	25	35, 625, 000
Wheat .... do....	17, 600, 000	6. 1	2, 885, 245	90	15, 840, 000
Rye .... do....	350, 000	14	25, 000	53	185, 500
Oats .... do....	21, 250, 000	25. 4	836, 614	23	4, 887, 500
Barley .... do....	5, 800, 000	24	241, 666	45	2, 610, 000
Buckwheat .... do....	140, 000	14. 8	9, 459	78	109, 200
Potatoes .... do....	7, 000, 000	80	87, 500	80	5, 600, 000
Tobacco .... pounds.	....	....	....	....	....
Hay .... tons.	1, 950, 000	1. 42	1, 373, 239	5 00	9, 750, 000
Total	....	....	10, 208, 723	....	74, 607, 200
MISSOURI.					
Indian corn .... bushels.	102, 500, 000	27. 8	3, 687, 050	28	28, 700, 000
Wheat .... do....	15, 240, 000	12. 4	1, 229, 032	89	13, 563, 600
Rye .... do....	680, 000	14. 8	45, 945	57	387, 600
Oats .... do....	13, 150, 000	20. 2	650, 990	26	3, 419, 000
Barley .... do....	435, 000	17	25, 588	65	282, 750
Buckwheat .... do....	55, 000	18	3, 055	67	36, 850
Potatoes .... do....	5, 400, 000	76	71, 052	42	2, 268, 000
Tobacco .... pounds.	43, 245, 000	775	55, 800	07	3, 027, 150
Hay .... tons.	750, 000	1. 35	555, 555	8 52	6, 390, 000
Total	....	....	6, 324, 067	....	58, 074, 950
KANSAS.					
Indian corn .... bushels.	82, 836, 000	43. 5	1, 904, 275	24	19, 880, 640
Wheat .... do....	16, 510, 000	14. 6	1, 130, 821	86	14, 198, 600
Rye .... do....	3, 450, 000	20. 8	165, 865	43	1, 483, 500
Oats .... do....	12, 389, 000	31. 7	390, 820	22	2, 725, 580
Barley .... do....	1, 960, 000	23. 5	83, 404	45	882, 000
Buckwheat .... do....	96, 000	16	6, 000	90	86, 400
Potatoes .... do....	5, 286, 000	105	50, 342	50	2, 643, 000
Tobacco .... pounds.	770, 000	700	1, 100	10	77, 000
Hay .... tons.	864, 000	1. 20	720, 000	4 90	4, 233, 600
Total	....	....	4, 452, 627	....	46, 210, 320
NEBRASKA.					
Indian corn .... bushels.	25, 500, 000	30	850, 000	27	6, 885, 000
Wheat .... do....	4, 330, 000	11. 5	376, 521	27	1, 169, 100
Rye .... do....	92, 000	16. 5	5, 575	40	36, 800
Oats .... do....	3, 500, 000	25. 3	138, 339	23	805, 000
Barley .... do....	470, 000	22	21, 363	32	150, 400
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	1, 400, 000	77	18, 181	32	448, 000
Tobacco .... pounds.	....	....	....	....	....
Hay .... tons.	380, 000	1. 40	271, 428	3 37	1, 280, 600
Total	....	....	1, 681, 407	....	10, 774, 900
CALIFORNIA.					
Indian corn .... bushels.	1, 600, 000	33	48, 484	1 07	1, 712, 000
Wheat .... do....	30, 000, 000	13	2, 307, 692	1 14	34, 200, 000
Rye .... do....	78, 000	15. 2	5, 131	95	74, 100
Oats .... do....	2, 450, 000	35	70, 000	74	1, 813, 000
Barley .... do....	11, 800, 000	22	536, 363	69	8, 142, 000

Table showing the product of each principal crop, &c., for 1876—Continued.

Products.	Quantity produced in 1876.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
CALIFORNIA—Continued.					
Buckwheat .... bushels.	....	....	....	....	....
Potatoes .... do....	4,000,000	125	32,000	$0 83	$3,320,000
Tobacco .... pounds.	....	....	....	....	....
Hay .... tons.	850,000	1.35	629,629	11 61	9,868,500
Total	....	....	3,629,299	....	59,129,600
OREGON.					
Indian corn .... bushels.	120,000	30	4,000	90	108,000
Wheat .... do....	4,675,000	17	275,000	70	3,272,500
Rye .... do....	5,200	21	247	75	3,900
Oats .... do....	2,750,000	38	72,368	50	1,375,000
Barley .... do....	540,000	29	18,620	68	367,200
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	1,000,000	140	7,142	64	640,000
Tobacco .... pounds.	....	....	....	....	....
Hay .... tons.	130,000	1.45	89,655	9 50	1,235,000
Total	....	....	467,032	....	7,001,600
NEVADA.					
Indian corn .... bushels.	15,500	28	553	1 00	15,500
Wheat .... do....	390,000	18.2	21,428	1 10	429,000
Rye .... do....	....	....	....	....	....
Oats .... do....	90,000	31	2,903	70	63,000
Barley .... do....	550,000	25.5	21,568	90	495,000
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	220,000	100	2,200	96	211,200
Tobacco .... pounds.	....	....	....	....	....
Hay .... tons.	55,000	1.35	40,740	13 50	742,500
Total	....	....	89,392	....	1,956,200
TERRITORIES.					
Indian corn .... bushels.	1,575,000	25	63,000	95	1,496,250
Wheat .... do....	3,850,000	18.2	211,538	1 00	3,850,000
Rye .... do....	....	....	....	....	....
Oats .... do....	2,150,000	30	71,666	68	1,462,000
Barley .... do....	850,000	28	30,357	89	756,500
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	1,750,000	110	15,909	72	1,260,000
Tobacco .... pounds.	....	....	....	....	....
Hay .... tons.	200,000	1 40	142,857	12 00	2,400,000
Total	....	....	535,327	....	11,224,750

Summary for each State, showing the product, the area, and the value of each crop for 1876.

States.	INDIAN CORN.			WHEAT.			RYE.		
	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.
Maine	1, 400, 000	45, 161	$1, 106, 000	296, 000	24, 666	$167, 680	33, 600	2, 400	$37, 296
New Hampshire	2, 029, 000	48, 309	1, 602, 910	192, 000	12, 800	297, 600	47, 000	2, 611	47, 000
Vermont	1, 892, 000	48, 512	1, 475, 760	421, 000	28, 639	602, 630	80, 000	4, 324	76, 800
Massachusetts	1, 150, 000	32, 857	862, 500	17, 500	972	22, 750	290, 500	21, 518	261, 450
Rhode Island	290, 000	8, 285	217, 500	....	....	....	18, 500	1, 541	16, 650
Connecticut	1, 850, 000	56, 923	1, 369, 000	35, 000	2, 413	45, 500	360, 000	30, 000	309, 600
New York	21, 000, 000	700, 000	14, 280, 000	9, 750, 000	650, 000	12, 772, 500	2, 760, 000	230, 000	2, 263, 200
New Jersey	9, 400, 000	261, 111	5, 264, 000	2, 176, 000	160, 000	2, 872, 320	520, 000	38, 518	421, 200
Pennsylvania	42, 250, 000	1, 207, 142	23, 237, 500	18, 740, 000	1, 419, 696	23, 425, 000	3, 240, 000	231, 428	2, 397, 600
Delaware	3, 850, 000	128, 333	1, 925, 000	920, 000	57, 500	1, 168, 400	12, 000	923	9, 600
Maryland	13, 780, 000	475, 172	6, 752, 200	6, 000, 000	480, 000	7, 620, 000	315, 000	23, 333	239, 400
Virginia	20, 600, 000	1, 030, 000	9, 476, 000	7, 875, 000	926, 470	8, 898, 750	475, 000	49, 479	304, 000
North Carolina	23, 000, 000	1, 575, 342	12, 420, 000	3, 000, 000	410, 958	3, 600, 000	360, 000	42, 857	316, 800
South Carolina	9, 700, 000	1, 182, 926	7, 566, 000	850, 000	106, 250	1, 411, 000	44, 000	6, 666	64, 680
Georgia	23, 620, 000	2, 147, 272	14, 172, 000	2, 840, 000	473, 333	3, 805, 600	....	....	....
Florida	2, 500, 000	250, 000	2, 150, 000	....	....	....	....	....	....
Alabama	26, 215, 000	2, 016, 538	12, 583, 200	1, 140, 000	175, 384	1, 402, 200	....	....	....
Mississippi	20, 000, 000	1, 333, 333	11, 000, 000	325, 000	42, 207	448, 500	....	....	....
Louisiana	12, 000, 000	697, 674	8, 400, 000	....	....	....	....	....	....
Texas	48, 000, 000	1, 920, 000	24, 000, 000	4, 750, 000	365, 384	5, 130, 000	56, 000	3, 200	53, 200
Arkansas	21, 500, 000	895, 833	8, 385, 000	1, 400, 000	170, 731	1, 330, 000	50, 000	4, 545	39, 500
Tennessee	54, 500, 000	2, 224, 489	17, 440, 000	11, 260, 000	1, 356, 626	10, 471, 800	355, 000	39, 444	326, 600
West Virginia	10, 605, 000	376, 063	4, 772, 250	3, 377, 000	307, 000	3, 748, 470	300, 000	23, 809	222, 000
Kentucky	63, 300, 000	1, 889, 552	18, 990, 000	8, 237, 000	823, 700	8, 237, 660	1, 150, 000	103, 603	805, 000
Ohio	115, 000, 000	3, 133, 514	43, 700, 000	21, 750, 000	1, 343, 220	24, 795, 000	460, 000	35, 937	312, 800
Michigan	21, 350, 000	736, 206	11, 102, 000	15, 170, 000	1, 264, 166	17, 597, 200	252, 000	18, 666	168, 840
Indiana	99, 000, 000	3, 300, 000	33, 660, 000	20, 000, 000	1, 818, 181	20, 400, 000	520, 000	42, 622	369, 200
Illinois	223, 000, 000	8, 920, 000	69, 130, 000	23, 440, 000	2, 520, 430	21, 799, 200	2, 580, 000	161, 250	1, 496, 400
Wisconsin	27, 000, 000	794, 117	11, 070, 000	16, 800, 000	1, 866, 666	16, 968, 000	1, 330, 000	95, 000	837, 900
Minnesota	7, 400, 000	291, 338	2, 960, 000	16, 000, 000	1, 882, 352	14, 400, 000	111, 000	6, 937	67, 710
Iowa	142, 500, 000	4, 750, 000	35, 625, 000	17, 000, 000	2, 885, 245	15, 840, 000	350, 000	25, 000	185, 509
Missouri	102, 500, 000	3, 687, 050	23, 700, 000	15, 240, 000	1, 229, 032	13, 563, 600	680, 000	45, 945	387, 600
Kansas	82, 836, 000	1, 904, 275	19, 880, 640	16, 510, 000	1, 130, 821	14, 198, 600	3, 450, 000	165, 865	1, 483, 500
Nebraska	25, 500, 000	850, 000	6, 885, 000	4, 330, 000	376, 521	1, 169, 100	92, 000	5, 575	36, 800
California	1, 600, 000	48, 484	1, 712, 000	30, 000, 000	2, 307, 692	34, 200, 000	78, 000	5, 131	74, 100
Oregon	120, 000	4, 000	108, 000	4, 675, 000	275, 000	3, 272, 500	5, 200	217	3, 900
Nevada	15, 500	553	15, 500	390, 000	21, 428	429, 000	....	....	....
The Territories	1, 575, 000	63, 000	1, 496, 250	3, 850, 000	211, 538	3, 850, 000	....	....	....
Total	1, 283, 827, 500	49, 033, 364	475, 491, 210	289, 356, 500	27, 627, 021	300, 259, 300	20, 374, 800	1, 468, 374	13, 635, 826

Summary for each State, showing the product, the area, and the value of each crop for 1876—Continued.

States.	OATS.			BARLEY.			BUCKWHEAT.		
	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.
Maine	2,352,000	102,260	$1,152,480	663,000	35,837	$497,250	397,000	17,644	$246,140
New Hampshire	1,222,000	37,030	598,780	108,000	4,354	92,880	97,000	5,105	63,050
Vermont	4,514,000	122,000	1,895,880	121,000	5,377	106,480	399,000	19,368	255,380
Massachusetts	490,000	16,333	219,000	55,000	2,200	49,500	54,000	4,153	35,100
Rhode Island	90,000	3,333	54,000	9,000	473	8,160			
Connecticut	1,050,000	43,750	504,000	27,500	1,100	25,300	130,000	8,666	104,000
New York	40,025,000	1,404,385	16,810,500	6,600,000	300,000	5,478,000	3,750,000	267,857	2,775,000
New Jersey	4,150,000	156,603	1,743,000				330,000	28,695	273,900
Pennsylvania	33,150,000	1,159,090	11,602,500	560,000	25,454	476,000	2,100,000	154,411	1,554,000
Delaware	375,000	14,423	127,500						
Maryland	4,450,000	206,976	1,513,000				75,000	3,846	45,750
Virginia	7,650,000	484,177	3,060,000				48,000	3,582	27,840
North Carolina	3,530,000	261,481	1,906,200						
South Carolina	1,100,000	75,862	902,000						
Georgia	5,700,000	491,379	3,876,000						
Florida	132,000	9,777	130,680						
Alabama	1,800,000	127,659	1,206,000						
Mississippi	780,000	47,852	538,200						
Louisiana									
Texas	3,650,000	117,741	2,117,000	80,000	2,758	65,600			
Arkansas	925,000	45,121	462,500						
Tennessee	5,400,000	306,818	2,106,000	80,000	4,321	72,000	97,000	5,914	80,510
West Virginia	2,800,000	124,444	980,000	52,000	3,333	44,200	83,000	4,715	53,950
Kentucky	6,850,000	311,363	2,466,000	275,000	12,790	231,000			
Ohio	24,500,000	924,528	7,595,000	800,000	40,000	624,000	390,000	31,967	292,500
Michigan	11,500,000	366,242	5,175,000	955,000	47,750	735,350	620,000	43,971	427,800
Indiana	13,270,000	534,581	4,113,700	400,000	26,315	316,000	160,000	9,302	121,600
Illinois	48,000,000	2,400,000	12,480,000	2,200,000	124,293	1,100,000	175,000	11,824	141,750
Wisconsin	21,700,000	700,000	6,510,000	1,800,000	81,818	1,170,000	425,000	23,611	259,250
Minnesota	12,000,000	480,000	4,440,000	1,520,000	69,406	957,600	47,800	3,296	31,548
Iowa	21,250,000	836,614	4,887,500	5,800,000	241,666	2,610,000	140,000	9,459	109,200
Missouri	13,150,000	650,990	3,419,000	435,000	25,588	282,750	55,000	3,055	36,850
Kansas	12,389,000	390,820	2,725,580	1,960,000	69,406	882,000	96,000	6,000	86,400
Nebraska	3,500,000	138,339	805,000	470,000	21,363	150,400			
California	2,450,000	70,000	1,813,000	11,800,000	536,363	8,142,000			
Oregon	2,750,000	72,368	1,375,000	540,000	18,620	367,200			
Nevada	90,000	2,903	63,000	550,000	21,568	495,000			
The Territories	2,150,000	71,666	1,462,000	850,000	30,357	756,500			
Total	320,884,000	13,358,908	112,865,900	33,710,500	1,766,511	25,735,110	9,668,800	666,441	7,021,498

Summary for each State, showing the product, the area, and the value of each crop, for 1876—Continued.

States.	POTATOES.			TOBACCO.			HAY.		
	Bushels.	Acres.	Value.	Pounds.	Acres.	Value.	Tons.	Acres.	Value.
Maine	5,868,000	58,680	$3,696,840	....	....	....	1,264,800	1,290,612	$14,165,760
New Hampshire	3,990,000	39,900	2,394,000	414,000	276	$49,680	702,000	780,000	8,620,560
Vermont	5,265,000	37,607	2,632,500	....	....	....	1,060,500	1,060,500	10,933,755
Massachusetts	3,250,000	32,500	2,697,500	4,050,000	2,835	437,100	675,000	661,761	10,800,000
Rhode Island	500,000	7,092	500,000	....	....	....	115,000	143,750	2,300,000
Connecticut	1,700,000	26,153	1,649,000	7,568,000	6,203	688,688	575,000	558,252	10,062,500
New York	23,000,000	418,181	18,400,000	1,500,000	2,142	126,000	5,600,000	4,869,565	62,720,000
New Jersey	2,100,000	52,500	2,520,000	....	....	....	590,000	491,666	9,381,000
Pennsylvania	6,800,000	136,000	5,780,000	13,200,000	9,565	1,188,000	2,900,000	2,357,723	35,264,000
Delaware	325,000	4,642	308,750	....	....	....	37,500	31,779	562,500
Maryland	1,150,000	17,968	839,500	21,500,000	31,159	1,720,000	237,000	197,500	3,436,500
Virginia	1,350,000	21,093	837,000	49,300,000	82,166	3,944,000	256,000	261,800	3,537,920
North Carolina	850,000	12,142	544,000	16,225,000	29,500	1,460,250	116,200	92,960	1,292,144
South Carolina	104,000	1,300	96,720	....	....	....	24,000	20,000	306,000
Georgia	....	....	....	....	....	....	23,600	18,153	347,628
Florida	....	....	....	225,000	321	45,000	....	....	....
Alabama	260,000	4,642	249,600	....	....	....	24,600	18,461	402,000
Mississippi	320,000	4,000	307,200	....	....	....	23,500	17,407	383,285
Louisiana	40,000	555	34,000	....	....	....	....	....	....
Texas	544,000	5,726	364,480	175,000	234	38,500	80,000	57,971	900,800
Arkansas	450,000	5,844	261,000	1,980,000	2,200	237,600	23,000	16,428	301,300
Tennessee	1,260,000	15,750	604,800	32,200,000	51,111	2,576,000	165,000	121,323	2,237,400
West Virginia	1,125,000	17,045	585,000	2,750,000	4,296	220,000	265,000	203,846	2,650,000
Kentucky	2,100,000	25,609	1,029,000	128,000,000	188,235	8,960,000	363,000	290,400	3,720,750
Ohio	9,000,000	128,571	5,580,000	26,500,000	32,716	1,722,500	1,950,000	1,625,000	16,419,000
Michigan	4,750,000	86,363	3,420,000	....	....	....	1,375,000	1,057,692	13,750,000
Indiana	4,300,000	66,153	2,408,000	16,500,000	22,000	940,500	1,150,000	920,000	9,855,500
Illinois	9,450,000	126,000	5,764,500	11,000,000	14,473	627,000	3,500,000	2,500,000	23,380,000
Wisconsin	5,820,000	72,750	2,851,800	3,300,000	4,125	198,000	1,533,000	1,095,000	11,880,750
Minnesota	3,100,000	32,291	1,116,000	....	....	....	1,060,000	757,142	5,300,000
Iowa	7,000,000	87,500	5,600,000	....	....	....	1,950,000	1,373,239	9,750,000
Missouri	5,400,000	71,052	2,268,000	43,245,000	55,809	3,027,150	750,000	555,555	6,390,000
Kansas	5,286,000	50,342	2,643,000	770,000	1,100	77,000	804,000	720,000	4,233,600
Nebraska	1,400,000	18,181	448,000	....	....	....	380,000	271,428	1,280,600
California	4,000,000	32,000	3,320,000	....	....	....	850,000	629,629	9,868,500
Oregon	1,000,000	7,142	640,000	....	....	....	130,000	89,655	1,235,000
Nevada	220,000	2,200	211,200	....	....	....	55,000	40,740	742,500
The Territories	1,750,000	15,909	1,260,000	....	....	....	200,000	142,857	2,400,000
Total	124,827,000	1,741,953	83,861,390	381,002,000	540,457	28,282,968	30,867,100	25,282,797	300,901,252

Table showing the average yield per acre, and the price per bushel, pound, or ton, of farm-products for the year 1876.

States.	Corn.		Wheat.		Rye.		Oats.		Barley.		Buckwheat.		Potatoes.		Tobacco.		Hay.	
	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Pounds.	Price per pound.	Tons.	Price per ton.
Maine	31	$0 79	12	$1 58	14	$1 11	23	$0 49	18.5	$0 75	22.5	$0 62	100	$0 63			0.98	$11 20
New Hampshire	42	79	15	1 55	18	1 00	33	49	24.8	86	19	65	100	60	1,500	$0 12	0.90	12 28
Vermont	39	78	14.7	1 43	18.5	96	37	42	22.5	88	20.6	64	140	50			1.00	10 31
Massachusetts	35	75	18	1 30	13.5	90	30	51	25	90	13	65	100	83	1,640	9.4	1.02	16 00
Rhode Island	35	75			12	90	27	60	19	90			65	1 00			0.80	20 00
Connecticut	32.5	74	14.5	1 30	12	86	24	48	25	92	15	80	65	97	1,220	9.1	1.03	17 50
New York	30	68	15	1 31	12	82	28.5	42	22	83	14	74	55	80	700	8.4	1.15	11 20
New Jersey	36	56	13.6	1 32	13.5	81	26.5	42			11.5	83	40	1 20			1.20	15 90
Pennsylvania	35	55	13.2	1 25	14	74	28.6	35	22	85	13.6	74	50	85	1,380	9	1.23	12 16
Delaware	30	50	16	1 27	13	80	26	34					70	95			1.18	15 00
Maryland	29	49	12.5	1 27	13.5	76	21.5	34			19.5	61	64	73	690	8	1.20	14 50
Virginia	20	46	8.5	1 13	9.6	64	15.8	40			13.4	58	64	62	600	8	1.25	13 82
North Carolina	14.6	54	7.3	1 20	8.4	88	13.5	51					70	64	550	9	1.25	11 12
South Carolina	8.2	78	8	1 06	6.6	1 47	14.5	82					80	93			1.20	16 50
Georgia	11	69	6	1 34			11.6	68									1.30	14 73
Florida	10	86					13.5	99							700	20		
Alabama	13	48	6.5	1 23			14.1	67					56	96			1.30	16 75
Mississippi	15	55	7.7	1 38			16.3	69					80	96			1.35	16 31
Louisiana	17.2	70											72	85				
Texas	25	50	13	1 08	17.5	95	31	58	29	82			95	67	745	22	1.38	11 26
Arkansas	24	39	8.2	95	11	79	20.5	50					77	58	900	12	1.40	13 10
Tennessee	21.5	32	8.3	92	9	92	17.6	39	18.5	90	16.4	83	80	48	630	8	1.36	13 56
West Virginia	28.2	45	11	1 11	12.6	74	22.5	35	15.6	85	17.6	65	66	52	640	8	1.30	10 00
Kentucky	23.5	30	10	1 00	11.1	70	22	36	21.5	84			82	49	680	7	1.25	10 25
Ohio	36.7	38	11.8	1 14	12.8	68	26.5	31	20	78	12.2	75	70	62	810	6.5	1.20	8 42
Michigan	29	52	12	1 16	13.5	67	31.4	45	20	77	14.1	69	55	72			1.30	10 00
Indiana	30	34	11	1 02	12.2	71	22.7	31	15.2	79	17.2	76	65	56	750	5.7	1.25	8 57
Illinois	25	31	9.3	93	16	58	20	26	17.7	50	14.8	81	75	61	760	5.7	1.40	6 68
Wisconsin	34	41	9	1 01	14	63	31	30	22	65	18	61	80	49	800	6	1.40	7 75
Minnesota	25.4	40	8.5	90	16	61	25	37	21.9	63	14.5	66	96	36			1.40	5 00
Iowa	30	25	6.1	90	14	53	25.4	23	24	45	14.8	78	80	80			1.42	5 00
Missouri	27.8	28	12.4	89	14.8	57	20.2	26	17	65	18	67	76	42	775	7	1.35	8 52
Kansas	43.5	24	14.6	86	20.8	43	31.7	22	23.5	45	16	90	105	50	700	10	1.20	4 90
Nebraska	30	27	11.5	73	16.5	40	25.3	23	22	32			77	32			1.40	3 37
California	33	1 07	13	1 14	15.2	95	35	74	22	69			125	83			1.35	11 61
Oregon	30	90	17	70	21	75	38	50	29	68			140	64			1.45	9 50
Nevada	28	1 60	18.2	1 10			31	70	25.5	90			100	96			1.35	13 50
The Territories	25	95	18.2	1 00			30	68	28	89			110	72			1.40	12 00

Table showing the average cash value per acre of the principal crops of the farm for the year 1876.

States.	Average value per acre.	States.	Average value per acre.
Maine	$13 54	Texas	$13 21
New Hampshire	14 79	Arkansas	9 65
Vermont	13 55	Tennessee	8 70
Massachusetts	19 88	West Virginia	12 47
Rhode Island	18 75	Kentucky	12 19
Connecticut	20 12	Ohio	12 96
New York	15 33	Michigan	14 46
New Jersey	18 90	Indiana	10 63
Pennsylvania	15 65	Illinois	8 10
Delaware	17 26	Wisconsin	10 93
Maryland	15 43	Minnesota	8 30
Virginia	10 73	Iowa	7 30
North Carolina	8 88	Missouri	9 18
South Carolina	7 49	Kansas	10 37
Georgia	7 09	Nebraska	6 40
Florida	8 94	California	16 29
Alabama	6 76	Oregon	14 99
Mississippi	8 77	Nevada	21 88
Louisiana	12 07	The Territories	20 96

Table showing the average cash value per acre of farm-products for the year 1876.

States.	Corn.	Wheat.	Rye.	Oats.	Barley.	Buckwheat.	Potatoes.	Tobacco.	Hay.
Maine	$24 49	$18 96	$15 54	$11 27	$13 87	$13 95	$63 00	....	$10 97
New Hampshire	33 18	23 25	18 00	16 17	21 32	12 35	60 00	$180 00	11 05
Vermont	30 42	21 02	17 76	15 54	19 80	13 18	70 00	....	10 31
Massachusetts	26 25	23 40	12 15	15 30	22 50	8 45	83 00	154 16	16 32
Rhode Island	26 25	....	10 80	16 20	17 10	....	65 00	....	16 00
Connecticut	24 05	18 85	10 32	11 52	23 00	12 00	63 05	111 02	18 02
New York	20 41	19 65	9 84	11 97	18 26	10 36	44 00	58 80	12 88
New Jersey	20 16	17 95	10 93	11 13	....	9 54	48 00	....	19 08
Pennsylvania	19 25	16 50	10 36	10 01	18 70	10 06	42 50	124 20	14 95
Delaware	15 00	20 32	10 40	8 84	....	....	66 50	....	17 70
Maryland	14 21	15 87	10 26	7 31	....	11 89	46 72	55 20	17 40
Virginia	9 20	9 60	6 14	6 32	....	7 77	39 68	48 00	17 27
North Carolina	7 88	8 76	7 39	7 29	....	....	44 80	49 50	13 90
South Carolina	6 39	13 28	9 70	11 89	....	....	74 40	....	19 80
Georgia	6 60	8 04	....	7 88	....	....	....	....	19 14
Florida	8 60	....	....	13 36	....	....	....	140 00	....
Alabama	6 24	7 99	....	9 44	....	....	53 76	....	21 77
Mississippi	8 25	10 62	....	11 24	....	....	76 80	....	22 01
Louisiana	12 04	....	....	....	....	....	61 20	....	....
Texas	12 50	14 04	16 62	17 93	23 78	....	63 65	163 90	15 53
Arkansas	9 36	7 79	8 69	10 25	....	....	44 66	108 00	18 34
Tennessee	7 84	7 71	8 28	6 86	16 65	13 61	38 40	50 40	18 44
West Virginia	12 69	12 21	9 32	7 87	13 26	11 44	34 32	51 20	13 00
Kentucky	10 05	10 00	7 77	7 92	18 06	....	40 18	47 00	12 81
Ohio	13 94	13 45	8 70	8 21	15 60	9 15	43 40	52 65	10 10
Michigan	15 08	13 92	9 04	14 13	15 40	9 72	39 60	....	13 00
Indiana	10 20	11 22	8 66	7 03	12 00	13 07	36 40	42 75	10 71
Illinois	7 75	8 64	9 28	5 20	8 85	11 98	45 75	43 32	9 35
Wisconsin	13 94	9 09	8 82	9 30	14 30	10 98	39 20	48 00	10 85
Minnesota	10 16	7 65	9 76	9 25	13 79	9 57	34 56	....	7 00
Iowa	7 50	5 49	7 42	5 84	10 80	11 54	64 00	....	7 10
Missouri	7 78	11 03	8 43	5 25	11 05	12 06	31 92	54 25	11 50
Kansas	10 44	12 55	8 94	6 97	10 57	14 40	52 50	70 00	5 88
Nebraska	8 10	8 39	6 60	5 81	7 04	....	24 64	....	4 71
California	35 31	14 82	14 44	25 90	15 18	....	103 75	....	15 67
Oregon	27 00	11 90	15 75	19 00	19 72	....	89 60	....	13 77
Nevada	28 00	20 02	....	21 70	22 95	....	96 00	....	18 22
The Territories	23 75	18 20	....	20 40	24 92	....	79 20	....	16 80

A general summary showing the estimated quantities, number of acres, and aggregate value of the principal crops of the farm in 1876.

Products.	Number of bushels, &c.	Number of acres.	Value.
Indian corn	1,283,827,500	49,033,364	$475,491,210
Wheat	289,356,500	27,627,021	300,259,300
Rye	20,374,800	1,468,374	13,635,826
Oats	320,884,000	13,358,908	112,865,900
Barley	38,710,500	1,766,511	25,735,110
Buckwheat	9,668,800	666,441	7,021,498
Potatoes	124,827,000	1,741,983	83,861,390
Total	2,087,649,100	95,662,602	1,018,870,234
Tobacco ... pounds.	381,002,000	540,457	28,282,968
Hay ... tons.	30,867,100	25,282,797	300,901,252
Cotton ... bales.	4,438,000	11,677,250	229,444,600
Total	....	133,163,106	1,577,499,054

Table showing the average yield and cash value per acre, and price per bushel, pound, or ton of farm-products for the year 1876.

Products.	Average yield per acre.	Average price per bushel.	Average value per acre.	Products.	Average yield per acre.	Average price per bushel, pound, or ton.	Average value per acre.
Indian corn..bushels.	26.1+	$0 37.0+	$9 69	Buckwheat...bushels.	14.5 +	$0 72.6+	$10 53
Wheat ....do....	10.4+	1 03.7+	10 86	Potatoes........do....	71.6 +	65.5+	48 14
Rye ....do....	13.8+	66.9+	9 28	Tobacco ......pounds.	705 —	07.4+	52 33
Oats...........do....	24.0+	35.1+	8 44	Hay ....tons.	1.22+	9 74	11 90
Barley.........do....	21.9+	66.4+	14 56	Cotton........pounds.	178.6 +	11	19 64

NUMBERS AND CONDITION OF FARM-ANIMALS.

The estimates of numbers of farm-animals show a small increase over the previous record, except as to sheep, which appear to have suffered a slight diminution. They foot up as follows:

	January, 1877.	January, 1876.
Horses	10,155,400	9,735,300
Mules	1,443,500	1,414,500
Milch-cows	11,260,800	11,085,400
Oxen and other cattle	17,956,100	16,785,300
Sheep	35,804,200	35,935,300
Swine	28,077,100	25,726,800

There is also a slight decline in the price of every kind of farm-animals. The averages for the entire country are thus given:

	January, 1877.	January, 1876.
Horses	$60 08	$64 96
Mules	68 91	75 33
Milch-cows	27 32	28 89
Oxen and other cattle	17 10	19 04
Sheep	2 27	2 60
Swine	6 09	6 80

The high prices of horses in the Middle States are much reduced. The decline has been greater in the South than in the West.

The price of cattle in Texas has not materially declined, nor in Missouri, Kansas, or Nebraska; but the high prices that have prevailed in Iowa and Minnesota have been somewhat reduced. There is little change in prices in Illinois, but more in the States farther east. A great decline has taken place in California, from the scarcity of feed and pasturage during the past year.

An increase in numbers of swine is noticed in several States; for particulars of which see the accompanying table.

CONDITION OF FARM-ANIMALS.

Returns of the condition of farm-animals indicate a general state of health and thrift above average. Feed has been abundant, except in sections where little or no precaution is taken to store up hay for winter. Except among hogs, there has been no prevalent epizootic, and local diseases reported are mainly either lingerings of chronic ailments or euphemisms for emaciation and death occasioned by want of proper food and attention.

HORSES.—Horses have enjoyed a general exemption from unusual diseases. Mild forms of catarrhal disease, with occasional cases of lung-fever, are reported from northern latitudes; and from the South more frequent mention of similar diseases and local losses from blind-staggers—less frequently from glanders; and in the Mississippi Valley a few cases of charbon.

CATTLE.—No county reports a condition below average in New England, and only one in each of the Middle States. In the Southern States the condition has been better than usual for that section; but the cruelty and bad economy of neglecting due provision for shelter and winter-feeding are quite apparent. The old story is repeated of exposure and starvation, resulting in deaths on an extensive scale, and in far greater losses from emaciation, engendered disease, and retarded growth in the surviving. Facts show that in many localities in the mild and productive South Atlantic States stock-raising is far less profitable than in the extreme Northern States, where the cold of winter is intense and cattle have to be fed from the barn six to eight months in the year. The obvious reason is that in the latter States due provision is made to prevent direct losses by death, and far greater indirect losses by emaciation, weakened constitutions, and engendered diseases, and from exposure and want. The return from Taylor, Georgia, reported that from these causes alone, out of a herd of 500, 150, or nearly 43 per cent., had died, and they were "still dying." This is perhaps an extreme case, but other localities, and not a few, report results scarcely less disastrous. In the Northwest and West a superior condition was generally reported. In the five States north of the Ohio, and those west of the Mississippi, scarcely one in ten of the returns have been unfavorable.

Diseases.—The only disease extensively reported is starvation, and that is confined to the mildest and most productive portions of the country. No disease of any kind is reported from New England or New York. Pleuro-pneumonia has prevailed to a limited extent in Burlington, New Jersey, and Baltimore and Montgomery, Maryland. The prevalence of abortion and milk-fever was noted in a few localities. Black-leg is reported to a limited extent from all sections of the country.

A report from Laurens, Georgia, says: "There has been a great loss of cattle from what owners call 'murrain;' but I think it is emaciation from much exposure and short feed during the cold winter." A disease was reported under the same name, and perhaps induced by similar causes, in Catoosa also, and in one county each in South Carolina, Texas, Tennessee, West Virginia, and Kentucky; two in North Carolina, Alabama, Louisiana, Missouri, and Nebraska; three in Virginia, and five in Arkansas.

A disease designated as "black-tongue," or "sore-tongue," has been reported from a few localities in Mississippi, Georgia, Arkansas, Kentucky, Tennessee, and Illinois. The return from Johnson, Illinois, reports that the disease is new to that section, and gives the following particulars: It first appeared in the autumn of 1876 in several localities about the same time. Its approach was indicated by apparent inability to take food into the mouth. This was soon followed by swelling of the throat, stiffness of the jaws and limbs, tenderness in the feet, and rapid emaciation. A disease, not named and described as new, fatal in its results, showed like symptoms in Georgetown, South Carolina, and Lewis, Kentucky. On the Pacific coast, the same or a similar disease, "not understood," appeared and excited considerable alarm. The report from Wasco, Oregon, described it as first manifesting itself by a slight swelling on the lower jaws, close up to the head. This extends over the entire head, which becomes enormously large. The affected pine away; and if the disease is left to run its course, it terminates fatally. Most of the attacked had been shot, through fear that the infection might prove contagious. The disease seemed to prefer for its victims cattle on the range in good condition.

Cases of charbon were reported in two parishes in Louisiana.

In Etowah, Alabama, evidently from semi-starvation, diseases of farm-animals were prevalent. Besides heavy losses from "bloody murrain," "hollow-horn," "hollow-tail," &c., very many milch-cows died from some mysterious difficulty in calving. "They are in great agony for from two to six days before they are rid of the calf. Afterward they recuperate, eat, give no milk, and, within five or six days, die." There was also unusual fatality among milch-cows in Shelby, ascribed by the farmers to "hollow-horn" or "hollow-tail;" but our reporter surmises that hollow-stomach, with want of due protection from cold and storms, was the true source of the fatality.

The return from Caldwell, Texas, tells that, as a consequence of exposure and starvation, all cattle recently imported from the North, and about 10 per cent. of the native stock, including "nearly all cows that were pregnant," died.

An unknown disease, often resulting fatally, prevailed in the autumn in Benton and Montgomery, Iowa; Nemaha, Kansas, and four counties in Nebraska. In all these localities it is attributed to feeding on smutty corn or dry corn-fodder, or the excrement of grasshoppers on the fodder. Our correspondent in Cass, Nebraska, thinks it is caused by the too sudden change from the juicy prairie-grass to the dry corn-fodder, and especially for the reason that the disease does not occur in cases where rye sown among the corn is sufficiently grown to be nipped when the cattle are turned in. A like opinion is expressed in the report from Madison.

Losses.—As a rule, cattle properly protected and fed have wintered with gain rather than loss. Among those left to provide their own shelter and food the loss by death, while relatively less than in more changeable and severe winters, has been absolutely great, and in the surviving the loss of everything except life itself has been enormous.

SHEEP.—Sheep are in medium condition, having suffered less than usual even in regions where they are not properly fed and sheltered. In portions of California, owing to the failure of the usual amount of rain, heavy losses have resulted from lack of feed. In Kern, there was no feed outside of alfalfa-lands; 25 per cent. died of starvation, not over 5 per cent. of the lambs had been saved, and thousands of sheep had been sold at 37½ to 50 cents per head, to be driven to Nevada and Oregon. In Stanislaus and southward they were reduced to the starvation point and dying rapidly; had been sold as low as 13 cents per head. In San Diego one-third in many flocks had died.

Diseases.—No extraordinary diseases have prevailed. In all sections, in localities where the necessary means of prevention and cure have been neglected, foot-rot and scab had been perpetuated. Grub in the head is noted in a few localities in Ohio. In the Southern States the disease called "rot" is frequently noted, particularly in localities where sheep "are not well cared for." In the same section, next to exposure and starvation, "dog-slaughter" is the most pestilent disease, and the one which has more influence than all others in discouraging sheep-husbandry.

Remedy for scab.—Californians recommend, as the cheapest remedy, and as effectual as any, a dip made from lime 1 part, and sulphur 2 parts, boiled together until both are dissolved; then reduce with hot water, 150 parts to 1, making the temperature of the dip 112° Fahr. They dip by swimming the sheep through a trough of the following dimensions: 24 feet long, 8 inches wide at the bottom, 30 inches at the top, with an inclined platform at one end for the sheep to drain upon, the liquid passing back into the trough. A half-barrel of lime and one barrel of sulphur is sufficient for 1,500 sheep. The sheep should be dipped at shearing, and again ten days after. They should be kept from the old yard and placed on a clean range. The cure will be permanent, unless they again come in contact with diseased sheep. In Humboldt about 25 per cent. have the scab. Most of the sheep are shorn twice each year. After being shorn, diseased flocks are dipped in a strong decoction of tobacco. One dipping generally does till the next shearing.

Losses.—The localities and causes of the heavier losses definitely reported were as follows: Disease of the throat: Jackson, Mississippi, 25 per cent. Diarrhea or purging: Loudoun, Virginia, and Campbell, Tennessee, 15 per cent.; Lake, Illinois, 10 per cent. Scab: Kaufman, Texas, and Taylor, Iowa, 10 per cent. Scab and hunger: Bee, Texas, 15 to 20 per cent. Rot: Wilkes, North Carolina, Union, Georgia, and Morgan, Tennessee, 10 per cent.; Monroe, Tennessee, 30 per cent. Foot-rot: Some flocks in San Jacinto, Texas, 50 per cent. Foot-rot and other diseases: Licking and Morrow, Ohio, 10 per cent. Exposure and hunger: Gaston, North Carolina, and Kosciusko, Indiana, 10 per cent.; Claiborne, Louisiana, and Hillsdale, Michigan, 20 per cent.; Clay, North Carolina, and Navarro, Texas, 25 per cent. Wolves: Freeborn, Minnesota, 20 per cent. Wolves and dogs: Nodaway, Missouri, 25 per cent. Dogs: Craighead, Arkansas, 15 per cent. Causes not known or not named: Harnett, North Carolina, and Marion, Kentucky, 10 per cent. In flocks of 200 or more, in Carroll, Kentucky, 20 per cent.

Extraordinary losses of spring lambs were reported in Prince George's, Maryland; Grenada, and Greene, Mississippi; and Monroe and Blount, Tennessee.

SWINE.—*Diseases.*—In New England, where hogs are kept in small lots, and usually well cared for, no disease prevailed the past year. In Columbia, New York, about 5 per cent. of the hogs died of lung-disease, ascribed to want of cleanliness in their pens. A "peculiar disease," by which the affected suddenly become sore in the back and hams, and lose the use of their hind legs, prevailed throughout Chatauqua. In Burlington, New Jersey, 10 per cent. died of "the scours."

Pennsylvania constitutes the northeastern border of a vast region infected with hog diseases, most of which are classed under the name of cholera. In this State 7 returns in 45 report the prevalence, to a greater or less extent, of disease so named; Maryland, 3 in 16; Virginia, 15 in 69; North Carolina, 28 in 51; South Carolina, 8 in 17; Georgia, 44 in 68; Florida, 6 in 14; Alabama, 20 in 30; Mississippi, 18 in 33; Louisiana, 6 in 19; Texas, 25 in 70; Arkansas, 15 in 34; Tennessee, 36 in 49; West Virginia, 5 in 34; Kentucky, 36 in 43; Ohio, 26 in 57; Indiana, 37 in 42; Illinois, 47 in 61; Iowa, 35 in 55; Missouri, 58 in 68; Kansas, 16 in 41; Nebraska, 11 in 30.

The following are the principal diseases reported under other names or no name: A disease reported in different localities under different names—such as "new," "unknown," "very different from any heretofore known," "diphtheria," "sore-throat," "head and neck disease," "mouth and throat disease," &c.—but the descriptions of which imply identity, is thus described in the return from Lauderdale, Alabama:

> It is principally confined to the mouth, throat, and lungs; but often affects the kidneys, occasioning copious discharges of bloody urine. In its first stages the mouth and tongue are much ulcerated, so that the hog cannot take usual food, being unable to masticate even a tender apple. Within three or four days a heavy coughing ensues, the lungs become badly ulcerated, and in many cases entirely consumed. At this stage great thirst prevails, and the hog will lie around near or in the water until death. In some cases they continue to live fifteen days without seeming to take any nourishment. In some localities 80 per cent. of all the hogs have died of this disease. It made its appearance here in July, and is still prevailing to a limited extent. It has thus far proved incurable.

In Ohio, Van Wert, the affected are taken with a cough, become stupid, refuse to eat, and have great difficulty in breathing; "they blow and throw up, leave the herd, linger around, lie down, and seldom get up again." The time between the attack and death ranges from one to fourteen days. In post-mortem examinations the lungs are found to be rotten, and to emit a very offensive odor. In Preble, "some do not live more than twenty-four hours after the attack, while others linger along for several days. The lungs at death are usually entirely gone." The report from Iroquois, Illinois, states:

> We have had among swine a disease new to us, which has taken many hogs of all ages, but is perhaps more prevalent among large fat hogs. The first symptom is a cough; in a short time they are troubled to breathe, and three out of four die within a period ranging from twenty-four hours to six days. On examination, after death, their lungs seemed to be the only part diseased. In some cases one lung will be entirely gone and the other swollen and hard, of a blue or purple color, and when cut into a a kind of yellow frothy matter springs out.

This disease, or a disease attended with like symptoms and results, is reported as occasioning a loss of 25 per cent. in Brunswick, Virginia, of 90 per cent. in Newberry, South Carolina, of 4,000 in Saint Clair, Alabama, and heavy losses in Lauderdale; also as more or less fatal, without definite specifications, in Rapides, Louisiana; Howard, Arkansas; Van Wert and Preble, Ohio; Elkhart, Indiana; Rock Island, Grundy, Carroll, and Iroquois, Illinois; Richland, Wisconsin; Muscatine, Iowa; Pemiscot and Clinton, Missouri; and Cass and Dodge, Nebraska. In Brunswick, Virginia, a few recover; in which cases, as soon as convalescence begins, every particle of hair comes out, and the skin breaks out all over in sores."

In Georgia, Union, a nameless disease prevails, which covers the attacked with sores resembling the eruptions of small-pox. In Laurens, large losses resulted from a disease called "yellow-sweat." Its prevalence is attributed to a lack of green food, since hogs which run in fields of winter rye and oats are not subject to it.

The prevalence of "thumps" is noted in Columbia and Santa Rosa, Florida; Cumberland, Kentucky; Lucas, Ohio; Martin, Indiana; Boone, Missouri; Brown, Kansas; and Pawnee, Nebraska.

Pneumonia, in Boyle, Butler, Scott, Bracken, Meade, Spencer, and Livingston, Kentucky; Greene, Ohio; Brown, Indiana; Perry, Schuyler, Warren, and Grundy, Illinois; Wayne, and Saint Francois, Missouri; and Chautauqua and Allen, Kansas.

Red mange, in Bienville, Louisiana; Titus, Hamilton, and Wood, Texas; and Bradley, Newton, Sevier, and Ouachita, Arkansas.

Quinsy, in Decatur and Grant, Indiana; Benton, Grundy, Hamilton, Jones, Marion, Mills, Sac, and Webster, Iowa; Livingston and Laclede, Missouri; Smith and Republic, Kansas; and Webster and Cass, Nebraska.

Diseases resulting from worms, in Bureau, Jackson, Grundy, Sangamon, Hancock, and Fulton, Illinois; Sherburne, Wisconsin; Livingston, Pike, Wayne, Johnson, Lincoln, and Stone, Missouri; Johnson and Lyon, Kansas; and Corning and York, Nebraska.

Lung-fever or lung-disease, in Tazewell, Macon, Montgomery, Carroll, Clark, and Ogle, Illinois; and Benton, Chariton, Pettis, and Clinton, Missouri.

In Ohio, the prevalence of blind-staggers among hogs is reported in Morrow, and of black-tooth and scurvy in Lorain.

In October and November a strange and fatal disease prevailed in two localities widely separated in Sauk, Wisconsin. In every case of attack death followed within twenty-four hours. The symptoms were, loss of appetite, stupor, and purging. In Walworth there had been greater fatality than for years, the cause of which could "not even be guessed at." Young pigs died in large numbers; also sows about the time of farrowing. In Wisconsin there was some fatality among fat hogs from an unknown disease, which deprives them of the use of their legs.

In Sherburne, Minnesota, some hogs lost the use of their hind legs, and pined away until worthless. These effects are attributed to kidney-worms.

In Woodson, Kansas, a disease resembling piles destroyed 25 per cent. of the pigs dropped in cold weather. "The rectum protrudes and appears much inflamed; the pigs become poor and lank, and though they continue to suck and eat with a good appetite, the disease progresses until it terminates in death." Doniphan reported large losses by a new disease. Post-mortem examinations showed diseased lungs, liver, and brain, and, in some cases, "ugly-looking worms in the neck."

In Merced, California, a new disease, mostly limited to hogs in good order, had appeared. The attacked lose the use of their fore legs, drop on the breast, and die within twenty-four hours.

Preventives and remedies.—Our correspondents in different localities report various antidotes and curatives for "cholera," as they have for years, but certainly no specific has been found. It is possible that some gleams of light may come from a publication of their views.

In Beaufort, North Carolina, the reporter, reporting that 10 per cent. of the hogs over, and 20 per cent. of those under, one year old have died of cholera, so called, adds:

I keep a trough, to which my hogs have access, well supplied with ashes, salt, and sulphur. The disease has been very fatal among the hogs of my neighbors, and of the tenants and laborers on my farm; but though I keep a large number, none have been affected except seven sucking pigs, all of which died.

Our correspondent in Wayne, Georgia, reports:

Cholera has been raging ever since October. In some neighborhoods it has killed nearly all; one man lost all but 6 out of 170; another, all but 1 out of 93. All the remedies applied have thus far failed to *cure;* but I believe that corn boiled in wood ashes or potash is a *preventive.* Once or twice a week I have fed my hogs on corn so prepared, and while my neighbors' hogs have died at a rapid rate, I have not lost a hog. The general loss is estimated at 50 per cent.

The report from Simpson, Kentucky, stating that hogs in that section are generally regarded as the most profitable farm-stock, adds:

As what is known as cholera is the prevailing disease, I will give the experience of five or six good farmers in my neighborhood. A few years since we were induced to believe that crude petroleum was a good thing to promote the health of stock of all kinds, and especially of the pig. We use a common tin sprinkler, and occasionally give them a thorough oiling. When not threatened with the disease, once in two or three months is sufficient. We also put the petroleum on corn fed to them. The result is that for five years not one who has practiced this has been troubled with diseased hogs; and that, too, when disease and death have surrounded us. These farmers keep severally from 75 to 200 hogs. We are thoroughly convinced that petroleum is an effectual preventive.

A correspondent in Du Page, Illinois, reports that his hogs, in common with others in the locality, were attacked with cholera last September. After about 20 of his best shoats had died he gave the surviving a plenty of charcoal in their slops, and it operated as an effectual cure. This is confirmatory of the first of the following extracts from Indiana reports:

De Kalb: The best remedy is a mixture of charcoal and soda, given in bran, or any other way the hogs can be induced to eat it. *Decatur:* The only remedy that has done any good is turpentine in slops. As a preventive, a teaspoonful is given to each hog twice a week; as a cure, the same dose daily. *Tippecanoe:* I had a pair of very fine sows affected apparently with the worst form of the disease called cholera. They were so reduced by purging that they could not stand. They were cured by administering large doses of soft soap. They seemed to crave it, and would eat it long after they refused corn or the best of sweet milk. The recovery was perfect. This unexpected result seems to sustain the theory of a neighbor, that worms in the intestines are the cause of the disease.

Our correspondent in Pope, Illinois, reporting a loss of 30 per cent. in the county, says:

My hogs have not been affected with the disease for years. I have given them warm soap suds once or twice per week. Whether this has been a preventive I will not say; but the disease has prevailed in the herds of my neighbors.

In Oakland, Michigan, "thumps," popularly credited with causing the death of 10 per cent., is believed to be caused by undue heat and impure air from close confinement in tight pens. From Tuscola, also, the report states: "Sow after sow is losing her entire litter, and we are unable to ascertain the cause; but I think one cause may be found in the fact that a great many breeding-sows are kept in close pens, and so do not get sufficient exercise."

The report from Grundy, Illinois, expresses the opinion that pneumonia results from penning hogs in such a way that, during cold nights, they are allowed "to pile up one above another;" the consequence is that those underneath, after becoming heated and getting into a state of perspiration, rush out into the cold air. The same report states that a mixture of copperas and sulphur, put in the swill, results in expelling worms from the intestines and generally improving the physical condition of hogs. In Dallas, Iowa, the farmers who allow "too many hogs to sleep together have suffered the heaviest losses;" and in Camden, Missouri, "hogs that have had clean, roomy pens, pure water, and sound grain have generally escaped disease."

Losses.—The Eastern, Middle, Lake, and Pacific States report scarcely any losses beyond those from ordinary casualties. The exceptions to this are in Maryland, where a loss of 15 per cent. in Montgomery and 10 in Charles and Worcester is attributed to cholera. In the interior belt, embracing Kentucky, Indiana, Illinois, and Missouri, and in the States bordering the Gulf, the losses are very heavy, involving a large portion of the entire area. For the most part losses are not specified in returns which report no disease or special cause, and therefore the percentage chiefly represents extraordinary losses; that is, losses from disease, starvation, and ill treatment. Taking the numbers and average values returned for the 1st of January, 1877, as the basis of calculation, the percentage, numbers, and values of the losses, during the year ending April 1, in the several States within the area named, as indicated by unusually full returns, are as follows:

States.	Per cent.	Number.	Value.	States.	Per cent.	Number.	Value.
Virginia	4	24, 296	$111, 275 68	West Virginia	4	10, 828	$51, 324 72
North Carolina	10	73, 550	308, 910 00	Kentucky	21	333, 522	1, 821, 030 12
South Carolina	10	28, 410	118, 753 80	Ohio	7	122, 899	930, 345 43
Georgia	10	148, 310	532, 432 90	Indiana	18. 6	441, 750	2, 893, 462 50
Florida	20	33, 320	90, 630 40	Illinois	22	605, 000	4, 840, 000 00
Alabama	24	190, 464	660, 910 08	Iowa	13. 6	443, 795	3, 235, 265 55
Mississippi	18	214, 074	783, 510 84	Missouri	30	768, 000	4, 185, 600 00
Louisiana	14	33, 964	127, 025 36	Kansas	14	50, 372	398, 946 24
Texas	12	137, 340	565, 840 80	Nebraska	6	10, 230	73, 451 40
Arkansas	16	160, 048	571, 371 36				
Tennessee	16	174, 064	750, 215 84	**Total**	......	4, 004, 236	23, 050, 303 02

Table showing the estimated total number and total value of each kind of live stock, and the average price, in January, 1877.

States.	HORSES.			MULES.			MILCH-COWS.		
	Number.	Average price.	Value.	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	80,100	$71 21	$5,703,921				167,500	$30 00	$5,025,000
New Hampshire	56,000	67 95	3,805,200				98,200	32 20	3,162,040
Vermont	75,200	70 87	5,329,424				215,700	29 00	6,255,300
Massachusetts	131,000	88 99	11,657,690				118,700	40 00	5,948,000
Rhode Island	14,500	94 62	1,371,990				20,400	37 50	765,000
Connecticut	52,100	75 83	3,950,743				112,000	38 12	4,269,440
New York	692,600	85 61	59,293,486	19,000	$90 92	$1,727,480	1,526,200	35 00	53,417,000
New Jersey	115,700	94 90	10,979,930	14,800	111 28	1,646,944	146,300	42 00	6,144,600
Pennsylvania	590,900	75 66	44,707,491	26,000	90 57	2,354,820	845,300	34 50	29,162,850
Delaware	19,600	76 80	1,505,280	4,000	99 30	397,200	23,000	34 00	782,000
Maryland	107,600	75 90	8,166,840	11,100	91 34	1,013,874	99,600	30 03	2,990,988
Virginia	198,700	64 54	12,824,098	29,800	79 42	2,366,716	229,200	21 88	5,014,896
North Carolina	141,000	70 30	9,912,300	52,700	73 87	3,892,949	203,000	15 26	3,097,780
South Carolina	57,400	82 29	4,723,446	45,500	92 08	4,189,640	162,400	20 00	3,248,000
Georgia	118,300	72 54	8,581,482	96,200	83 33	8,016,346	270,400	16 68	4,510,272
Florida	16,700	72 96	1,218,432	9,100	84 17	765,947	67,400	15 12	1,019,088
Alabama	105,400	62 91	6,630,714	102,400	69 56	7,122,944	171,500	17 78	3,049,270
Mississippi	90,800	69 21	6,284,268	96,100	86 70	8,331,870	178,000	18 48	3,289,440
Louisiana	77,000	56 31	4,335,870	79,100	76 29	6,034,539	89,600	20 71	1,855,616
Texas	785,800	30 23	23,754,734	112,900	49 42	5,579,518	505,100	14 53	7,339,103
Arkansas	162,000	47 96	7,769,520	85,900	60 19	5,170,321	165,700	15 30	2,535,210
Tennessee	331,100	55 28	17,750,408	99,800	59 88	5,976,024	225,700	18 82	4,247,674
West Virginia	114,100	55 34	6,314,294	2,400	59 36	142,464	125,500	26 53	3,329,515
Kentucky	368,300	53 19	19,589,877	82,400	51 25	4,223,000	217,100	29 18	7,210,378
Ohio	750,000	63 46	47,595,000	26,500	66 20	1,754,300	700,000	32 91	23,037,000
Michigan	305,800	75 19	22,993,102	3,800	93 21	354,198	368,300	31 74	11,689,842
Indiana	675,600	54 74	36,982,344	60,100	63 88	3,839,188	439,200	26 70	11,726,640
Illinois	1,102,600	58 62	64,634,412	113,300	68 08	7,713,464	724,900	27 87	20,202,963
Wisconsin	359,100	65 56	23,542,596	8,500	85 71	728,535	474,000	26 86	12,731,640
Minnesota	310,000	66 70	20,677,000	6,000	83 61	501,660	249,800	21 05	5,258,290
Iowa	726,900	58 65	42,632,685	37,700	75 90	2,861,430	665,300	23 56	15,674,468
Missouri	598,900	42 33	25,351,437	121,900	50 56	6,314,944	460,100	21 11	9,712,711
Kansas	234,100	50 31	11,777,571	26,200	65 41	1,713,742	273,400	23 26	6,359,284
Nebraska	111,000	68 00	7,548,000	9,000	95 61	860,490	85,200	26 83	2,285,916
California	260,000	39 50	10,270,000	26,500	67 75	1,795,375	381,900	30 64	11,701,416
Oregon	97,700	43 95	4,293,915	3,400	41 87	142,358	88,900	20 45	1,818,005
Nevada	11,000	43 00	473,000	1,100	71 00	78,100	10,000	31 50	315,000
The Territories	120,800	43 66	5,274,128	27,300	68 52	1,870,596	296,300	25 52	7,561,576
Total	10,155,400		610,206,631	1,443,500		99,480,976	11,260,800		
Grand average of prices		60 08			68 91			27 32	307,743,211

Table showing the estimated total number and total value of each kind of live stock, and the average price, in January, 1877—Continued.

States.	Oxen and other cattle.			Sheep.			Hogs.		
	Number.	Average price.	Value.	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	199,800	$25 78	$5,150,844	520,600	$2 90	$1,509,740	59,900	$10 11	$605,589
New Hampshire	119,100	29 01	3,455,091	242,400	2 66	644,784	38,700	14 99	580,113
Vermont	131,800	23 35	3,077,530	475,700	2 84	1,350,988	53,300	10 31	519,523
Massachusetts	110,400	40 81	4,505,424	61,000	3 67	223,870	78,600	14 80	1,163,280
Rhode Island	15,600	46 12	719,472	25,000	3 70	92,500	17,100	13 80	235,980
Connecticut	112,900	38 66	4,364,714	92,500	3 60	333,000	58,400	15 74	919,216
New York	663,200	30 15	19,995,480	1,897,700	3 58	6,793,766	580,000	9 30	5,394,000
New Jersey	82,100	38 18	3,134,578	125,800	4 87	612,646	151,400	9 56	1,417,384
Pennsylvania	701,000	26 01	18,233,010	1,607,600	3 17	5,096,092	901,200	9 48	8,543,376
Delaware	31,700	25 62	812,154	23,600	4 17	98,412	46,700	8 38	391,346
Maryland	116,900	21 09	2,465,421	144,000	3 68	529,920	252,100	6 68	1,684,028
Virginia	393,500	17 12	6,736,720	367,000	2 81	1,031,270	607,400	4 58	2,781,892
North Carolina	316,300	10 63	3,362,269	281,000	1 54	432,740	735,500	4 20	3,089,100
South Carolina	181,800	11 95	2,208,360	144,100	1 82	262,262	284,100	4 18	1,187,538
Georgia	404,900	9 30	3,765,570	378,600	1 63	617,118	1,483,100	3 59	5,324,329
Florida	363,400	6 44	2,340,296	40,400	2 02	81,608	166,600	2 72	453,152
Alabama	330,500	9 96	3,291,780	195,100	1 71	333,621	793,600	3 47	2,753,792
Mississippi	310,100	10 81	3,352,181	163,900	1 72	281,908	1,189,300	3 66	4,352,838
Louisiana	171,900	10 02	1,722,438	71,500	1 87	133,705	242,600	3 74	907,324
Texas	3,390,500	9 24	31,328,220	2,826,700	2 04	5,766,468	1,144,500	4 12	4,715,340
Arkansas	261,300	10 33	2,699,229	190,400	1 77	337,008	1,000,300	3 57	3,571,071
Tennessee	317,200	10 92	3,463,824	345,100	2 01	693,651	1,087,960	4 31	4,688,849
West Virginia	235,200	20 92	4,920,384	544,500	2 30	1,252,350	270,700	4 71	1,283,118
Kentucky	377,900	21 47	8,113,513	690,400	2 79	1,926,216	1,588,200	5 46	8,671,572
Ohio	775,000	23 37	18,111,750	3,900,000	2 52	9,828,000	1,755,700	7 57	13,290,649
Michigan	397,700	24 18	9,616,386	2,100,000	2 72	5,712,000	505,600	7 36	3,721,216
Indiana	764,500	17 72	13,546,940	1,175,000	2 23	2,620,250	2,375,000	6 55	15,556,250
Illinois	1,287,000	21 20	27,284,400	1,258,500	2 50	3,146,250	2,750,000	8 00	22,000,000
Wisconsin	466,800	21 22	9,905,496	1,151,100	2 45	2,820,195	562,300	6 71	3,773,033
Minnesota	339,300	18 07	6,131,151	209,200	2 33	487,436	215,500	5 72	1,232,660
Iowa	958,800	17 82	17,085,816	1,680,500	2 29	3,848,345	3,263,200	7 29	23,788,728
Missouri	846,300	17 17	14,530,971	1,297,000	1 91	2,477,270	2,560,000	5 45	13,952,000
Kansas	525,000	17 09	8,972,250	142,400	2 41	343,184	359,800	7 92	2,849,616
Nebraska	195,400	20 86	4,076,044	60,600	2 75	166,650	170,500	7 18	1,224,190
California	1,053,500	16 52	17,403,820	7,290,000	1 40	10,206,000	417,700	6 20	2,589,740
Oregon	147,200	11 80	1,736,960	859,700	1 80	1,547,460	188,700	3 42	645,354
Nevada	48,100	19 00	913,900	24,000	2 10	50,400	5,400	9 00	48,600
The Territories	809,500	18 00	14,571,000	3,201,600	2 25	7,203,600	116,500	9 54	1,111,410
Total	17,956,100	....	307,105,386	35,804,200	....	80,892,683	28,077,100	....	171,077,196
Grand average of prices	....	17 10	....	....	2 27	....	....	6 09	....

COTTON INVESTIGATION.

The cotton crop deservedly claims the attention of the industrial world, not because it represents more money-value than any other agricultural product, for corn and hay each exceed it, and wheat equals it; but because it is the largest export product, the largest crop of the South, and one that must ever exercise an important influence upon the industry of that section. Meat-production also largely surpasses it in value, and the surplus of meat-production exported comes next to the figures of cotton exports; and when rotation and rational culture shall rule in the agriculture of the future, and home manufacture shall restrict exportation of raw material, the meat exports of the cotton States alone may equal the foreign shipments of the coveted fiber. Meat and breadstuffs together surpass cotton in value of exports.

There is no portion of the world occupied by civilized nations, and probably no equal extent of the earth's surface, so peculiarly suited to cotton-culture as the States of the Gulf coast. There are large areas with the requisite soil and the high temperature required, but with these essentials the necessary degree of humidity is rarely combined in so complete equilibrium. It constitutes an advantage which virtually gives the monopoly of cotton-production to the United States. The policy of Great Britain has ever been to obtain a controlling proportion of raw material for her manufacturers from her own colonies, and to this end her Cotton Supply Association has searched the world over for cotton-fields that would make her independent of this country. This is a natural and laudable ambition, a means of self-protection, and the highest measure of "protection" she could institute; for while she commends free trade to other nations, she finds in it the highest form of protection, precisely as she built up her manufacturing system by restrictive duties up to a period when the opposite policy tended to secure a continuance of the superiority thus wisely gained. When debarred from our cotton-fields by civil war, the receipts from India were increasing under the stimulus of this self-protecting effort; yet with a cotton famine in Manchester, and starvation threatening the spinners, the increase from 369,000,000 pounds in 1861 to 506,000,000 in 1864 was less than the advance from 1857 to 1861. In the very first year of peace in this country these imports declined one-eighth, though they rallied in 1866 to 615,000,000, the highest figures ever attained, and rapidly declined afterward to less than half that quantity.

In 1858 and 1860 the receipts from America constituted four-fifths of the British imports. In 1863 they amounted to a fraction of 1 per cent.; in 1864, 1½ per cent., and in 1862 but 2½ per cent. Starting at 37 per cent. in 1866, in 1876 the proportion reached 62 per cent., and the proportion of India cotton had fallen to 18½ per cent.

The price, as an index of quality, tells the story of India's inability to compete with the United States. The average value per pound, in pence, of British imports, is thus given:

	1872.	1873.	1874.	1875.	1876.
Cotton of the United States	9.9	9.1	8	7.7	6.4
Cotton of India	7.	6.4	6	5.7	5.1

American seed and American planters have in vain been introduced into India; the fiber inevitably deteriorates, becomes short, dry, harsh, and brittle, with a low rate of yield.

With an assured market, constantly enlarging with the augmenting requirements of extending civilization, the American cultivator is by no means uniformly happy. Protesting that the demand could never be supplied under existing demoralization of labor, he has seen the price decline 37 per cent. by an increased product in a single year of 38 per cent. Declaring that 3,000,000 bales could never again be produced, 4,500,000 appear before his wonder at the rapid recuperation has grown old. He has learned, if an apt scholar, that 10,000,000 can be attained within ten years, if such a quantity shall be needed for the world's consumption. He should know that, when restorative culture shall take the place of exhaustive cropping so long in vogue, such a crop can easily be had upon an area not greatly larger than that now cultivated.

As no one can doubt the ability of this country to supply all that may be needed for a period running far into the future, the important point of profitable culture is to be settled. For ten years past it has been the constant endeavor of this Department to aid the thinking, progressive cultivators of cotton in their endeavor to break up the spoliating practice of exclusive and continuous growing of "white crops," of corn and cotton. Not that cotton in itself is necessarily an exhausting crop, if its stalk and seed are returned to the soil; but in a climate with sunlight so intense, with the clean culture essential to the growth of cotton, there is waste by the decomposition of organic matters sufficient in a single season to feed several crops. Pease in light soils, red clover in clays, or lucerne in deep, rich, well-drained lands, would supply essential parts of a rotation that would give a wealth of animal products and a nearly doubled yield of cotton, derived from animal manures, the green manuring of vegetable decomposition, and the saving of much of the serious waste of valuable humus in continuous clean culture.

THE RECENT INVESTIGATION.

Few are aware of the rapidity of the recuperation in cotton production since the prostration of the war period. It is not generally known that the aggregate product since 1865 exceeds that of a similar period prior to 1861. If we include the crop of 1876, the excess of its production in the period of twelve years, from 1849 to 1860 inclusive, over the former period, is about 2,000,000 bales.

Leaving out the large crop of last year, the statistics of which are not yet complete, similar periods of eleven years make a comparison also favoring the production of the later. The aggregate of the crop movement of the former is 36,169,117 bales, or 15,869,176,615 pounds, averaging 3,288,101 bales per annum, or 1,442,652,419 pounds. A similar statement for 1865 to 1875, inclusive, reads, 36,331,582 bales, or 15,939,344,833 pounds, averaging 3,302,871 bales per annum, or 1,449,031,348 pounds. An average increase of nearly 15,000 per annum. The great crop of 1859 was but 2 per cent. larger than that of 1875. Three crops since the war are each larger than any prior to it, with the above single exception; these are, in order of size, 1875, 1870, 1873. The crop of 1872 was larger than that of 1858, and every crop preceding the latter is surpassed by every crop of the seven past years, with one exception, 1871. This is a remarkable result, which is a surprise to planters themselves, and an indication of what can be accomplished in the future when the cotton area shall be an essential part of a rotation, and fertilizers shall be not the least important product of the plantation, and two bales are made to grow where one grew before, as can easily be accomplished on many acres of present slovenly cultivation.

The details of production during the two periods named are thus given, the pounds per bale being the average net weight of Liverpool receipts, which include a large portion of each crop:

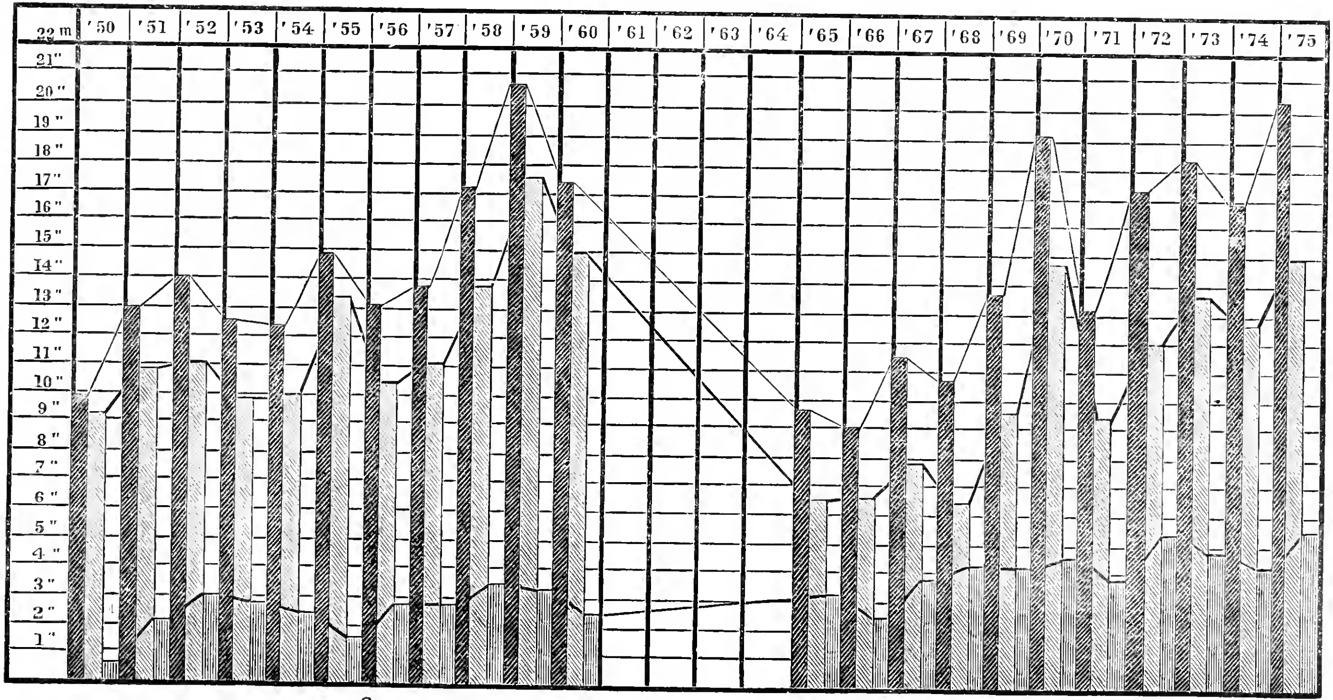
Years.	Bales.	Weight per bale.	Pounds.
1850	2, 355, 257	416	979, 786, 912
1851	3, 015, 029	428	1, 290, 432, 412
1852	3, 262, 882	428	1, 396, 513, 496
1853	2, 930, 027	430	1, 259, 911, 610
1854	2, 847, 339	434	1, 235, 745, 126
1855	3, 527, 845	420	2, 481, 694, 900
1856	2, 939, 519	444	1, 305, 146, 436
1857	3, 113, 962	442	1, 376, 371, 204
1858	3, 851, 481	447	2, 721, 612, 007
1859	4, 669, 770	445	2, 078, 047, 650
1860	3, 656, 006	477	1, 743, 914, 862
	36, 169, 117		15, 860, 176, 615
1865	2, 193, 987	441	967, 548, 267
1866	2, 019, 774	444	896, 779, 656
1867	2, 593, 993	443	1, 149, 138, 899
1868	2, 439, 039	437	1, 065, 860, 043
1869	3, 154, 946	434	1, 369, 246, 564
1870	4, 352, 317	438	1, 906, 314, 846
1871	2, 974, 351	439	1, 305, 740, 089
1872	3, 930, 508	440	1, 729, 423, 520
1873	4, 170, 388	439	1, 830, 800, 332
1874	3, 832, 991	439	1, 682, 683, 049
1875	4, 669, 288	436	2, 035, 809, 568
	36, 331, 582		15, 939, 344, 833

Nine years ago an investigation was undertaken that showed about four-fifths of the arable culture of the cotton States to be cotton and corn, of which cotton occupied the larger area, in the proportion of 44 to 38. This may not have been precisely accurate, but it properly represented cotton as occupying the larger area. It was also shown that wages were less than in 1860, and labor less efficient; that a small proportion of laborers took money wages, the prevalent practice being what is usually known as the "share system," a partnership in which labor wrought without direction and capital was advanced without security. There was some disposition of freedmen to secure land, but little success in creating the means of payment. As a matter of course, there was a general reduction in the size of farm-holdings.

For the purpose of comparison with the report of 1868, (see last article in the annual volume of 1867,) circulars were issued to county correspondents in January, 1877, and information sought upon the following points, viz:

1. The number of bales produced in the county in 1876.
2. Number of acres of cotton cultivated.
3. Ratio of increase or decrease of acreage since 1875.
4. Percentage of area, respectively, in cotton, corn, and other crops, (the latter taken collectively.)
5. Fertilizers, proportion of area fertilized, kinds used, rate of application, and prices.
6. Changes in modes of culture or implements used.
7. Tendency as to size of plantations.
8. Prices of labor.
9. Proportion hired for cash, renting, or working on shares.
10. Proportion cultivated, respectively, by black and white labor.
11. Percentage of negro cultivators who own the land they cultivate.
12. Cost of producing cotton in 1876.
13. Average price in home markets.

PLATE IX.



COTTON PRODUCTION BEFORE AND SINCE THE WAR.

14. Examples of large yields and best farms.
15. Varieties of seed preferred.
16. Tendency as to production of home supplies.

Answers were received with estimates covering about half the entire area in cotton, each State having from three-eighths to five-eighths of its field of production represented. They indicate great progress since the first investigation was made, showing that the labor of the freedman is steadier and more efficient, a larger proportion of white labor is represented in the crop, and a larger production is obtained per hand. Farms continue to decrease in size. The use of home-made composts is increasing. There is greater economy of the fertilizing resources of cotton-seed; a larger proportion of corn to cotton; more interest in improved implements; a larger proportion of home supplies of meat; and a disposition among advanced cultivators to adopt a rotation, and to give to domestic animals a higher place in the farm economy. Not that these reforms are far advanced or equally essayed. Where white labor is increasing exists the strongest tendency toward the use of labor-saving implements. In many of these points little more than a promising beginning has been made.

THE COTTON AREA.

The first four questions were intended mainly to aid in a more accurate understanding of the area actually cultivated in cotton, and incidentally to show the local changes in cotton-growing and local differences in fertility of soil.

The acreage of cotton has never been given in the census. Areas of special culture have never been comprehended in the census schedules, nor the aggregate area in cultivation; the only returns made being the amount of land in farms and the proportion in "improved" land, *i. e.*, cultivated and fallow lands and permanent pasture.

The first estimates of acreage published were issued by this Department. They were deduced from State averages of local estimates of yield per acre, knowing that direct estimates of the rate of production are invariably too high; not in every individual case, but in averages. The returns of yield were closely scanned and modified where errors could be shown; but the result was somewhat too high, and the deduced area producing the given crop was therefore somewhat too small. These estimates were published for years, with annual modifications, by the commercial press, the yearly comparisons favoring the producer, the crop increasing, but the acreage apparently remaining nearly the same for a period of years, with some annual fluctuation. To these two causes are due a misconception of the real extent of the cotton-field that is much to be regretted. So apparent was this error, that, as early as 1874, the publication of cotton acreage estimates ceased in these reports, and every opportunity for gaining data for correction was used. A multiplicity of other statistical work demanded attention. No general systematic investigation was undertaken till 1875, when the difficult task was essayed, and in the monthly report for June the following important but inconclusive results were reported:

We have obtained an actual census, wherever it was possible, for a given district, whether a large or a small portion of the county, both of bales produced and the number of acres upon which they were grown. Our correspondents were urged to avoid estimates and give only ascertained facts. So a census of a few farms would be taken here, a neighborhood there, and occasionally a larger district. The local officers were in some instances enlisted in the work. The results are not complete, and are not deemed quite sufficient for an authoritative estimate which can be relied on in the future as a perfectly accurate basis of comparison; yet they are too important to be withheld, and will be received by a fair-minded public as the best known data for an approximate estimate of the real area in cotton.

In the following statement the number of counties are given in which such enumerations were made, either for their total or partial area, respectively, with the number of bales produced on the acreage given in 1874:

States.	Counties.	Bales.	Acres.	Acres to the bale.
North Carolina	12	70, 402	202, 412	2. 87
South Carolina	9	84, 249	271, 477	3. 21
Georgia	41	199, 810	707, 187	3. 54
Florida	6	17, 513	67, 751	3. 86
Alabama	13	62, 534	245, 094	3. 92
Mississippi	12	105, 280	308, 060	2. 92
Louisiana	6	56, 450	124, 016	2. 19
Texas	38	139, 762	404, 005	2. 89
Arkansas	13	49, 544	140, 690	2. 84
Tennessee	11	25, 654	83, 934	3. 27
Total	......	811, 198	2, 554, 626	3. 15

This makes the average in over 40 per cent. of the cotton-breadth of Georgia 3.54 acres per bale, while the official report of the State of Georgia makes the number 3½ acres; results almost exactly alike, as in the reports of the area of the present crop.

Without perfecting these estimates, it is evident that the true acreage of 1874 cannot fall very much short of three times as many acres as were produced of bales in 1874, or at least 11,000,000 acres, possibly a figure a little larger. This corresponds with the mass of facts brought to our observation annually for two years past.

The results of recent investigations render it certain that 3.15 acres to the bale may be considered a liberal estimate even for so poor a season as 1874. The areas reported in the above table are evidently rather better than the average of each State, but still very near the rate of yield for that year. The yield of 1875 was the largest per acre, as well as the largest in aggregate quantity, since the war. It was but 2 per cent. less than the largest crop ever produced, that of 1859. Its marked superiority was due to the length of the season, killing frosts having been delayed, in more southern districts, to the first week in December; an almost unprecedented date. The past season was also very favorable, but shorter, with some decrease in the yield per acre.

The following table of estimates of the acreage and rate of yield of the crop of 1876 is presented as a result of our recent investigation in harmony with those of the past three seasons:

States.	Bales.	Acres per bale.	Acres.
North Carolina	210, 000	2. 9	609, 000
South Carolina	310, 000	3. 05	945, 500
Georgia	505, 000	3	1, 515, 000
Florida	50, 000	3. 3	165, 000
Alabama	533, 000	3. 25	1, 732, 250
Mississippi	760, 000	2. 6	1, 976, 000
Louisiana	560, 000	2. 25	1, 260, 000
Texas	690, 000	2. 15	1, 483, 500
Arkansas	515, 000	2. 2	1, 133, 000
Tennessee	260, 000	2. 85	741, 000
Indian Territory and other districts	45, 000	2. 6	117, 000
Total	4, 438, 000	2. 63	11, 677, 250

The figures representing rate of yield approximate a fair representation of the differences of the fertility of the present cotton-lands of the several States, except that Alabama has an exceptionally low rate, 69 representing condition of her crop in October, the general average being

80. There is much worn land in this State, but the central canebrake district is scarcely surpassed as a cotton-field. Mississippi is credited with a rate of yield for 1876 almost identical with the general average. In 1860 this State produced nearly one-fourth of the entire crop; in 1876 its proportion is one-sixth, grown on one-sixth of the total acreage; and this area, in natural fertility, represents fairly the average fertility of the aggregate, being made up in part of the very fertile bottoms of the Mississippi and Yazoo, and the rotten limestone soils of the counties of Warren and Hinds, together with the less productive uplands of the southern and eastern portions of the State.

The wonderfully productive alluvion of the Red and Ouachita Rivers, and the never-failing richness of the Arkansas bottoms, give to the present area cultivated in Louisiana and Arkansas a high rate of yield; and the selected virgin soils of Texas are of equal productiveness. South Carolina and Georgia have more of partially exhausted soil, of lower natural fertility, which, without fertilization and good culture, would not average a fourth of a bale to the acre. Under present management they average nearly a third of a bale. The North Carolina returns of yield for the past ten years have been quite uniformly higher than those of the other Atlantic States.*

The comparative importance of the several States in cotton-production seems not to be well understood. The commercial distribution by cotton ports leaves in the obscure background the view of production by States. The progress of this industry, like that of most others in this country, is westward. In 1849 Alabama stood in the front rank, with 22.8 per cent. of the crop, and Georgia ranked next, with Mississippi following closely. Scarcely an eighth of the crop was produced west of the Mississippi.

In 1869 about three-tenths of the product came from beyond the Mississippi. North Carolina had declined from 2.9 to 2.7 per cent., South Carolina had fallen from 12 to 6.4, and Georgia from 19.8 to 13. Louisiana had advanced from 7.2 to 14.4, and Arkansas from 2.2 to 6.8. At the present time more than three-eighths of the crop is grown west of the Mississippi, Texas making rapid strides, evidently destined in 1877 to lead the column of cotton States. Some have hastily assumed that Texas already equals Mississippi in production, and that Arkansas and Louisiana stand on nearly the same level; but there is no evidence that the difference between 18.7 and 8.2 (in Mississippi and Arkansas) has been annihilated in seven years. The following statement gives the percentages of the crop produced by each State, as deduced from the census, with the estimated proportion in 1876:

States	1849.	1859	1869.	1876.	States.	1849.	1859.	1869.	1876.
North Carolina	2.9	2.7	4.8	4.7	Mississippi	19.5	22.3	18.7	17.1
South Carolina	12	6.4	7.4	7.0	Louisiana	7.2	14.4	11.6	12.5
Georgia	19.8	13	15.7	11.4	Texas	2.3	8	11.6	15.5
Florida	1.01	1.24	1.3	1.13	Arkansas	2.2	6.8	8.2	11.3
Alabama	22.8	18.3	14	12	Tennessee	7.8	5.5	6	5.8

While the rate of yield is sustained in the East by fertilization, it is still kept up in the West by opening fresh land. On the whole, it is evi-

* Our Beaufort correspondent says: "The number of acres in cotton in 1876 was 12,000. The average product is one-half bale to the acre. One-half of all the land planted averages three-fourths of a bale. That which fell under one-half bale constituted but a small part of the area planted. I have a personal knowledge of more than twenty farms, and only one of them fell under one-half bale; most of them produced from two-thirds to three-fourths of a bale per acre, and the season was decidedly unfavorable. One-half bale per acre gives 12,000 acres planted."

dent that the yield per acre is larger than in 1860, the tendency of fertilization, reduction of size of farms, and increase of white labor being toward increase of yield. Yet the difference is not great. In Mississippi, in 1860, the area in cultivation exceeded that of last year by more than a half million acres. The entire area in cotton in 1860 was certainly not less than 13,000,000 acres.

ACREAGE IN CORN AND COTTON.

A comparison of the relative areas in cotton, corn, and other products of agriculture betokens a gradual change for the better in the extension of the area in corn, wheat, oats, clover, pease, as well as in fruits and vegetables, for home use and shipment to northern markets. The difference is noticed in all sections by our correspondents.

When we consider the adaptation of this section to a range of production including all the growths, cereal, textile, the fodder-plants, and fruits found in the temperate zone, together with a great variety of sub-tropical fruits and fibers, the proportion of cultivated area in cotton is surprising.

It is the more so, as we remember that one-half the cotton is grown in a little more than a tenth of the total number of counties of this belt; that 93 of 759 counties in 1870 produced no cotton whatever; and that 227 others from less than a thousand bales down to a single one. Corn, on the contrary, is grown everywhere as a prominent crop. There are 23 counties in Tennessee that produce no cotton, and 4 of the 85 yield four-tenths of the crop. In North Carolina a large portion of the area is not adapted to cotton; not a bale was returned in 1870 from 20 counties, and its distribution in the tide-water region is very unequal. The unequal distribution of cotton is shown in the accompanying map, (frontispiece,) on which the counties producing not less than 10,000 bales are marked, only 79 in number, yet aggregating 48 per cent. of the entire crop. The following is a condensed exhibit of this inequality:

	Per cent.		Per cent.
In North Carolina 2 counties yield	18.3;	68 counties yield	81.7
In South Carolina 5 counties yield	46.7;	26 counties yield	53.3
In Georgia 7 counties yield	25.5;	119 counties yield	74.5
In Alabama 14 counties yield	57.6;	51 counties yield	42.4
In Mississippi 20 counties yield	67.8;	43 counties yield	32.2
In Louisiana 14 counties yield	67.3;	37 counties yield	32.7
In Texas 7 counties yield	28.1;	98 counties yield	71.9
In Arkansas 6 counties yield	34;	54 counties yield	66
In Tennessee 4 counties yield	40.2;	58 counties yield	39.8

The list of counties is as follows:

State and county.	Bales.	State and county.	Bales.
NORTH CAROLINA.		GEORGIA.	
Edgecombe	18,361	Burke	14,290
Halifax	11,716	Dougherty	14,034
		Lee	10,179
Total	30,077	Monroe	10,434
State	144,935	Stewart	13,643
		Sumter	12,823
Per cent	18.3	Washington	11,338
SOUTH CAROLINA.			
Abbeville	13,924	Total	86,741
Barnwell	24,910	State	473,934
Darlington	34,591	Per cent	25.5
Edgefield	17,553		
Fairfield	14,024	ALABAMA.	
		Barbour	17,011
Total	105,002	Bullock	17,973
State	224,500	Dallas	24,819
		Hale	18,573
Per cent	46.7	Lee	11,591

State and county.	Bales.
ALABAMA—Continued.	
Lowndes	18, 369
Macon	11, 872
Madison	12, 180
Marengo	23, 614
Montgomery	25, 517
Perry	13, 449
Russell	20, 796
Sumter	11, 646
Wilcox	20, 095
Total	247, 504
State	429, 482
Per cent	57. 6
MISSISSIPPI.	
Adams	20, 140
Bolivar	15, 571
Carroll	14, 135
Claiborne	14, 776
Coahoma	11, 456
Copiah	15, 653
De Soto	24, 118
Hinds	27, 394
Holmes	19, 027
Issaquena	15, 821
Jefferson	13, 719
Lowndes	16, 073
Madison	19, 269
Marshall	18, 379
Noxubee	15, 473
Panola	15, 764
Warren	32, 175
Washington	35, 902
Wilkinson	12, 430
Yazoo	26, 047
Total	383, 332
State	564, 938
Per cent	67. 8
LOUISIANA.	
Avoyelles	10, 129
Bossier	13, 506
Caddo	26, 387
Carroll	20, 384
Claiborne	14, 900
Concordia	26, 712
De Soto	15, 809
LOUISIANA—Continued.	
East Feliciana	10, 252
Madison	17, 189
Morehouse	11, 154
Natchitoches	15, 671
Ouachita	14, 239
Saint Landry	14, 305
Tensas	25, 371
Total	236, 018
State	350, 832
Per cent	67. 3
TEXAS.	
Austin	11, 967
Falls	14, 126
Fayette	10, 653
Grimes	10, 025
Rusk	12, 752
Travis	16, 769
Washington	22, 452
Total	98, 744
State	350, 628
Per cent	28. 1
ARKANSAS.	
Arkansas	12, 315
Chicot	10, 187
Hempstead	10, 664
Jefferson	18, 390
Phillips	18, 002
Pulaski	14, 891
Total	84, 449
State	247, 968
Per cent	34. 0
TENNESSEE.	
Fayette	20, 131
Haywood	10, 510
Shelby	32, 434
Tipton	10, 052
Total	73, 127
State	181, 842
Per cent	40. 2

In view of these limitations of cotton-culture, and the present tendency to increase of other products, the fact that more than one-third of the cultivated area of ten States is annually planted in cotton, as shown by results of the investigation, is a remarkable one in the history of the culture of the "industrial" plants. Corn is credited with rather more than four-tenths of the acreage, and other crops, together, with one-fourth. The distribution is by the following percentages:

States.	Cotton.	Corn.	Other crops.
North Carolina	19	46	35
South Carolina	35	44	21
Georgia	35	48	21
Florida	26	41	33
Alabama	37	44	19
Mississippi	50	34	16
Louisiana	52	30	18
Texas	35	40	25
Arkansas	47	37	16
Tennessee	15	45	40

The States in which cotton most asserts supremacy are Louisiana, Mississippi, and Arkansas; those in which corn is most prominent, Tennessee, North Carolina, Georgia, and Alabama. Miscellaneous products claim comparatively more attention in Tennessee, North Carolina, and Florida. Of the area in "improved" land, only about one-fourth is annually cultivated. In 1870 the reported area "improved" was 138,635,313 acres. The present area actually cultivated is estimated at about thirty-four million acres, of which cotton has nearly twelve millions and corn over fourteen millions. The nearest percentages, discarding fractions, are: corn, 41; cotton, 34; other crops, 25. This indicates an advance in nine years, in miscellaneous products, from 18 per centum to 25.

FERTILIZERS.

The use of commercial fertilizers for cotton is a practice obtaining since the war, and confined mainly to the Atlantic coast. The worn and partially exhausted lands of the older States responded to special fertilization in a gratifying increase of product; and as the wages of labor ruled high, and farm supplies were dear, it was an object to make a heavy cash outlay for these aids to production, especially while prices of cotton continued high. Thus the expenditure for guanos and bone phosphates and superphosphates increased, the prices of cotton declined, and the outlay became a burden upon industry, often a partial loss of the investment by injudicious or excessive application.

Nine years ago, in canvassing this subject, this Department deprecated the *injudicious* and excessive use of commercial fertilizers, most of which in those days cost far more than a fair estimate of their actual cash value, based upon the commercial prices of their essential constituents. The local resources for fertilization were briefly pointed out, and shown to be abundant, accessible, and inexpensive. Among the suggestions presented were the following:

> Every farmer should rely mainly upon his stock for manures; hogs should be fattened upon field-pease; cattle and horses should be penned at night in deeply-littered yards. Accretions to the manure-pile may be made from a great variety of sources, including all decaying vegetable and animal matter, waste and wash from the kitchen, muck from the swamps, and pine straw or leaves from the forest.
>
> There are many special fertilizers in this section ample for a perpetual supply of all possible drain upon the resources of the soil. The coast-line from Virginia to Texas, including all the sounds, inlets, bays, and estuaries, has an aggregate extent of thousands of miles, and every mile can furnish abundant stores of fish and sea-weed for manuring adjacent fields. Oyster-shell lime is also plenty and cheap in the tide-water regions.
>
> No mineral manure is more abundant than marl, which is found in the whole tide-water section of the Atlantic coast, in the Mississippi Valley, and in Texas. It underlies wide belts at various depths, often very near the surface; it is in many localities easily obtained in large quantities: and its value, though variable, is undoubted for application for soils needing lime. Gypsum can be obtained from native beds at no great distance from any locality in the south. Lime is abundant in the mountain valleys from Virginia to Northern Alabama; and the "rotten-limestone" formations of Alabama and Mississippi are unsurpassed for fertility.
>
> All these home resources should be used in bringing up the average cotton yield from 190 to 300 pounds per acre, and obtaining from half of the present acreage all of the fiber needed, leaving free a sufficient area to produce the bread, the fruits, the vegetables, the beef and mutton necessary for the home population, and a surplus of the lighter products for exportation.

The progress made since 1868 in utilizing many of these resources has been considerable, in some sections very noticeable. The commissioner of agriculture of Georgia has been empowered by the State with the inspection of chemical fertilizers, and the prohibition of the sale of worthless and fraudulent brands, which has had the effect to increase the intrinsic value 16 per cent., while the cost per ton has been diminished 7 per cent. He reported the inspection of 48,648 tons in the season of 1874, and 56,596 in 1875, costing $2,481,048 and $2,640,203. The publication of these analyses and results of experiments, especially with composts, had the effect to arouse caution against fraud, and to stimulate the exercise of judicious discrimination in the selection and skill in the composting and use of them. So positive has been this progress, that nearly half of the fertilizers in 1875 were so composted as to yield for every ton four tons of compost, deemed to be of equal value with the uncomposted fertilizer, adding twofold to the volume and value of every ton of commercial fertilizers inspected by the State.

The formula for a compost extensively used on cotton contains 750 pounds each of stable-manure and of green cotton-seed, with 500 pounds of acid phosphate or dissolved bone. Alternate layers of the stable-manure and seed, three or four inches thick, are each sprinkled with the phosphate after thorough moistening with water. When fermentation has destroyed the vitality of the seed, in three to six weeks, the layers are cut through vertically, and the whole mass well pulverized and mixed, and left for further fermentation. Satisfactory results are obtained by the application of 200 pounds in the opening furrow and 100 in the seed-drill. Some make a heavier application by sowing 400 pounds and applying 100 in the drill. If the ammonia of the manure has been evaporated by exposure, 60 pounds of sulphate of ammonia and 40 of muriate of potash are used, with 650 pounds each of seed and stable-manure and 600 of phosphate. The cost, aside from home materials and labor, is from $7.50 to $10 per ton.

The estimate of proportion of cultivated area fertilized was not uniformly given, and may therefore only roughly approximate the truth. So far as they could be consolidated, the averages were 60 per cent. for South Carolina, 42 for Georgia, and 35 for North Carolina. If returns from every county had been received, it is probable the difference between the South Carolina and Georgia estimates might be less. While some commercial fertilizers are applied in Florida and from the Georgia line to the Mississippi, it is true that the field for their sale at present is mainly included in the three States named. The percentage of area fertilized, as averaged, is 10 in Florida, 12 in Alabama, and 15 in Mississippi; and a large element of this small proportion is cotton-seed or composts. The proportion is scarcely appreciable in Louisiana and Texas, and in Arkansas and in Tennessee experiments in fertilizing are on too limited a scale to make a percentage. Our correspondent in Fayette, Texas, reports no fertilizers used, but expresses the opinion that manure would double the crops on uplands, while the bottoms may be rich enough without manure.

The practice of fallowing or "resting" the land is a practical protest against the waste of continuous clean culture. The growth of grass and weeds shades and protects the surface, appropriates the ammonia of the atmosphere when plowed under for a crop, and restores to the soil its supply of vegetable matter wasted under the direct rays of a burning sun. Our correspondent in Chickasaw, Mississippi, says:

> The cheapest and only practicable way of fertilizing large farms is to rest a portion of it one or two years, then turn under weeds, grass, and all vegetation while green. It greatly improves it, and costs but little for a farmer cultivating 1,200 acres. To attempt to fertilize much of it would take all his crop. Doing it fifty acres at a time, he would die of old age before he could get round.

It is beginning to be realized that it does not pay to cultivate the uplands of any portion of the South, unless in marl and limestone sections, without fertilizing systematically; and some have learned that such soils may be kept actually improving by the use of cheap and accessible home resources of fertilization. Our correspondent in Geneva, Alabama, reports, "In 1870, planted 20 acres cotton in pine-land, without fertilizing, and made three bales; 1876 he planted three acres and applied the manure of two cows, mare, and colt for three months, and made 2,970 pounds seed-cotton."

The tendency of farm practice is judicious and sensible in the direction of a greater use of fertilizers, greater discrimination in their selection, and superior wisdom in the mode and extent of application. In this they are following the teachings of this Department, which are found to coincide with the results of extended and varied experience during the past ten years. While not discarding the use of commercial products, cultivators are learning to use them to supplement their domestic or native supplies, with due reference to the manifest defects of the soil to which their application is made, and generally in judicious combination with domestic manures. The following extracts from correspondence will give details of this practice in all the States:

NORTH CAROLINA.—*Anson:* Guano and the phosphates are used. *Beaufort:* Home-made manures are extensively used on all plantations and farms; commercial are applied on one-half. The kinds most used are the ammoniated dissolved bones, about 200 pounds per acre. The amount used has greatly decreased in the last two years. *Caldwell:* No commercial fertilizers used except on the tobacco-crop. *Camden:* Home-made fertilizers generally; cost from $15 to $25 per ton. *Catawba:* 100 pounds per acre on cotton and wheat; commercial fertilizers in a limited quantity. *Chowan:* Very little except home-made and lime; cost $10 per ton. Some guano used, about 200 pounds per acre, costing $50 per ton. *Columbus:* Home-made fertilizers are used on all plantations, about 25 cart-loads per acre; commercial, 200 pounds per acre, cost $60 per ton. *Cumberland:* 150 pounds per acre, costing $50 per ton. *Duplin:* Ammoniated superphosphates, 150 to 200 pounds per acre when used alone, 75 to 100 pounds when used in connection with home-made manures. Acid phosphates are growing in favor, used in the same quantity. A mixture consisting of 250 pounds of fine bone dust, 250 pounds of land-plaster, 60 pounds sulphate of ammonia, 40 pounds nitrate of soda, 100 pounds of salt, mixed with enough rich earth to make a ton, costing about $15, is largely used for cotton, 300 pounds per acre, with results equal to the costly superphosphates. Ammoniated superphosphate costs from $40 to $50 per ton cash, and from $50 to $60, or 400 to 450 pounds cotton, on crop time. *Edgecombe:* A compost of marl, lime, cotton-seed, stable-manure, and earth is largely used, 200 to 750 bushels to the acre. Commercial fertilizers are applied; 200 pounds per acre. *Franklin:* Superphosphates used; an average of 160 pounds per acre. *Gates:* 200 pounds per acre of manipulated guano; cost $45 per ton. *Gaston:* Home-made is used on most farms, at a cost of $2 per acre. Commercial used on cotton-lands; cost $3 per acre. *Greene:* Almost every kind used; about 200 pounds per acre; prices average $50 per ton. *Guilford:* The greatest part of the manure used is a compost made in the barn-yard. The different kinds of commercial fertilizers are applied to some extent, about 100 pounds per acre; prices from $50 to $75 per ton. *Harnett:* For cotton, 100 pounds of guano are used to the acre; cost $50 per ton. The use of commercial fertilizers is decreasing, and farmers are relying more on home-made fertilizers. *Hertford:* Various kinds; 125 pounds per acre. *Hyde:* Composts of various kinds used. *Iredell:* All the different kinds of commercial and domestic used; 150 to 200 pounds per acre in the row. Without some fertilizer cotton does not pay. *Jones:* Cotton-seed is used, from 20 to 60 bushels per acre, costing 10 cents per bushel. *Lenoir:* Several years ago fertilizers were purchased in large quantities; last year farmers used but little; they find that it does not pay; about one-tenth use 200 pounds per acre; cost $50. *Lincoln:* 150 tons used last year in this county; 150 pounds per acre. Acid phosphate is composted with cotton-seed and stable-manure. From 600 to 700 pounds per acre of this compost is applied. *Moore:* Some used on cotton. *Nash:* 350 pounds per acre of a mixture of 100 pounds Peruvian guano, 100 pounds of dissolved bone, 100 pounds salt, and 50 pounds of plaster. It is a good manure for cotton or corn; cost $83 per ton. *Orange:* Guano and phosphates used, from 100 to 200 pounds per acre; cost $55 per ton. *Pasquotank:* Home-made manures almost exclusively used. *Person:* Barn-yard and commercial used on the tobacco-crop; 200 pounds per acre is applied; cost $60 per ton. *Perquimans:* A number of kinds used; about 200 pounds per acre; does not pay. *Pitt:* Home-made manures are generally depended upon. *Rowan:* Home-made are found to be the best and cheapest. *Rutherford:* All kinds have been used; about 200 pounds per acre; cost $50 per ton. *Tyrrel:* On the largest number of plantations a home-made compost is used. A few apply guano, 200 pounds per acre; cost $50 per ton. *Wake:* Grange fertilizer and acid phosphate, 200 pounds per acre: cost from $34 to $40 per ton. *Warren:* Various kinds used; 200 pounds per acre. *Wayne:* A small part of the farmers use guano; cost $50 per ton cash; $55 on time, or a 450-pound bale of cotton. *Wilson:* All kinds; about 200 pounds per acre, average cost $55 per ton. *Yadkin:* None, except stable-manure made on the place.

SOUTH CAROLINA.—*Barnwell:* From 100 to 200 pounds per acre of phosphates (chiefly prepared in the State) are used; cost from $40 to $55 per ton. *Beaufort:* From 150 to 200 pounds per acre of guano or phosphates applied; price from $40 to $60 per ton. *Chester:* A dozen different qualities of fertilizers used, at an average cost of $56 per ton. *Clarendon:* Fertilizers are generally used; 150 to 300 pounds per acre; prices from $50 to $75 per ton. *Colleton:* 200 pounds of commercial fertilizers per acre; cost $45 per ton cash, $65 on time. *Edgefield:* Fertilizers are used at the rate of 100 pounds per acre; average cost $60 per ton. *Fairfield:* 100 pounds of superphosphate are applied to the acre; price from $35 to $60 per ton. *Georgetown:* A compost made of forest *débris*, cow-pen and stable manure is chiefly used. *Greenville:* On cotton-lands, from 100 to 200 pounds per acre applied; some farmers use a compost of cotton-seed, stable-manure, and woods' earth. *Horry:* Fertilizers are used; 200 pounds per acre. *Laurens:* 100 pounds per acre of Charleston phosphates; cost $45 per ton. They are so much adulterated, that farmers are rejecting them, and using more home-made fertilizers. *Lexington:* 100 pounds per acre of phosphate; price per ton from $30 to $60. *Marion:* Guano and acid phosphate are the most popular; 125 pounds per acre applied; cost, guano $75 per ton, phosphate $33. *Marlborough:* Various kinds of fertilizers applied; about 200 pounds per acre; price from $50 to $60 per ton. *Orangeburgh:* All kinds used; 150 pounds average per acre; $50 to $60 per ton. *Spartanburgh:* From 100 to 250 pounds of fertilizer to the acre; $35 to $65 per ton. *Union:* Phosphate used; 200 pounds per acre; cost $35 to $55 per ton.

GEORGIA.—*Banks:* Bone and super phosphate, about 100 pounds per acre, costing $75 per ton. *Bartow:* Principally acid phosphate composted with cotton-seed and barn-yard manure, from 200 to 300 pounds per acre; cost from $12 to $15 per ton. *Bibb:* 100 pounds of commercial fertilizers to the acre; price, 400 pounds of lint-cotton per ton and $3 per ton freight. *Brooks:* All kinds used; cost $50 per ton. *Butts:* 20 different brands used; 120 pounds per acre; price from $60 to $70 per ton, on time, with cotton option. *Calhoun:* A compost of chemical and home-made manures most popular; cost about $20 per ton. Commercial fertilizers are used; 150 to 200 pounds per acre. *Campbell:* 100 pounds per acre of phosphates and superphosphates; cost, cash, from $35 to $50, on time, $45 to $70. *Catoosa:* 150 to 300 pounds per acre of fertilizers applied, costing from $55 to $65 per ton. *Carroll:* Nearly all kinds used, 100 to 300 pounds per acre; price from $60 to $80 per ton. Black's compound is likely to supersede all other fertilizers; cost $6 per ton and labor of preparing. *Clayton:* From 100 to 200 pounds per acre used; price $30 to $60 per ton. *Clay:* Extensively used, and very expensive. *Cobb:* About 200 pounds per acre on nearly all cotton-lands; average cost $50 per ton. *Coffee:* Home-made fertilizers are almost exclusively used. *Columbia:* All kinds used, at the rate of 200 pounds per acre, at a cost of $5 per acre. *Dawson:* 70 per cent. of the farmers use home-made fertilizers. *Dooly:* 200 pounds per acre, costing from $50 to $80 per ton. *Early:* All kinds used; cost from $40 to $60 per ton, or from 400 to 430 pounds of lint-cotton. *Elbert:* From 100 to 250 pounds per acre, costing from $60 to $80 per ton. *Emanuel:* 150 to 200 pounds applied per acre; price $60 per ton cash, or $70 credit, with cotton option at 15 cents per pound. *Fayette:* Superphosphates are used, 100 pounds per acre; cost $50 per ton. *Floyd:* Nearly all kinds used, principally on cotton, 250 pounds to the acre. *Forsyth:* 150 pounds per acre. *Franklin:* Extensively used. *Gordon:* 150 pounds per acre. *Gwinnette:* 150 pounds per acre, costing from $20 to $60 per ton. *Habersham:* Crops will not pay unless fertilizers are used. *Harris:* A mixture of guano, phosphate, bone, and plaster is used; 150 to 250 pounds per acre. A cheap compost of phosphate, bone, and cotton is used by many. *Heard:* From 100 to 200 pounds per acre; cost $50 per ton cash, $70 on time. *Jackson:* 200 to 400 pounds per acre of home-made fertilizer and 100 to 200 commercial. *Liberty:* Used by a few farmers on tobacco-crop; cost from $50 to $75 per ton. *Lincoln:* A compost of guano, phosphate, and cotton-seed is most popular; 150 pounds per acre; cost from $55 to $65. *Macon:* 100 to 300 pounds per acre; price $35 to $60. *Madison:* All use an average of 150 pounds per acre, at a cost of $4.50 per acre. *Marion:* Used to a limited extent; 150 pounds per acre; price $60 per ton. *Meriwether:* 100 pounds per acre; cost from $55 to $60 per ton. *Milton:* Superphosphate and home-made manures are used; 150 pounds per acre of phosphate and 500 pounds of domestic. *Mitchell:* Dissolved bone and guano. *Morgan:* Extensively used; 150 to 200 pounds per acre of commercial fertilizers and from 200 to 300 pounds of compost. *Murray:* 150 to 200 pounds per acre. *Muscogee:* 150 to 200 pounds per acre. *Oglethorpe:* Largely used; 90 per cent. of it on the cotton crop: 150 pounds per acre. *Pike:* About 75 pounds per acre for cotton and 40 to 50 pounds for corn. *Schley:* All kinds used. *Stewart:* 125 pounds per acre. *Talbot:* Special fertilizers are used, costing $60 per ton, paying in cotton at 15 cents per pound. *Taylor:* 150 pounds used to the acre, at an average cost of about 425 pounds of lint-cotton per ton. *Thomas:* 150 to 200 pounds per acre. *Terrell:* 45 different kinds used, at an average of 100 pounds to the acre. *Washington:* From 100 to 300 pounds per acre. *Walton:* 150 to 200 pounds per acre; price from $40 to $70 per ton, payable in cotton at 15 cents per pound. *Wilkes:* Various kinds used; cost of guano from $40 to $60 per ton, and from $20 to $35 for composting fertilizers. *Wilcox:* 100 to 200 hundred pounds of guano per acre, costing from $50 to $65 per ton. *Whitfield:* Various kinds, at an average. *White:* Stable-manure generally used.

FLORIDA.—*Clay:* All use compost. *Gadsden:* Commercial fertilizers have been nearly abandoned on account of adulteration, and increased attention paid to the production of domestic manures. *Hillsborough:* Farmers are beginning to look to the barn-yard for fertilizers. *Jackson:* 200 pounds applied to the acre; cost $55 per ton. *Madison:* Cotton-seed and stable-manure; from 30 to 50 bushels of cotton-seed per acre, worth from $8 to $10 per ton. *Sumter:* Swamp-muck chiefly. *Santa Rosa:* Fertilizers are used to a greater extent than formerly; cotton-seed meal, in combination with mineral salts, is the most valuable; from 100 to 300 pounds to the acre; cost $45 per ton.

ALABAMA.—*Bibb:* 100 pounds per acre. *Bullock:* The use of commercial fertilizers almost entirely abandoned. Cotton-seed and home-made manures are generally used. From 50 to 100 bushels of cotton-seed applied to the acre; worth 10 cents per bushel. *Butler:* About 200 pounds per acre; cost $55 per ton. *Calhoun:* Both commercial and home-made are used, at a cost of $2 to $8 per acre. Many farmers purchase chemicals and make their own fertilizers, at a cost of $20 per ton. *Clay:* The various kinds used. *Coffee:* But little except stable-manure and litter of cow-lots. *Conecuh:* Cotton-seed is used to some extent; 15 to 25 bushels per acre; price 12½ cents per bushel. *Crenshaw:* On a few farms; from 100 to 200 pounds per acre; cost from $60 to $70 per ton. *De Kalb:* Commercial fertilizers are used, at a cost of $6 to $8 per acre; price from $50 to $75 per ton. *Elmore:* They use 150 pounds per acre; price $55 per ton. *Etowah:* 166 pounds per acre; cost $60 to $75 per ton. *Geneva:* Home-made fertilizers chiefly used. Straw and leaves, after being tramped up, are applied in the drill for cotton and in the hill for corn. Most farmers plant less and manure more than formerly *Hale:* Cotton-seed and barn-yard manure. *Henry:* An average of 125 pounds per acre. *Jefferson:* Home-made fertilizers much used. They have paid from 50 to 100 per cent. this year by bringing the crop forward from ten to fifteen days earlier. *Lauderdale:* Every farmer is making all the home-made manures possible. *Marion:* Barn-yard manures, 20 bushels per acre; price 10 cents per bushel. *Morgan:* Very few except home fertilizers used, at the small cost of $5 per ton. *Pike:* Three-fourths used are home-made fertilizers. *Russell:* 200 pounds per acre. *Shelby:* Barn-yard manures used on one-fifth of the farms. Guano is used on about one-twelfth of the farms—180 pounds to the acre; cost $60 per ton. *Saint Clair:* All kinds used; many farmers prepare a compost of barn-yard manure, litter, and cotton-seed. 300 pounds of guano is usually applied to the acre; price $60 per ton; paid for with cotton at 15 cents per pound. *Sumter:* 200 pounds per acre; price $55 per ton.

MISSISSIPPI.—*Adams:* Cotton-seed and barn-yard are the only fertilizers used; cost 65 cents per acre. *Alcorn:* Barn-yard manure almost exclusively used, and all utilized. *Amite:* Chiefly home fertilizers used; cotton-seed, 40 bushels per acre; barn-yard, 60 to 80 bushels per acre. *Carroll:* The only fertilizer used is cotton-seed on corn-land. *Choctaw:* Cotton-seed and barn-yard manure; 10 bushels of cotton-seed per acre; worth 10 cents per bushel. *Copiah:* A very few use 100 to 200 pounds per acre of Stern's phosphate, bone, &c. *Covington:* Home-made compost of straw, leaves, ashes, and barn-yard manure is the only fertilizer used. *Franklin:* Cotton-seed the only fertilizer used; 20 bushels applied to the acre. *Grenada:* Cotton-seed and stable-manure used on nearly all farms; no commercial. *Harrison:* Cotton-seed meal is used as a fertilizer for corn; cost $30 per ton. *Lawrence:* Cotton-seed chiefly; worth from 10 to 15 cents per bushel. *Lincoln:* None except what are made on the farm. *Lowndes:* Commercial fertilizers have been used, but results have been unsatisfactory. *Madison:* Cotton-seed only. *Marion:* About 500 pounds per acre of superphosphate; cost $20 per ton. *Newton:* Dissolved bones used; 100 pounds per acre; price $60 per ton. *Neshoba:* Barn-yard manures only. *Perry:* To a small extent; 500 pounds per acre of cotton-seed meal is applied, costing from $30 to $35 per ton. Small farmers save all their stable and barn-yard manure and apply it in about the same quantity per acre. *Winston:* None used except stable-manure and cotton-seed; 30 to 40 bushels of cotton-seed to the acre worth 12½ cents per bushel.

LOUISIANA.—But few counties report the use of any fertilizers, and those only such as are found on the plantation. *Bossier:* One-third of the farmers use cotton-seed, 60 bushels, worth from 8 to 10 cents per bushel; manures one acre of corn in the hill. *Cameron:* They are beginning to spread the cotton-seed on the land they cultivate; formerly it was left to rot at the gin or burned for fuel. *Union:* On plantations where cotton is grown, from 20 to 25 bushels of cotton-seed per acre is generally applied.

TEXAS.—*Anderson:* Barn-yard and cotton-seed. *Austin:* Barn-yard and such as is gathered on the range. *Burnet:* Sheep-raisers use the manure from their sheep-pens and stables: 12 loads per acre applied. *Chambers:* Barn-yard manure and decayed vegetation. *Cherokee:* From 20 to 60 bushels of cotton-seed per acre; worth from 6 to 10 cents per bushel; some farmers haul out lot-manure, 10 to 12 loads per acre. *Colorado:* In a few instances cow-penning is practiced by the Germans. *Smith:* Cotton-seed is used, 20 bushels per acre. *Titus:* In some instances farmers carry out barn-yard manure, (when it is in the way;) a few make compost.

ARKANSAS.—*Arkansas:* Some cotton-seed and stable-manure. *Boone:* Barn-yard manure only. *Craighead:* Barn-yard; no other. *Crittenden:* Sometimes cotton-seed is used, but without system. *Cross:* What is gathered about the stable and yard. *Dallas:* Cotton-seed is usually put on corn. Ashes and stable-manure are hauled out to the field. *Izard:* A part of the barn-yard manure is used, but the largest part lies as a nuisance or is swept away by freshets. *Johnson:* Such as are gathered from the lots and stables. *Marion:* Not over half a ton of commercial fertilizers used in the county. Stable-manure is used more or less upon nearly every farm. *Prairie:* Barn-yard and cotton-seed are used by a few farmers. *Sevier:* A few use barn-yard manure. *Van Buren:* Stable is used to a limited extent.

TENNESSEE.—*Bradley:* Fifty per cent. more barn-yard used at this time than ever before; value $1 per two-horse load. *Bedford:* Plaster is used on clover. A very few use phosphate; cost $20 per ton. Turning under green crops of clover, weeds, &c., is practiced. Barn-yard manure is the chief fertilizer used. *Cannon:* Clover and barn-yard manure are the principal reliance. *De Kalb:* Domestic manures are used by about half the farmers. *Dickson:* No fertilizers used except barn-yard manure, and that only on gardens or small lots. *Gibson:* For old ground clovering is the principal fertilizer used, but the barn-yard furnishes the chief source for fertilizing the soil. *Hardeman:* A little stable-manure and cotton-seed used. *Henderson:* Mostly stable-manure, worth $2 per ton. Guano is used to a limited extent with remunerative results. *Lauderdale:* A small amount of cotton-seed and stable-manure. *Lawrence:* Stable-manure is the only kind used. *Lincoln:* Clover and barn-yard manure are the chief fertilizers used. *Maury:* Used on nearly all plantations, principally clover and barn-yard manure, which are considered the cheapest and best. Land-plaster is used to a considerable extent on clover, especially on thin land; from 50 to 75 pounds per acre is applied. About the same amount per acre has been used on cotton with signal success. *Madison:* Planters depend upon clover; generally all the stable-manure is wasted. *Smith:* Most farmers use some stable-manure; there is some land-plaster used; from 50 to 200 pounds per acre. *Sumner:* Some stable-manure used on the poorest part of our land. Stock is not stabled much, and the amount of manure is small. *Warren:* Small quantities of barn-yard manure used.

CHANGES IN MODES OF CULTURE.

There is little evidence of change in modes of culture. The old practice is founded on generations of experience and investigation. If radical change were desirable, it could not easily be made successful by negroes trained to the former routine. Yet there is indicated a change in the closer copying of model practice, and especially in a more general use of improved implements. If the old forms of implements are retained, there is marked improvement in grace of outline and perfection of finish, as well as in economy of material and power. Such improvements are more general on the Atlantic coast and in Texas than in the Mississippi Valley. Two-thirds of the returns of the Carolinas indicate such improvement, and thirty-eight of the fifty-seven counties represented in Texas. Half of the Georgia returns indicate such changes; some are silent on the subject, and nearly one-fourth report no material change. In Alabama nearly two-thirds report noticeable change, and more than half in Tennessee and Arkansas. Louisiana is most conservative on this point, indicating very little change, and in Mississippi less than one-third report changes.

The use of double plows and sulky-cultivators is extending upon the large plantations of Texas. Cotton-planters are coming into use. Wherever white labor is predominant, labor-saving implements are coming into general use. "The negro is not apt in the use of improved implements," is asserted in substance by many. Our correspondent in Concordia, Louisiana, says: "The negroes were so well drilled in the ways of working cotton before the war that they are mere machines, and it would be impossible to change much, if a change was desirable. The difficulty of gathering the crops now made with the plow and hoe makes improved labor-saving implements of no use. Furnish a cotton-picking machine, and improved implements will follow."

"The old iron turning-plow, made by the awkward country blacksmith, has been replaced" in all progressive sections by the various improvements of popular manufacturers, largely made in the South and to some extent in the North and West.

Inc ulture, improvements mainly consist in greater thoroughness of preparation, deeper plowing prior to planting, with more frequent and very shallow cultivation afterward. Subsoiling is more in vogue. Our correspondent in Shelby, Alabama, says: "In preparation of lands, subsoiling is practiced by 15 per cent. of the farmers. In cultivation, side-harrows are used by about 30 per cent.; the remaining farmers prepare and plant as their 'daddies' did forty years ago."

DECREASE IN SIZE OF FARMS.

The average size of farms in the cotton States in the past three decennial periods is thus reported, together with total number:

States.	Number.			Average size: acres.		
	1870.	1860.	1850.	1870.	1860.	1850.
North Carolina	95, 565	75, 203	56, 963	212	316	369
South Carolina	51, 889	33, 171	29, 967	233	488	541
Georgia	69, 956	62, 003	51, 759	338	430	441
Florida	10, 241	6, 568	4, 304	232	444	371
Alabama	67, 382	55, 128	41, 964	222	346	289
Mississippi	68, 023	42, 840	33, 960	193	370	309
Louisiana	28, 481	17, 328	13, 422	247	536	372
Texas	61, 125	42, 891	12, 198	301	591	942
Arkansas	49, 424	39, 004	17, 758	154	245	146
Tennessee	118, 141	82, 368	72, 735	166	251	261

From 1850 to 1860 the average increased in Florida, Alabama, Mississippi, Louisiana, and Arkansas. In the succeeding ten years none of the States appear to have enlarged their average. The tendency has always been to reduction, except during the early years of the period of extension in cotton-growing, when cultivators were providing, by purchase of large tracts of cheap lands, for the system of spoliation which followed, involving the clearing annually of new lands to replace exhausted and abandoned fields.

On investigation of the comparative reduction of the different classes of farms, arranged as to size, the curious fact is found that in the case of each one of the ten States the number of farms of each class above 100 acres is decreased, and of every class below 100 acres is increased. The average decrease of large farms in all is 22 per cent., and the increase in the number of farms less than 100 acres in size is 55 per cent.

The largest ratios of increase are found in South Carolina and Louisiana, respectively 121 and 120 per cent. Florida gives 74 per cent.; Tennessee, 66; Mississippi, 65; Texas, 55; North Carolina, 44; Alabama, 39; Arkansas, 33; Georgia, 27.

The decrease of farms of 1,000 acres or more was from 3,634 to 1,572; of farms of 500 to 1,000, 12,187 to 6,537; of 100 to 500, 113,625 to 92,940, distributed as follows:

States.	100 acres.		500 acres.		1,000 acres.	
	1870.	1860.	1870.	1860.	1870.	1860.
Alabama	11,719	13,455	1,119	2,016	306	696
Arkansas	3,465	4,231	133	307	33	69
Florida	1,570	1,432	175	211	72	77
Georgia	17,490	18,821	1,506	2,692	419	902
Louisiana	3,753	4,955	650	1,161	142	371
Mississippi	8,938	11,498	853	1,868	233	481
North Carolina	13,819	19,220	889	1,184	116	311
South Carolina	7,112	11,369	465	1,359	129	482
Tennessee	18,806	21,903	412	921	50	158
Texas	6,268	6,831	305	468	72	87

The increase of small farms is thus indicated:

States.	Farms below 100 acres.		Per cent. of increase.	States.	Farms below 100 acres.		Per cent. of increase.
	1870.	1860.			1870.	1860.	
Alabama	54,208	38,961	39	North Carolina	78,741	54,488	44
Arkansas	45,793	34,397	33	South Carolina	44,183	19,961	121
Florida	8,424	4,848	74	Tennessee	98,873	59,386	66
Georgia	50,541	39,588	27	Texas	54,480	35,505	53
Louisiana	23,936	10,841	120				
Mississippi	57,999	35,083	65	Total	517,178	333,058	55

The number of farms of 3 to 10 acres was enormously increased in South Carolina, from 352 to 10,286; the increase in Mississippi was from 563 to 11,003; Louisiana from 626 to 3,016; in several others the ratio is less, about 1 to 3.

The reduction in average size still continues. Reports from North Carolina indicate a decreasing average, ranging from 20 to 50 per cent. decrease in the several counties. Nearly all counties in South Carolina and three-fourths of those in Georgia return decreased size. In Florida there is an increase in about one-third and a decrease in two-thirds of the counties reported. There are few exceptions to the rule of decrease in Alabama, Mississippi, and Louisiana. It is not quite so marked in Arkansas, and in Texas and Tennessee indications of decrease are given in only about half the returns. It is stated of *De Soto*, Mississippi, that "there are five times as many farms as existed before the war." Many of the large plantations in the Mississippi Valley are growing up in broom-sedge. In *Dallas*, Arkansas, "there are four acres in sedge to one cultivated" on certain plantations. In some instances, as in *Conecuh*, Alabama, an apparent increase of several hundred per cent. in the number of farms comes from the renting on shares to squads of laborers, and not from a permanent division of farms. In *Alcorn*, Mississippi, farms in 1860 ranged from 160 to 2,000 acres, where one of the latter size is now rare, it being "common to see farms of 40, 60, and 100 acres, though there are a few of 640 acres." In *Perry*, Mississippi, they are smaller by 50 per cent., and "some of the best have gone to waste, grown up with briers and broom-sedge." Our *Duplin* (North Carolina) correspondent says: "Counting tenants as farmers and land worked by them as farms, the farms would average, perhaps, not more than one-third of size in 1860. Taking plantations by the owners, they would average about three-fourths of size in 1860; perhaps more."

Our correspondent in *Concordia*, Louisiana, tiring of answering so many questions, propounds the following:

> Why is it that, with thousands of acres uncultivated in almost every neighborhood, more especially in Mississippi and other high-land States, we still raise as much cotton as we did before the war? I am unable to account for it, and have never questioned one yet who could answer it.

The answer is not difficult. 1. The main reason is a change of location. A considerable extent of new land is cultivated in Texas. Numerous small patches are cultivated on small farms, in nearly all the States, where little was formerly grown. 2. The yield per acre is somewhat greater. As the size of farms decreases the yield of cotton increases, as is shown conclusively in another chapter. 3. Another cause of increase of yield is the general use of fertilizers on the Atlantic coast, and greater economy in the manurial use of cotton-seed in other sections.

Ten years ago, in communications to this Department, the most positive prophecies of failure were predicted, and elaborate statistical "proof" was adduced that the cotton-crop of the United States could never be brought up to 3,000,000 bales; but in 1869 that limit was passed, and the very next year exceeded it by a million and a quarter bales.

LABOR.

Prices.—The extraordinary price of cotton in 1866 caused a feverish excitement in cotton-planting, and induced the offer of higher wages than were warranted by the condition of land and labor. The crop of 1865 had averaged at the ports of shipment 43 cents per pound. When that of 1866 yielded 30, a fall that had been expected by intelligent observers, there was still a lively competition for labor to be expended on the crop of 1867, and higher prices were obtained than were warranted by the efficiency of labor and prospect of stability of price. When the price of that crop fell below 20 cents failure and panic resulted, and the rates for labor fell heavily, as seen in the accompanying table. Since that date the efficiency of labor has gradually increased, production has greatly enlarged, and though cotton has declined in value, wages have advanced in most of the States from that period of lowest depression. The results of our investigation are given in connection with the figures reported in 1868 for that and the previous year. The figures for 1860 were reported at the same time, and, therefore, their complete accuracy may be open to question, though they were given upon consultation with the most reliable of the old planters.

This table gives the price per annum with rations, which consist of 3 to 3½ pounds of bacon per week for each hand, (in some instances 4 pounds,) and a peck of corn-meal, and usually occasional supplies of molasses, sweet-potatoes, and other extras, and the use of a "cabin," very rarely with a small allotment of land for a garden. In 1860, besides rations, an allowance of clothing was generally included in the contract. The column for "men" means "full hands," the women are becoming scarce in the fields, and the "youth" are comparatively few and unreliable. The "full hand" is necessarily the standard of value, and the figures in this column are therefore more instructive, and are probably more accurate, because it is easier to average the wages of this principal class.

States.	1860.			1867.			1868.			1876.		
	Men.	Women.	Youth.	Men.	Women.	Youth.	Men.	Women.	Youth.	Men.	Women.	Youth.
North Carolina	$110	$49	$50	$104	$45	$47	$89	$41	$39	$105	$55	$46
South Carolina	103	55	43	100	55	41	93	52	42	101	54	41
Georgia	124	75	57	125	65	46	83	55	47	102	57	42
Florida	139	80	65	139	85	52	97	50	44	110	68	50
Alabama	138	89	66	117	71	52	87	50	40	107	61	44
Mississippi	166	100	71	149	93	61	90	66	40	124	76	52
Louisiana	171	120	72	150	104	65	104	75	60	136	82	55
Texas	166	109	80	139	84	67	130	72	65	144	90	66
Arkansas	170	108	89	158	94	78	115	75	67	148	92	72
Tennessee	121	63	60	136	67	65	109	51	45	120	60	54

Labor contracts.—The contracts for labor are of three kinds: for money-wages by the month or year, for a share of the crop, and for specific rent in money or products. The first has been practiced to a limited extent by the best and most prosperous planters, and many more who assume it to be impracticable under existing circumstances deem it the best for planter and laborer if they could harmoniously agree to adopt it. The share system has been most in vogue, for two prominent reasons, the laborers greatly affected a quasi proprietorship, and the owners of land were inexperienced in managing free labor and disinclined to have anything personally to do with it. Between them, the plan hit upon was the best possible to destroy fertility and profit and demoralize labor.

The share-allowance to labor varies in different situations and circumstances. In North Carolina three-fourths of the proprietors allow one-half, everything being furnished except rations; others four-tenths, one-third, and one-fourth in a few instances. One-half, one-third, and in some instances three-eighths are reported in South Carolina, the former rate predominating. Four-fifths of the counties of Georgia report one-half for labor subsisting itself. In some cases one-third is given, or one-fourth, with 100 pounds of meat to each laborer. There is much minor variation of the terms of the contract. In Alabama and the States farther west, essentially the same allowance is made; if rations are furnished, one-fourth of the cotton and one-third of the corn is usually allowed. If the land is rented without implements or stock, one-fourth to one-third is demanded, usually one-fourth of cotton and one-third of corn. Much the larger proportion of farms are occupied on the share system, nearly all in Mississippi by sharers and renters, and a very large proportion in Louisiana, about two-thirds in Georgia, South Carolina, Arkansas, and Tennessee. Florida and Alabama report the payment of wages in larger proportion than the other States. So far as is reported, the wages system is deemed best, though it may not be found practicable, because laborers prefer not to hire for money, and the planters have not the money to pay promptly. It is almost universally acknowledged that, in view of the greater yield and superior condition of the land, the wages system is preferable.

The testimony is general to a gradual increase in efficiency of freedmen's labor. Still the disposition exists to congregate in towns, on the part of many, and eke out a precarious living by transient jobs; and the women and youth are too much inclined to decline field-labor even when there is no other profitable calling to occupy their time.

There is a better understanding between land-owners and freedmen. The one is more willing to be advised, the other to give needed direction to labor. Many farmers have been nearly ruined by neglect to exercise wholesome supervision of the farm economy, and waste and improvidence of share-laborers. Some have benefited themselves and laborers by a judicious control. Our correspondent in Chickasaw, Mississippi, gives his own experience as follows:

The man who has the best tact in managing free negroes is the best farmer. He can get labor when others cannot. The writer has freedmen, not his old slaves either, who have lived seven and eight years with him. He buys their shoes, clothing, provisions, and all necessary supplies for cash or short time—and his credit is nearly equal to cash—charges them to his hands, adding in moderate interest. At the end of the year each one has money coming to him, and is satisfied, and wants to remain, while scores apply, more than he wants or needs. I never wrong them out of one cent in settlement. Having thirty negro families on my place, and no help, I am compelled to trust them some. I find but little trouble in controlling them, except in politics, and that I never attempt. A number of them have money to loan, but prefer remaining with me to buying land and going elsewhere from under my management and advice, while I have made $10,000 in clear cash in the last seven years, laid out in land and mules.

The following notes are given from correspondence to show the variety in terms of contract:

NORTH CAROLINA.—*Columbus:* Owners furnish team; laborers find their own board. *Caldwell:* Landlord furnishing everything except laborers' board; the tenant receives one-third of the crop of corn and one-half the crop of cotton. *Gaston:* A majority of owners furnish land and teams, and receive 67 per cent. of the crop. *Greene:* I think that 50 per cent. work as follows: Owner furnishes team and feed for team, and all necessary implements; the laborer furnishes board for himself; owner getting 60 per cent. of the crop. *Edgecombe:* The laborer boards himself; the landlord furnishes everything else, and gives the laborer 40 per cent. of lint-cotton and 33 per cent of other crops. *Harnett:* Share-contracts are decreasing. *Guilford:* When laborer boards himself, he gets one-half of the crop; when boarded by landlord, one-third. *Iredell:* Owners bear all expenses; laborers board themselves, and receive one-third of all the grain, and one-half of the cotton and tobacco, and furnished with house, fire-wood, and garden. *Duplin:* Owner furnishes team, implements, and pays same proportion for fertilizers as he gets of crop; laborer furnishes his own rations, and receives from 40 to 50 per cent. of crop. *Camden:* Share-contracts for cotton only; when land and team are furnished, the laborer has 33 per cent. of the crop. *Rowan:* The land takes one-third stock and feeding the same, and tools and rent one-third; manual labor one-third. *Tyrrel:* The land-owner furnishes and feeds the team and furnishes the implements; the laborer cultivates and gathers in the crops, and they share alike. *Wilson:* One-third and one-fourth of cotton and corn; laborer furnishes himself.

SOUTH CAROLINA.—*Barnwell:* One-third of the crops without rations, or one-fourth with rations. *Chester:* 800 pounds of lint-cotton to the horse. *Edgefield:* Gives 800 pounds lint-cotton for a one-horse farm. *Georgetown:* A large proportion of planters work on the three day system; which is three-days for the proprietor and three days for the laborer.

GEORGIA.—*Banks:* One-third to one-fourth to landlord. *Baker:* Laborer gets one-half of all he can make, landlord furnishing everything necessary to make the crop except board for laborers. *Bartow:* Landlord furnishes and feeds the stock; the laborer gets one-half. *Bibb:* Some give one-third of the crop for labor. Others give the laborer one-half of the crops, the laborer boarding himself, and dividing expenses. *Catoosa:* One-third of produce to landholder. *Columbia:* The laborers usually put their labor against the land and stock, and divide the expenses. *Dawson:* 40 per cent. work on shares, landlord to furnish land alone for one-third of production; 40 per cent. of labor is done by the land-owners. *Dooly:* The owner furnishing everything, and the laborer finding his own board, receives one-third of the corn and one-fourth of the cotton. *Early:* An average of share-contracts is one-third of all crops housed and 100 pounds of meat to laborer. *Elbert:* Laborer finds himself and does the work, landlord finds the stock and feed, pays contingent expenses, and divides the crop equally. *Forsyth:* The landlord furnishes stock and tools and houses; produce divided equally. *Harris.* Laborer gets one-half of the corn and one-third of the cotton, the employer furnishing everything but the labor and board. *Milton:* Owner furnishes stock, tools, feed for stock, and seeds for planting, and gives the tenant one-half, after paying for fertilizers.

Muscogee: Planter gives one-third to the laborer, who finds his own board; sometimes he feeds the laborer and gives one fourth of the crop. *Oglethorpe:* Some laborers get one-half and feed themselves; some work for one-third and feed themselves; some, for one-fourth and rations. *Taliaferro:* Contracts range variously from one-fourth to one-half, according to proportion of expenses which the laborer bears. *Wilcox:* Tenants keep up the place and give the owner one-fourth of the crop housed, except potatoes, cane, and all garden-products, which are all kept by the tenant. *Wilkes:* Contracts are varied; some one-third, some one-half, and some one-fourth deducted for rent, and then divided. In all these cases the laborers feed themselves. *Twiggs:* Laborer gets one-half corn and other products, except cotton, of which the laborer gets one-third; some contract to work four days for their employer and two for themselves. *Thomas:* Contracts are one-third of the provision-crop and one-half the cotton, owner paying all expenses, except rations for hands.

FLORIDA.—*Clay:* The owner takes one-fourth of the cotton; all other crops, one-third. *Columbia:* If the laborer is found rations, he gets 33⅓ per cent. of the crop; if he finds himself, he gets 50 per cent. *Gadsden:* The usual share is one-half the crop, the proprietor furnishing team, and the laborer boarding himself. *Jackson:* The laborer generally gets one-fourth of the crop and rations. *Madison:* From one-sixth to one-fourth of the cotton and one-sixth to one-third of corn. Some furnish team and one-half feed and give one-half of all crops. *La Fayette:* All labor is done for cash. *Leon:* Some contracts are one-fourth to one-third, and rations; others, one-half the crop, and laborers furnish rations. *Orange:* All cash. *Suwannee:* Laborers get one-third when found, and one-half when they find their own rations. *Taylor:* Laborers receive one-half of the crop, doing the work and boarding themselves, the owner furnishing the team and feed, seed, and implements.

ALABAMA.—*Geneva:* But few contract the same. When the laborer feeds himself, and does all the work, growing and gathering the crop, he gets one-half; if he finds his own team and implements, he gets three-fourths of the corn and fodder and one-third of the cotton. *Henry:* The laborer shares one-third to one-half the proceeds, he furnishing his own rations. *Jackson:* Owner furnishes team and feed, and pays one-half of the expense of repairing tools, and takes one-half the crop. *Madison:* Owner furnishing land, fuel, quarters, team, and paying all necessary expenses; the laborer, finding his own rations, gets one-half the crop; when boarded, one-third; when owner furnishes only land, fuel, and quarters, the laborer gets two-thirds of the corn and three-fourths of the cotton. *Russell:* White laborers generally work for half of everything they raise and find their rations; colored laborers generally have everything furnished, except their clothing, and get what land they can cultivate in 1½ days in each week, commencing Friday at 12 noon. *Shelby:* Sixty per cent. of laborers board themselves, owners furnish everything else, and divide the crop equally; 15 per cent. labor as above, and get only one-third of the crop; those that are boarded by the employer receive one-fourth of the crop. *Sumter:* Laborers get one-half of what they make, expenses being equally divided. *Winston:* Owner receives one-third when laborer furnishes stock, feed, and implements, and one-half when these are furnished by owner. *Baldwin:* When tenant furnishes everything but land, the owner gets one-fourth of gross proceeds. When landlord furnishes stock and advances to make the crop with, he takes one-half and repays himself for the advances, including interest. *Butler:* Contracts generally provide that the owner furnish stock and pay all expenses of the farm, and the laborer finds his own rations, and the crop is divided equally. Laborer gets one-fourth of the crop when owner finds rations. *Calhoun:* Owner furnishing stock and tools, the laborer gets one-third of the crops; when laborer furnishes everything, he gets two-thirds of the corn and small grain and three-fourths of the cotton. *Coffee:* Laborers feed themselves and get one-half the crop; owners furnish teams and feed and implements. *Crenshaw:* Owner furnishing team and feed gets one-half the crop; when tenants furnish themselves, the owner gets one-fourth of the cotton and one-third of the corn. *De Kalb:* Owner furnishes stock, and gets one-half the grain and one-third of the cotton; when tenant furnishes himself, the owner gets one-third of the grain and one-fourth of the cotton. *Elmore:* Laborers who furnish their own rations get one-half of the crop; when rations are furnished, the laborer gets one third of the corn and one-fourth of the cotton. *Etowah:* Laborer gets two-thirds of the corn and other grain and three-fourths of the cotton when he furnishes team and implements, and one-half when they are furnished with implements.

MISSISSIPPI.—*Adams:* In nearly every instance the owner is compelled to lease his land for one bale of cotton for a man and one-half bale for a woman. *Perry:* Laborers receive one-third when found rations and one-half when they find their own. *Alcorn:* One-third of the corn and one-fourth of the cotton goes to the landlord where the laborer furnishes his own rations, team, and feed. *Lincoln:* Eighty per cent. of laborers work on shares for half the crop, feeding themselves, and employer furnishing everything else. *Lowndes:* One-half the cotton, one-third of the corn and other crops, the laborer paying for his supply of meat advanced. *Madison:* Owner furnishing team and feed, implements, and other things necessary; the laborer finds his own board and gets one-half the products. *Marion:* Employer furnishes teams and implements and gets half the crop; when he furnishes land alone, he gets one-fourth. *Rankin:* The laborer subsists himself and keeps up the status of land as to fences, ditches, &c. The owner furnishes all the teams, implements, &c., and the crop is equally divided. *Washington:* The proprietor puts the place in order, furnishes everything, the laborer having the garden and house-rent free, and gets one-half of all he produces.

LOUISIANA.—*Bienville:* Share-contracts are one-half; laborer to board himself. *Bossier:* One-half the produce for the laborer, he finding his own rations. *Caddo:* Laborers furnishing everything but land get three-fourths; when they feed themselves, only one-half; everything found them by the proprietor, one-third. *Claiborne:* Laborer gets one-third when rations are furnished, and when furnished by himself one-half. *Concordia:* When laborer feeds himself, he gets one-half the crop; planter furnishing everything, laborer gets one-third; some contract to pay so many pounds of lint-cotton for the use of a given number of acres of land. *Franklin:* Proprietor gives one-third of the crop and furnishes the laborer with tools; or one-half, furnishing everything except rations. *Iberia:* Crop divided equally, the owner furnishing team and half the feed; laborers feed themselves and pay half the expenses, such as blacksmith's bill, &c. *La Fayette:* Crops worked entirely by share-contracts. Laborers feed themselves and receive one-half of all the crop. *Rapides:* Three-fourths to laborer when he furnishes everything but houses and land. *Terre Bonne:* When laborer furnishes everything, he gets three-fourths. *Union:* Laborer receives one-half of the crop and supplies himself; the planter furnishing team and implements. *Vermillion:* Laborer gets two-thirds when he finds his rations and furnishes team and implements, and one-third when owner furnishes all.

TEXAS.—*Anderson:* Landlord furnishing teams, &c., gets one-half; when these are furnished by laborer, landlord gets one-fourth of the cotton; one-third of the corn and other crops. *Austin:* Laborer furnishing his board, team, and tools gets three-fourths of the cotton; two-thirds of the corn. Laborer boarding himself, without furnishing team, &c., gets one-half of the crop; when all are furnished by owner, he gets one-fourth of the cotton, one-third of the corn. *Bexar:* Ninety per cent. get cash; when the owner contracts to furnish team, implements, and seed, he gets one-half. If tenant furnishes everything, he pays one-third of the crop made. *Brazos:* When laborers feed themselves, share one-half; when fed by planter, one-third and one-fourth. *Burleson:* Owner furnishing team and feed, share one-half. If tenants furnish these, they get three-fourths of the cotton; two-thirds of all other corps. *Cherokee:* Planter to furnish team, tools, and feed for team, and take one-half the crop; renter boarding himself. Laborer finding team, &c., he gets two-thirds of the corn, three-fourths of the cotton. *Colorado:* Planter furnishes team, implements, and feed for team, and takes one-half the crop; when land alone is furnished by owner, he gets one-third of the corn and one-fourth of the cotton. *Dallas:* Laborer being at all the expense, gets three-fourths of the cotton and one-third the corn. *Denton:* The tenant gives one-fourth of the cotton, one-third other crops. *Falls:* When laborer furnishes and feeds team and finds implements, he gets two-thirds the corn and three-fourths of the cotton. When these are furnished by landlord and laborer finds his own board, he gets one-half. *Fayette:* The landlord furnishes teams and implements, and gets one-half the crop; or the laborer may furnish himself with these, and get two-thirds of the corn and three-fourths of the cotton; each one paying the expense of ginning and baling on his share of cotton. *Fort Bend:* Laborers board themselves, owner furnishing everything else, and divide equally. *Galveston:* Planter furnishing team and implements, laborers furnishing their own board and feed for teams, and divide the crop equally. *Hamilton:* One-third and one-fourth of crops to the owner. *Hardin:* Landlord finds team and implements, and has one-half the crop; when the owner finds only land, he gets one-third of the corn and one-fourth of the cotton. *Hunt:* When owner furnishes teams and implements, the crop is divided equally; when this is not done, the landlord receives one-third of the corn, &c., and one-fourth of the cotton. *Houston*: Laborer furnishing team, board, &c., the proprietor gets one-third of the corn and one-fourth of the cotton. *McLennan:* Owner furnishing land and house, (which is the usual way,) receives one-fourth of the cotton and one-third of the grain. *Parker:* All cash. *Rusk:* A great majority of contracts provide that the planters furnish everything and take one-half the crops. *Titus:* Landlord furnishing tools, team and feed for team, gets one-half of all the crop. *Travis:* Fifty-five per cent. of laborers furnish team and tools, and receive three-fourths of the cotton and two-thirds of all other crops. *Williamson:* Tenants share three-fourths of the cotton and two-thirds of all other crops.

ARKANSAS.—*Crawford:* When owner furnishes teams, seed, and feed for team, he takes one-half the crop; when furnished by the laborer, he gets three-fourths of the cotton and two-thirds of all other crops. *Conway:* One-fourth of the cotton and one-third of other crops to the landlord. *Crittenden:* Owner furnishes everything but labor, and the crop is divided equally. *Cross:* Owner receives one-fourth of the cotton and one-third of other crops. *Dallas:* The owner furnishing house, fuel, and garden, gets one-fourth of the crop, and when he furnishes team in addition he gets one-half of crop. *Independence:* Usually the owner gets one-third of the crop, the laborers furnishing themselves, or one-half when owner furnishes team, implements, and feed for team. *Jefferson:* Laborer gets one-third of the cotton and one-fourth of other crops, landlord furnishing everything except board. A great many hire lands, paying from 60 to 100 pounds lint-cotton per acre. *Johnson:* The principal contracts now are, the owner furnishes the land only, and gets one-fourth of the cotton and one-third of other crops. *Prairie:* When laborer furnishes everything but land, he gets three-fourths of the cotton and two-thirds of other crops; when landlord furnishes team and implements, one-half. *Saint Francis:* Landlord furnishing team, fuel, and tools, gets one-half; when they are furnished by laborer, he gets one-third of the cotton and one-fourth of the corn. *Woodruff:* Owner furnishing teams, tools, &c., he gets one-half; laborers furnishing the same receive three-fourths of the crop.

TENNESSEE.—*Bedford:* Landlord furnishing stock, tools, &c., he gets two-thirds of the crop; when tenant furnishes the same, he gets two-thirds. *Bradley:* Owner finding everything gets three-fourths of crop; laborer finding everything, owner receives one-third. *Cannon:* Landlord furnishing everything gets two-thirds of the crop. *Decatur:* Landlord finds everything and gets one-half. *Dickson:* Landlord furnishes stock, implements, and feeds stock, gives laborer one-half. On very productive land the laborer gets but 40 per cent. of crop. *Gibson:* Laborer receives one-half the crop; employer finding stock, implements, and feed for stock, laborer boarding himself; he is required to repair fences, get up the fire-wood, and for all work beyond this he is allowed additional compensation. *Hardeman:* Planter furnishing rations, team, feed for team, and tools, gets one-half the crop; when the tenant furnishes the same, he gets two-thirds of the crop. *Henderson:* Owner furnishing everything except board receives one-half the crop, or rents for one-third of the corn and one-fourth of the cotton. *Lincoln:* Owner furnishing everything gets one-half; tenant furnishing the same gets two-thirds. *McNairy:* Laborer furnishing himself entirely, gets two-thirds of the corn and three-fourths of the cotton. *Sevier;* Laborer hires a place, he gets two-thirds; on bottom-lands, one-half.

Rations.—The amount and cost of rations are variously indicated in the following extracts from correspondence:

NORTH CAROLINA.—*Hertford:* Rations worth about $5 per month. *Jones:* Value of rations, 80 cents per week. *Orange:* Amount of rations per hand for the year, 15 bushels of corn and 225 pounds of bacon. *Person:* Rations for the year, 15 bushels of corn and 300 pounds of pork. *Yadkin:* Rations for one year, 150 pounds bacon, 12 bushels of corn, with garden vegetables. Value from $30 to $40.

GEORGIA.—*Banks:* Amount of rations for the year, 200 pounds bacon, 13 bushels of meal. *Cobb:* Rations cost per year from $40 to $50. *Dooly:* Rations per month, 14 pounds bacon, 1 bushel of meal, and 1 gallon of sirup. *Elbert:* Rations per month, 1 bushel of meal, 12 pounds bacon, with milk and vegetables. *Gwinnett:* Rations estimated at 18½ cents per day. *Jackson:* Each hand receives 12 pounds of bacon, 1 bushel meal, and 1 gallon molasses per month. *Macon:* Rations, 150 pounds bacon and 12 bushels meal per year. *Pike:* Value of rations about $50 a year. *Washington:* Rations per month, 15 pounds of meat, 1 bushel of meal, a gallon of molasses, pint of vinegar, 1 pound of tobacco, and pepper and salt. *Whitfield:* Value of rations per man, $60 per year; not quite so much for women and youths.

FLORIDA.—*Orange:* Rations valued at $40 per man per year. *Sumter:* Price of rations per day, 18½ cents. *Suwannee:* Rations for year, 25 bushels of corn, 150 pounds of pork, and 5 gallons of sirup. Value, $35.

ALABAMA.—*Calhoun:* Rations worth from $3 to $4 per month. *Crenshaw:* Rations for the year, 150 pounds bacon, 12 bushels meal. *Geneva:* Hands that work for wages are fed from the kitchen, and eat what the employer does. *Jackson:* No rations furnished for use of hands.

MISSISSIPPI.—*Amite:* Amount of rations for each laborer is $35. *Chickasaw:* Rations for one hand for year, 12 bushels corn, worth 25 to 35 cents per bushel, 150 pounds side meat. They generally have milk and vegetables part of the year. *Lowndes:* Rations, 200 pounds of meat, 10 cents per pound, 12 bushels of meal, 35 cents per bushel. *Oktibbeha:* Amount of rations, 200 pounds meat, 13 bushels of meal for the year. *Washington:* Rations cost $4 per month. Amount of rations, 16 pounds of bacon, 1¼ bushels of meal, or equivalent in flour, salt, and sometimes sugar and coffee. *Wayne:* Amount of rations per year, 12 bushels of corn, 200 pounds bacon, vegetables, &c.

LOUISIANA.—*Caddo:* Value of rations, $40. *Catahoula:* Amount of rations for year, 13 bushels of meal, 1 barrel of pork, 6½ gallons molasses. *Claiborne:* Value of rations for year, from $50 to $75. *Union:* Amount of rations per month, 20 pounds bacon, 1 bushel corn-meal, one-half gallon molasses.

TEXAS.—*Collin:* Hands generally board with the family. *McLennan:* Hands usually eat from the same kitchen as the employer. *San Saba:* Hands board with the family. *Uvalde:* Rations worth $75 per annum.

TENNESSEE.—*Henderson:* Rations for year, 15 bushels corn, 6 bushels wheat, 300 pounds pork, coffee, sugar, &c. *Lawrence:* Rations worth at least $50 per annum. *Maury:* Rations per month, 20 pounds bacon, 1 bushel meal. *Madison:* Rations, 200 pounds bacon, 12 bushels meal.

WHITE LABOR IN COTTON-GROWING.

It was formerly an opinion that obtained quite generally, away from the cotton-fields, that the climate was a bar to any extensive use of white labor in this industry. It is now as generally acknowledged that labor in the open air is practicable in all portions of the South, except, perhaps, in the rice-fields and other malarious localities. At least nine-tenths of the area of the cotton States consists of dry and salubrious uplands.

There has also been some cotton cultivated and gathered by white labor. There is perhaps no accurate data to show the exact proportion. It was always small, however. While labor was mainly compulsory and servile, there could be no material increase in the proportion accredited to the whites; the incentives of high prices and accumulated savings were apparently powerless in opposition to the pride of race and the power of caste. Some writers have assumed, prior to the change of the labor system, one-sixth as the proportion of white laborers in the cotton-fields.

The proportion has been increasing for the last ten years, until now there are two States, according to the reports of our correspondents, in which the larger part of the product is grown by whites. Returns from more than half the cotton area of Texas make the proportion of cotton grown by white labor five-eighths; and data representing three-eighths of the Arkansas area establish the proportion of six-tenths. In every State there is a large increase of white-labor production. While the percentage for each State might be nearer to perfect accuracy if the information covered every acre of the cotton area, the actual canvassing of about half the field, ranging in each State from three-eighths to five-eighths of its area, furnishes the best attainable means of estimating the proportion of the cotton-crop grown by whites. On this basis the proportions are, 60 per cent. by black labor, 40 per cent. by white. The proportions, by States, are as follows:

States.	Black.	White.
North Carolina	65	35
South Carolina	68	32
Georgia	66	34
Florida	72	28
Alabama	59	41
Mississippi	68	32
Louisiana	77	23
Texas	38	62
Arkansas	40	60
Tennessee	59	41

The proportion of white cultivators will not decrease. As population increases, the white element will be stronger in numbers; and a larger proportion of the cotton will be grown by small proprietors, while the African element will drift into menial service in towns and in manufacturing and mining enterprises, and many who aspire to occupancy of land will earn only a precarious existence. Doubtless there will be others of more stable and persistent character who will acquire a comfortable competency. However large the class may ultimately become, the accretion by immigration will give a constantly-increasing preponderance to the white element. As the negro may be deemed, in a rude sense, a skilled laborer in the cotton-field, his services should be retained there by a wise and generous policy on the part of land-proprietors, and the value of his labor should be increased by augmenting his comforts, inspiring a desire for accumulation, and improving his mental and moral status. He may be made a useful co-laborer in industrial advancement; or, neglected and antagonized, he may become an outcast and a nuisance.

FREEDMEN LAND-OWNERS.

An attempt has been made to ascertain to what extent the freedman has sought to provide himself with a home of his own. He is more inclined to seek a lot and house in a town or village than to settle upon a farm. He is of course debarred by his poverty, as a rule, from assuming proprietorship of land. There is public land, at a low price, but not in the vicinity of towns or in the fertile cotton districts. So far as reported, the proportion of freedmen occupying their own land is 4 per cent. in Tennessee and Alabama; between 4 and 5 in North Carolina and Georgia; 5 in South Carolina and Texas; between 5 and 6 in Mississippi, Louisiana, and Arkansas; and 8 in Florida. The average, if it fairly represents the unreported portion of the cotton area, indicates that nineteen out of twenty have no homes. In some counties not one in a hundred owns land. Our correspondent in Dooly County, Georgia, says: "Having been census-taker in 1870, and tax-receiver, I am personally acquainted with every section of the county, and there are but five land-owners in the county out of a voting population of 558." In Catoosa, Georgia, only one in eighty owns land. In Beaufort, North Carolina, one-third own the tracts on which they live, but cultivate land of others. Our correspondent in Bibb, Georgia, says: "There are 3,000 negro adults in Bibb County; 1,600 live in the city of Macon, 1,400 outside of the city. Of those living in the city, 114 own property valued at $95,000. Of those living outside, 250 live in the suburbs, who are principally mechanics and laborers, and make a living by working either in town or country, but greatly prefer to take their chances to get work in town. Necessity alone drives them in the country during the busy season, (cotton-picking time, &c.) These parties own small places containing from two to four acres, and as a general rule have tolerably good houses. Their property aggregates $100,000. One hundred men own and cultivate in the county 2,500 acres, valued at $30,000. The farms range in size from 5 to 50 acres. About 8 per cent. of the freedmen in the county own land." Our Chickasaw, Mississippi, correspondent says: "Not 3 per cent. of the negro laborers own the land they cultivate; many more have bought and made partial payments, and may or may not pay all. A much larger number rent land, say 15 per cent.; they own the mules or horses that work it, and cultivate with negro labor, and frequently do well. Quite a number get broke the first and second years. Those who work on shares do best."

COST AND PRICE.

It is not practicable to obtain the exact cost of production, for the reason that few cultivators keep systematic accounts. It is perhaps easier to *approximate* the real cost of cotton than of other products of agriculture; being a prominent specialty, sometimes monopolizing the resources of cultivation, it is less complicated than mixed farming.

The price obtained is that at home markets, making the aggregate value less than the commercial value of cotton at shipping ports. Our correspondents have promptly responded to this part of the circular, and their returns (in districts with similar conditions) have been remarkably uniform, but of course less so as to cost than as to price. The State averages are as follows, in cents and fractions per pound, of upland cotton:

	Cost.	*Price.*
North Carolina	$0 09.3	$0 09.8
South Carolina	9.4	9.7
Georgia	9.3	9.8
Florida	8.7	9.2
Alabama	9.9	10.1
Mississippi	9.8	10.2
Louisiana	9.7	10.2
Texas	8	9.1
Arkansas	9	9.9
Tennessee	9	9.8

This gives to Texas the largest proportion of profit, or 11 mills per pound; Arkansas, 9; Tennessee, 8; the others 2 to 5; the average slightly exceeding half a cent, being $2.60 per average bale; making the net profit to the cultivators $11,500,000 in round numbers, in an aggregate of about 205,000,000. This is within a fraction of 6 per cent. of the gross receipts, and, if assumed to be substantially correct, is too small a margin for a good season. It illustrates the necessity of increased returns. How shall they be obtained? By increasing the yield and diminishing the cost of supplies. Both ends are reached by a single operation: the adoption of a restorative rotation, which involves animal production and green manuring, a cheapening of fertilizers and supplies for man and beast, a partial protection of the soil from washing and waste, a large yield at a small cost, and increase of fertility instead of exhaustion.

Alabama reported during the past season the lowest averages of condition, resulting in the lowest yield per acre. It now returns the smallest margin of profit, only two mills per pound. In South Carolina, where low condition also prevailed, the net profit made is but three mills.

Some correspondents make the cost per pound to those who pay high rates of interest upon indebtedness for high-priced supplies twice as much as to those who produce their own supplies. In every State the cultivator who buys least saves most, according to universal testimony. Those who make cotton a surplus product are getting rich; in a sense, the crop becomes all profit.

So great is the waste attendant upon large operations on a credit basis, and involved in the prevalent irresponsible management under the share system, that the counties with large plantations and heavy aggregate production generally give the smallest net profit. In Mississippi the cost per pound in several such counties averages more than the price received. A few large counties in Arkansas make the cost 2 cents greater than the price. The principal districts in North Carolina average 10 cents for cost and the same for price. The districts of heaviest production in Texas only make an average of 2 to 3 mills net profit, while the average of the State exceeds 1 cent. In Louisiana, the districts of heavy production make a better showing, yet here there are some of the largest that return cost higher than price.

Here is convincing proof of two things: the superior economy of small holdings, and the wastefulness of the share system, especially with large gangs of hands.

INSTANCES OF LARGE YIELDS.

With cotton, as with all other products, instances can be given of yields threefold greater than the average. With 12 bushels as the general average for wheat, every State can furnish examples of 30 to 40 bushels; so, while nearly three acres are required to produce a bale of cotton, if results are averaged, the individual yields may vary from 100 pounds of lint per acre to 500, with extremes even higher and lower than these figures. It is a disparity having many causes, among which are different degrees of natural fertility, the use of fertilizers, modes of culture, degree of attention bestowed upon the crop at all stages of growth, meteorological casualties, and insect depredations. No amount of skill can secure equality of results in all cases, or like results by individuals in the operations of a series of years; yet the best cultivators suffer a smaller proportion of loss from every cause of depreciated yield than the average cultivator. Examples might be cited showing these differences to constitute the margin between success and failure, and to furnish the most powerful stimulus to persistent effort and increase of skill.

An extraordinary result upon pine-wood land, with high fertilization, is reported from Wayne County, North Carolina: "Mr. Michael Edgerton, on five acres, average low grounds pine-wood land, surface dark loam, with clay subsoil, raised 15,100 pounds of seed-cotton. He put in drills 400 pounds Navassa guano to the acre, and broadcasted 75 loads of barn-yard manure to the acre." The barn-yard manure he estimates at one-third of the value of horse-manure. This is 906 pounds of lint per acre, at 30 pounds per 100, which is a low yield of lint for such cotton; 1,000 pounds per acre would probably be the outcome, or two large bales.

In response to inquiries for the largest known local yields, with a statement of the area, soil, and mode of culture, facts illustrating the above-mentioned views are given, which are here presented. They show that, with very rare exceptions, the largest rates of yield are made upon very small areas, usually 10 to 20, and often 1 to 5 acres. In one instance, in *Dallas County*, Texas, 700 bales are reported from 700 acres; in *Bossier Parish*, Louisiana, 600 bales from 480 acres, and in *Union* 250 from 200; in *Murray*, Georgia, 400 pounds of lint per acre on 100 acres; and in *Nash*, North Carolina, 300 pounds per acre on 200 acres. These are marked and rare exceptions. A bale per acre on a very few acres is frequently reported from every State. In *Hyde*, North Carolina, two bales per acre are reported on two acres. A boy in Texas grew six bales on four acres. In North Carolina, 25 bales were reported on 25 acres. In most of the States there is no instance given of a bale per acre on a large plantation. In many counties the best results on large farms scarcely exceed half a bale, and in some it is denied that there is a farm that has averaged a third of a bale the past year. An examination in detail of the reports of best results will indicate the variety of instances of high production.

VIRGINIA.—While very few counties in Virginia grow cotton, there are cases of large yields. Mr. R. M. Griswold, of *Dinwiddie*, made 60 bales on 100 acres of light gray soil, fertilized. It is cultivated in the usual way, with three hoeings and five plowings.

Mr. William H. Jarrall, of *Sussex*, made 15 bales on 12 acres, with farm-yard manure and a small amount of commercial fertilizers. It cost less than 8 cents per pound.

NORTH CAROLINA.—The largest yield noticed is 20 bales on 25 acres in *Columbus* County.

On gray chincapin soil, in *Gaston*, in several cases, a bale per acre has been made by high manuring.

In *Greene*, 42 acres manured with a home-made compost, at a cost of $3.50 per acre, produced 42,000 pounds seed-cotton. Cultivation, $6.50; profit, $20.

A five-acre field, with clay subsoil, in *Harnett*, averaged 750 pounds of lint, giving 50 per cent. profit.

In *Guilford*, best yield 200 pounds.

Our correspondent in *Hyde* reports, from 2 acres of black loam, stirred with plow every five days, a yield of 2 bales per acre.

The best average in *Iredell* is 1,000 pounds seed per acre on 16½ acres of loam fertilized, cultivated with a sweep and hand hoe.

A farm in *Lenoir*, with 100 acres in cotton, made 80 bales of 500 pounds at a cost of $1,600. Cotton sales, $3,926.

In *Lincoln*, a small patch has produced 1,500 pounds seed per acre, planted in rows 3 feet apart, highly fertilized, and kept clean throughout the season.

A bale per acre has been obtained in *Mecklenburgh*.

A neighbor of our *Hertford* correspondent made 25 bales of 475 pounds each from 20 acres; an average of 593 pounds per acre. A compost of guano and cotton-seed with loam was used.

In the gray soil of the pine-lands of *Pitt*, several small farms have averaged a bale per acre. These are the farms that produce needed home supplies.

The sandy loams of *Moore*, subsoiled and well fertilized, often produce a bale per acre, at 25 to 35 per cent. profit.

A large farm in *Nash* averaged 300 pounds on 200 acres; a yellow sandy loam, with clay subsoil, fertilized with 150 pounds Peruvian guano.

The best crop in *Orange* was, on gray sandy soil, 22 bales for 35 acres.

Nearly a bale per acre on 100 acres was made in *Pasquotank;* 300 pounds deemed a good result on the best farms.

On the farm of Capt. J. J. Davis, our *Franklin* correspondent, a colored man, with good ordinary culture, on a tract of gray surface and red subsoil, got 17 bales of 425 pounds on 16 acres, and, with 32 bushels of corn and other products, cleared $450.

The largest yield in *Duplin* is 40 bales of 500 pounds on 45 acres; soil, a stiff loam; fertilizers, 200 pounds acid phosphate; 15 bushels cotton-seed per acre.

In *Cumberland*, 14 bales on 15 acres produced a profit of $500.

In *Catawba*, a crop of 250 pounds per acre is reported; fertilized with a bag of bone dust costing $6.

One bale per acre is the largest yield in *Chowan*.

Mr. Thomas H. Blount, of *Beaufort*, on a loam with clay subsoil, got 54 bales of 400 pounds on 52 acres at a cost of 8½ cents per pound; deep preparatory culture, with shallow cultivation.

One bale per acre is the best result in *Camden*.

Two-thirds of a bale per acre is occasionally obtained in *Warren*.

In *Wayne*, an average of 450 pounds has been obtained by Messrs. J. T. Pearson, Michael Egerton, and Joseph Parks.

In *Perquimans*, a crop of 30 bales averaged 850 pounds seed-cotton per acre, and a profit of $5.

SOUTH CAROLINA.—*Barnwell* reports 250 pounds per acre on 150 acres, sandy loam with clay subsoil; more heavily manured and thoroughly cultivated than usual. No profit in 1876.

In the red soil of *Chester*, 500 pounds lint per acre were made at a clear profit of 40 per cent.

On 125 acres in *Colleton*, 50 bales were made on sandy land, and sold for 11 cents per pound.

Small areas in *Fairfield* produced 300 pounds lint per acre.

In *Georgetown*, two-thirds of a bale per acre on 20 acres.

One acre in *Horry* yielded 1,347 pounds lint. The seed planted was the "Cheatham."

In *Marion*, 10 bales were grown on 4 acres by a man who does his own work and makes his own supplies. Cost of fertilizers used, $40 per acre.

Our correspondent in *Marlborough*, Mr. T. C. Weatherby, made 56 bales of 450 pounds on 47 acres light sandy loam on stiff red clay subsoil.

In *Newberry*, a planter produced 400 pounds lint per acre on gray sandy soil, manured principally with acid phosphate, stable, and compost manure. Profit, 33 per cent. His negro-croppers got 106 bales from 120 acres. Profits of the farm, $2,500.

GEORGIA.—The best product in *Brooks*, on hummock-land, broken deeply, with shallow cultivation, is a half-bale to the acre.

In *Campbell*, the yearly application of home-made manure produces 1,400 pounds seed-cotton, or about one bale per acre.

Mr. J. Rice, in *Calhoun*, obtained 35 bales from 65 acres, fertilized by chemicals and cotton-seed.

A freedman in *Catoosa* got 452 pounds from an acre, fertilized with 300 pounds of guano, at a cost for production of 5 cents per pound.

In *Cobb*, the best farms average 250 pounds per acre, though highly fertilized patches make a bale per acre.

Five acres of pine-land in *Decatur*, with stable-manure and 200 pounds per acre of Logan's compound, averaged 500 pounds per acre of lint.

Thirty acres in *Early*, with the aid of 3 tons of guano and 200 bushels of cotton-seed, yielded 9,000 pounds of cotton.

In *Elbert*, 1,000 pounds of seed-cotton per acre on 50 acres of gray sandy loam, after subsoiling and thorough preparation.

Two farmers in *Emanuel* got 8 bales from 8 acres with 200 pounds per acre of a compost containing Bradley's superphosphate of lime.

A farmer in *Floyd*, on Coosa River bottoms, realized 70,000 pounds from 200 acres, or 350 pounds per acre.

A neighbor of our *Forsyth* correspondent has a farm of 820 acres, produced 35 bales from 80 acres of "mulatto" land, and realized $600 profit on his farm operations.

The crop of Mr. J. M. Ambrose, of *Gwinnett*, averages 300 pounds per acre.

Mr. Reuben M. Mobley is said to have made the best crop in *Harris*—about a half-bale per acre—with 150 pounds of compost made of raw bone, plaster, cotton-seed, and stable-manure.

The best result in *Heard* is 800 pounds seed-cotton per acre.

The best yield in *Houston* is 250 pounds lint.

In *Jackson*, half a bale is the best average.

Our *Liberty* correspondent refers to estimates by "grangers" in his county, for farms of 10 to 20 acres, of 500 to 600 pounds of ginned cotton per acre, when the land is highly manured.

In *Lincoln*, the best average for a farm is half a bale, though a few patches of 1 to 4 acres, highly fertilized, have yielded a bale per acre.

A two-horse farm in *Macon* yielded 22 bales of 480 pounds from 56 acres, or very nearly 190 pounds per acre. Gross proceeds, $1,050, with food for stock and food for a family of seven persons; expenses for fertilizers and labor, $650.

In the red lands of *Madison*, somewhat reduced in fertility, 800 pounds seed (240 lint) is an average yield of best farms.

Our *Marion* correspondent, Mr. Kemp, claims, for an acre cultivated by Mr. B. T. Peacock, with fertilizers costing $10, 2,700 pounds of seed-cotton.

A farm of 90 acres (two mules) in *Meriwether* yielding a net profit of $500, with a product of 35 bales of cotton and 200 bushels of corn.

The farm said to be the best equipped and most profitable in *Bibb* County is that of Messrs. A. J. Lane and J. G. Evans, having 500 acres in cultivation, with equal areas of corn and cotton and 50 acres in small grain and "truck patches." The soil is a red loam, its natural growth black-jack and pine; and its mode of culture is the "Dickson plan." The annual product is 150 to 175 bales of cotton and 3,000 to 4,000 bushels of corn.

A rather uncommon result in *Milton* is a product of 1,900 pounds seed cotton per acre, on a light, gray soil, in stubble deeply turned under in January, with 200 pounds superphosphate in bedding. This gave $30 per acre.

In *Mitchell*, the best averages are 400 pounds of lint per acre, 5,000 to each mule, and a net profit of $5 per acre.

Col. David S. Johnston, of *Morgan*, gets 400 pounds per acre, at a cost of 7 cents, (sold at 10,) making a profit of $12 per acre. His land is sandy clay, originally growing oak and hickory, fertilized with 450 pounds compost horse-manure with 50 pounds acid phosphate and 300 of cotton-seed.

A farmer in *Murray* gets 400 pounds per acre on 100 acres of black sandy loam, but cannot tell what profit he makes.

The greatest yield in *Pike* was 12 bales on 18 acres, gray surface with mulatto subsoil, fertilized with 100 pounds compost per acre.

Mr. Lucius Humber, of *Stewart*, got 84 bales from 120 acres creek-bottoms, with six mules, at a cost of 6 cents per pound, with an aggregate profit of $1,680.

In *Talbot*, the best yields are 250 pounds per acre.

In *Taliaferro*, the best yield reported is 105 bales on 300 acres. Profit, $450. Mr. Aretus Turner, from 50 acres of ordinary upland, got 13,390 pounds, and a profit of 25 per cent.

In *Jefferson*, 70 bales on 140 acres, fertilized, with common culture.

In *Wilcox*, 340 pounds per acre on 20 acres.

The largest yield in *Whitfield* is 1,500 pounds seed per acre, without fertilizers.

From 45 acres in *Walton* 40 bales were obtained.

Small lots in *Thomas* have yielded a bale per acre, at great expense for fertilizers and cultivation. Similar results are returned from *Terrell*.

With three plows, 52 bales were produced on 75 acres of pine-land in *Baker* by the Dickson mode.

FLORIDA.—In *Clay* County, 4 bales to 8 acres is the largest yield on sandy soil with clay subsoil.

In *Gadsden*, instances are reported of 500 pounds of lint per acre with liberal home-made manure and ordinary culture.

In *Hernando*, Mr. John B. Gould, white, with labor of his own family, made 1,200 pounds seed per acre on 5 acres sandy upland, manured by penning cattle on ground. Price, 5 cents in seed or 22½ cents lint, sea-island cotton.

One farmer in *Jackson* made 62 bales cotton and 300 bushels corn on 100 acres hummock-land, highly improved by horse and cow-manure for years.

Mr. T. F. Johnson, of *Jefferson*, with labor of self and son, produced 12 bales cotton and 200 bushels corn, with fodder, potatoes, sirup, and other supplies.

There are a few cases in *Madison* of 450 pounds lint per acre on new or fertilized land.

The best results in *La Fayette* are 500 pounds seed-cotton for long staple, 1,000 pound for short staple, per acre.

In *Suwannee*, 500 short and 300 long staple have been obtained.

ALABAMA.—In *Bullock*, an instance is reported of 8 bales on 10 acres, with 90 bushels of corn planted in alternate rows of 1¾ acres of the same, manured with washings from stock-yards. Profits, $268.

The largest yield in *Butler* was 300 pounds lint per acre on 40 acres, sandy loam, ordinary culture.

In *Calhoun*, a bale per acre on small lots, with extra pains, has been obtained. In one instance, 17 bales to 30 acres. In common culture, an average crop is a bale to 3½ acres.

Mr. W. D. Tomlinson, in *Conecuh*, had 800 pounds seed-cotton (275 pounds lint) on one-quarter acre sandy loam.

Mr. Everett Davis, in *Crenshaw*, got 2,400 pounds seed-cotton per acre on 4 or 5 acres rich bottom, without manure.

A bale of 500 pounds on an acre of black loam was made in *Dade*.

The largest crop in *De Kalb* was 800 to 1,000 pounds seed-cotton per acre, with Pacific guano and stable-manure; usual culture.

A farmer in *Elmore* got 5½ bales on 11 acres river-bottom, with ordinary culture.

In *Etowah*, 500 lint is frequent on small areas, 1 to 5 acres, with barn-yard and commercial manures.

In *Geneva*, a bale (500 pounds) per acre has been produced on pine land well manured. The average is not more than one-fourth of a bale.

A very few farms in *Henry* average 1 to 2 bales per acre.

In one instance, in *Jefferson*, 1,500 pounds lint per acre on 5 acres black land with red clay subsoil, manured with gypsum and barn-yard manure.

In *Lauderdale*, in 1876, a few small farms produced 1,400 pounds seed-cotton per acre, thoroughly prepared and highly manured with barn-yard and leached ashes. Net profit, $25 per acre.

In *Limestone*, 1 bale on 2 acres.

Instances in *Monroe* of 700 pounds (seed) per acre are given.

The best yield per acre on upland sandy soil, manured with 1 ton barn-yard, and cultivated in ordinary way, in *Morgan*, is 1,340 pounds of seed-cotton.

Nearly a bale per acre on a few acres has been realized in *Perry*, but 300 pounds seed is above the usual average.

In *Saint Clair*, 1 bale per acre is sometimes grown on small lots of 5 or 6 acres, one-half bale per acre on two farms with 100 acres each in cotton.

The best yield in *Walker* is 60 bales on 125 acres sandy soil; usual culture.

MISSISSIPPI.—*Alcorn*, 13 bales on 25 acres.

A few small farms in *Amite* yield 600 pounds lint per acre; soil well prepared and liberally fertilized.

On the best creek-bottoms in *Carroll* three-quarters to 1 bale per acre.

In *Choctaw*, 800 pounds seed, with clean culture, may be obtained.

A small farmer in *Chickasaw* sometimes makes "by accident" 1,500 pounds seed-cotton per acre; but few large farms make a very close approximation to that figure.

One bale per acre on a few acres is made in *Copiah*.

One acre fresh sandy pine-land in *Covington*, fertilized with stable-manure, realized $55; cost of manuring and cultivating, $10; gathering, $8; hauling to gin, $3; to market, $5; total, $26; net gain, $29.

A farm in *De Soto* yielded 37 bags on 40 acres, at a cost of 5½ cents per pound.

In *Franklin*, 120 bales on 225 acres black sandy soil.

In *Grenada*, 18 bales on 30 acres, common culture.

In *Attala*, the best result is 180 pounds per acre on 8 acres.

One bale per acre on small farms is sometimes got in *Jefferson*.

A farm in *Lawrence*, but not one producing the best results, yielded 1,300 pounds lint per acre on 8 acres common soil, giving a profit of $10 per acre.

In one instance in *Lincoln* there was a yield of 1,000 pounds seed-cotton per acre on creek-bottom three years in culture.

Our correspondent in *Newton* knows no man who has made 1 bale to 3 acres, and not a man who is making any profit.

In *Neshoba*, a yield of 2,500 pounds seed per acre is reported on one small farm; fine sandy soil; cultivated with plow and hoe.

A farmer in *Oktibbeha* got 100 bales on 200 acres stiff black hummock with common culture.

In *Perry*, 1,000 pounds seed per acre may easily be obtained in black sandy loam, with good preparation, well stirred with cultivator. One hand will tend 15 acres cotton; 5 in corn and pease; 2 in potatoes and rice; 1 in sugar-cane and sorghum.

LOUISIANA.—Mr. Isaac A. Dillard, in *Bossier*, got 600 bales on 480 acres in 1875. He had 500 bales in 1876. One tenant got 30 bales on 20 acres. Clear profit, $15,000.

Some of the river-farms in *Caddo* produced 500 pounds lint per acre.

In *Claiborne*, the highest result on best lands is 1,000 pounds seed-cotton per acre.

In *Concordia*, 400 pounds lint and sometimes 1½ and 2 bales per acre are realized. If overflows could be stopped, the parish would be a garden.

In *Cameron*, 1 bale to 1½ per acre, with ordinary culture, is not uncommon.

On two farms in *East Baton Rouge*, 1½ bales per acre on 8 or 10 acres were obtained on each, on excellent soil, with ordinary culture.

Some farmers in *Grant* make 1,200 pounds seed-cotton on hill-land. The average is about 500 pounds.

In *La Fayette*, 9 bales of 450 pounds on 9 acres black loam, ordinary mode but more careful culture.

A farm in *Union* produced 250 bales on 200 acres; product, $15,000; expenses, $12,000.

TEXAS.—In *Anderson*, 200 bales were made on 500 acres dark sandy loam, cultivated mainly by blacks, whose labor cannot be intelligently controlled.

In *Angelina*, a farm owned in New Orleans, and rented to different parties, made the best yield. A boy of 12 years made 6 bales on 4 acres and another 5 on 4 acres.

In *Blanco*, one-half bale per acre was made on 40 acres stiff black soil well cultivated.

In *Brazoria*, 500 pounds lint is claimed to be a fair yield; 750 or more often produced.

In *Burleson*, 1½ bales per acre are claimed on rich alluvial bottoms of the Brazos, bedded in fall and again in spring.

Average in *Cass* one-half bale per acre.

A place in *Chambers* produced 15 bales (500 pounds) on 14 acres black stiff soil.

In *Cherokee*, a case is reported of 115 bales (500 pounds) on 250 acres; soil, one-third dark mulatto, one-third stiff red, one-third gray sand; profit, 8 per cent. on cost.

In *Collin*, a yield is reported of 500 pounds lint on a few acres; common soil, but superior culture.

In *Colorado*, 500 pounds of lint per acre can be made on best bottom by two applications of "dead-shot" worm-poison, but owing to ravages of worm 250 pounds of lint is an average.

The largest farm in *Coryell* is 500 acres, river-bottom. It yielded half a bale per acre.

Mr. William Caruth, of *Dallas*, cultivated 700 acres, black waxy soil, broken deep in fall, planted early in April, kept clean by hoe and plow; got 700 bales. Profit, $10 per acre.

In *Denton*, many farms of sandy land make one bale per acre.

On the Brazos bottoms, in *Falls*, one bale per acre was made on 150 acres light loamy soil. Profit, $10 per acre.

On a farm in *Fayette*, one bale per acre was obtained on timbered alluvial soil plowed often.

A large farm in *Gonzales* produced 150 pounds per acre on 300 acres sandy loam; ordinary culture. Profit, $1,800.

In *Grayson*, the best result is 1½ bales per acre.

In one instance in *Hardin* 1 bale per acre was realized on 14 acres black sandy soil.

In *Henderson*, one farm produced 100 bales on 100 acres, cultivated with sweeps every 10 days moderately deep.

The largest yield in *Jack* is one bale per acre, sandy loam.

In *Jasper*, 1½ bales per acre can be grown with ordinary culture.

On a few places in *Kerr*, seven-eighths of a bale per acre on experimental patches has been made.

In *Liberty*, one bale per acre can be made on black sandy land with improved seed.

Mr. F. J. Nally cultivated 20 acres on the Brazos bottoms in *McLennan*, and gathered 13,000 pounds of lint. Two hands cultivated the cotton and supplies of other crops. Cost, including $7 per acre rent, 8 cents per pound. Other larger farms made over 500 pounds of lint per acre.

A farm in *Palo Pinto* made 1¼ bales per acre on 75 acres; $2,000 clear.

The largest yield in *Parker* is 2,000 pounds seed-cotton per acre.

Two farms under control of our correspondent in *Robertson*, Mr. H. D. Pendergast, each of 100 acres, in cotton, averaged a bale per acre. One was leased by a white man, the other by a negro.

Mr. H. Maxwell, of *San Saba*, grew 12½ bales (500 pounds) on 7 acres, with ordinary culture, but with irrigation.

The most profitable farm in *Smith* County is that of G. S. Gilchrist, producing 93 bales on 220 acres red soil, 190 acres in corn, 140 in small grains. Net profits on seven hands, share system, $600; on three hands, renting, \$337.75; on three hands, (two at \$12.50 and one at \$10 per month,) under control of land-owner, \$1,202. Total, \$2,199.75.

In *Titus*, 26 bales were made on 35 acres, on a sandy loam bottom, bedded early in March, subsoiled and rebedded, seed sown in drill, harrowed as soon as up; in 10 days cultivated lightly with sweep and hilled up; again in 12 days with sweep, then close and deep with bull-tongue; then chop to stand, and sweep till July 20.

Several farms in *Tyler* have averaged 1 bale per acre on 10 to 50 acres, black land and creek-bottom, broken six inches deep and carefully worked with plow and hoe. The usual style is very slovenly.

The largest yield in *Upshur* was 1,000 pounds seed per acre on 22 acres deep sandy loam. "It costs less to raise cotton at 1½ acres per bale than 2¾ acres per bale."

In *Uvalde*, 300 pounds lint per acre may be realized on black sandy loam, with flat beds, and thorough and late culture by irrigation.

The best crop made in *Wilson* was a little more than three-quarters of a bale per acre.

ARKANSAS.—In *Oakland*, 750 pounds lint per acre on 30 acres rich bottom, usual culture, and 30 per cent. of whole crop lost by bad weather.

In *Boone*, a farm produced 1,000 pounds seed per acre on 80 acres of light sandy loam.

The largest yield in *Craighead* was 1,500 pounds per acre on 150 acres dark sandy bottom, with usual culture.

Our *Crawford* correspondent, Dr. L. C. White, made three-fourths of a bale per acre on 20 acres creek-bottom, sandy loam, cultivated with turning-plow, cultivator, and hoe.

Our correspondent in *Conway*, Mr. N. W. Moore, made 60 bales on 90 acres in 1876, and in 1875 a bale per acre. Another farm produced 1,000 pounds seed-cotton.

A few single acres in *Fulton* yield 2,000 pounds seed-cotton, and several instances are reported of 1,500 pounds per acre on 5 acres; soil virgin, semi-prairie or upland.

A farm in *Grant*, produced 1 bale per acre on 18 acres of sandy loam, creek-bottom, with ordinary culture.

In *Independence*, 1,200 pounds seed-cotton can be obtained on 1 acre upland black soil, known as "manganese land," by the usual mode, but with more thorough cultivation.

Any of the bottom-land farms of *Jefferson*, if well cultivated, will yield a bale per acre.

In *Mississsippi County*, the largest yield indicated is 1¼ bales per acre, on sandy loam, with some black or buckshot land.

Mr. George F. Roselle, in *Perry*, made 400 bales on 1,000 acres best river-bottom.

The largest yield in *Saint Francis* is estimated at 300 pounds lint per acre on dark loam with very little sand.

A farm in *Scott* produced 500 bales, or 75,000 pounds seed-cotton, on 95 acres loam.

One man in *Sevier* made 7 bales on 12 acres of sandy land.

TENNESSEE.—In *Hardeman*, 13 bales (500 pounds) were made on 18 acres.

A field of 50 acres in *Henderson* yielded 250 pounds lint per acre, black sandy bottom, fertilized with stable-manure. Profits, 4 cents per pound.

The largest yield in *Lauderdale* is 500 pounds lint per acre.

Mr. Samuel Ozier, in *Madison*, got 60 bales from 120 acres. He also had 70 acres in corn, 1,750 bushels; 120 in wheat, oats, and grass; and

210 bushels wheat, 150 of oats, 10 tons hay; cured 7,000 pounds pork; kept 75 head stock-hogs, besides cattle; and cleared $1,600.

In one instance in *Maury*, 1,250 pounds seed-cotton were made. The seed was rolled in land-plaster (50 pounds per acre) and 40 pounds more applied as top-dressing when the plant was one foot high. It matured three weeks earlier than cotton on same soil not plastered, which yielded only 300 pounds seed-cotton per acre.

In *McNairy*, there is a product of 1,000 pounds seed-cotton per acre on 10 acres sandy upland, manured with stable and lot manure; usual culture.

MISSOURI.—Our correspondent in *New Madrid*, Mr. C. C. Thomas, made in 1872 1,600 pounds seed-cotton per acre.

In *Scott*, 30 bales were last year made on 40 acres.

VARIETIES OF SEED.

There is deterioration of seed in unfavorable conditions and unsuitable soils quite as marked in cotton as in other plants. Careless culture is the prolific cause of deterioration in the vitality and value of every plant grown by the farmer as a crop. Favorable conditions as surely secure improvement in seed as improper culture causes deterioration. So surely does like produce like, that it is always unsafe to procure seed for planting from a careless cultivator, and profitable to select it from the gin-house of a successful cotton-grower.

So well known is this principle of vegetable physiology that the quest for the best seed has ever been lively and general among intelligent cultivators. With an active demand, the commercial instinct is invoked for a supply, selfishness readily leads to exaggeration, greed sometimes oversteps boundaries of fair dealing, and then the doubting or suspicious boldly declare all assumptions of improvement shams and frauds. Thus, some of our correspondents say, "One seed is as good as another." The truth lies between these extremes. There is great advantage in a judicious choice of seed. There is no sort so immeasurably superior as to commaad the preference uniformly of a majority of cultivators in all States. It is probable that several kinds may each have a locality and soil in which they have been developed and to which they are best suited. When a correspondent asserts, as in Washington, Mississippi, that "it is susceptible of proof that all the cotton in this county is dwarfing," it is evident that either the seed or the style of culture should be changed. Some correspondents in Arkansas refer to the practice, which has become a necessity, of obtaining fresh seed every few years from that prolific cotton region, the bottoms of the Arkansas.

A careful consideration of the change of seed is therefore one of the first requisites of wise and skillful cultivation. But credulity should never usurp the place of belief in seed improvement, and enthusiasm never be allowed to run away with judgment.

Among the named sorts of general distribution, the Dickson, Peeler, Cheatham, Boyd's Prolific, Simpson, and Petit Gulf are prominent. The Johnston is found less generally east than west of the Mississippi. The Hurlong is frequently a preferred seed from Alabama to Texas. In Texas, a sort spelled Shupeck, Schupach, and in more ingenious ways, is very generally commended. In Alabama and Georgia, many prefer a seed called Ramases. In the West, there is a fancy seed known as "Taylor's Silk," and another called "Matagorda Silk," which are occasionally commended. The Java Prolific is mentioned in Arkansas and elsewhere. The South American Champion and many other kinds, with some names evidently synonyms of some already mentioned, are also given as locally new-found seeds.

The Dickson has by far the most general and positive preference, though some express their want of faith in its superiority. It is usually reported a very prolific cotton, with a strong fiber of good medium length. Its originator is one of the very foremost planters of the South for uniformly large yield; and the habit established by generous fertilization and thorough culture continues its potent influence in all sections and soils, just as thoroughbreds among animals exhibit remarkable constancy of type in their offspring. The Peeler is a cotton of great length and fineness of staple, but prolificacy is not so confidently asserted of it. The Cheatham is very highly commended by some, while others sneeringly assert that its name is indicative of its quality. As in most products of the farm or orchard elsewhere, productiveness, quantity, outweighs quality in preference for varieties of cotton.

INCREASE OF AREA IN SUPPLY PRODUCTS.

From the mass of correspondence asserting a tendency to greater variety of crops, especially such as are needed for subsistence, the following illustrative notes are appended:

NORTH CAROLINA.—*Nash:* Increase the past year. Farmers commence 1877 with more corn, oats, fodder, pork, &c., than for eight years. Profits are increased in proportion as they raise their supplies; fewer "crop liens" than in 1876. *Pasquotank:* Increase in all field-crops, and a large increase in beef and pork, very much to profit of producer. *Duplin:* Increase in all, especially in small grains, particularly winter oats. Pork crop 25 per cent. larger than since 1865. No farmer prospers who does not produce his supplies. Most have plenty of meat. *Pitt:* Growing tendency to raise home supplies. Wheat growing in favor. But for cholera for two years ample supply of pork would have been cured. *Cumberland:* Decided increase in all, to great satisfaction of producers. *Chowan:* Much increase in corn, fodder, pease, and oats. *Catawba:* Increase in all, and a decrease in price from money stringency and not from overproduction. *Camden:* All farmers raise their supplies and a surplus of corn, pork, and potatoes. *Beaufort:* Great increase in all. Six years ago thousands of bales of hay were imported from the North, now none. Pork imports decreased 50 per cent. Seed-oats, all imported formerly; now many have them for sale. Abundance of beef at 5 cents per pound dressed. The increase of home supplies has saved us from ruin. *Rutherford:* Abundance of all. The difficulty is to find market for surplus, having no railroads. *Warren:* Considerable increase in grain and forage, some in beef; would be in pork but for cholera. Credit and mortgage system generally abandoned, and the rigid economy necessitated by a cash basis working good to planters. *Wilson:* Yes, with a decrease of expenses and increase of profit. *Yancey:* At a stand-still.

SOUTH CAROLINA.—*Marion:* Yes; Home demand not yet supplied, but those prosper most who produce supplies for sale. *Marlborough:* Wonderful change; with low prices of cotton, will soon make enough to feed all our people; corn, oats, wheat, pease, &c., plenty, and sheep, hogs, &c., increasing. *Spartanburgh:* No increase. Flour and bacon coming in by the car-load from other States. *Union:* Yes, beyond question. Less cotton; home supplies varied, with continual improvement in condition of farmers. *Barnwell:* Real but not great increase since 1870. Clear profit, as it is not at the expense of the cotton-crop. *Colleton:* Increase considerable in corn, oats, pease, and fodder; not much in pork and beef. *Edgefield:* Marked increase in cerals, especially oats, which has reduced expense of raising cotton fully 25 per cent. *Fairfield:* Considerable in corn and oats and some in other grains, with profit to those who raise enough for home use. Pork will not grow without a fence law, not to mention thieves. *Horry:* Twenty-five per cent. increase in product of corn in past ten years, and 50 per cent. in cotton by improved culture. *Georgetown;* Not 10 per cent. of provisions raised in county. Live stock decimated by disease and outlawry; labor stagnant, and 1,000 acres rice-land idle which was planted last year. *Greenville;* Little increase as yet, but a general determination that there shall be. All agree that it will increase the profits of the farm.

GEORGIA.—*Baker:* General increase of provision-crops. No dividends where such increase has not been made. *Bartow:* Two hundred to three hundred per cent. increase. Less money made, but less needed, and greater independence. Hard blow on merchants. *Bibb;* Fully 25 per cent. increase and circumstances much easier, requiring little aid from factors and other outsiders. *Camden:* In corn, oats, and beef, with benefit to producer. *Campbell:* General increase, especially in sorghum. A firm conviction that it is cheaper to raise supplies at home. *Calhoun:* Some increase. Those who produce home supplies are more independent. *Catoosa:* Very perceptible, with greater independence rather than much money-profit these hard times. The increase of manure and improvement of land from pea-crop a substantial benefit. *Carroll:* Largest crop of cereals last year ever made, and bringing only half usual price. *Clayton:* Those prosper best who raise their own supplies. *Coffee:* For three or four years past less cotton and more corn, oats, and pork. Seldom buy western corn and bacon now. *Decatur:* Much increase in corn and oats. Chufa being rapidly introduced. Many hogs raised, but beef scarcer and higher priced. *Dooly:* Considerable. Can be produced as cheaply here as in the West, saving freights. *Elbert:* Increase last year in corn and hogs, afterward destroyed by flood and cholera. *Emanuel:* Great increase, and while prices are lower, the producer has plenty for home use. *Fayette:* Marked. Those prosperous who raise home supplies, while the all-cotton policy brings poverty and ruin. *Forsyth:* In corn, oats, wheat, pork, and beef, profits increased. County self-sustaining as to pork. *Gwinnett:* General increase, with benefit, though prices are lower. *Habersham:* Customarily, home supplies are produced first, and cotton extra, as a money-crop. *Harris:* Yes; with wonderful effect in increasing profits of cotton, and improving soil by rotation, and increasing independence. *Jackson:* Yes; and will be still greater this year. Raising of home supplies necessary to the prosperity of our farmers. *Jefferson:* Decided, with growing conviction that home supplies should be raised at home. Corn and meat cheaper than since the war. *Liberty:* Corn, oats, and pease are considered most profitable in proportion to capital, except rice, which grows on naturally rich land. Home supplies increasing, and no prosperity otherwise. *Lincoln:* Decided, with a saving of large sums formerly sent away for their purchase. *Macon:* None in corn and pease; much in oats, which promises to be the best crop for cheapening mule-feed; very slight in pork and beef. *McIntosh:* Decided, in all. Section well adapted to stock-raising. *Marion:* Ten per cent. in corn and pork in 1876. Decrease of 25 per cent. in price of corn and 12½ per cent. in pork from January, 1876, to 1877. *Meriwether:* In corn, oats, pease, pork, with increased profit. A more healthy condition as to supplies than for ten years. *Milton:* In corn, 30 per cent.; oats and pease, 25 per cent.; fodder, 50 per cent.; pork and beef, 10 per cent. No surplus, the profit being the saving of purchase from abroad. *Mitchell:* Oats nearly doubled, and most profitable crop, giving fine pasturage for hogs, which must have pasture here. *Morgan:* Near 50 per cent., through fertilizers, cultivation, and good season. Most prosperous, those raising home supplies, or a good portion of them. *Murray:* Increase in product, but prices lower and income not larger. *Oglethorpe:* Great in oats, corn, pork, and beef, especially in 1876. We have learned that the only key to success is to raise supplies. Fortunes have been made by such as do, but none otherwise. *Pike:* Corn, 25 per cent.; oats, 40.; fodder, &c., 50; pork, 20; beef, 5; pease, no increase. Increase on profit of whole farm not over 10 per cent. *Schley:* Twenty-five per cent. in corn; plenty for first time since the war; sells near towns at 75 cents. Oats, pease, and fodder in abundance; 50 per cent. of a supply of pork, worth 5 to 7 cents. Taking all together, they are a surplus; cotton being profit. *Stewart:* In a few years cotton will be a surplus, when all will prosper. *Talbot:* One hundred per cent. in corn; 400 in oats. Not much change in others, except, of course, in corn-fodder. *Taliaferro:* Considerable in corn, oats, pease, and German millet. *Taylor:* At least 25 per cent.; the increase of cereals and meat have materially improved the condition of the farmer. *Terrell:* Yes; with happy effect. In a few years cotton will not be half as much grown. *Thomas:* High prices of guano, provisions, and poor labor makes cotton cost 3¼ cents more than price in home market. *Troup:* If farms were self-sustaining, cotton made a profit if sold at 10 cents. *Walton:* Corn and pork were with many to spare, while exclusive cotton-growers are always hard up. *Washington:* Great increase in profit, as they use the same labor which is employed on cotton, but at seasons which do not interfere. *Wilkes:* Yes; increases profits, as it only slightly diminishes cotton.

FLORIDA.—*Columbia:* Increase in oats as laborers abandon farms. *Gadsden:* Marked, with decided decrease in cost of raising. *Hillsborough:* We propose to produce all supplies possible, as cotton-culture does not pay. Have introduced fine Berkshire hogs from the North. *Jackson:* Large in oats and pork. Home raising of supplies the secret of success. *Madison:* Yes; the main source of profit. Cotton mostly raised only because of the ready money. *La Fayette:* Some increase in corn, oats, pease, and pork—say 5 per cent.—but not enough to meet increasing demand. *Orange:* In corn and Guinea grass. *Suwannee:* He who produces his supplies makes the money. *Santa Rosa:* Very large, with much addition to home comforts and resources of producer. *Taylor:* Corn, 33 per cent.; oats, 100 per cent.; pease, 33 per cent.; pork and beef, 10 per cent. Increased profit, 25 per cent.

ALABAMA.—*Bullock:* Decided among small farmers, giving a larger surplus of cotton. A large proportion raised by small farmers and thrift following the policy. *Butler:* Greater last year than at any time since the war. Material benefit. *Calhoun:* Considerable for three years past. Little increase in actual cash income, but of great benefit indirectly. *Conecuh:* Marked with great relief to farmer. Pork 6 cents cheaper than since 1860. *De Kalb:* Gradual, and, but for swine disease, profit would be considerable. *Elmore:* Thirty-three per cent. since 1869 in corn, oats, pease, pork, and beef. *Etowah:* Manifest, with disposition to still further increase. Decided benefit, and if farmers would raise all at home, cotton, as a surplus, would pay. *Geneva:* In 1876 50 per cent. more corn, 10 per cent. oats, 20 per cent. field-pease, than in 1875. Price of corn decreased from $1.25 to 62½ cents; pork, from 10 cents to 7 cents. Farmer gets less money, but has more to sell. *Greene:* Large in corn and pork, with benefits seen by all in reduction of store-bills and cost of living. Country in better condition than at any time since the war. *Hale:* Twenty per cent. more in hogs and cattle last year than any year since the war. *Henry:* Yes; among good farmers, in corn, pease, oats, pork, and such farmers decidedly more thrifty than exclusive cotton-growers. *Jackson:* In corn, pork, and beef. Cotton considered as profitable as any as a surplus. *Jefferson:* Twenty per cent., and it is redeeming our farmers from debt and starvation. *Lauderdale:* Enough for home supply for first time since war, and will place farmers in better condition. *Winston:* Fifteen per cent. increase. Enough corn, beef, and pork. Nearly self-sustaining. *Macon:* The increase has been such as to leave little to buy, and there is less stealing and greater production among blacks also. *Madison:* Considerable in clover, and, in consequence, more hogs and horses and less corn required to feed them. Little increase in corn, oats, or pease. *Monroe:* Large, in corn, oats, and cane for molasses. Considerable increase in pork, with great advantage. *Morgan:* Considerable in cereals, hay, &c., and farmers are in better condition. *Perry:* In forage and grain, and the farmers raising them in better condition than the all-cotton men. *Pike:* Small increase in feed, with very material increase in profit. *Russell:* Most in rust-proof oats; next in pork. *Saint Clair:* Marked, and thrift follows the policy. No bacon will be bought in 1877; does not pay to buy corn and bacon to raise cotton with. *Sumter:* General increase. More hogs killed this winter than since 1861. Considerable increase in profit. *Walker:* Only in German millet, pork, and beef; profits in proportion.

MISSISSIPPI.—*Attala:* General increase. Without it would have been starvation. *Amite:* Very great. Many farms producing all home supplies and saving the outgo of money. *Alcorn:* Much in pork. *Carroll:* Result very favorable, though the policy is not established fully yet. *Choctaw:* Considerable, except in hay, and a growing interest in that. *Coahoma:* Some in corn, oats, and grasses; not much in beef, but considerable in pork. *Copiah:* Decrease, with bad effect. *Covington:* Very decided, with greater independence and less debt. *De Soto:* In oats, pease, pork, and beef. Those who raise plenty have money to lend. *Franklin:* Those most successful who raise home supplies. *Grenada:* Yes; and the effect great in diminishing cost of living, giving them cotton unencumbered, which can be held for best prices. *Lawrence:* Yes. Large percentage of farmers and hands have corn and meat of home raising. *Lowndes:* Rapid increase in hogs, and general disposition to raise home supplies, with very beneficial results. *Madison:* Large in oats, pease, and hay, and much cheaper than formerly. Also increase in pork. *Newton:* Twenty-five per cent. in corn and oats. Also increase in pork and beef. *Neshoba:* No. Raising of pork and beef for home use increases profit about 25 per cent. *Oktibbeha:* Two hundred per cent. in corn, 125 per cent. in oats, 100 in pease, 500 in pork, 150 in beef. *Perry:* Attention generally given to lumber-trade. *Rankin:* Notably in red oats, and some in corn.

LOUISIANA.—*Catahoula:* Always "to be done," but interfered with by overflows. *Claiborne:* Fine increase in oats, pease, pork, beef, and mutton. Almost net gain. *Concordia:* Increase in corn, consequently more of everything to eat. Home raising of supplies the only key to success. *East Baton Rouge;* Very marked. Especially oats, (red rust-proof,) pork, beef, and mutton. Considerable increase of profit. *Jackson:* Some increase, with good effect. *La Fayette:* Some in corn, pease, hay, pork, and beef, with evident advantage. *Union:* Very marked. Some planters make all their pork and beef. Such generally thrifty. *Vermillion:* Decided, with condition of those adopting the plan bettered 200 per cent. Price and profits not affected.

TEXAS.—*Austin:* Steady increase in forage-crops, but pork and beef the reverse. *Bell:* Great in feed, with lower price of pork, but higher in beef. Are only learning to feed economically. *Bexar:* Corn, 100 per cent.; oats, 150. All home supplies raised and surplus sold. Hogs shipped by rail to Saint Louis. *Blanco:* Increase last year, but as corn is plenty and cheap, it may be neglected again. Corn worth 50 cents. *Brazoria:* None. With the finest country for hog raising, we buy our bacon, and beef steadily increasing in price. *Brown:* Very great; but prices not lowered, owing to immigration. *Burleson:* Yes; with beneficial effect. Proceeds of cotton, instead of going to pay for home supplies, can be used for improvements, &c. *Cherokee:* Yes; with favorable effect. Nearly all out of debt. *Coryell:* Very decided, except in beef. Farming interest advancing greatly. *Dallas:* Great in corn and oats; little in pork and beef. Corn and oats so low that it did not pay for growing, except with those who happened to have cattle or hogs to fatten. *Falls:* Yes; especially in pork. General condition much more comfortable. *Grayson:* Pork on the increase; price unchanged. Beef decreasing; market advancing. *Hays:* In oats; lowering the price of corn. *Henderson:* No real increase; county self-sustaininlg. *Hunt:* None. *Houston:* Some in feed-crops; none in hogs, owing to cholera. Decrease in beef. *Jack:* Very great, with good prices. Heavy influx of population. *Jasper:* Considerable in corn and oats. Prices 10 per cent. lower. *Kaufman:* Yes; 200 per cent. Profits on the increase this year will nearly pay off debts of past two or three years. *McLennan:* Real in forage-crops, with decrease in profit to producer. Increase in pork, but not to affect market. Great reduction in beef. *Rusk:* Real increase, saving money formerly spent for supplies. Corn-meal 50 cents per bushel, and enough for supply. Last year $20,000 paid for meal alone. *Smith:* It is not in the present generation of this people to change from cotton to anything. The Immigration Agency of the International Railroad turn their attention to the cotton States, for *they* want men who will raise cotton to haul off and give *them* bacon and flour to haul back. On the contrary, our country wants or needs *western* men, so called, who will devote their labor to producing home supplies. Bacon can be made cheaper in this county than in Illinois, Indiana, or Ohio. *Titus:* Thirty per cent. in corn, oats, and pease in 1876; plenty to fatten stock and to spare, and plenty pork and beef; has been salvation of farmers. One more year of all cotton would have bankrupted us. *Tyler:* Large increase in red rust-proof oats. *Upshur:* Oats increasing, and corn will, now that cotton does not pay. Experiments are being made with ground-pease; cheap as sorghum for hogs. *Uvalde:* Corn has increased 1,000 per cent. since 1860. *Van Zandt:* Ship 3,000 head of cattle; 12,000 bushels of wheat; 100,000 pounds of hides, and some hogs. *Wilson:* Increase in corn and oats has kept price low for corn, 47 cents; oats, 50. Home supplies of corn and beef raised. Cholera unknown.

ARKANSAS.—*Arkansas:* In corn and pease, especially pease. Most raise meat enough and are looking for some surplus money this year. *Craighead:* Yes; and pays better than cotton. Purchasers from Saint Louis now here paying a good price for pork. *Crawford:* A dozen men have adopted policy of raising home supplies, and are better off than their neighbors, but no general increase. *Conway:* Twenty-five per cent. in food-crops. Wild-grass giving out; 50 per cent. more pork and beef than formerly; money kept at home. *Crittenden:* Yes; corn two years ago $1 per bushel; now 30 cents; equal increase in hogs; and this besides all the cotton that can be gathered. When all supplies are raised at home, the farmers will grow rich at once. *Dallas:* None to be relied on as permanent. People in debt must raise cotton till they break. *Fulton:* Some; but prices not much affected; crops abundant, and farmers generally out of debt. *Izard:* Large in German millet; considerable in oats, and some in pork; not enough to affect profits. *Johnson:* At least 60 per cent.; giving more money; greater independence; further increase indicated. *Mississippi:* Eighty per cent. more pork and corn than seven years ago; 90 per cent. hay; 80 per cent. more oats and fodder; corn and pork 75 per cent. lower, and plenty on hand for 1877. *Prairie:* Corn enough and to spare; also beef; a few farmers raising pork to sell, getting 7 cents, and much more prosperous than all-cotton men; raising wheat and all supplies. *Saint Francis:* Corn-crop of 1876 nearly double 1875; no market, and consequently less to be planted this year. *Scott:* Yes; and it slightly decreases profits of producer. *Van Buren:* Yes; entirely self-sustaining, and export meal, flour, pork, and beef, and great bulk of cotton clear profit. *White:* Much, owing to immigration from North. *Woodruff:* Effect so favorable, that those producing home supplies will continue to do so.

TENNESSEE.—*Bedford:* Yes; and increased thrift invariably follows, especially where stock-feeding is practiced. *Gibson:* Very marked, with great benefit. For the first year in several, corn, pork, and beef have been sold beyond home consumption. *Hardeman:* In corn, pease, pork, sorghum, and nearly enough. Generally in debt, but in a fair way to prosper by raising home supplies. *Hickman:* Decided, in corn, hay, pork, and beef. Many going into stock-raising exclusively. *Lauderdale:* In pork and beef, with lessened profits. *Maury:* Considerable in grass and clover. Enough pork and a large surplus of beef. *McMinn:* All farmers try to raise home supplies. *McNairy:* Very considerable in nearly all, especially pork and hay. *Sumner:* In pease, hay, cattle, and sheep. Decrease in corn, oats, and hogs. *Weakley:* Corn and pease for stock-feeding. The latter is a good fertilizer as well as feed.

SUMMARY OF RESULTS.

The following are the more prominent facts indicated as the result of this investigation:

1. The area in cotton is rapidly extending west of the Mississippi upon new and fertile soils; the fields of the large plantations in the old planting States are only partially occupied, and in smaller proportion by cotton than formerly. It is less than in 1860, but includes about eleven and a half million acres in round numbers.

2. The relative proportion of corn and other supply crops to cotton is increasing in all the States. The estimated proportions are 41 per cent. for corn, 34 for cotton, and 25 for all other cultivated crops.

3. On nearly half the cotton area of the Atlantic States fertilizers are regularly applied; in the remaining States east of the Mississippi a greater economy of cotton-seed and lot-manures is practiced and a few experiments made with commercial fertilizers, but the crop is grown mainly without any attempt at fertilization; and beyond the Mississippi, with occasional exceptions, no manures are used. There is a strong tendency to the use of commercial fertilizers, mainly in connection with composts of home material, such as cotton-seed, animal-manure, marl, forest-refuse, &c.

4. There is gradual improvement in culture, rather in thoroughness than in change of mode, a deeper preparation, with a lighter and more frequent after-culture. This improvement is not general, and is nowhere sufficiently developed. Improvement in implements is more marked, but by no means universal; and it is most observable in districts in which white labor is in largest proportion.

5. The size of farms is diminishing. Between 1860 and 1870 the number of farms of 100 acres and upward decreased in every cotton State and those of less than 100 increased, the reduction in one case being 22 per cent. and the increase in the other 35 per cent. This movement is still progressing, the largest ratios of increase of small farms being in South Carolina, Louisiana, and Florida.

6. The rates of wages paid for labor is higher in Texas than in 1867, about the same as at that date in the Carolinas, and lower in the other States. The reduction is less in Alabama and the Mississippi Valley than in Georgia. It ranges from $101 in South Carolina to $145 in Arkansas for a "full hand" per annum, with rations. The share system still predominates over wages. Contracts vary widely in details, but are most generally based upon the following equivalents: Bare labor, one-fourth of cotton in rich land, one-third in poor soils; labor and rations, one-half as a general rule, four-tenths in some very productive lands; labor, rations, stock, and supplies, two-thirds to three-fourths of the product.

The proportion of white labor is increasing, producing now in some cases one-third to four-tenths of the crop. It predominates in Texas and in Arkansas.

7. One in twenty of the freedmen are cultivating lands of their own. The largest proportion is found in Florida—one in twelve.

8. The average cost of the crop of 1876 is made $9\frac{1}{4}$ cents per pound, and the price received $9\frac{8}{10}$ cents. The net profit is about $11,500,000, not quite 6 per cent. of the gross receipts, which amount in round numbers to $205,000,000. The average profit is about $2.60 per bale. Texas has the largest margin of profit, 11 mills per pound; Arkansas, 9; Alabama, owing to a poor crop, the least, 2 mills; in most of the other States, 5 mills.

9. The varieties of seed having the widest popularity are the Dickson, Peeler, Cheatham, Boyd's Prolific, Simpson, and Petit Gulf.

10. Testimony is almost universal to the superior economy of producing home supplies, a wider range of production, with cotton as a surplus product.

SUGAR PRODUCTION.

The sugar supply of this country is becoming a matter of great importance. With increase of population there has also been a tendency to a larger consumption per man. In times of low prices we consume 40 pounds to each inhabitant, besides a large supply of saccharine material in the form of molasses of cane and sorghum, sugar and sirup from maple, not to mention glucose from corn and other products, which may to a limited extent take the place of cane-sugar. The advance in price, and probably the hard times, have checked consumption, so that but 638,000 tons only have been taken for consumption the past year in the Atlantic ports, against 710,000 in 1874. There was a deficiency in the world's production of cane-sugar in 1875 of 200,000 tons, in part made up by increase of 171,738 tons of beet-sugar; but by the shrinkage of the beet-sugar crop of 1876 a marked rise in price was induced. The commercial estimate of the supply of the past year is as follows:

	Tons.
Cane-sugar, domestic and foreign	638, 369
Cane-sugar received on the Pacific coast	28, 300
Cane-sugar made from molasses	43, 600
Maple-sugar	13, 000
Domestic beet, sorghum, &c	2, 000
Taken for consumption in 1876	725, 269
Taken for consumption in 1875	773, 002

On the basis of a population of 45,000,000 the consumption would be 36 pounds to each in 1876, and 38 for the population of 1875. The sugar supply of the commercial world in 1875 was 3,457,623 tons, of which 40 per cent. was beet-sugar made in Europe. Cuba produced one-third of the cane-sugar; the other West India islands, and Brazil, Java, and Mauritius, are all prominent sources of supply. The following is an estimate from high authority of the quantities produced of both kinds in 1875:

Cane-sugar.

	Tons.		Tons.
Cuba	700, 000	Martinique and Guadaloupe	100, 000
Porto Rico	80, 000	Louisiana	75, 000
British, Dutch, and Danish West Indies	250, 000	Peru	50, 000
Java	200, 000	Egypt	40, 000
Brazil	170, 000	Central America and Mexico	40, 000
Manila	130, 000	Reunion	30, 000
China	120, 000	British India and Penang	30, 000
Mauritius	100, 000	Honolulu	10, 000
		Natal	10, 000
		Australia	51, 000
Total tons			2, 140, 000

Beet-root sugar.

	Tons.		Tons.
German Empire	346, 646	Austria and Hungary	153, 922
France	462, 259	Belgium	79, 796
Russia and Poland	245, 000	Holland and other countries	30, 000
Total tons			1, 317, 623

The cost of these sweets is a serious burden upon the country. We have the soil to produce a full supply either of cane or beet sugar and laborers suffering for work, and measures should be taken for a rapid increase of home production. The details of cost of the sugar used in this country, subject to a slight reduction from re-exportation, are thus given in the statistics of the customs receipts:

Fiscal year of 1876.

Sugar, brown	pounds..	1,414,254,663	$55,702,903
Sugar, refined	pounds..	19,931	1,685
Molasses	gallons..	39,026,200	8,157,470
Melada, sirup, &c	pounds..	79,702,878	2,415,995
Candy, &c	pounds..	87,955	18,500
			66,296,553

Fiscal year of 1875.

Sugar, brown	pounds..	1,695,726,353	$70,015,757
Sugar, refined	pounds..	15,251	1,202
Molasses	gallons..	49,112,255	11,685,224
Melada	pounds..	101,768,386	3,313,597
Candy	pounds..	76,816	16,737
			85,032,517

The average cost of the brown sugar of 1875 at the foreign port of shipment was $4\frac{12}{100}$ cents per pound; of that of 1876, $3\frac{93}{100}$ cents.

Since June 30, 1876, the price has materially advanced. The amount received in the quarter ending December, 1876, is 198,318,913 pounds, costing 4.6 cents per pound, or 17 per cent. advance over the average of the previous fiscal year. This was caused by the shortage of beet-sugar. Analyzing the receipts of that year, we find that the highest prices are paid for imports from the Sandwich Islands. The sugar of British Guiana, Cuba, and the Dutch West Indies, respectively, come next in order of value per pound.

The following table shows the sources and values of the importation of the past year; the remainder, which is but 3 per cent. of the whole, comes from 21 other nations:

Countries.	Quantity.	Value.	Price per pound.
	Pounds.		
Cuba	1,008,413,671	$41,039,048	4.06
Spanish possessions	110,445,708	3,572,400	3.23
Porto Rico	70,155,045	2,610,418	3.72
French West Indies and Guiana	49,687,265	1,751,478	3.52
Brazil	40,010,416	1,329,938	3.32
Dutch East Indies	26,187,830	1,052,953	4.02
British West Indies and Honduras	23,212,168	844,144	3.63
British Guiana	21,865,691	912,101	4.17
Sandwich Islands	20,978,374	1,051,987	5.01

The following statement gives in detail the amount of domestic and foreign sugars taken annually for consumption since 1860, the imports minus the small quantity re-exported, exclusive of those on the

Pacific coast, and the fluctuating proportions of domestic to foreign supply:

Years.	Total consumption.	Imported.	Domestic.	Proportion of domestic.	Increase in consumption.	Decrease in consumption.
	Tons.	*Tons.*	*Tons.*	*Per ct.*	*Per ct.*	*Per ct.*
1860	415, 281	296, 250	119, 031	28. 6	....	3. 68
1861	363, 819	241, 420	122, 399	33. 6	....	12. 39
1862	432, 411	241, 411	191, 000	44. 1	18. 85	....
1863	284, 308	231, 398	52, 910	18. 6	....	34. 25
1864	220, 660	192, 660	28, 000	12. 7	....	22. 38
1865	350, 809	345, 809	5, 000	1. 4	58. 98	....
1866	391, 678	383, 178	8, 500	2. 1	11. 65	....
1867	400, 568	378, 068	22, 500	5. 6	2. 27	....
1868	469, 533	446, 533	23, 000	4. 9	17. 21	....
1869	492, 899	447, 899	45, 000	9. 1	4. 97	....
1870	530, 692	483, 892	46, 800	8. 8	7. 66	....
1871	633, 314	553, 714	79, 600	12. 5	19. 33	....
1872	637, 373	567, 573	69, 800	10. 9	0. 64	....
1873	652, 025	592, 725	59, 300	9. 1	2. 29	....
1874	710, 369	661, 869	48, 500	6. 8	8. 95	....
1875	685, 352	621, 852	63, 500	9. 2	....	3. 52
1876	638, 369	561, 369	77, 000	12	....	6. 85

The foregoing figures do not include the cane-sugar consumed on the Pacific coast, all of which is imported. The reported consumption, as ascertained by commercial statistics at San Francisco, was a little above 30 tons in 1873 and 1874, and about 27 tons in 1875.

The statistics for the consumption of cane-molasses in the same years are as follows:

Years.	Total consumption.	Imported.	Domestic.	Proportion of domestic.	Increase in consumption.	Decrease in consumption.
	Gallons.	*Gallons.*	*Gallons.*	*Per ct.*	*Per ct.*	*Per ct.*
1860	47, 318, 877	28, 724, 205	18, 594, 672	39. 3	....	12. 79
1861	40, 191, 556	20, 383, 556	19, 808, 000	49. 2	....	15. 06
1862	62, 668, 400	25, 650, 400	37, 018, 000	59	55. 92	....
1863	37, 569, 088	26, 569, 088	11, 000, 000	29. 2	....	40
1864	32, 410, 325	28, 582, 325	3, 828, 000	11. 8	....	13. 73
1865	35, 185, 038	34, 335, 038	850, 000	2. 4	8. 56	....
1866	45, 140, 110	43, 840, 110	1, 300, 000	2. 8	28. 29	....
1867	49, 776, 465	46, 776, 465	3, 000, 000	6	10. 27	....
1868	55, 957, 969	52, 587, 969	3, 370, 000	6	12. 41	....
1869	54, 361, 092	47, 961, 092	6, 400, 000	11. 7	....	2. 85
1870	49, 323, 171	42, 723, 171	6, 600, 000	13. 3	....	9. 26
1871	52, 065, 784	41, 165, 784	10, 900, 000	20. 9	5. 56	....
1872	53, 695, 203	42, 995, 203	10, 700, 000	19. 9	3. 13	....
1873	51, 485, 526	41, 985, 526	9, 500, 000	18. 4	....	4. 11
1874	48, 206, 257	39, 506, 257	8, 700, 000	18	....	6. 36
1875	58, 608, 734	46, 418, 734	12, 190, 000	20. 8	21. 57	....
1876	48, 809, 504	36, 459, 504	12, 350, 000	25. 3	....	16. 71

SUGAR-PRODUCTION IN THE UNITED STATES.

Sugar-cane is said to have been brought into Louisiana from San Domingo by the Jesuits in 1751, and that sugar was first manufactured about 1764. Accounts of the progress of this industry under Spanish rule are conflicting. After the cession of Louisiana by France, in 1803, circumstances were more favorable to the production of sugar, but the annual product has fluctuated greatly, as shown in the following table, which has for its authority M. Boucherou, the sugar statistician of

Louisiana, which, however, differs slightly from his table published in our report of 1873:

Years.	Hogsheads.	Years.	Hogsheads.	Years.	Hogsheads.
1823	30, 000	1842	140, 000	1859	221, 840
1824	32, 000	1843	100, 000	1860	228, 753
1825	30, 000	1844	200, 000	1861	459, 410
1826	45, 000	1845	186, 000	1863	76, 801
1827	71, 000	1846	140, 000	1864	10, 387
1828	88, 000	1847	240, 000	1865	18, 070
1829	48, 000	1848	220, 000	1866	41, 000
1832	70, 000	1849	247, 923	1867	37, 647
1833	75, 000	1850	211, 201	1868	84, 256
1834	100, 000	1851	236, 547	1869	87, 090
1835	30, 000	1852	321, 934	1870	144, 881
1836	70, 000	1853	449, 324	1871	128, 461
1837	65, 000	1854	346, 635	1872	108, 520
1838	70, 000	1855	231, 427	1873	89, 498
1839	115, 000	1856	73, 296	1874	116, 867
1840	87, 000	1857	279, 697	1875	144, 146
1841	90, 000	1858	362, 296	1876	169, 331

The crop of sugar produced in Louisiana during 1876–'77 amounted to 169,331 hogsheads, or 190,672,570 pounds net, according to the census of Mr. Louis Boucherau, against 144,146 hogshead, or 163,418,070 pounds net, in 1875–'76, an increase of over 16 per cent. Of the total product, 40,768,140 pounds were clarified sugar, produced from the juice by vacuum-pans, against 31,717,710 pounds produced by this process the previous year, an increase of nearly 29 per cent. This kind of sugar, which does not include brown sugar refined, was produced by 65 special factories using the vacuum-pans, an increase of 8 factories over the previous year. By the old process of open kettles or open pans the product was 149,904,430 pounds, against 131,700,360 pounds the previous year, an increase of nearly 14 per cent. The number of sugar-houses using the old process was 975, an increase of 42. The vacuum-pan production is then increasing at a far more rapid rate than that by the old process.

The quantity of molasses produced the last season was 12,024,108 gallons, or 71 gallons for each hogshead of sugar; during the previous season the product was 10,870,546, or 75 gallons per hogshead of sugar. The number of gallons produced by the 65 factories using vacuum-pans was 1,876,436, or 59 gallons per hogshead of clarified sugar; in the previous season the number of gallons produced was 1,525,662, or 57 gallons per hogshead of clarified sugar. The quantity of molasses produced by sugar-houses using the old process was 10,147,672 gallons, or 76 gallons for each hogshead of brown sugar; the previous year the product was 9,344,884 gallons, or 82 gallons per hogshead of brown sugar.

The table below will give the general statistics of sugar-production in Louisiana for the last nine years. In 1868 the number of acres of cane actually ground for sugar was 63,199, and the average product per acre was 1,504 pounds of sugar, and 80 gallons of molasses. In that year 8,000 acres of cane, for various reasons, were left uncut, and consequently lost. In 1870 the number of acres cut was 151,876, and the average product per acre 1,112 pounds of sugar and 68 gallons of molasses. The number of acres in the four subsequent years is not given; there was some increase on the whole in 1871, but in 1874 quite an amount of sugar-land was diverted to rice and other cultures. The largest number of sugar-houses, 1,224, was in 1871, but gradually declined to 982 in 1875, with a considerable increase in 1876. The later reports contain fuller statistics, especially of acreage, showing the number of acres cut and ground at 91,761 in 1875, and 104,944 in 1876. The sugar product averaged 1,782 pounds per acre in 1875, and 1,817 in 1876; molasses product $118\frac{1}{2}$ pounds per acre in 1875, and 114 in 1876.

Year.	Sugar-houses— Total.	Sugar-houses— Using steam-power.	Sugar-houses— Using horse-power.	Sugar-houses— Using open kettles.	Sugar-houses— Using open pans.	Sugar-houses— Using vacuum-pans.	Portable mills.	Pounds of sugar produced. Brown sugar by old process.	Pounds of sugar produced. Refined and clarified sugar by vacuum-pans.	Pounds of sugar produced. Total.	Molasses produced. Total gallons.	Molasses produced. Gallons per each hogshead of sugar.
1868..	673	540	133	567	60	46	8	81, 506, 093	13, 545, 132	95, 051, 225	6, 081, 907	72
1869..	817	664	153	683	81	53	44	....	....	99, 452, 946	5, 724, 256	65
1870..	1, 105	837	268	868	95	53	78	147, 562, 588	21, 346, 004	168, 878, 592	10, 281, 419	71
1871..	1, 221	907	317	946	114	58	90	126, 649, 952	20, 256, 173	146, 906, 125	10, 019, 958	78
1872..	1, 181	889	292	920	120	56	76	108, 501, 004	16, 845, 489	125, 346, 493	8, 898, 640	82
1873..	1, 080	856	224	857	117	55	44	88, 058, 278	15, 182, 841	103, 241, 119	8, 203, 944	92
1874..	1, 000	776	224	775	112	52	55	110, 856, 363	23, 648, 328	134, 504, 691	11, 516, 828	98
1875..	982	754	228	755	113	57	52	131, 700, 360	31, 717, 710	163, 418, 070	10, 870, 546	75
1876..	1, 040	786	254	781	129	65	60	149, 904, 430	40, 768, 140	190, 672, 570	12, 024, 108	71

While the coast counties of Texas afford a productive field for sugar-extension, and most of Florida, especially the rich undrained (at present) and cheap lands on the Gulf coast in Western Florida, is well suited to sugar culture, the principal sugar-production is still confined to Louisiana. There is some cane grown for local use in the form of sirup in all of the Gulf-coast States, and a few hogsheads of sugar are annually made. In the future of this industry, with the aid of central factories, equipped with the best machinery, surrounded by laborers on small farms who shall plant such patches of cane as they can cultivate and sell to these factories, the possibilities of rapid increase in production are very hopeful. The great mass of laborers are poor and cannot equip such a factory, or even find means to establish a co-operative factory, but they can cultivate each ten or twenty acres of cane, just as they now grow a little cotton and pay toll for ginning and baling at a neighboring gin. Land is abundant and cheap, and every man who has a spark of energy or ambition cannot be restrained from the location of a home. On this account it is impracticable to extend sugar-growing on the old system. The adoption of this plan, which requires systematic effort for the establishment of factories as a prime requisite, with an understanding and contracts with the prospective cane-growers, ought to secure a rapid enlargement of our sugar productions, a corresponding reduction of the importation, and an annual saving to the country of millions of dollars.

BEET-SUGAR.

In the United States, beet-sugar production is scarcely yet past the experimental stage, out of which, in Europe, success only emerged after long trial and repeated reverses and failures. There, while the industry was struggling for an assured foothold, success or failure depended much upon legislation; but here the chief cause of many failures in first attempts has been a want of practical knowledge and skill in a business new to the agriculturist and manufacturer. Prominent among early attempts in this country which have not been crowned with ultimate success, except in the way of developing mistakes for later attempts to shun, were one in Hampshire County, Massachusetts, about the year 1837; one in Livingston County, Illinois, inaugurated in 1863, and transferred to Stephenson County in 1870; and one in Fond du Lac County, Wisconsin, in 1867. The superintendent of the last-named enterprise was Mr. A. Otto, who had had experience in the manufacture of beet-sugar in Germany. In the spring of 1870, he, with the beet-sugar interests which he superintended, removed to Alameda County, California, and became a constituent part of the Alvarado Beet-Sugar Company, Mr. Otto being the superintendent. He was subsequently transferred to the superintendency of the beet-sugar works now in successful operation at Soquel, Santa Cruz County.

The State Agricultural Society of California reported, in 1874, that the production of beet-sugar in the State amounted, in 1870, to 500,000 pounds; in 1871, to 800,000; in 1872, to 1,125,000; 1873, to 1,500,000. The product of beets reported for 1873 was 10,073 tons. Contracts for 1877 have been made for beets at $4 per ton.

A beet-sugar enterprise was conducted for several years in Sacramento, California, but its apparent success has not established the manufactory as a permanency. Its machinery, costing in Germany $160,000, is for sale, it is reported, at $45,000, and will probably be set up at some other point in California.

SORGHUM.

The value of sorghum is scarcely realized by the general public. It has fluctuated in production, and the expectations of some concerning sugar from it have not been met; still it is increasing in area in many of the States, while decreasing in others. In a State not in existence when sorghum was introduced into this country, Kansas, the production of sirup has attained a volume equal to one-third of the entire yield reported by the census of 1860.

From small beginnings, with various local fluctuations, but with a steady advance in the knowledge of its culture, soil required, and best processes of manufacturing, its culture has extended over large portions of the country and become one of our important industries. The aggregate of sirup reported from the census of 1860 was 6,749,123 gallons. The first State in production was Iowa. It reported 1,211,512 gallons, followed by 881,049 in Indiana, 806,589 in Illinois, 796,111 in Missouri, 779,076 in Ohio, and 706,663 in Tennessee. For the census of 1870 the aggregate was 16,050,089 gallons. Indiana reported 2,026,212; Ohio, 2,023,427; Illinois, 1,960,473; followed in the order of decrease by Kentucky, Missouri, Tennessee, Iowa, and West Virginia. Iowa, the first in production in 1859, but the seventh in 1869, returned 1,218,636 gallons, an advance only of 7,124. But the State census of 1867 gives for 1865 an area of 21,452 acres, producing 1,436,605 gallons; and for 1867, 25,796 acres, producing 2,094,557 gallons. The State census for 1875 gives, for 1874, 15,768 acres, yielding 1,386,908 gallons.

The definite statistics for the State of Ohio, annually published since 1861, afford a fair illustration of the gradual advance in production up to about 1866 and the subsequent gradual decline throughout the section between the Ohio and the Missouri, and including the State of Missouri. The production in Ohio for the years named was as follows:

Years.	Acres.	Sugar.	Sirup.	Years.	Acres.	Sugar.	Sirup.
		Pounds.	*Gallons.*			*Pounds.*	*Gallons.*
1862	30,872	27,486	2,696,159	1869	53,317	27,048	1,683,042
1863	31,255	27,359	2,347,578	1870	23,450	21,988	2,187,673
1864	29,392	41,660	2,609,728	1871	23,072	23,505	1,817,042
1865	37,042	56,066	4,003,754	1872	12,932	34,599	968,130
1866	43,101	102,313	4,629,570	1873	9,426	36,846	692,314
1867	17,804	20,094	1,255,807	1874	12,108	36,410	941,510
1868	25,257	28,668	2,004,055	1875	13,144	21,768	928,106

In the Ohio Valley there has been a tendency to decrease in area of sorghum since 1869, while there has been a marked increase in the South and west of the Missouri. For fourteen years, ending with 1875, the average product of sirup in Ohio has been 2,054,605 gallons, a little more than the crop of 1869; the average area is 25,868 acres, and the yield 79.4 gallons of sirup and 1.39 pounds of sugar per acre.

As an illustration of the increase in new Western States, the product, in 1875, in Kansas is reported as 2,542,512 gallons; in 1869, by the census returns, 449,409 gallons. The crop of 1875 was produced on 23,026 acres; average per acre, 110 gallons.

Georgia reported the same year 15,905 acres, yielding 73 gallons per acre, or 1,161,065 gallons, averaging 66 cents per gallon, and estimated to cost 28 cents per gallon. A larger quantity of sirup is extracted as experience is acquired and processes improved.

As an estimate for twenty-one years since the introduction of sorghum, 11,000,000 gallons of sirup per annum might approximate the product. At an average value of 65 cents, (it is less now,) the value of the annual product would be $7,150,000. The sugar of sorghum is a small item, yet in fourteen years, in Ohio alone, it amounts to 506,000 pounds. Including sugar and forage, the annual value must be not less than $8,000,000, and the aggregate value $168,000,000 since its introduction by the Department of Agriculture.

MAPLE-SUGAR.

In sections where the rock-maple prevails the manufacture of sugar and sirup from it is a remunerative adjunct to other farming industries. The season of manufacture—beginning where winter ends and ending before the ground is sufficiently thawed and settled for "spring work" proper to begin—occupies a period in which little other farm-work can be pursued. The apparatus for collecting the sap and manufacturing involves a very small investment. The fuel consumed is usually on the ground, consisting of the prunings of the maple grove, which is benefited thereby; and within a month or six weeks from the time the process of production begins the farmer may have the cash in hand for his surplus product, and that at a season when he rarely has other cash productions to dispose of.

Vermont has probably given more attention to the development of this industry, and been more on the alert to discover and promptly adopt improved processes of manufacture, than any other State. As a consequence, it has made large relative gains on other States having like resources. Though among the smallest in productive area, at the last census, in the amount of sugar produced, it had outstripped all others, exceeding New York, the next highest, by 2,202,262 pounds. Estimating the product of that season at 10 cents per pound for sugar and $1 per gallon for sirup, the value of the crop would be $901,453. Except the labor of the ordinary force on the farm, at the most impracticable season for other farm-work, the outgoes are so small, that at least 90 per cent of this gross sum is net income, earned, as it were, incidentally, while waiting for the frost to come out of the ground. It is not strange, therefore, that the beautiful rock-maple "orchards," which embower the declivities and crown the hill-tops of this agricultural State, "are often held at a higher value than other land covered with hardwood timber or land under cultivation."

Maple-sugar production is mainly limited to the States named below, and the returns for quantities of sugar and sirup produced in each census year of the last three completed decades are as follows:

States.	Sugar.			Sirup.		
	1870.	1860.	1850.	1870.	1860.	1850.
	Pounds.	*Pounds.*	*Pounds.*	*Gallons.*	*Gallons.*	*Gallons.*
Illinois	136, 873	134, 195	248, 904	10, 378	20, 048	8, 354
Indiana	1, 332, 332	1, 541, 761	2, 921, 192	227, 880	292, 908	180, 325
Iowa	146, 490	315, 436	78, 407	9, 315	11, 405	3, 162
Kentucky	269, 416	380, 941	437, 405	49, 073	140, 076	30, 079
Maine	160, 805	306, 742	93, 542	28, 470	32, 679	3, 167
Massachusetts	399, 800	1, 006, 078	795, 525	2, 326	15, 307	4, 693
Michigan	1, 781, 855	4, 051, 822	2, 439, 794	23, 637	78, 998	19, 823
Minnesota	210, 467	370, 669	2, 950	12, 722	23, 038	....
Missouri	116, 980	142, 028	178, 910	16, 317	18, 289	5, 636
New Hampshire	1, 800, 704	2, 255, 012	1, 298, 863	16, 884	43, 833	9, 811
New York	6, 692, 040	10, 816, 419	10, 357, 484	46, 048	131, 843	56, 539
Ohio	3, 469, 128	3, 345, 508	4, 588, 209	352, 612	370, 512	197, 308
Pennsylvania	1, 545, 917	2, 767, 335	2, 326, 525	39, 385	114, 310	50, 652
Tennessee	134, 968	115, 620	158, 557	4, 843	74, 372	7, 223
Vermont	8, 894, 302	9, 897, 781	6, 349, 357	12, 623	16, 253	5, 997
Virginia	215, 093	938, 103	1, 227, 665	11, 400	99, 605	40, 322
West Virginia	490, 606	....	....	20, 209	....	....
Wisconsin	507, 192	1, 584, 451	610, 976	31, 218	83, 118	9, 874
United States	28, 413, 645	40, 120, 205	34, 253, 436	921, 057	1, 597, 589	106, 782

The total product of maple-sugar reported for the census of 1840 was 35,105,705 pounds. The proportions of sugar and sirup manufactured vary considerably from year to year, but, so far as indicated by the above table, it appears that in Illinois, Indiana, Maine, Missouri, New Hampshire, and Ohio about one-half of the product in weight and value is in the form of sirup. In Kentucky the proportion of sirup is considerably greater, while in Vermont it is much less. The Massachusetts census for 1875 reports the value as well as the quantity of both sugar and sirup: the former averages 11.3 cents per pound; the latter, $1.183 per gallon; making 1 gallon of sirup very nearly equal in value to 10½ pounds of sugar. If we estimate 10 pounds of sugar as the average equivalent for 1 gallon of sirup throughout the country, the production of the leading States reported in 1870, reckoned in pounds, is as follows: Vermont, 9,014,532; New York, 7,152,520; Ohio, 6,995,248; Indiana, 3,611,132; New Hampshire, 1,969,544; Pennsylvania, 1,939,767. The total products returned in 1870 and 1860, estimated in the same way, are equivalent, respectively, to 37,654,215 and 56,096,095 pounds.

According to a statement in the Agricultural Report by the Commissioner of Patents in 1853, (p. 234,) in 1811, while Vermont produced only 1,200,000 pounds, Kentucky produced 2,471,647, and Ohio 3,033,806.

The principal official State returns forwarded to this Department since the last national census are as follows: Massachusetts reported in 1875 1,082,202 pounds of maple-sugar, valued at $123,013, and 23,015 gallons of sirup, valued at $27,235. In Michigan the quantity returned for the national census of 1870 was 56 per cent. less than in 1860; but 4,319,793 pounds were returned for 1874, exceeding the product of 1860 by 6.6 per cent. In Minnesota the State return for 1870 was considerably larger than that reported for the national census, being 231,602 pounds of sugar, and 17,394 gallons of sirup. In 1871 the sugar product was 141,982 pounds; sirup, 22,923 gallons. The average annual product for the next three years was 160,275 pounds and 17,394 gallons. Iowa returned for 1874 132,204 pounds and 19,613 gallons.

GRAPE-SIRUP.

Mr. J. C. Weinberger, of Napa County, California, is reported as having experimented with success, which promises a remunerative industry, in manufacturing a delicious sirup from the grape. He uses for this purpose the Mission grape, for the alleged reason that, while less valuable for wine-making than other varieties, it is richer in saccharine matter. A ton of these grapes yields 120 gallons of juice fit for sirup. As the juice expressed after it begins to be discolored is not suitable for making sirup, there is a residuum for wine-making, distillation, or feed for hogs. Three gallons of juice make one of sirup. Cook's patent evaporator (manufactured at Cincinnati) will reduce 250 gallons of juice to sirup in about 12 hours.

A correspondent, writing in January, 1877, reports that Mr. Weinberger and another person made at Saint Helena, the past season, from 3,000 to 4,000 gallons of grape-sirup, far superior to that from cane, which finds a ready sale at 50 cents per gallon; that at that price it will be sufficiently remunerative to enable the manufacturer to pay the producer $20 per ton for grapes; and that the farmers will become rich if they can sell their immense surplus at that rate.

SUGAR FROM WATERMELONS.

The following facts respecting an enterprise in California for manufacturing sugar, alcohol, and oil from the watermelon are communicated by our correspondent at San Francisco. The islands in the delta formed by the Sacramento River on the north and the San Joaquin on the south, (in Sacramento County,) recently reclaimed, aggregate about 400,000 acres of alluvial deposit of marvelous fertility. The soil and climate are especially adapted to the production of watermelons in great perfection. The yield was so abundant that to find a profitable outlet for surplus crops, amounting to hundreds of tons, became to the farmers an important inquiry, and stimulated endeavors and experiments in that direction. By using only crude, primitive apparatus, they succeeded in manufacturing sugar so satisfactory in quantity and quality, that several enterprising farmers on Andros Island were inspired with faith to unite in an enterprise for obtaining the best apparatus known, and manufacturing on an extensive scale. The result is an organization incorporated under the name of the California Sugar-Manufacturing Company, with a capital stock of $2,000,000, of which, at last accounts, 50,000 shares had been sold. The company are erecting, at Isleton, a factory and appurtenances, for which they have imported machinery from Germany at a cost of $10,000. The design, as reported, includes the manufacture of two or three grades of sugar from the purer juice, alcohol from a remainder in the pulp and rind, and oil for the table from the seeds. The claim that the melons will yield about 10 per cent. of sugar and the seeds 25 per cent. of oil savors of sweetening and lubricating a little too profusely, and needs confirmation.

AGRICULTURAL EXPORTS.

Statement of the exports of agricultural products of the United States, with their immediate manufactures, for the two fiscal years ending June 30, 1876, compiled from the reports of the Bureau of Statistics of the Treasury.

Products.	1875.		1876.	
	Quantity.	Value.	Quantity.	Value.
Animals, living:				
Hogs......number..	64, 979	$739, 215	68, 044	$670, 042
Horned cattle......do....	57, 211	1, 103, 085	51, 593	1, 110, 703
Horses......do....	3, 220	242, 031	2, 030	234, 964
Mules......do....	2, 802	356, 828	1, 784	224, 860
Sheep......do....	124, 416	183, 898	110, 312	171, 101
All other and fowls......	....	47, 448	....	24, 617
Animal matter:				
Bone black, ivory black, &c.....pounds..	1, 598, 888	74, 648	686, 635	29, 271
Bones and bone dust......cwt...	71, 376	132, 246	40, 432	69, 159
Candles......pounds..	1, 605, 332	236, 676	1, 513, 475	229, 311
Furs and fur-skins......	....	4, 396, 424	....	4, 398, 883
Glue......	131, 244	22, 745	24, 288	5, 798
Hair—				
Unmanufactured......	....	429, 598	....	310, 761
Manufactures of......	....	19, 278	....	6, 254
Hides and skins other than furs......	....	4, 729, 725	....	2, 905, 921
Leather—				
Sorts not specified......pounds..	24, 154, 193	6, 286, 397	31, 947, 001	8, 394, 580
Morocco and other fine......	....	335, 086	....	948, 980
Boots and shoes......pairs..	293, 051	429, 363	263, 508	368, 633
Saddlery and harness......	....	74, 102	....	87, 730
Other manufactures......	....	199, 848	....	209, 062
Oil—				
Lard......gallons..	146, 594	147, 384	146, 323	149, 156
Other animal......do....	12, 136	12, 515	22, 631	24, 498
Provisions:				
Bacon and hams......ponnds..	250, 286, 549	28, 612, 613	327, 730, 172	39, 664, 456
Beef......do....	48, 243, 251	4, 197, 956	36, 596, 150	3, 186, 304
Butter......do....	6, 360, 827	1, 506, 996	4, 644, 894	1, 109, 496
Cheese......do....	101, 010, 853	13, 659, 603	97, 676, 264	12, 270, 083
Condensed milk......	....	123, 565	....	118, 549
Eggs......dozen..	34, 119	8, 743	29, 633	8, 300
Lard......pounds..	166, 869, 393	22, 900, 522	168, 405, 839	22, 429, 485
Pork......do....	56, 152, 331	5, 671, 495	54, 195, 118	5, 744, 022
Preserved meats......	....	735, 112	....	998, 052
Soap:				
Perfumed and toilet......	....	16, 233	....	11, 007
All other......pounds..	10, 167, 655	677, 258	10, 057, 478	673, 732
Tallow......do....	65, 461, 619	5, 692, 619	72, 432, 775	6, 734, 378
Wax......do....	353, 425	96, 578	218, 610	69, 127
Wool:				
Raw and fleece......do....	178, 034	62, 754	104, 762	13, 845
Manufactures of......	....	154, 401	....	336, 389
Total value of animals and animal products.	....	104, 314, 988	....	113, 941, 509
Breadstuffs and their preparations:				
Barley......bushels..	91, 118	61, 408	317, 781	210, 584
Bread and biscuit......pounds..	11, 729, 460	610, 092	12, 066, 469	632, 580
Corn......bushels..	28, 858, 420	24, 456, 937	49, 493, 572	33, 265, 280
Corn-meal......barrels..	291, 654	1, 290, 533	354, 240	1, 305, 027
Oats......bushels..	504, 770	290, 537	1, 466, 228	588, 583
Rye......do....	207, 100	204, 590	543, 841	480, 083
Rye-flour......barrels..	9, 993	54, 964	7, 553	39, 054
Wheat......bushels..	53, 047, 177	59, 607, 863	55, 073, 122	68, 382, 899
Wheat-flour......barrels..	3, 973, 128	23, 712, 440	3, 935, 512	24, 433, 470
Other small grain and pulse......	....	804, 193	....	1, 136, 515
Other preparations of grain......	....	364, 708	....	707, 478
Rice......	277, 377	19, 831	439, 991	30, 918
Total breadstuffs......	....	111, 478, 096	....	131, 212, 471
Cotton and its manufactures:				
Sea-island......pounds..	4, 439, 120	1, 538, 769	2, 644, 791	941, 803
Other unmanufactured......do....	1, 255, 979, 783	189, 099, 856	1, 488, 760, 543	191, 717, 459
Colored goods......yards..	7, 593, 723	939, 061	16, 488, 214	1, 455, 462
Uncolored goods......do....	21, 224, 020	2, 313, 270	59, 319, 267	5, 314, 738
All other manufactures......	....	819, 551	....	952, 778
Total cotton, &c......	....	194, 710, 507	....	200, 382, 240

Statement of the exports of agricultural products, &c.—Continued.

Products.	1875.		1876.	
	Quantity.	Value.	Quantity.	Value.
Wood and its products:				
Boards, planks, joists, &c. M feet	213, 974	$3, 693, 909	252, 427	$3, 862, 793
Laths, palings, pickets, &c. M	6, 777	22, 535	5, 675	16, 501
Shingles M	40, 628	160, 925	33, 636	130, 847
Box-shooks		471, 942		105, 796
Other staves and headings		5, 239, 329		4, 322, 252
Hogsheads and barrels number	202, 879	459, 085	152, 228	349, 456
All other lumber		235, 984		321, 790
Fire-wood cords	1, 973	8, 023	3, 032	9, 029
Hop, hoop, and telegraph poles		556, 450		476, 312
Logs, masts, and other whole timber		572, 801		616, 197
Timber sawed or hewn cubic feet	13, 553, 714	2, 357, 842	21, 786, 414	3, 463, 352
All other timber		366, 975		138, 553
Household furniture		1, 711, 769		1, 574, 935
Wooden ware		342, 815		342, 860
Other manufactures		1, 539, 701		1, 565, 602
Ashes, pot and pearl pounds	1, 726, 624	115, 622	1, 309, 861	75, 597
Bark for tanning		193, 938		223, 276
Rosin and turpentine barrels	937, 527	2, 774, 419	824, 256	2, 188, 623
Spirits of turpentine gallons	5, 599, 624	1, 924, 544	5, 178, 934	1, 672, 068
Tar and pitch barrels	54, 905	127, 206	69, 138	164, 647
Total wood, &c.		22, 875, 814		21, 620, 486
Miscellaneous:				
Brooms, brushes, &c		146, 988		198, 914
Cordage, ropes, &c pounds	3, 035, 241	391, 165	2, 126, 524	271, 090
Fruits—				
Apples, green, ripe, or dried pounds	4, 813, 270	1, 048, 440	891, 138	289, 679
Other green, ripe, or dried		269, 632		210, 177
Preserved, in cans, &c		315, 931		327, 422
Ginseng pounds	497, 487	658, 926	550, 624	646, 954
Hay tons	7, 183	110, 225	7, 528	134, 017
Hemp—				
Unmanufactured cwt	2, 140	21, 856	870	8, 318
Cordage, cables, &c do	11, 133	171, 196	11, 200	147, 009
Other manufactures		706, 309		737, 042
Hops pounds	3, 066, 703	1, 286, 501	9, 191, 589	1, 384, 521
quors, alcoholic—				
Beer, ale, porter, and cider—				
In bottles dozen	3, 633	7, 600	7, 045	13, 007
In casks gallons	61, 661	16, 604	99, 310	29, 657
Spirits distilled from—				
Grain gallons	130, 460	140, 519	130, 381	93, 666
Molasses do	414, 564	210, 169	1, 088, 133	457, 259
Other materials do	219	666	264	766
Wine gallons	45, 039	50, 308	31, 915	33, 483
Oil-cake pounds	247, 016, 095	5, 138, 300	287, 119, 800	5, 774, 585
Oil—				
Cotton-seed gallons	417, 387	216, 640	281, 054	146, 135
Linseed do	32, 370	30, 689	30, 331	23, 770
Essential or volatile		217, 576		248, 270
Seeds—				
Cotton pounds	5, 316, 113	63, 128	5, 164, 546	69, 605
Flax or lint bushels	43	137	98	257
All other		1, 227, 750		1, 348, 750
Starch pounds	7, 382, 862	442, 682	9, 685, 552	524, 956
Sugar—				
Brown pounds	362, 552	31, 111	22, 714	2, 354
Refined do	23, 789, 836	2, 585, 382	51, 840, 977	5, 552, 587
Molasses gallons	3, 575, 980	1, 135, 995	4, 408, 412	1, 158, 585
Candy and confectionery		41, 029		32, 245
Tobacco—				
Leaf pounds	223, 901, 913	25, 241, 549	218, 310, 265	22, 737, 383
Cigars M	336	17, 072	707	23, 407
Snuff pounds	21, 894	7, 570	10, 551	4, 793
Other manufactures		2, 578, 279		2, 804, 955
Vegetables and their preparations—				
Onions bushels	47, 695	51, 259	61, 816	54, 015
Pickles and sauces		18, 865		19, 086
Potatoes bushels	609, 642	522, 182	704, 379	431, 443
All other		169, 425		133, 272
Vinegar gallons	16, 345	4, 756	19, 325	6, 133
Total miscellaneous		42, 594, 411		46, 079, 567

Statement of the exports of agricultural products, &c.—Continued.

RECAPITULATION.

	1871.	1872.	1873.	1874.	1875.	1876.
Animals and animal matter	$47,010,312	$77,060,849	$99,806,599	$99,607,669	$104,314,988	$113,941,509
Breadstuffs, &c	79,519,387	85,155,523	98,762,891	161,225,939	111,478,096	131,212,471
Cotton, &c	221,885,245	182,988,925	230,190,597	214,319,420	194,710,507	200,382,240
Wood, &c	15,820,029	21,425,068	25,854,120	27,675,300	22,875,814	21,620,486
Miscellaneous	33,060,081	40,139,296	37,901,458	45,486,626	45,294,411	46,079,567
Total agricultural exports	397,304,054	406,769,661	492,515,665	548,314,954	478,673,816	513,236,273
Total exports	562,518,651	549,219,718	649,132,563	693,039,066	643,094,767	644,956,406
Per cent. of agricult'l matter	70	74	76	79	74	79

Our agricultural exports were nearly 80 per cent. in value of the total domestic exports, against 74 per cent. in 1875. Their actual increase in value was $37,542,438, or nearly 8 per cent., while the total domestic export increased only $1,861,439, or less than one-third of 1 per cent. An increase is noted in all the leading branches, except wood and its products, which fell off about 6 per cent. Animal matter increased over 9 per cent., though living animals fell off considerably. Bacon, hams, leather, and tallow show an increase of over $12,000,000, while beef, butter, and cheese declined about $2,000,000. Breadstuffs increased nearly $20,000,000, the leading items of increase being nearly $9,000,000 in corn and corn-meal, and $9,500,000 in wheat and flour. Oats, rye, and rye-flour fell off nearly half, amounting to but little over a half million of dollars. Barley, always a small export, shows a considerable increase. Raw cotton barely held its own, while manufactures of cotton nearly doubled in value. The export of uncolored goods rose from 21,224,020 yards in 1875 to 59,319,267 yards in 1876; the aggregate value from $2,313,270 to $5,314,738. Miscellaneous matter increased about 9 per cent. The leading items of increase are found in hops, distilled spirits, oil-cake, seeds, starch, refined sugar, and manufactures of hemp and tobacco. Cordage, fruits, brown sugar, tobacco leaf, and vegetables show a decline.

Comparing the figures of the six years embraced in the recapitulation above, we find that the proportion of agricultural matter to the total domestic export has gradually risen from 70 per cent. in 1871 to nearly 80 per cent. in 1876, with a decline to 74 per cent. in 1875, but after deducting the precious metals, the proportion will be found to be uniformly about five-sixths of the remainder; animal matter rose from less than 12 per cent. of the agricultural export in 1871 to over 22 per cent. in 1876; breadstuffs from 20 to $25\frac{1}{2}$ per cent., reaching in 1874 nearly 30 per cent.; cotton fell from about 60 per cent. to 39 per cent.; wood, with its products, has ranged between 4 and $5\frac{1}{3}$ per cent.; miscellaneous matter, between $7\frac{1}{2}$ per cent. and 10 per cent.

FLOUR AND GRAIN MOVEMENTS.

EXPORT TRADE.

The steady growth of our export trade in cereals marks an important change in the production of the civilized world. For several years there has been a growing deficiency in the breadstuff-crops of some European countries. The development of international communications and of close commercial relations between the different states of that continent has utilized the surplus of the wheat-producing countries by giving it easier access to the wheat-consuming countries. But of late years the reduction of wheat-acreage has rendered necessary an increased import from other continents. An example of this reduction is especially noticeable in the United Kingdom, which has been gradually narrowing her wheat-fields to enlarge her permanent pasturage. The demand for animal food is trenching upon cereal production. The acreage of Great Britain in wheat fell from 3,571,894 acres in 1871 to 2,994,957 acres in 1876, a decline of 16 per cent. The gradual progress of this decline shows it is the result of steady and permanent causes. In Ireland this declining movement is still more marked, the area falling from 246,954 acres in 1871 to 119,597 in 1876, a loss of 52 per cent. The whole United Kingdom, including the Channel Islands, shows a decrease from 4,185,974 acres in 1857 to 3,126,555 acres in 1876, or 25 per cent. The rate of yield, with some fluctuations, has gradually fallen from 33⅓ bushels per acre in 1857 to 27 in 1876. Meanwhile, as population and wealth have increased, and as the humbler classes have improved in their circumstances and aspirations, using better food than formerly, the demand for wheat-bread has increased in the British islands to an extent which, in 1876, required from 90,000,000 to 100,000,000 bushels of foreign grain to meet it.

Across the English Channel the same deficiency in production has manifested itself, though to a smaller extent. The Echo Agricole, a leading French agricultural journal, estimates the crop of 1876 in France at 256,726,250 bushels, of which but a small surplus will be left after supplying the domestic demand. The official statistics of the government give the aggregate product at 262,454,038 bushels. The statistics of foreign trade, however, show that these estimates are too high, or that home consumption is greater than French statisticians are willing to allow. The excess of imports of wheat over exports averaged 16,671,500 bushels during the last six years. The average annual acreage of those six years fell short of the average of the previous ten years 314,334 acres, or about 2 per cent. The decline of wheat-production in France, then, if less rapid than in the British islands, is clearly indicated.

As an example of what are called the wheat-producing countries of Europe, we notice a rapid decline in the product of the Austro-Hungarian Empire. The American consul at Vienna, in his report of November 1, 1875, to the State Department, shows that during the ten years closing with 1871 the excess of cereal exports of the empire averaged about $25,000,000 per annum in value. But in 1872 there was a surplus of imports which took out of the country $5,000,000; this deficiency increased to $18,000,000 in each of the two following years. The total product of the empire fell from 118,003,880 bushels in 1868 to 99,014,790 bushels in 1874; the last-named crop showed a considerable increase over its predecessor. Meanwhile civilization has been advancing in Austro-Hungary; other industries have been flourishing, trade relations have been extended and perfected with surrounding countries; an increased amount of wheat is taken for home consumption. The result is a deficit in production and an excess of importation over exportation. Whether the shortness of the late crops is a permanent feature in production is yet to be seen, but even if the former standard of growth be re-established, it is evident that the surplus for export will be constantly narrowed by the increasing wants of the population.

The same causes are at work in other countries of Eastern and Southeastern Europe. The conditions of wheat-production are changing. Agricultural labor becomes scarcer and higher priced as general industries are developed; land rises in value, and all the elements which enter into the cost of raising a bushel of wheat are enhanced. In America this enhancement is met by a wonderful development of mechanical labor-saving processes in agriculture, but even with this advantage the wheat-production of this country is rapidly shifting to the cheap lands beyond the Mississippi. In the wheat-producing countries of Southern Europe this economy of labor is not studied and practiced as in the United States. Processes of culture are still quite primitive, and do not advance in efficiency as rapidly as the increased demands for subsistence in Europe generally. Political settlements in this quarter are not favorable to a general development of industry. The old unsettled eastern question has assumed one of its most threatening phases, and the war now in progress between Russia and Turkey threatens not only a decline in production, but also a serious obstruction of the channels of trade. All of these circumstances point to a still more enlarged scope of the American export trade, at least for several years to come.

In a statistical report published by authority of the French government, of which an abstract is given elsewhere in this report, the average annual product of Europe is estimated at 5,153,808,000 bushels, or 17 bushels *per capita* of the population. The average annual consumption *per capita* is set down at 15.6 bushels for food, seed, and various manufactures. If these estimates are only approximately correct, it is evident that Europe raises its own supply of cereal products. But the large importation of wheat and other breadstuffs from America, Australia, India, and elsewhere shows in these grains the home production is not equal to the demand.

Of European countries, the United Kingdom is by far the greatest consumer of foreign breadstuffs. Her wheat imports, with considerable fluctuations, show a steady increase. Her supplies, prior to 1860, came principally from Russia, Germany, and France. In 1859, the imports from the United States were given at 430,504 cwts.; in 1861 they had risen to 15,610,472 cwts. From 1860 to 1872, inclusive, we supplied the British population with 28.10 per cent. of their foreign flour and wheat, while Russia contributed 24.7 per cent., and Germany 17.2 per cent. In 1873, we furnished 45 per cent. of the wheat imported into the British islands and 25 per cent. of the flour; in 1874, 53 per cent. of the wheat and nearly 53 per cent. of the flour; in 1875, 45 per cent. of the wheat and $37\frac{1}{2}$ per cent. of the flour; in 1876, nearly 43 per cent. of the wheat and 39 per cent. of the flour. During the last four years Russia furnished the following proportions of the wheat consumed in the United Kingdom, viz: 1873, nearly 22 per cent.; 1874, nearly 14 per cent.; 1875, $19\frac{1}{3}$ per cent.; 1876, $19\frac{4}{5}$ per cent. The flour received from Russia was too inconsiderable for mention in the Treasury statistics. Germany furnished, in 1873, 5 per cent. of the wheat and 11 per cent. of the flour; in 1874, 7.3 per cent. of the wheat and 12.3 per cent. of the flour; in 1875, $10\frac{4}{5}$ per cent. of the wheat and 13 per cent. of the flour; in 1876, 5 per cent. of the wheat and $15\frac{3}{5}$ per cent. of the flour. France, in 1873, furnished less than 3 per cent. of the wheat and nearly 27 per cent. of the flour; in 1874, less than 1 per cent. of the wheat and $10\frac{1}{2}$ per cent. of the flour; in 1875, $2\frac{1}{2}$ per cent. of the wheat and nearly 29 per cent. of the flour; in 1876, about five-eighths of 1 per cent. of the wheat and 18 per cent. of the flour.

The above facts and figures show something of our current relations to the greatest consuming grain market in the world. From considerations before cited, we are assured that our three leading competitors named above—Russia, Germany, and France—will fall behind in the movement, but we will be able to occupy but a portion of the field vacated by them. Other countries are sending their products to this market—countries in which the cost of production is less than in either the United States or Europe. In 1876, Turkey increased her import 67 per cent. and Egypt 42 per cent.; but the present Turko-Russian war will paralyze this trade. Chili raised her contribution nearly 50 per cent.; India nearly tripled, and unenumerated countries with small importations nearly doubled their previous aggregate. All the great wheat-producing countries, including the United States, fell off in 1876 from the previous aggregate. The sudden increase of the import from India attracted special attention. Some attributed it to temporary causes, especially to the decline in the value of silver in Europe without any corresponding decline in India. It was stated that during 1876 an English wheat importer could procure by exchange 10,000 rupees for about £833, whereas in India the former retained their full purchasing power of £1,000. This difference not only paid the cost of transportation, but added considerably to the margin of profit. It was very sensibly argued that such a state of things could only be temporary, and that the equilibrium between supply and demand would speedily adjust itself in such manner as to absorb this extra margin, and to place this trade on a par with that of other countries. Others argue that the great improvements in internal transportation in India and the construction of the Suez Canal have created a class of economic conditions which will give this trade a permanent vitality, especially as the cotton production of Hindostan has begun to decline, leaving capital, cheap labor, and cheap land available for cereal production.

It is evident that wheat-culture is constantly seeking the cheapest possible conditions of production. Our vast area of virgin land annually brought under culture by our pioneer settlers and our extended communications by water and rail, together with our immense labor-saving machinery, still give us measurably the advantage in the supply of wheat and other grains that will bear distant transportation; but it is still a question how long this advantage will remain with us. For the immediate future, however, indications are sufficiently strong that our export trade in cereals will greatly increase.

Our exports of wheat and flour during the last fifty-one fiscal years were as follows:

Five years ending—	Wheat.	Flour.	Wheat, including flour reduced.	Per cent. of flour in the total quantity.
	Bushels.	*Barrels.*	*Bushels.*	
1830	125,547	4,651,940	23,385,247	99.46
1835	614,145	5,241,964	26,823,965	97.2
1840	1,842,841	4,092,932	22,307,501	91.7
1845	2,946,861	6,274,697	34,320,346	91.1
1850	10,184,645	12,284,828	71,608,785	85.77
1855	16,446,955	13,149,518	82,194,545	79.9
1860	38,808,573	15,778,268	117,699,913	67
1865	138,306,907	19,757,733	237,095,572	42.09
1870	81,808,364	11,454,785	139,082,289	41.2
1875	224,019,376	16,797,684	308,007,796	27.2
Total for fifty years	515,104,214	109,484,349	1,062,525,959	51.5
1876	55,073,122	3,935,512	74,750,682	26.32

The declared value of these exports was as follows:

Five years ending—	Wheat.		Flour.		Wheat and flour, reduced.		Per cent. of flour in the total value.
	Aggregate value.	Average value per bushel.	Aggregate value.	Average value per barrel.	Aggregate value.	Average value per bushel.	
1830	$112,754	$0 89.8	$24,708,090	$5 31.1	$24,820,844	$1 06.1	99.5
1835	737,365	1 20	29,347,649	5 59.9	30,085,014	1 13.7	97.55
1840	1,817,067	98.6	27,231,952	6 65.3	29,049,019	1 30.2	93.7
1845	2,900,785	98.4	31,056,156	4 94.9	33,956,941	98.8	91.5
1850	12,801,093	1 25.7	69,375,741	5 64.7	82,176,834	1 18.8	84.4
1855	21,864,762	1 32.9	75,775,220	5 76.2	97,639,982	1 18.8	77.6
1860	53,343,918	1 37.4	104,368,446	6 61.5	157,712,364	1 34	66.2
1865	178,470,444	1 29	133,356,875	6 74.8	311,827,319	1 31.6	42.8
1870	117,527,424	1 43.7	92,071,717	8 03.9	209,599,141	1 50.8	43.9
1875	296,540,060	1 32.2	114,401,066	6 86.9	410,941,126	1 33.2	27.8
Total for fifty years	686,115,672	1 33.1	701,692,912	6 40.9	1,387,808,584	1 30.6	50.6
1876	68,382,899	1 24.1	24,433,470	6 20.8	92,816,369	1 24.2	26.32

The above figures present some very interesting indications in regard to our foreign wheat trade. The enormous increase of exports in the five years ending with 1865 is especially remarkable, being more than double those of the previous five years. These were years of civil strife and bloodshed, of gigantic struggle to conquer a peace with revolted States. These States had previously consumed a large proportion of the wheat products of the North and West, but the operations of war broke up this internal trade and threw an immense surplus into the channels of our export trade. The next five years, closing with 1870, showed a reduction of nearly 100,000,000 bushels, or 20,000,000 bushels per annum, but the five years ending with 1875 more than doubled the export. It is noticeable that the average export values of wheat during the civil-war period were lower than in the semi-decades immediately previous or subsequent; while those of flour were but a few cents above the previous period, and far below the exceptional rates of the semi-decade immediately succeeding.

The proportion of flour shows a steady and invariable decline. Fifty years ago it constituted nearly the whole of our wheat export, but in 1876 it was but little over one-fourth of the whole, either in quantity or value. A special reason for this is found in the necessity of giving every possible scope to industrial production in Europe. The increasing cost of grain production in Europe on the one hand, and the improvement in transatlantic transportation on the other, gave to the milling interest, especially in England and France, a margin of profit in grinding American grain, which secured to that interest an enormous development. Vast improvements in milling machinery and market arrangements were devised, and strenuous efforts made to secure the manufacture of flour to domestic enterprise. Meanwhile American millers found more profitable markets in other countries. Over half the exports of the last two fiscal years were to South America, West Indies, China, and Japan; countries in which flour-manufacture scarcely exists. To a large portion of this field we send our cheaper flours, superfines and low-grade extras. The United Kingdom receives an increasing amount of our better grades of flour, the aggregates being 1,231,374 barrels in 1875 and 1,335,185 barrels in 1876, the last being over a third of the whole flour export. France took 1,020 barrels in 1875, and only 19 barrels in 1876; Germany took 7,929 barrels in 1875, and 14,113 barrels in 1876.

But while European millers have enlarged and fortified their interest by the latest scientific appliances, American millers have shown still greater enterprise. With the world's markets for cheap flours practically assured them, they have entered upon a keen competition with European millers for the supply of the better grades. At the beginning of the present century our processes of milling were of a very primitive description, embracing generally but a single pair of buhrs and a reel. Many improvements upon this rude mechanism were gradually introduced during the first half of the century, but the original crude idea was still maintained, the production of as much flour as possible from a single grinding. The cells of gluten and starch in the grain were separated by mashing or squeezing, so as to leave a minimum of middlings, as the latter could be made available only in low-grade flour. This was the exclusive *rationale* of milling in American mills till within a few years.

What is called the new process in flour-manufacture was but lately heard of in the mills of Minnesota. Though a new process in this country, it is only the adaptation of an idea that has prevailed in the mills of Hungary for sixty years, represented there in a process called "half-high milling." American millers, however, have introduced very important modifications. The object of both the American and Hungarian systems is to obtain the maximum proportion of middlings and the purification of the middlings before regrinding into flour. The Hungarian system accomplishes these results by a complicated and bewildering series of processes. The American system, with constant improvements in machinery, is abridging this series, and obtaining nearly the same results with fewer and simpler manipulations. The delegate of the Austro-Hungarian Millers' Association to the late Centennial Exposition at Philadelphia says that the two systems are identical in principle and results, and that American flour production is destined to become a still more formidable competitor to European millers. Both seek first to disintegrate, not to crush, the granules of the wheat, which are, as far as possible, preserved unbroken; their coating of cellular tissue protects their nitrogenous contents from the consuming chemistry of the atmosphere and from the germs of microscopic vegetation floating everywhere around us. The buhrs also do not heat the cells as under the old system, involving, as it did, the absorption of moisture and chemical changes in the body of the grain. The new process avoids several chemical compounds of disagreeable taste and smell which formerly affected the flour, which now embraces all the normal elements of the berry in their natural state.

The American process originated in Minnesota. A brief article in the annual report of this Department for 1875 gives some interesting facts in regard to its origin and introduction. At least one-fourth of the mills of Minnesota are constructed with reference to this "high-milling" process. The wheat of that region is almost entirely spring-sown, but its hard, brittle nature renders it peculiarly fit for this kind of manufacture. Spring-wheat flour formerly ruled much below winter-wheat flour; but the "patent springs" now lead the finest winter-wheat brands in the most fastidious consuming markets of the East. This flour is made from disengaged uncrushed middlings; the flour-dust that is unavoidably produced in the grinding is of low grade. This process has been introduced as yet to only a limited extent in other regions. It is already used to some extent with manifest advantage, in milling winter wheat. It has utilized the cheaper spring wheat and rendered it available for high flour production. It is a leading salient fact in the grain movement of this country, which looks to very important changes in the near future, and promises a great extension of an export trade.

Our exports of maize have assumed great importance within the last few years. The following table shows the quality and value of our exports during the last fifty-one years by semi-decades:

Five years ending—	CORN.			CORN-MEAL.		
	Bushels.	Aggregate value.	Average value per bushel.	Barrels.	Aggregate value.	Average value per barrel.
1830	3, 530, 710	$2, 019, 926	$0 57. 5	783, 408	$2, 404, 371	$3 07.
1835	2, 568, 946	1, 801, 711	70. 1	817, 383	2, 731, 077	3 34. 1
1840	1, 184, 973	873, 104	73. 7	843, 930	2, 471, 215	4 11. 3
1845	3, 474, 109	1, 755, 602	50. 5	1, 132. 749	2, 037, 021	2 68. 1
1850	43, 822, 153	31, 277, 920	71. 1	2, 493, 700	8, 984, 252	3 60. 3
1855	23, 905, 196	17, 712, 699	74. 1	1, 121, 456	4, 147, 318	3 69. 8
1860	27, 597, 896	19, 789, 181	71. 7	1, 291, 342	4, 917, 515	3 80. 8
1865	52, 612, 028	34, 903, 365	66. 3	1, 176, 607	5, 323, 270	4 52. 4
1870	47, 993, 276	47, 143, 817	98. 2	1, 355, 024	7, 345, 448	5 42
1875	146, 152, 915	104, 464, 944	71. 5	1, 604, 053	6, 461, 588	4 02. 8
Total for fifty years.	352, 842, 202	261, 742, 269	74. 2	12. 619, 652	48, 823, 075	3 87
1876	49, 493, 572	33, 265, 280	67. 2	354, 240	1, 305, 027	3 59. 9

The exports of unmanufactured corn up to 1845 were small and fluctuating both in quantity and value. The semi-decade ending with 1850, during which the disastrous famine in Ireland occurred, showed an aggregate export nearly thirteen times as great as its predecessor, and an average value per bushel 50 per cent. greater. The exports of corn-meal more than doubled, and the average value per barrel increased one-third. The excessive demand caused by the famine subsided, and hence the exports in the following semi-decade fell off nearly half; but this cereal had made a permanent lodgment in the European markets, developing an increased demand. The semi-decade ending with 1875 nearly tripled the exports of its predecessor, while the exports of 1876 amounted to over three times the average of the previous five years. The consumption of this grain for horse and cattle food is rapidly increasing, while even as an article of human diet it is finding new applications. The United Kingdom imported 39,958,226 cwt. of maize in 1876, against 20,420,292 cwt. in 1875, the largest previous importation, except in 1872. Increasing shipments are being made to Italy, Sweden, Denmark, Holland, Belgium, and France. There has been an increased consumption of maize in Paris and other continental cities, especially for feeding horses. This grain has demonstrated a feeding value for the same money superior to that of oats, hence an increased demand for this cereal is created in the European grain-markets.

The other cereals show but a small export, and that only in later years. A brief analytical review of our foreign cereal trade during the last thirteen fiscal years is now presented:

During the fiscal year ending June 30, 1876, our exports of grain, including flour and meal, reduced to their equivalent in grain, amounted to 128,026,829 bushels, (an increase over the previous year of 23 per cent.,) almost equaling the enormous aggregate of 1873–'74. The total declared value of this export was $128,704,980, an increase of 18 per cent. The average value per bushel, compared with the previous year, fell from $1.05½ to $1.00½, which was lower than during the last fiscal year before the war, when values were reckoned from a gold standard exclusively. In 1861–'62, abundant crops and the closing of the southern markets by the operations of war left a large surplus in the Northwest available for export at very low prices, and hence, although gold had begun to depreciate, the average value of the grain exports sank to its minimum, 99½ cents per bushel. But as the depreciation of the metallic currency became more marked, the average value of grain exported, being estimated in legal-tender currency, began to enhance. It reached its maximum, \$1.95¾ per bushel, in 1864–'65, the fiscal year during which the war closed; during that year the average of the monthly means of the gold premium was 202⅓ per cent. In subsequent fiscal years there was a general decline both in the average export value of grain and in the gold premium. The decline of the latter being regulated by more general considerations, has been more uniform than that of the former. The price of grain has been subject to fluctuations from the variation in the yield of European crops. The average export value, which in the year immediately after the close of the war had fallen to \$1.21 per bushel, rose two years after to \$1.70½, after which it fell to \$1.03¾ per bushel, in 1872–'73. In the following year it reached to \$1.22¼ under the extraordinary demand created by the failure of the crops of 1873 in Europe, but subsequently fell to the low figures of the last fiscal year. These variations, together with that of the gold premium, will be found in one of the tables below.

Wheat.—Of wheat and flour consolidated, our exports amounted to 74,750,682 bushels, an increase of 2½ per cent. compared with the previous year. Of this quantity, 26.32 per cent. was in the form of flour, against 27.24 per cent. in 1874–'75; our flour export amounted to 3,935,512 barrels, a loss of 37,616 barrels; our exports of unground wheat were 55,973,122 bushels, an increase of 2,025,945 bushels. The aggregate value of wheat and flour exported was \$92,816,369, an increase of 11⅓ per cent.; the average export value \$1.24.1 per bushel, against \$1.14.3 the previous year. The aggregate value of the exports of flour was \$24,433,470, an increase of 3 per cent.; the average value per barrel was \$6.20.8 against \$5.96.8 the previous year. The aggregate value of our exports of unground wheat was \$68,382,899, an increase of 14¾ per cent.; and the average value per bushel \$1.24.1 against \$1.12.4.

It is customary to estimate an average of 5 bushels of wheat for each barrel of flour. With improvements in milling perhaps, 4½ bushels would be nearer the truth. During the previous years the margin of price, at 5 bushels, had been growing narrower on the whole, but with some variations. Thus, in 1863–'64, ground wheat was valued 11.1 cents per bushel higher than unground; in 1864–'65 the margin was 8.4 cents; in 1865–'66, 27.9 cents; in 1866–'67, 69.5 cents; in 1867–'68, 11.5 cents; 1868–'69, 15.8 cents; in 1869–'70, unground wheat was 6.7 cents, and in 1870–'71, 0.03 cents higher than wheat in the form of flour; in 1871–'72, ground wheat recovered its supremacy, being worth 1.7 cents more than the unground; in 1872–'73, this margin increased to 19.6 cents, but declined in 1873–'74 to 0.1 cent; in 1874–'75 it rose to 6.9 cents, but during the last fiscal year it entirely disappeared.

In explanation of this fact, it is stated that our best brands of flour are mostly consumed at home, and that the bulk of our flour export consists of that made from poorer kinds of wheat. On the other hand, foreign millers of late years demand our best wheats for their own mills. This raw-wheat export has for years been enlarging its relative proportion to the total wheat-export. In 1865–'66, our flour export embraced 66.17 per cent. of the quantity and 70.11 per cent. of the entire value of the wheat export. But those proportions declined in subsequent years, reaching their minimum, 22.37 per cent. in quantity and 22.21 per cent. in value, in 1873-'74. During the last two years the proportion of flour has somewhat increased, but is still but little over a fourth of the whole in quantity and value.

Later improvements in grinding-machinery now render it practicable to obtain an increased quantity of flour from the same amount of wheat, and to make the flour from less-esteemed varieties of wheat as attractive to consumers as the brands which formerly ruled the market. Our improved and patented spring-wheat flours are largely replacing the finest winter-wheat brands in the eastern and European markets. Thus, we find more profit in exporting our best varieties of wheat unground, and our cheaper varieties in the form of flour. These facts go to explain the seeming anomaly of selling to foreigners our ground wheat at prices no higher than those obtained for the unground.

Wheat, including flour, still constitutes the greater part of our cereal exports. It fell below half the quantity of the total export only in 1866-'67, in which the short crop of 1866 formed the basis of the trade; but even in that year its aggregate value surpassed that of all other cereals. The maximum proportion of wheat exports, 95 per cent. in quantity and value, was in 1869-'70, the abundant crop of 1869 affording a very large surplus for foreign consumption. In general terms, it may be stated that flour and wheat, consolidated, have averaged over two-thirds of the quantity and three-fourths of the value of the annual cereal exports since the close of the late civil war.

During the last fiscal year the exports of wheat and flour constituted 25.58 per cent. of the estimated wheat-crop of 1875, whereas the exports of the previous fiscal year were 23.23 per cent. of the estimated crop of 1874. Of the crops of the previous calendar years, the proportions exported were as follows: Crop of 1873, 32.54 per cent.; 1872, 20.8 per cent.; 1871, 16.82 per cent.; 1870, 22.28 per cent.; 1869, 20.72 per cent.; 1868, 13.72 per cent.; 1867, 12.23 per cent.; 1866, 8.32 per cent.; 1865, 11.1 per cent.; 1864, 14.3 per cent.; 1863, 24 per cent. Of later years, we spare about one-fourth of our annual production for the wants of foreign countries, while our annual yield is steadily increasing in spite of fluctuations; this gives us the basis of a permanently-enlarged export.

Corn.—The exports of corn, including meal reduced to its equivalent in grain, (estimated at 4 bushels per barrel,) during the last year amounted to 50,910,532 bushels, the largest amount ever exported in a single fiscal year, and nearly 70 per cent. greater than the previous year. Of this quantity, the proportion sent out in the form of meal was but 2.81 per cent. of the whole, the smallest proportion within the last thirteen fiscal years. The largest proportion, 34.96, was in 1869-'70, but it has steadily fallen off since that time. This, however, is not the result of a falling off in the number of barrels of meal, but of an increase in the number of bushels of grain exported. The aggregate value of the exports of corn and meal was $34,570,307, an increase of 33.84 per cent. over the previous year, and by far the greatest value ever exported; it averages $0.67.9 per bushel, against $0.85.7 the previous year. The maximum value during the last thirteen fiscal years, $1.43.1 per bushel, was in 1864-'65, but subsequent years have shown a general tendency to decline, though with some fluctuations. Of the total declared value only 3.75 per cent. represents corn-meal, the smallest proportion on record. The average value of meal per barrel fell from $4.42.5 to $3.59.9, the minimum for thirteen years past; the maximum, $7.47.1, was in 1864-'65. The average value of unground corn was $0.67.2

against \$0.84.7 the previous year. The anomaly noted in the case of flour is also observable in the case of corn-meal. The margin between the average values of corn in the form of meal and of corn unground is gradually narrowing; probably the same causes are operative in both cases. Thus, in 1864–'65, the difference in the average values of corn in the form of meal and as simple grain was 56 cents; or, allowing 4 bushels of corn to each barrel of meal, \$2.24 per barrel for the expense of manufacturing. Last fiscal year the margin had reached its minimum of \$0.22.7 per bushel, allowing only \$0.90.8 per barrel for the expense of manufacture.

Compared with the entire cereal export, corn and corn-meal, during the last fiscal year, represented 39.84 per cent. of the quantity and 26.79 per cent. of the value. The largest proportion during the last thirteen fiscal years, 53.96 per cent. in quantity and 43.49 per cent. in value, was in 1866–'67; the smallest proportion, 3.78 per cent. in quantity and 3 per cent. in value, was in 1869–'70, during which the short crop of 1869 was marketed. Of the estimated crop of 1875, the exports of corn and meal during the last fiscal year amounted to 3.84 per cent., a proportion very nearly the same as in the four crops next preceding. Of the eight crops closing with that of 1870, the average amount exported was 1.3 per cent.; of the five subsequent crops, the average export amounted to 3.71 per cent. The average of the estimated yield of the first eight crops was 768,009,545 bushels; the average yield of the last five crops was 1,039,619,700 bushels. Thus, while the average yield has greatly enlarged, the proportion sent abroad has also greatly increased. These facts illustrate the great enlargement of our foreign trade in corn.

The enormous crop of 1875, which was marketed during the last fiscal year, bore such low prices in the western markets as to suggest the practicability of a greatly enlarged export trade. An attempt was made by parties at Chicago and other great commercial points to establish a large trade with British farmers for stock-feeding. From low prices and freights then prevailing it was calculated that corn could be laid down in the British markets so as to be sold, with a fair margin of profit, at 26 shillings per quarter. But this movement partially defeated itself by calling out supplies of grain in excess of a normal demand and, consequently, by cutting down prices in England below the calculated minimum. Some of the grain, from lack of care in shipment, was injured by heating on its ocean transit, causing considerable losses. On the whole, it is estimated that the profits of this movement somewhat overbalanced its losses. This was one of the causes that so greatly enlarged the export of corn during the last fiscal year. It seems clear that such an export trade is exceptional in its conditions, and that it is only an accident of a period of excessive production, low prices, and low rates of transportation.

Rye.—The export of rye and rye-flour consolidated, during the last fiscal year, about doubled its previous aggregate, both in quantity and value; yet it amounted to less than half of 1 per cent. of the entire cereal export. In no instance during the last thirteen years has it equaled 2 per cent. It is dependent upon very uncertain conditions, and hence betrays great instability. The annual export since the war ranged between 80,924 bushels in 1870–'71 and 1,956,675 bushels in 1873–'74. During the last fiscal year the average value per bushel of the whole rye and rye-flour export was \$0.89.3, the lowest during the last thirteen years. The maximum, \$1.69.2, was in 1867–'68. Of unground rye, the average of last year was \$0.88.3, against \$0.98.8 the previous year. Of rye-flour, the average value was $5.16.9, the lowest value for thirteen years. The maximum, $8.24.3, was in 1864–'65. Allowing 5 bushels of rye as necessary to make a barrel of flour, the margin between the export values per bushel of ground and unground rye has varied very capriciously from year to year, with a general tendency to diminish. During the last three fiscal years the difference between these averages were respectively as follows: $0.49.6, $0.11.2, and $0.14.1 per bushel, amounting to $2.48, $0.56, and $0.70.5 per barrel. The same causes are doubtless operative in this case as in that of wheat-flour and corn-meal. The proportion of flour to the total export in 1875–'76 was 6.49 per cent. in quantity and 7.52 per cent. in value against 19.44 per cent. in quantity and 21.04 per cent. in value the previous year. In 1868–'69, the proportion of flour reached its maximum, 42.19 per cent. in quantity and 48.28 per cent. in value. Compared with our annual yield, the rye export of the last fiscal year was 3.2 per cent. against 1.74 per cent. the previous year. The proportion for thirteen years ranged from 0.4 per cent. in 1867–'68 to 12.33 per cent. in 1873–'74.

Oats.—Our last annual export of oats amounted to 1,466,228 bushels, being nearly three times that of the previous year and the largest on record. This increase was the natural result of the abundant crop of 1875, which was 64 per cent. greater than its predecessor. The oats export of 1875–'76 amounted to 1.14 per cent. of the total cereal export against 0.5 per cent. the previous year. The export of oats has never exceeded half of 1 per cent. of the crop of the previous calendar year. The aggregate value of the oats export was $588,583, or double that of the previous year. The average value per bushel was $0.40.1, the lowest figure of the last thirteen fiscal years. The maximum, $0.93.6, was in 1867–'68. The value of the oats-export was 0.45 per cent. of the total cereal export against 0.73 per cent. the previous year.

Barley.—The exports of barley were 317,781 bushels, or about three and a half times the aggregate of the previous year, and amounted to about 1.06 per cent. of the estimated crop of 1875. In most years the proportion falls below one-half of 1 per cent. The export is but 0.2 per cent. of the whole cereal export. In one year only did it reach one-half of 1 per cent., 1870–'71. The aggregate value of the export was $210,586, or three and a half times that of the previous year. The average value per bushel was $0.66.3 against $0.67.4 in 1874–'75. In value barley amounted to 0.23 per cent. of the total export against 0.15 per cent. the previous year.

The following analytical tables show the exports of wheat, corn, rye, oats, barley, flour, and meal for the thirteen fiscal years ending June 30, 1876, with their proportions and values:

Fiscal years.	FLOUR.			WHEAT.			WHEAT AND FLOUR, REDUCED.			PER CENT. OF FLOUR.	
	Barrels.	Aggregate value.	Average value per barrel.	Bushels.	Aggregate value.	Average value per bushel.	Bushels.	Aggregate value.	Average value per bushel.	Quantity.	Value.
1863-'64	3, 557, 347	$25, 588, 249	$7 19. 3	23, 681, 712	$31, 432, 133	$1 32. 7	41, 463, 447	$57, 020, 382	$1 37. 5	42. 89	44. 87
1864-'65	2, 604, 542	27, 222, 031	10 45. 2	9, 397, 152	19, 397, 197	1 95. 2	22, 959, 862	46, 619, 228	2 03. 0	56. 72	58. 39
1865-'66	2, 183, 050	18, 396, 686	8 42. 7	5, 579, 103	7, 842, 749	1 40. 6	16, 494, 353	26, 239, 435	1 59. 1	66. 17	70. 11
1866-'67	1, 300, 106	12, 803, 775	9 84. 7	6, 146, 411	7, 822, 555	1 27. 2	12, 646, 941	20, 626, 330	1 63. 1	51. 40	62. 07
1867-'68	2, 076, 423	20, 887, 798	10 05. 9	15, 940, 899	30, 247, 632	1 89. 7	26, 323, 014	51, 135, 430	1 94. 2	39. 44	40. 85
1868-'69	2, 431, 873	18, 813, 865	7 73. 2	17, 557, 836	24, 383, 259	1 38. 8	29, 717, 201	43, 297, 124	1 45. 7	40. 92	43. 45
1869-'70	3, 463, 333	21, 169, 593	6 11. 3	36, 584, 115	47, 171, 229	1 28. 9	53, 900, 780	68, 340, 822	1 26. 8	32. 13	30. 98
1870-'71	3, 653, 841	24, 093, 184	6 59. 4	34, 304, 906	45, 143, 424	1 31. 6	52, 574, 111	69, 236, 608	1 31. 7	34. 75	34. 79
1871-'72	2, 514, 535	17, 955, 684	7 14. 1	26, 423, 080	38, 915, 060	1 47. 2	38, 995, 755	56, 870, 744	1 45. 8	32. 24	31. 57
1872-'73	2, 562, 086	19, 381, 664	7 56. 5	39, 204, 285	51, 452, 254	1 31. 2	52, 014, 715	70, 833, 918	1 36. 1	24. 62	27. 36
1873-'74	4, 094, 094	29, 258, 094	7 14. 6	71, 039, 928	101, 421, 459	1 42. 8	91, 510, 398	130, 679, 553	1 42. 8	22. 37	22. 39
1874-'75	3, 973, 128	23, 712, 440	5 96. 8	53, 047, 177	59, 607, 863	1 12. 4	72, 912, 817	83, 320, 333	1 14. 3	27. 24	28. 45
1875-'76	3, 935, 512	24, 433, 470	6 20. 8	55, 073, 122	68, 382, 899	1 24. 1	74, 750, 682	92, 816, 369	1 24. 2	26. 32	26. 32

Fiscal years.	CORN-MEAL.			CORN.			CORN AND MEAL, REDUCED.			PER CENT. OF MEAL.	
	Barrels.	Aggregate value.	Average value per barrel.	Bushels.	Aggregate value.	Average value per bushel.	Bushels.	Aggregate value.	Average value per bushel.	Quantity.	Value.
1863-'64	262, 357	$1, 349, 765	$5 14. 5	4, 096, 624	$3, 353, 280	$0 81. 8	5, 146, 192	$4, 703, 045	$0 91. 4	20. 39	28. 69
1864-'65	199, 419	1, 489, 886	7 47. 1	2, 812, 726	3, 679, 133	1 30. 8	3, 610, 402	5, 169, 019	1 43. 1	22. 09	28. 63
1865-'66	237, 275	1, 129, 484	4 76. 0	13, 516, 651	11, 070, 395	81. 9	14, 465, 751	12, 199, 879	84. 2	6. 55	9. 26
1866-'67	284, 281	1, 555, 585	5 47. 2	14, 889, 823	14, 871, 092	99. 9	16, 026, 947	16, 426, 677	1 02. 5	7. 09	9. 47
1867-'68	336, 508	2, 068, 430	6 14. 7	11, 147, 490	13, 094, 036	1 17. 4	12, 493, 522	15, 162, 466	1 21. 4	10. 77	13. 64
1868-'69	309, 867	1, 656, 273	5 34. 5	7, 047, 197	6, 820, 719	96. 8	8, 286, 665	8, 476, 992	1 02. 3	14. 96	19. 54
1869-'70	187, 093	935, 676	5 00. 1	1, 392, 115	1, 287, 575	92. 5	2, 140, 487	2, 223, 251	1 03. 9	34. 96	42. 09
1870-'71	212, 641	951, 830	4 47. 6	9, 826, 309	7, 458, 997	75. 8	10, 676, 873	8, 410, 827	78. 8	7. 97	11. 32
1871-'72	308, 840	1, 214, 999	3 93. 4	34, 491, 650	23, 984, 365	69. 5	35, 727, 010	25, 199, 364	70. 5	3. 46	4. 82
1872-'73	403, 111	1, 474, 827	3 65. 8	38, 541, 930	23, 794, 694	61. 7	40, 154, 274	25, 269, 521	62. 9	4. 01	5. 84
1873-'74	387, 807	1, 529, 399	3 94. 4	34, 434, 606	24, 769, 951	71. 9	35, 985, 834	26, 299, 350	73. 1	4. 31	5. 81
1874-'75	291, 654	1, 290, 533	4 42. 5	28, 858, 420	24, 456, 937	84. 7	30, 025, 036	25, 747, 470	85. 7	3. 89	5. 01
1875-'76	354, 240	1, 305, 027	3 55. 6	49, 493, 572	33, 265, 280	67. 2	50, 910, 532	34, 570, 307	67. 9	2. 78	3. 77

Fiscal years.	Rye flour. Barrels.	Rye flour. Aggregate value.	Rye flour. Average value per barrel.	Rye. Bushels.	Rye. Aggregate value.	Rye. Average value per bushel.	Rye and flour reduced. Bushels.	Rye and flour reduced. Aggregate value.	Rye and flour reduced. Average value per bushel.	Per cent. of flour. Quantity.	Per cent. of flour. Value.
1863–'64	6,999	$37,991	$5 42.8	154,960	$150,109	$0 96.8	189,955	$188,100	$0 99.0	18.42	20.19
1864–'65	3,935	32,438	8 24.3	132,459	133,430	1 00.7	152,134	165,868	1 09.0	12.93	19.56
1865–'66	13,304	68,144	5 12.2	417,127	381,498	91.4	483,647	449,642	92.9	13.75	15.15
1866–'67	14,603	112,414	7 69.7	147,353	133,514	90.6	220,368	245,928	1 11.6	33.13	45.72
1867–'68	10,592	90,958	8 58.7	501,349	836,838	1 66.9	554,309	937,796	1 69.2	9.55	9.69
1868–'69	7,228	52,249	7 22.8	49,501	55,957	1 11.0	85,641	108,206	1 26.3	42.19	48.28
1869–'70	6,974	38,458	5 51.4	157,606	178,275	1 13.1	192,476	216,733	1 12.6	18.12	17.74
1870–'71	6,250	34,135	5 46.1	49,674	44,678	89.9	80,924	78,813	97.4	38.61	43.31
1871–'72	6,287	34,401	5 47.1	794,967	703,929	88.5	826,402	738,330	89.3	3.80	4.66
1872–'73	8,288	46,129	5 56.5	562,021	469,547	83.5	603,461	515,676	85.4	6.87	8.94
1873–'74	59,820	388,313	6 49.1	1,564,484	1,568,362	1 00.2	1,863,584	1,956,675	1 04.0	16.05	19.84
1874–'75	9,993	54,964	5 50.0	207,100	204,590	98.8	257,065	259,554	1 00.9	19.43	21.17
1875–'76	7,553	39,054	5 17.0	543,841	480,083	88.3	581,606	519,137	89.3	6.49	7.52

Fiscal years.	Oats. Bushels.	Oats. Aggregate value.	Oats. Average value per bushel.	Barley. Bushels.	Barley. Aggregate value.	Barley. Average value per bushel.	Total cereals. Bushels.	Total cereals. Aggregate value.	Total cereals. Average value per bushel.	Average of the monthly means of value of gold.
1863–'64	305,755	$268,345	$0 87.7	66,482	$64,423	$0 96.9	47,176,761	$62,244,295	$1 32	1.58 1/3
1864–'65	318,117	256,949	80.7	44,248	57,651	1 30.3	27,084,763	52,268,715	1 92.9	2.02 1/8
1865–'66	1,245,658	703,711	56.5	....	....	....	32,689,409	39,592,667	1 21	1.41 1/8
1866–'67	825,895	465,974	56.4	....	....	....	29,720,151	37,764,909	1 27.0	1.41 1/8
1867–'68	122,554	105,167	85.8	9,810	10,981	1 11.9	39,503,209	67,351,840	1 70.5	1.40 3/8
1868–'69	481,871	306,678	63.6	59,077	46,290	78.3	38,630,455	52,235,290	1 35.2	1.37 3/4
1869–'70	121,517	76,528	62.9	255,490	140,512	54.9	56,610,750	70,997,846	1 25.4	1.23 1/12
1870–'71	147,572	83,080	56.2	340,093	200,625	58.9	63,819,573	78,009,953	1 22.2	1.13 1/4
1871–'72	262,975	135,129	51.4	86,891	63,407	72.9	75,899,033	83,606,974	1 09.3	1.11 3/4
1872–'73	714,072	290,575	40.7	482,410	323,187	66.9	93,968,932	97,232,877	1 03.7	1.12 5/6
1873–'74	812,873	383,762	47.2	320,399	210,738	65.8	130,493,088	159,530,078	1 22.2	1.12 1/2
1874–'75	504,770	290,537	57.5	91,118	61,408	67.4	103,790,806	109,679,302	1 05.5	1.12 5/8
1875–'76	1,466,228	588,583	40.1	317,781	210,584	66.3	128,026,829	129,026,980	1 00.7	1.14 1/8

Proportions of the different grains in each annual export of the last thirteen fiscal years.

Fiscal years.	Wheat and flour.		Corn and meal.		Rye and flour.		Oats.		Barley.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1863–'64	87.9	91.60	10.91	6.34	0.4	0.26	0.65	0.37	0.14	0.13
1864–'65	84.77	89.10	13.33	9.79	0.48	0.31	1.18	0.48	0.16	0.21
1865–'66	50.45	66.27	44.25	30.81	1.48	1.1	3.81	1.77	......	......
1866–'67	42.55	54.61	53.92	43.49	0.74	0.65	2.77	1.23	......	......
1867–'68	66.63	75.92	31.45	22.51	1.37	1.39	0.31	0.16	0.02	0.02
1868–'69	76.92	82.88	21.45	16.23	0.22	0.2	1.25	0.6	0.15	0.12
1869–'70	95.21	96.25	3.78	3.00	0.36	0.3	0.21	0.11	0.45	0.24
1870–'71	82.38	88.75	16.73	10.78	0.13	0.11	0.23	0.10	0.53	0.30
1871–'72	51.37	68.5	47.07	30.35	1.09	0.75	0.34	0.16	0.11	0.68
1872–'73	55.35	72.84	42.73	25.98	0.65	0.53	0.76	0.30	0.51	0.35
1873–'74	70.12	81.9	27.49	16.48	1.42	1.22	0.62	0.24	0.24	0.16
1874–'75	70.25	75.96	28.90	23.47	0.19	0.23	0.38	0.26	0.09	0.05
1875–'76	58.31	71.93	39.76	26.86	0.45	0.42	1.14	0.45	0.20	0.16

DOMESTIC TRADE.

The following table shows the annual receipts of flour, meal, wheat, corn, rye, oats, and barley at the seven leading outports of our foreign trade during six calendar years:

Products.	1871.	1872.	1873.	1874.	1875.	1876.
Flour ... bbl.	9,709,695	9,239,559	10,300,848	11,476,184	10,889,544	10,889,306
Wheat ... bush.	43,497,362	28,188,129	52,938,252	63,308,229	54,938,667	43,074,032
Corn-meal ... bbl.	267,445	316,682	377,141	347,046	248,323	365,393
Corn ... bush.	53,251,350	77,586,345	51,407,806	54,857,006	51,961,559	88,758,833
Wheat, including flour .. do..	92,000,837	74,385,904	104,442,492	120,689,149	109,386,387	97,520,562
Corn, including meal ... do..	54,321,130	78,853,073	55,916,370	56,245,190	52,954,851	90,220,410
Oats ... do..	24,027,948	24,522,650	24,144,032	21,906,211	21,236,003	25,669,813
Rye ... do..	1,624,273	1,023,897	1,305,902	987,743	659,438	2,640,024
Barley ... do..	4,202,596	5,309,385	2,415,126	3,941,718	6,214,017	8,121,878
Total ...	176,176,784	184,094,909	188,223,922	203,770,011	190,450,699	224,172,687

The receipts at these ports—New York, Boston, Portland, Montreal, Philadelphia, Baltimore, and New Orleans—represent the great leading currents of our flour and grain movements, though these are but a small part of our total domestic trade. It will be noted that the aggregate operations along these lines of shipment during 1876 exceeded those of any former year in our history. All kinds of grain were marketed in increased quantities except wheat, which shows a falling off both as unground grain and in the form of flour. Our foreign export of flour during the fiscal year ending June 30, 1876, was less than 40 per cent. of what was sent to these outports during the calendar year 1876. The proportion was about the same during the three previous years. The exports of raw wheat, however, which include heavy shipments from the Pacific coast, far exceeded the receipts of these ports. Our corn exports were less than 57 per cent. of the receipts at the outports, rye about 22 per cent. oats about 5¾ per cent., barley less than 4 per cent. These facts partly indicate the very small proportion which our foreign trade bears to our domestic trade, even when our view is limited to wholesale operations on a large scale. The great mass of the shipments to seaboard markets supply only the home demand, either in city consumption, in the coasting trade, or in distribution to local markets by land carriage. When we extend our view and take into consideration the minor wholesale and the retail trades, our imposing foreign exports sink into comparative insignificance.

The following table shows the receipts and eastward shipments of flour and grain for the last four calendar years at the following western lake and river ports, viz, Chicago, Milwaukee, Toledo, Detroit, Cleveland, Saint Louis, Peoria, and Duluth:

Products.	1873.		1874.		1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Flour..bbl.	6,332,259	6,445,394	6,159,574	5,827,056	5,022,510	5,539,965	5,578,950	4, 997, 845
Wheat .bu.	68,108,613	57,995,184	78,860,187	60,301,991	70,669,657	57,899,899	55,834,141	48, 799, 613
Flour and wheat.bu.	99,769,908	89,221,154	109,658,057	89,437,271	95,782,207	85,599,724	83,728,891	73, 798, 838
Corn...bu.	61,249,356	49,776,823	57,393,142	44,572,481	48,989,721	43,979,250	81,654,249	75, 010, 881
Oats....bu.	30,208,074	21,482,214	26,842,681	16,701,265	25,341,390	19,322,370	24,881,498	20, 093, 245
Barley..bu.	6,394,538	4,259,376	6,554,296	3,061,182	6,233,151	2,814,470	8,937,089	3, 947, 086
Rye....bu.	1,763,177	1,348,459	1,598,943	2,994,947	2,829,494	927,340	2,854,900	2, 511, 047
Total...	199,335,053	167,089,026	202,047,119	156,767,156	179,175,963	152,143,154	201,456,627	175, 351, 097

The eastward shipments from these lake and river ports, it will be seen, were larger during 1876 than in any former year, constituting nearly 80 per cent. of the receipts of the seaboard ports. The remainder is made up of flour and grain from more southern and eastern ports. The shipments of the two previous years bore about the same proportion, those of 1873 being somewhat greater. The western ports shipped to the seaboard ports, in 1876, 87 per cent. of their entire receipts against 85 per cent. in 1875, 77 per cent. in 1874, and 83 per cent. in 1873. Of flour during 1876 they furnished over half the receipts of the seaboard ports, 80 per cent. of the flour and wheat consolidated; 86½ per cent. of the corn, 82 per cent. of the oats, and over 50 per cent. of the barley. The eastward shipments of rye were greater than the receipts at the seaboard ports; probably heavy shipments were made too late for acknowledgment during the year at the outports.

The increased demand for western flour and grain in the markets of the Eastern States is noteworthy in this connection. It is estimated that New York alone requires annually about 45,000,000 bushels of grain besides what is raised within her own borders. In the New England States the deficit of home production is still greater, while even in the agricultural States of Pennsylvania and Maryland the bread-crops fall short of the demand upon them. Southern wheat-production is still on too small a scale to meet home necessities, and hence, though some choice brands of flour and wheat are sent to the eastern markets and to Europe, a much greater amount is received from the Northwest.

In the distribution of this east-bound traffic the changes noted in the annual report of this Department for 1875 continued to operate through 1876. The encroachment of rail-routes upon water-routes was still more marked. The competition was very sharp, greatly narrowing the profits of the carrier. From Chicago to New York the rates of lake and canal transport, via Buffalo, during the navigation season of 1876, averaged 9.58 cents per bushel for wheat weighing 60 pounds per bushel, and 8.8 cents for corn weighing 56. Rail-transportation between the same points for grain of all sorts and grades averaged 13.5 cents per bushel from April 26 to May 5, and 12 cents from May 5 to December 18; after the close of the water-routes the tariff was raised to 18 cents. The rail-rates from Buffalo to New York were, in several instances, less than the canal-charges, which averaged 6.68 cents per bushel for wheat, and 6.02 cents for corn from Buffalo to New York. In 1876 the State toll on wheat was 0.0207 cents per bushel for wheat and 0.0193 cents for corn. During the current year these rates have fallen to 0.01035 cents for wheat and 0.00965 cents for corn. The comparative cost per ton of transporting wheat from Chicago to New York by lake and canal was $3.193, and for corn $3.093; the all-rail route averaged $4 for each. From Chicago to Buffalo, by lake, the charges were $0.967 and $0.943; from Buffalo to New York, $2.226 and $2.15. The canal-rates included the insurance paid by the carrier; on the lake the owner insured his own freight. Deducting canal-tolls, the carrier realized only 7.4 cents per bushel for transporting grain 1,419 miles against 30.3 cents in 1867. Water-freights have steadily declined ever since 1872. Including lake-insurance, transfer, and reshipment, the water-rates involved a cost nearly, if not quite, equal to the average railway-charges. The rail-routes presented specific advantages to shippers, such as greater dispatch, a smaller interest on ventures, and less liability to decay by heating. Both rail and water routes suffered from the great disproportion between eastward and west-ward bound freight, as the heavy agricultural products of the West required at least three tons for every one of the lighter wares of the East. A wide margin of profit on the east-bound freight was therefore necessary to make up the enforced loss of running so many empty cars westward. This disproportion was formerly as 4 to 1, but an increased demand for eastern products, especially coal, has reduced the disproportion. The increase of western population annually requires an increased import of eastern manufactures, which tend still further toward an equilibrium.

The reduction of lake and canal charges would have entirely destroyed the competition of this line but for the great improvements in transportation. Lake-vessels of 1,000 to 3,000 tons have driven the old fleet of 500-ton schooners out of the trade. Barges, also, have been introduced, vessels furnished with just enough rigging to enable them to take care of themselves in case of being accidentally turned adrift. A powerful tug-steamer transports from four to six of these barges loaded with 150,000 to 200,000 bushels of grain. These barges being graduated to the requirements of the New York canals, finally deliver their freight at tide-water without transshipment, thus saving heavy charges at Buffalo.

The monetary panic that has depressed business for nearly four years deprived the railroads of a large proportion of their carrying trade, especially west-bound freights. Our foreign import-trade fell off enormously, and western demand for eastern and European products has greatly declined. To compensate this loss, and to give employment to the enormous rolling-stock that had been accumulated by the railway lines, the latter enlarged their facilities and presented additional inducements for the shipment of western produce. The advantages of direct shipment to southern markets, and the removal of expensive transshipments of grain, made this method of transport more profitable to shippers than a considerably lower rate by water. It was found that grain in cars was much less liable to injury from heating than when stored in the damp holds of ships or in the immense bins of warehouses. The combined rolling-stock of the competing lines of railway-transport amounted to nearly 60,000 cars, capable of transporting 1,200,000 tons each trip. The Baltimore and Ohio and Pennsylvania Central Roads have shorter lines but heavier grades than the New York routes. Previous to February, 1876, the schedule of freight-charges was $2 per ton less to Baltimore and $1 per ton less to Philadelphia than to New York on all eastern-bound freight from competing points in the West. A drawback of 60 cents per ton was also allowed on corn exported making the cost of placing western corn on shipboard at Baltimore 7.28 cents per bushel and at Philadelphia 4.24 cents less than New York, while the ocean-freights showed scarcely any perceptible differences. These discriminations, with other expedients by the southern lines, drew an immense amount of trade from quarters that had formerly patronized the New York roads. The eastward movement of flour and grain by lake and canal via Buffalo fell from 50,854,076 bushels in 1873 to 27,773,977 bushels in 1876, or nearly one-half. The cost of winter-transport in the more genial southern railway belt is an important advantage, of which the Baltimore and Ohio and Pennsylvania Central lines have availed themselves to the utmost. The erection of large elevators at Baltimore and Philadelphia, and the general enlargement of facilities for foreign shipment at these two cities, have given special inducements to the grain-shippers of the West to choose these shorter lines to seaboard. How long this competition between rail and water routes will continue is a matter of speculation. During the year, shippers began to complain of lack of accommodations. It was stated that several of the railways were storing their cars on side-tracks and refusing to furnish facilities for transport except at higher rates. It was urged that the necessity of hauling so many extra cars westward, added to the cost of eastward transport, left no margin of profit, if indeed it did not entail a loss.

The supremacy of New York as an outport of our foreign trade in cereals is rapidly waning. In 1876 she retained but 48 per cent. of a trade which she once practically monopolized. How this will be when business shall have renewed its tone and our foreign-import trade its former relative dimensions, it is impossible to predict. The other great Atlantic ports are making strenuous efforts to retain and to enlarge that portion of the export trade which they have secured. New York capitalists have had their attention challenged to this great loss in their trade by the city press. The immense cost of transporting freight across Manhattan Island, which is alleged as one of the special difficulties at this point, estimated by the Shipping List at $26,000,000 per annum, is a tax upon the city trade which is difficult to understand, considering that a water-transport around the city is practicable, and that, if necessary, exports could be shipped from elevators on the west bank of the Hudson.

The tendencies to centralization of trade seem to have reached their limit, and now opposite tendencies begin to prevail. The indications of the present are that the opening of new grain-fields in the South and West will place our production in different relations to the lines of communication, and will cause a greater diffusion of this important traffic to different outlets at various points on our Atlantic coast.

The statistics of our leading grain-markets are given herewith.

NEW YORK.

The aggregate receipts of grain, flour, and meal at New York during 1876 were 95,610,563 bushels, against 91,685,890 in 1875, an increase of 4.1 per cent. Of this aggregate, 49.97 per cent. were wheat and flour, against 57 per cent. in 1875; the actual decline of these items was 6,620,934 bushels, or 12.28 per cent. from the receipts of 1875. Corn and corn-meal constituted 28.92 per cent. of the receipts, against 25 per cent. in 1875, showing an increase of 4,626,023 bushels, or 20 per cent., in the actual receipts of those articles. Oats constituted 12.81 per cent., about the same as in 1875, but the actual quantity received shows an increase of 1,615,187 bushels, or 15.19 per cent. Barley increased 2,068,934 bushels, or 44 per cent., and rye 1,325,463 bushels, making its receipts about five times those of the preceding year; the receipts of barley constituted about 7 per cent., and those of rye about 2 per cent. of the total receipts, against 5 per cent. and $1\frac{1}{3}$ per cent. the previous year.

The total exports of 1876 were 53,568,157 bushels, against 49,976,097 in 1875, an increase of 7.2 per cent. Of this aggregate $65\frac{2}{3}$ per cent. were wheat and flour, against 72 per cent. in 1875, showing an actual decline of 2,032,818 bushels, or 5 per cent. from the previous exports of the same articles. Corn and corn-meal constituted 32.84 per cent. of the total cereal export, against 27 per cent. in 1875, showing an actual increase of 4,921,582 bushels, or 27.9 per cent. over their previous export. The rye export amounted to $2\frac{1}{2}$ per cent. of the whole, showing an increase of 1,129,529, or five times the aggregate of the previous year. The oats export was about $1\frac{1}{6}$ per cent. of the whole and four times the oats export of 1875. Barley exports were quite insignificant. Of the two last named grains, nearly the whole receipts were required for city consumption.

The movements of grain, flour, and meal for the last five calendar years were as follows:

Products.	1872.		1873.		1874.	
	Receipts.	Exports.	Receipts.	Exports.	Receipts.	Exports.
Flour ....barrels.	3, 042, 907	1, 202, 792	3, 546, 568	1, 655, 331	4, 017, 207	2, 462, 723
Wheat ....bushels.	16, 238, 433	13, 299, 320	35, 559, 870	27, 801, 829	41, 817, 215	33, 541, 740
Corn-meal ....barrels.	178, 150	144, 530	211, 591	136, 084	178, 839	176, 393
Corn ....bushels.	40, 800, 939	25, 652, 603	24, 576, 345	15, 416, 787	29, 329, 000	26, 447, 807
Flour and wheat....bushels.	31, 452, 968	19, 313, 280	53, 292, 710	36, 078, 484	61, 903, 250	45, 855, 380
Corn and meal.........do....	41, 513, 539	26, 234, 723	25, 422, 709	15, 961, 123	30, 044, 356	27, 253, 379
Oats...................do....	12, 442, 127	32, 718	11, 235, 420	49, 573	10, 792, 919	122, 528
Rye ....do....	491, 851	623, 355	995, 447	1, 069, 140	592, 114	641, 661
Barley.................do....	3, 964, 441	17, 402	2, 444, 206	40, 040	2, 770, 000	3, 560
Total	89, 864, 926	46, 221, 478	93, 390, 492	53, 198, 360	106, 102, 639	73, 876, 508

Products.	1875.		1876.	
	Receipts.	Exports.	Receipts.	Exports.
Flour...barrels.	3. 941. 331	1, 953, 667	4, 051, 665	1, 914, 183
Wheat ....bushels.	34, 214, 768	26, 193, 693	27, 042, 164	24, 358, 295
Corn-meal.....................................barrels.	131, 885	178, 257	188, 277	178, 221
Corn ....bushels.	22, 488, 707	12, 955, 525	26, 899, 162	16, 877, 251
Flour and wheat ....bushels.	53, 921, 423	35, 962, 028	47, 300, 489	33, 929, 210
Corn and meal.................................do....	23, 016, 247	13, 668, 553	27, 652, 270	17, 590, 135
Oats...do....	10, 636, 078	138, 508	12, 251, 265	624, 431
Rye ....do....	301, 654	206, 898	1, 627, 007	1, 336, 423
Barley..do....	4, 710, 598	110	6, 779, 532	87, 958
Total	91. 686, 000	49, 976, 097	95, 610, 563	53, 568, 157

BOSTON.

Flour.—The receipts of flour during 1876 were 1,836,985 barrels, an increase from the previous year of 199,013, or over 12 per cent.; shipments, 268,093 barrels, a decrease of 3,077. Prices of the highest grades of flour were quite firm during the whole year. For local trade the best products of western mills are in constant requisition, and brands that are reliable, that fully maintain their standard, will always meet with ready sale, commanding from 25 to 50 cents per barrel more than brands whose reputation is not well established. The best patent flours sold at $8.50 to $10; the best Saint Louis and Illinois, $8 to $9; the best Ohio, Indiana, and Michigan, $6.50 to $7.50. Inferior flours are either exported abroad or shipped coastwise.

Wheat.—Receipts of 1876, 504,767 bushels, or less than half of those of 1875; shipments, 112,915 bushels, against 784,941 in 1875. The wheat trade of Boston has been of a fluctuating character, and has always been limited in extent, compared with other great markets. Of wheat and flour together the receipts of 1876 amounted to 9,689,692 bushels, an increase of 464,723, nearly as much as all receipts of raw wheat; shipments, 1,453,380 bushels, a decline of 687,411. Boston being almost exclusively a consuming market, the proportion of flour to grain is constantly increasing.

Corn.—Receipts of 1876, 9,005,375 bushels, a gain of 3,659,035, or over 68 per cent.; shipments, 4,160,817 bushels, a gain of 2,609,041, or 168 per cent. The extreme annual range of prices of corn for ten years past was as follows: 1867, $1.10 to $1.60; 1868, 95 cents to $1.42; 1869, 80 cents to $1.35; 1870, 78 cents to $1.25; 1871, 72 to 93 cents; 1872, 64 to 81 cents; 1873, 60 to 90 cents; 1874, 82 cents to $1.06; 1875, 65 to 93 cents; 1876, 58 to 75 cents. The corn-meal trade of Boston shows the receipts of from 80,000 to 100,000 barrels, the shipments taking nearly the whole of the receipts.

Oats.—The receipts of oats during 1876 were 2,622,150 bushels, a decline of 211,394, or nearly 8 per cent., the receipts being mostly for local consumption. The exports are too small to attract the notice of local statisticians and journalists; the range of prices in 1876 was from 30 to 58 cents per bushel, against 41 to 82 cents in 1875, and 52 to 72 cents in 1874.

Rye.—Receipts of 1876, 34,594 bushels, an increase of 6,716 over 1875; the receipts being mostly for local consumption; no shipments are noted. Prices ranged, in 1876, from 75 cents to $1 per bushel; in 1875, from 95 cents to $1.25; in 1874, from $1 to $1.25.

Barley.—Receipts of 1876, 798,689 bushels, an increase of 268,150 bushels, or 50 per cent.; no shipments noted.

The grain movements of the last five years were as follows:

Products.	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Flour ....barrels	1, 586, 017	217, 586	1, 795, 272	231, 361	1, 890, 487	287, 718
Wheat ....bushels.	402, 426	151, 860	880, 747	486, 128	1, 362, 017	1, 062, 366
Corn-meal ....barrels.	91, 538	63, 832	120, 296	84, 926	97, 938	76, 277
Corn ....bushels.	5, 090, 755	1, 673, 769	3, 558, 363	162, 739	3, 303, 641	380, 254
Wheat and flour....bushels.	8, 332, 511	1, 239, 790	9, 857, 107	1, 642, 933	10, 814, 452	2, 500, 956
Corn and corn-meal...do....	5, 456, 907	1, 929, 097	4, 039, 547	502, 433	3, 691, 793	685, 362
Oats.......................do...	2, 725, 641	....	3, 663, 364	....	3, 037, 269	....
Rye ....do....	13, 989	....	33, 335	....	34, 273	....
Barley ....do....	539, 038	....	332, 849	....	418, 615	....
Total.....................	17, 068, 086	....	17, 926, 202	....	17, 996, 402	....

Products.	1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.
Flour....barrels.	1, 637, 972	271, 170	1, 836, 985	268, 093
Wheat....bushels.	1, 035, 109	784, 941	504, 767	112, 915
Corn-meal....barrels.	84, 108	73, 848	81, 265	90, 106
Corn....bushels.	5, 346, 340	1, 551, 776	9, 005, 375	4, 169, 817
Wheat and flour....bushels.	9, 224, 969	2, 140, 791	9, 689, 692	1, 453, 380
Corn and corn-meal....do....	5, 682, 772	1, 847, 168	9, 331, 435	4, 521, 241
Oats....do....	2, 833, 544	....	2, 622, 150	....
Rye....do....	27, 878	....	34, 594	....
Barley....do....	530, 539	....	798, 689	....
Total....	18, 299, 702	....	22, 476, 560	....

The year 1876 shows the largest receipt of cereals on record. The increase, however, is chiefly in flour, corn, and barley, and is mostly to supply the demand of an increased local consumption.

PHILADELPHIA.

The flour and grain trade of Philadelphia exhibits a marked increase of volume, the receipts of 1876 amounting to 40,573,880 bushels, the largest aggregate in the history of the city. A considerable increase in flour is especially noticeable, which was due, most probably, to the increased consumption of the city for the subsistence of visitors at the great Centennial Exposition. Wheat and barley fell off, but corn, oats, and rye were marketed in greatly increased quantities, especially corn, of which the receipts were nearly triple those of 1875.

Flour.—The flour trade of 1876 was on the whole satisfactory to dealers, the receipts amounting to 970,781 barrels, against 922,190 barrels in 1875. The manufactures of the mills in and around the city amounted to 532,000 barrels, against 587,390 in 1875. The exports were 192,433 barrels, valued at $1,295,910, averaging $6.76 per barrel; the exports of 1875 were 160,748 barrels, valued at $943,107, averaging $5.86 per barrel. The greater part of this export goes to either the United Kingdom or its colonies, especially the British West Indies. An increased demand is also noted from South America and the West Indies generally. Patent flours from the Northwest are becoming quite popular in city consumption. Spring-wheat flour, since the recent improvements in its manufacture, has rivaled, if not surpassed, the finest brands of winter-wheat, and now commands the highest market price. Philadelphia, with increased facilities of transportation, is annually attracting a larger portion of this production. The mills of Philadelphia and its vicinity have also increased in number and efficiency. They sold more flour in 1876 than in any former year, though the number of barrels manufactured was not quite equal to that of 1875. The aggregate capacity of the city mills is estimated at 2,500 barrels in each twenty-four hours. Allowing sixty days in each year for repairs, there will remain about 250 working days, giving an aggregate production of 625,000 barrels per annum. The production of 1876, then, fell less than 15 per cent. short of the running capacity of the machinery. The grades of flour manufactured in Philadelphia have a wide range, but the bulk is made from prime red and amber wheat. The exports to South America and the West Indies are generally Pennsylvania and southern red and amber. Some spring-wheat is mixed with winter-wheat in the manufacture of low grades for the British markets. Prices ruled low during 1876. Superfine opened at \$4 to \$4.37½ on the 1st of January, fell to \$3.25 to \$3.50 June 1, but rallied gradually to \$3.50 to \$4 December 1; Pennsylvania extra to choice ranged from \$3.75 to \$6.25 in August and September to \$4.50 to \$6.75 in January; western extra to choice from \$4.25 to \$6.60 in March to \$5.25 to \$8 in June.

Wheat.—The receipts of wheat fell off considerably, being 4,485,000 bushels in 1876, against 5,550,800 bushels in 1875. The decline is attributed to the smaller number of direct orders from Europe. The quality of the receipts was mostly very good, the bulk being Pennsylvania and southern red and amber, which are great favorites with Philadelphia millers. Western red winter No. 1 and No. 2 were also received in considerable quantities and of superior quality. The western wheat trade has greatly increased of late years. Spring-wheat seems to be but little known in the market, from the fact that no quotations of prices are extant. Winter red ranged \$0.70 @ \$1.17 in August to \$1.15 @ \$1.42 in June; amber, from \$1.18 @ \$1.22½ in August to \$1.50 @ 1.55 in May; white, from \$1.20 @ \$1.30 in August to \$1.50 @ \$1.58 in April.

Corn.—The receipts of corn rose from 7,130,000 bushels in 1875 to 20,261,675 bushels in 1876, and that grain now stands at the head of the cereal products marketed at Philadelphia. With short supplies of wheat in the Old World in several years past, the use of corn as human aliment has become more general. The exports amounted to 16,790,691 bushels, valued at \$10,448,938, or nearly one-fifth of the aggregate value of the total foreign exports of the city. The exports from Philadelphia are mostly to the United Kingdom, but an increasing amount is annually shipped to Portugal and to Northern Europe. Italy used to import alcohol from the United States, but lately she has found it cheaper to import our corn and distil the spirit upon her own soil. Philadelphia has profited by this new trade movement. Prices were steady during the year, ranging from 51 @ 57 cents per bushel in September to 56 @ 68 cents in January. Of corn-meal the export amounted to 25,510 barrels, valued at \$81,096, against 26,367 barrels, valued at \$108,956, in 1875.

Oats.—The receipts of oats also showed a great increase, amounting to 4,484,000 bushels, against 3,820,400 bushels in 1875. Prices took a wide range, opening January 1 at 43 @ 50 cents per bushel, and gradually falling to 28 @ 41 cents December 1. The exports amounted to 861,176 bushels, valued at \$355,783; in 1875 the export was only 33,800 bushels, valued at \$22,104. This is one of the numerous facts illustrating the success of the late efforts of the business men of Philadelphia to secure a larger portion of the cereal trade of the country. The oats crop of 1876, from which the exports of the latter part of the year are mostly derived, was about 10 per cent. short of the crop of 1875; yet in spite of the shortened domestic supply, Philadelphia increased her export twenty-six fold.

Rye.—The receipts of rye also show an enormous rate of increase, rising from 187,550 bushels in 1875, to 679,100 bushels in 1876. The exports were 431,223 bushels, valued at \$345,867. The exports of rye in 1875 were too insignificant for even an official record. The exports of rye-flour amounted to 766 barrels, valued at \$3,80,4, against 543 barrels, valued at \$2,91,7, in 1875. Rye opened at 88 @ 90 cents January 1, rose to \$1.25@\$1.50 in May, and fell to 68@75 cents in November.

Barley.—The receipts of barley were 1,329,200 bushels in 1876, against 1,652,700 bushels in 1875. The exports of both years were too small to attract attention. All the barley brought to this market is for brewing, and hence the best qualities are in constant request, the receipts being mostly absorbed in the manufacture of beer, either in the city or its immediate neighborhood. Prices, January 1, were $0.70 @ $1.35 per bushel; became nominal in June, were quoted at 55 @ 95 cents in July, and rose to 60 @ 95 cents December 1. The brewers prefer malt of their own manufacture, or malted in the city malt-houses; but Canadian, northern, and western malt was marketed in large quantities during the year.

The receipts (not including the product of the city mills) and exports of flour and grain were as follows:

Products.	1873.		1874.		1875.		1876.	
	Receipts.	Exports.	Receipts.	Exports.	Receipts.	Exports.	Receipts.	Exports.
Flour.........bbls.	954, 680	142, 386	915, 636	....	922, 190	160, 748	970, 781	192, 433
Wheat.......bush.	4, 372, 800	1, 938, 310	5, 471, 700	....	5, 550, 800	3, 302, 054	4, 485, 000	2, 989, 704
Flour and wheat, bushels	9, 146, 200	2, 650, 240	10, 049, 880	....	10, 161, 750	4, 105, 794	9, 338, 905	3, 951, 869
Corn..........bush.	8, 233, 400	2, 002, 368	5, 954, 700	....	7, 130, 000	4, 601, 586	20, 261, 675	16, 790, 691
Oats............do..	5, 980, 565	....	4, 715, 000	....	3, 820, 400	33, 800	4, 484, 000	861, 176
Rye............do..	270, 600	....	210, 191	....	187, 550	....	679, 100	431, 223
Barley.........do..	1, 066, 392	....	1, 236, 392	....	1, 652, 700	....	1, 329, 200	....
Total	24, 697, 157	....	22, 156, 163	....	22, 952, 400	....	36, 092, 880	....

BALTIMORE.

The receipts of flour and grain at Baltimore during 1876 show an increase of nearly 60 per cent. compared with 1875, and nearly 50 per cent. compared with the great grain year of 1874. The increase is mostly in corn; the other items, excepting rye, show a decline. The most of this trade consists in flour, wheat, and corn.

Flour.—The Baltimore Flour and Corn Exchange reports the aggregate receipts of 1876 at 1,389,538 barrels, against 1,391,843 barrels in 1875, a decline of 2,305 barrels. This report does not include the coasting-trade with Richmond, Va., which in 1876 is estimated at 65,000 barrels, making the total receipts 1,454,538 barrels. Of the receipts, 321,852 were reported as contributed by the city mills, an aggregate which is considered as considerably below the truth. It should probably be placed as high as 400,000 barrels. Shipments to home points are not given. The foreign exports of 1876 amounted to 426,094, a decline of 6 per cent. from the figures of 1875. Of the exports of 1876, about 58 per cent. went to South America, 24 per cent. to the West Indies, and the remainder mostly to Europe, Great Britain taking 51,032 barrels. The character of the flour made by the Baltimore mills was fully maintained during the year. The wheat crop of the neighboring regions, upon which the city mills mostly depend for supply, was remarkably good, and the manufacture carefully conducted. The market ruled low for inferior brands during most of the year, but improved toward the close, rising full $1 per barrel above previous minimum quotations. High grades of city mills manufacture fluctuated with the cost of wheat. During the first three months the price ranged from $6.50 @ $7 per barrel, rising in May to $8, when a decline set in, which culminated in October at $6.25 @ $6.50 per barrel; a subsequent rise brought prices to $7.25 @ $7.50. Howard-street superfine opened at $4.25 @ $4.50 per barrel, declined late in the summer to $3.75 @ $4, and rose in December to $4.50 @ $5. Western extra opened at $4.50 @ $5.25, fell to $3.50 @ $4.25 late in the season, and rose to $5.25 @ $5.50 in the middle of December.

Wheat.—The receipts of wheat during 1876 were 3,945,247 bushels, a decline of 464,423 bushels, over 10 per cent., from the receipts of 1875. The foreign exports amounted to 1,659,861 bushels, a decline of 19 per cent. At the beginning of the year the stock left over from 1875 in the hands of millers and dealers amounted to 311,043 bushels, which, added to the current receipts, made the total stock in the market during the year 4,256,290 bushels. Of this amount, about 2,000,000 bushels were ground by the city mills, 1,659,861 bushels exported to foreign countries, about 100,000 bushels shipped coastwise or to millers of neighboring districts, with 247,856 bushels left in the elevators, and 248,573 in the hands of millers and dealers or on shipboard. The crop of 1875, in regions dependent upon the Baltimore market, was considerably shortened, which caused a reduction in the receipts of the first six months. The crop of 1876 being larger, the receipts were more abundant and of better quality. Southern red wheat, on the 1st of January, was quoted at $1.35 @ $1.45 per bushel. It showed a rising tendency through the winter and spring, reaching $1.40 @ $1.50 in May. Subsequently it declined as the prospects of the crop around Baltimore became more cheering, falling to $1.18 @ $1.22 in August, but rallied to the opening figures at the close of the year. Southern white exhibited about the same range of fluctuations, opening and closing at $1.45 @ $1.55. Of wheat, and flour reduced to wheat, the receipts amounted 10,892,937 bushels, a decline of 1,351,288, or 11 per cent., from 1875.

Corn.—Receipts, 24,684,230 bushels, an enormous increase over the receipts of 1875, which embraced but 9,567,141 bushels. This increase gives Baltimore the leadership in the corn trade among the distributive markets on the Atlantic coast. It results from a judicious management of the immense railroad facilities centering at Baltimore in offering differential rates of transportation for through freight. During the last seven months of the year the Baltimore and Ohio Railroad, competing with rivals farther north, put down the tariff on transportation to 17½ cents per cental from Chicago to Baltimore. Of the receipts, about 3,000,009 bushels came by the Chesapeake Bay. The stock on hand at the opening of the year was 155,385 bushels, which, added to the receipts, amounted to 24,839,615 bushels. This aggregate was disposed of as follows: Exported to foreign countries, 20,953,724 bushels; exported coastwise, 600,000 bushels; ground by city mills, 250,000; taken by distilleries, 350,000; taken for local wants, 1,200,000; stock left in elevators, 1,038,650; stock left in hands of millers and others and on shipboard, 447,241. The prices of southern white corn were uniformly lower than in 1875. The year's quotations opened at 48 @ 55 and closed at 55 @ 56, the maximum, 62 @ 63, being reported in April and May. Southern yellow averaged about the same.

Oats.—Receipts, 810,212 bushels, a decline of 167,302. The receipts were nearly all taken for home consumption, the shipments being too small to be worthy of notice. The receipts were cut down by a failure in the demand, caused by the inferior character of the crop as well as by the abundance of the hay crop of 1876, which largely superseded it as a feeding material. Prices were uniformly lower than during 1875; January 1, the quotations were 40 @ 50 cents; they gradually subsided to 30 @ 36 November 1, with a partial reaction toward the close of the year.

Rye.—Receipts 112,160 bushels, an increase of 37,631 bushels, or 50 per cent., over 1875. The annual receipts of the last few years show great variations, showing a fluctuating relation between supply and demand. Greater storage facilities for this branch of the grain trade, it is thought, would enlarge the local consumption, and induce a profitable foreign-export trade. Prices show a marked reduction all through the year. January opened at 78@85 cents, but quotations fell to 54@55, September 1, with a subsequent reaction, which carried them nearly up to their opening figures at the end of the year.

Barley.—No receipts of this grain are noted in the commercial reports of Baltimore.

The following table represents the flour and grain movements of the last five years:

Products	1872.		1873.		1874.	
	Receipts.	Foreign shipments.	Receipts.	Foreign shipments.	Receipts.	Foreign shipments.
Flour .... barrels..	1, 175, 967	282, 553	1, 312, 612	359, 566	1, 560, 997	474, 758
Wheat .... bushels..	2, 456, 100	88, 025	2, 810, 917	1, 158, 097	6, 456, 834	3, 556, 848
Flour and wheat .. bushels..	8, 335, 935	1, 500, 700	9, 373, 977	2, 955, 927	14, 261, 819	5, 930, 638
Corn .... do....	9, 045, 465	5, 157, 235	8, 330, 449	6, 003, 618	9, 355, 567	5, 959, 757
Oats .... do....	1, 959, 161	....	1, 255, 072	....	1, 149, 188	....
Rye .... do....	90, 938	....	100, 519	....	118, 634	....
Total...............	19, 431, 499	....	19, 060, 017	....	24, 885, 208	....

Products.	1875.		1876.	
	Receipts.	Foreign shipments.	Receipts.	Foreign shipments.
Flour .... barrels..	1, 391, 843	453, 000	1, 389, 538	426, 094
Wheat .... bushels..	4, 409, 670	2, 046, 430	3, 945, 247	1, 659, 861
Flour and wheat .... bushels..	11, 368, 885	4, 311, 430	10, 892, 937	3, 790, 331
Corn .... do....	9, 567, 141	6, 989, 807	24, 684, 230	20, 953, 724
Oats .... do....	977, 514	....	810, 212	....
Rye .... do....	74, 529	....	112, 160	....
Total...............	21, 988, 069	....	36, 499, 539	....

CINCINNATI.

The statistics of the flour and grain trade of Cincinnati are compiled chiefly from the annual reports of the chamber of commerce, and represent "commercial years" instead of calendar years. The report for the twelve months ending August 31, 1876, of course, shows but a small portion of the crops last harvested, and embraces mainly the crops of 1875. The flour trade during the last commercial year was very unsatisfactory both to millers and dealers. The wheat crop in many districts dependent on the Cincinnati market suffered serious disaster during the growing and harvest season of 1875, which not only reduced the amount of flour marketed, but rendered much of it very unsound. This is especially true of wheat in Ohio and Indiana, where destructive floods were numerous during the summer of 1875. The trade in raw grain, however, shows the same steady increase in the last commercial year that characterized it during several preceding years. Cincinnati, which has long been a large consuming market, is annually extending its distributive trade. This extension is partly the result of favorable railroad prices of transportation, while on the other hand the enlargement of the volume of that trade tends to perpetuate those favorable terms. Elevating machinery is being brought into play for the handling of grain, and all the modern improvements of a great grain market are in progress of construction or in contemplation. The Cincinnati Southern Railroad, now under construction, will open a still wider field of commercial enterprise, giving access to many southern interior markets with which Cincinnati traders have now no direct relations.

Flour.—Receipts of 1875-'76, 636,504 barrels, a decline of 61,074 barrels, or nearly 9 per cent., from the previous twelve months. Shipments, 396,217 barrels, a reduction of 77,243 barrels, or 16 per cent. The amount of unsound flour received was greater, perhaps, than during any previous year, on account of the poor wheat-crops of 1875. To meet the deficiency, winter-wheat from Michigan and Northern Ohio, which usually sought other markets, was imported by the millers; but the success of this expedient was by no means remarkable. An increased amount of spring-wheat flour from the Northwest was marketed here, and an increased demand for this article by bakers and families for home consumption was the result. The better grades of winter-wheat flour steadily gained ground in public favor; even the poorer classes are preferring high grades. Poor flour was abundant during the year, realizing but a limited demand for shipment, especially as Cincinnati prices were relatively higher than those of many other markets. The increased consumption of high grades left a smaller surplus for shipment. For these reasons and others, the shipments fell off in greater proportion than the receipts. Very little of speculation disturbed the regular course of the trade. The market during the year was languid. During the months immediately following the harvest of 1875 there was some activity, but this subsided after it was found that the reports of bad condition of the crop were greatly exaggerated. During the last five years family flour averaged $7.32 per barrel in 1871-'72, $7.46.8 in 1872-'73, $6.60.4 in 1873-'74, $5.43 in 1874-'75, $5.52.3 in 1875-'76. Extra flour, during the same years, respectively averaged $7.14.6, $7.15, $6.25.5, $5.18.3, and $4.65.6; superfine, during the same years, averaged $6.06, $5.56½, $5.06¼, $4.41.7, and $3.90.

Wheat.—The crop of 1875 was inferior, but a large surplus remained from the excellent crop of 1874 in first hands, which came into market in such quantities as to prevent a great rise in prices. It was also mixed with the imperfect new grain to improve the quality of the flour, but a considerable portion of the latter was found entirely unfit for milling, and hence was thrown into the feeding-trough. As the harvest of 1876 approached, the fine prospects of the crop greatly depressed the price of the old one. The demand, however, was good during the whole year. The receipts were 1,052,952 bushels, a decline from the preceding year of 82,436 bushels, or over 7 per cent. Shipments, 558,252 bushels; a decline of 42,370 bushels, or 7 per cent. As but little wheat was authoritatively graded during the year, it is difficult to compare prices. Sales were generally made by sample, and the average on the full range of samples was $1.10,17 per bushel, against $1.16,6 the preceding year.

Corn.—The corn trade exceeded that of any previous year, receipts, 4,115,564 bushels, an increase of 420,003 bushels, or over 11 per cent.; shipments, 1,028,325 bushels, an increase of 432,410 bushels, or 72 per cent. The crop of 1875 was very abundant, but in many regions dependent on the Cincinnati market it had not been secured in very good order, and hence it presented a very inferior quality. As but a small proportion could be graded as No. 2, a new grade (No. 3.) was established by authority of the chamber of commerce. At the opening of the commercial year the market showed considerable strength, prime mixed ear being quoted at 70 to 71 cents per bushel; but all through the year prices declined, with some partial reactions. The closing quotations were 44 to 47 cents. The annual average prices of this kind of corn for the last five commercial years, respectively, were as follows: 1871-'72, 45 cents; 1872-'73, 42.6 cents; 1873-'74, 60.5 cents; 1874-'75, 72.52 cents; 1875-'76, 51.62 cents.

Oats.—Notwithstanding the comparative failure of the oats-crop of 1875 in Kentucky and Southern Ohio and Indiana, the trade in this grain showed great enlargement. The receipts were 1,441,158 bushels, a gain of 117,778 bushels, or nearly 9 per cent. Shipments, 321,755 bushels, a gain of 128,513 bushels, or 66 per cent. Regions generally contributing to other markets came in to supply the deficiency of the districts immediately around the city. The northern counties of Ohio, Indiana, and Illinois furnished a good quality of feeding-oats, while Southern and Central Missouri sent some less desirable. The crop of 1874 went out at high prices. The crop of 1875 opened at 40 @ 52 cents for No. 2 mixed, but steadily declined until nearly the close of the year, reaching 31 to 35 cents at the end of August, 1876. The average price of this grade was 38 cents, against 59 cents in the preceding year and 48.2 cents in 1873–'74.

Rye.—The rye trade, on the whole, exceeded that of any previous year; receipts, 500,515 bushels, an increase of 164,105 bushels, or nearly 50 per cent.; shipments 178,403 bushels, an increase of 80,158, or over 81 per cent. The supply throughout the year was abundant, but the quality poor, having shared in the disasters of 1875, so fatal to the small grains of this region. A large part of the crop of Ohio, Indiana, and Illinois was returned as rejected. Its apparent lack of keeping qualities prevented speculation, as none desired to accumulate grain that showed tendency to spoil. Rye from Wisconsin and some from Kansas and Missouri was, on the whole, above this suspicion, but there were exceptions. Prices for No. 2 opened at 80 @ 82 cents, but shrunk through the whole year, with an occasional fitful reaction, and closed at 55 @ 58 cents. The average for the year was 74.4 cents per bushel, against \$1.05,8 the preceding year, 92.9 cents in 1873–'74, and 75.8 cents in 1872–'73. The samples of the crop of 1876, marketed at the close of the year, were good, on the whole, and indications of an abundant yield caused a decline in prices.

Barley.—The receipts exceeded those of any previous year, being 1,551,944 bushels, an increase of 442,251 bushels, or nearly 40 per cent. Shipments, 232,556 bushels, an increase of 149,823 bushels, or 181 per cent. The barley marketed was mostly inferior, but good samples came from California, Canada, and New York. The market was active and well supplied throughout the year. Owing to injuries from bad weather, very little of the barley in the market was graded. No. 2 spring opened at \$1.16 @ \$1.18, and fell off by November \$1 @ \$1.10; No. 2 fall appeared in the latter part of the year, ranging from 70 to 80 cents per bushel. It was mostly sold by sample, and that which approximated No. 2 fall averaged \$1.20 per bushel, against \$1.41 the preceding year.

The flour and grain movements at Cincinnati during the last five commercial years were as follows:

Products.	1871–'72.		1872–'73.		1873–'74.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Flour .... barrels..	582,930	410,501	765,469	560,829	774,916	551,774
Wheat .... bushels..	762,144	323,405	860,454	412,722	1,221,176	783,990
Flour and wheat .. bushels..	3,676,794	2,375,910	4,687,799	3,216,867	5,095,756	3,542,860
Corn .... do....	1,829,866	246,632	2,259,514	324,183	3,457,164	658,718
Oats .... do....	1,160,053	230,963	1,520,979	324,718	1,372,464	216,660
Rye .... do....	357,309	110,464	426,660	61,577	385,934	117,349
Barley .... do....	1,177,306	26,984	1,228,215	37,456	1,084,500	90,688
Total	8,201,328	2,990,953	10,123,227	3,961,801	11,395,818	4,626,275

Products.	1874-'75.		1875-'76.	
	Receipts.	Shipments.	Receipts.	Shipments.
Flour .... barrels..	697, 578	473, 460	636, 504	396, 217
Wheat .... bushels..	1, 135, 388	600, 622	1, 052, 952	558, 252
Flour and wheat .... bushels..	4, 623, 278	2, 967, 922	4, 235, 472	2, 539, 337
Corn .... do....	3, 695, 561	595, 915	4, 115, 564	1, 028, 325
Oats .... do....	1, 323, 380	193, 242	1, 441, 158	321, 755
Rye .... do....	336, 410	98, 245	500, 515	178, 403
Barley .... do....	1, 109, 693	82, 733	1, 551, 944	232, 556
Total	11, 088, 322	3, 938, 057	11, 844, 653	4, 300, 376

CHICAGO.

Flour.—The receipts of flour were 2,955,197 barrels, a gain of 329,314 barrels, or 12½ per cent., over 1875, and the shipments 2,634,838, a gain of 349,725, or 15 per cent. The city mills manufactured 271,074 barrels, against 249,653 in 1875; they were kept running during the whole year to nearly their full capacity. The city manufacture was confined mostly to three establishments. The market was generally quiet, and frequently dull. The wholesale trade, especially, was greatly reduced. Formerly trade was not considered as very active unless transactions involved the sale of 15,000 or 20,000 barrels per day. During 1876 few days exceeded 4,000 barrels, while the average of the year was not over 3,000 barrels per day. Yet with this low average of the wholesale trade the sales of 1876 somewhat exceeded those of 1875. The decline in wholesale transactions is due to the growing disposition of bakers and store-keepers to order direct from the mill and thus save one set of middlemen's profits. Much flour not handled by city operators was sent to Chicago to gain the benefit of the excellent inspection laws there in force. The increase in shipments prevented any great accumulation of stocks, and hence holders were not at any time under an undue pressure to sell. The city mills disposed of their products chiefly in direct sales to consumers or retail dealers.

A great change has taken place in later years in the character of the Chicago flour trade. The milling capacity of the Northwest has greatly increased. Formerly the country mills found it to their interest to send their stocks to Chicago, where a steady demand existed for shipment to the Eastern States and to Europe, but of later years they have established direct relations with the markets of consumption in the East, and now ship direct. The foreign export trade has been greatly affected by the improvements in handling grain by elevators, which have lessened the expense of shipping raw grain. English millers now purchase American wheat and largely mix it with cheaper wheats from Southeastern Europe and Egypt, thereby producing a flour which meets the great bulk of the home demand. The English mills have also extensively introduced the "middlings purifier," which enables them to extract a larger amount of flour than formerly from the crushed grain. This revival of the flour manufacture of England has especially curtailed the foreign export from Chicago, shifting the demand from flour to wheat. But the decline in shipments to the East and to Europe has been partly made up by an increase in local consumption and in the supply of neighboring regions. The spring-wheat flour of the Northwest, with its recent improvements in manufacture, is encroaching even upon the winter flour of regions farther south, and successfully competing with best white winter flour in all the leading markets of the country. A considerable foreign trade in bagged flour has sprung up, embracing grades below average spring extras. These bagged flours are mostly sent to Scotland and the north of England, where they meet a popular prejudice in favor of flour put up in this way. The quality of the flour made from the crop of 1875 was unsatisfactory, and especially destitute in keeping qualities. Hence there was no disposition to accumulate stocks. This kept the market steady in small transactions to meet current wants. The mixture of old wheat with new caused some prejudice against the crop of 1876, but its superiority soon became apparent. Kansas flour declined in receipts; its dark color overbalanced its other good qualities, and the demand became restricted. Nebraska mills have gained some reputation by samples already afforded, and an increasing trade in their flour is anticipated. The Department record of prices, compiled at the beginning of each month, shows that choice winter extras ranged from $6.50 to $7.87 per barrel during the year; patent springs, from $6 to $9; spring superfines, from $2.50 to $4. The maximum prices were in the early summer. The average price for the year for shipping extras was $4.75, against $4.92½ in 1875 and $5 in 1874. Minnesota flour of all grades averaged about $5.75.

Wheat.—The wheat trade fell off greatly in 1876; receipts, 16,574,058 bushels, a decline from 1875 of 7,632,312 bushels, or over 31 per cent.; shipments 14,361,950 bushels, a decline of 8,822,399, or 38 per cent. Prominent among the reasons of this diminished trade was the poor quality of the crop of 1875, together with the small demand for low grades, which constituted the greater portion of that crop. The close inspection which thus classified the crop was considered remarkably strict and deterred many shippers from passing their grain through this market by the fear that it would not meet the requirements of the board of trade. Yet, strict as it was, a large quantity of wheat graded as No. 2 was defective in the keeping qualities required for this grade, and injured the reputation of the market by heating in the bin. A combination was also formed for the shipment of the low grade wheats, representing them as equal to Chicago No. 2, but their deficiency in keeping qualities prevented their export to Europe, and they lay in New York magazines, slowly worked off to meet the demands of local consumption. This combination, though short lived and ending in serious disaster to all its participants, succeeded in injuring greatly the reputation of Chicago wheat. The market dragged heavily through the spring, and prices went down in consequence of exaggerated reports of the poor condition of the crop of 1875. Another combination during the summer quietly cornered the wheat-market and succeeded in bearing prices to a very low point, just in time to take advantage of a rise caused by threatening aspects of the Turkish question. A lack of transportation facilities eastward by rail was severely felt by shippers during the summer and fall. These are some of the causes alleged for the diminished wheat movement at this point. The following table shows the annual and monthly range and the average of prices of No. 2 spring-wheat during the year and for the last four years:

Month.	Lowest.	Highest.	Average.	Month.	Lowest.	Highest.	Average.
January	$0 95	$1 02¼	$0 98½	October	$1 05¼	$1 16½	$1 09½
February	97⅜	1 05	1 01¾	November	1 06¾	1 13⅞	1 10 5-6
March	96¾	1 05	1 00 4-5	December	1 14¾	1 20¾	1 19⅜
April	95½	1 05¼	1 01⅔				
May	95⅞	1 08	1 03	Year—			
June	1 02¼	1 08	1 04¼	1876	83	1 20¾	1 03
July	83	1 04¾	93½	1875	83½	1 31	1 02
August	84¼	97¼	89 9-10	1874	81½	1 28½	1 08
September	93⅞	1 11	1 03½	1873	89	1 40	1 17

The improvement in prices toward the close of the year is due to short crops in the Northwest, as well as to the better quality; there was a good demand for old wheat at the close of the year. Minnesota wheat has become quite popular with the English millers as one of the most available for mixing with other wheats, but the short crop of Minnesota in 1876 limited this branch of trade at Chicago.

Corn.—The corn trade of 1876 shows a great enlargement; the receipts were 48,668,640 bushels, an increase of 20,327,490 bushels, or over 71 per cent., over 1875; the shipments were 45,629,035 bushels, a gain of 19,185,151 bushels, or 73 per cent. This increased trade is attributed to the great yield of corn in 1875 and to its inferior condition, which made producers and traders indisposed to hoard it. It was gathered, generally, in a damp condition, and was destitute of keeping qualities. Complaints against the inspection authorities caused some changes in the official board, after which the complaints ceased. The crop of 1876 was abundant and good, and a general disposition to crib it caused the receipts to be light. It was secured generally in good order, and hence would bear keeping. The low prices offered at the close of the year presented but little inducement to holders to part with it. The range of prices was remarkably limited, and less disturbed by speculation than formerly. A systematic effort was made to enlarge the consumption of western corn in England, and a large quantity was shipped from Chicago. As long as the grain commanded at least 26 shillings per quarter in the European market, it was found profitable to ship it; but the supplies sent forward were in excess of the demand, and not over 25 shillings per quarter could be obtained for lots in good condition, while some that had been spoiled by heating on the passage were sold at 19 @ 22 shillings. The crop of 1875, not being in as good condition generally, as had been calculated, made a less favorable impression in England than had been anticipated, and this materially affected both the price and the demand. The annual and monthly range and average of prices of No. 2 corn during the year and the last four years were as follows:

Month.	Lowest.	Highest.	Average.	Month.	Lowest.	Highest.	Average.
January	$0 40	$0 47⅛	$0 43.4	October	$0 42	$0 46⅞	$0 43.6
February	38⅝	43	41.2	November	41¾	46½	43.85
March	42¼	47½	44.62	December	44⅛	46¾	45.26
April	44⅝	48¾	45.84	Year—			
May	44	49	46.3	1876	38⅝	49	44⅝
June	43¼	47⅝	45.7	1875	46	76¾	63¼
July	42⅝	48	45.61	1874	53	86	65
August	41¾	47⅛	44.65	1873	29	53¾	37
September	42½	47⅛	45.31				

Oats.—The market for oats exhibits a small increase in quantity but a decrease of nearly half in the value of the grain. The receipts were 13,030,121 bushels, against 12,916,428 in 1875; shipments, 11,271,642, against 10,279,134. The course of the market was regular, and the trade was remarkably free from corners; the disastrous results of the corner of 1875 still lingered as a warning in the memory of speculators, while the new rules of the board of trade rendered the process of combination more difficult. The natural play of supply and demand depressed prices, as the large surplus of the crop of 1875 was even larger than had been estimated. The shipping movement of the old crop was very satisfactory, being much larger than during the preceding year. The low grades mostly went to New York, and the higher to New England and Europe, especially to England, where the feeders found a profit in using our oats. The new crop of 1876 was poor and deficient, not so much in the number of measured bushels as in weight per bushel. Oats weighing 25 to 26 pound per measured bushel were graded as No. 2, while at least three-fourths of the offerings failed to meet even this poor test. The result was a great demoralization in the market. The new crop came in slowly, as holders, calculating from the short yield that prices would be higher, were disposed to hold on to their stocks. Western buyers did not care to take them, and hence they were sent forward to glut the eastern market. During the last five months of the year Chicago prices ruled relatively higher. The annual and monthly range and average of prices during the year and the last four years were as follows:

Month.	Lowest.	Highest.	Average.	Month.	Lowest.	Highest.	Average.
January	$0 29⅞	$0 31⅜	$0 30.6	October	31⅜	34⅛	32.87
February	30⅝	32½	31.4	November	30¾	33¼	32.21
March	31⅝	34¼	32.78	December	33	34⅛	33.74
April	30	33½	32.28				
May	28¼	31½	30.22	Year—			
June	28¾	31⅛	29.71	1876	27	35	31⅛
July	27	30¼	28.77	1875	29½	63	47
August	30	33	30.8	1874	37½	85	46
September	30⅞	35	33.42	1873	23¼	40½	28⅜

Rye.—The receipts nearly doubled, being 1,447,917 bushels in 1876, against 699,583 in 1875; the shipments were 1,433,976, against 310,592, an increase of fourfold. This great disproportion in the shipments was caused by the close of nearly all the distilleries for the winter, necessitating the shipment of the receipts to other markets. Prices dragged through the winter and spring, but in June a fair demand for European export arose, which advanced the prices of No. 2 to 72½ cents per bushel, but the free receipts of the new crop reduced quotations to 50 cents. With a partial rally prices remained steady to November, when reports of a short crop in Germany caused a rapid clearing of the rye-bins of Chicago for shipment to Europe, which strengthened prices. In December it was believed that most of the "visible supply" in the country was controlled by a single Chicago firm.

The annual and monthly range and average of prices during the year and the last four years were as follows:

Month.	Lowest.	Highest.	Average.	Month.	Lowest.	Highest.	Average.
January	$0 66	$0 67½	$0 66.7	October	$0 59	$0 62¾	$0 60.71
February	62	67½	65.26	November	56	67	61.63
March	60	66	64	December	67½	73	71.09
April	63	66	65.19				
May	61½	71	65.67	Year—			
June	67	72½	69.9	1876	50	73	63¾
July	50	67	59.78	1875	65	1 15	88¾
August	50	58	54	1874	77	1 01	....
September	57½	65⅛	62	1873	56	81	....

Barley.—Receipts 4,716,360 bushels, an increase of 1,609,063, or over 50 per cent.; shipments 2,687,932, an increase of 819,726, or 44 per cent. The market throughout the year was languid and unsatisfactory. The crop of 1875 in regions dependent on Chicago was poor, while Canada and New York raised abundant crops of good quality. This reduced prices to an unusual depression. An unsuccessful attempt at cornering brought heavy loss on the parties engaged in it; they were obliged to receive at 95 cents a large quantity of barley for which they

13 A

were glad to accept 40 cents in New York, the grain being fit only for feeding. The new crop was better than its predecessor, yet it was deficient in choice brewing grain, hence a large quantity was imported from California, Canada, and other quarters. The fall trade in western barley was, therefore, as unsatisfactory as in the previous part of the year. The low grades were shipped eastward for feeding, while the small proportion of No. 2 remained to be speculated on, though orders from the East were few. The annual and monthly range and average of prices for 1876 and for the last four years were as follows:

Month.	Lowest.	Highest.	Average.	Month.	Lowest.	Highest.	Average.
January	$0 75	$0 87	$0 81.31	October	$0 80	$0 95	$0 85.48
February	51	80	67.1	November	62	80	73.63
March	52	64	58.8	December	62¼	68¼	65.91
April	55¾	64	59.72				
May	62½	80	68.76	Year—			
June	55	63	59	1876	49	95	69.38
July	49	71	59.8	1875	81	1 40	126
August	69	80½	73.8	1874	81	2 00	....
September	72	88¼	79.5	1873	50	1 58	....

The flour and grain movement of the last five years may be summarized as follows:

Products.	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Flour .... barrels	1,532,014	1,361,328	2,457,376	2,303,490	2,666,679	2,306,576
Wheat .... bushels	12,724,141	12,160,046	26,266,562	24,455,657	29,764,622	27,634,587
Wheat and flour .... bushels	20,384,211	18,966,686	38,703,442	35,973,107	43,098,017	39,167,467
Corn .... do	47,366,087	47,013,552	34,157,232	36,754,943	35,799,638	32,705,224
Oats .... do	15,061,715	12,255,537	17,888,724	15,694,133	13,901,235	10,561,673
Rye .... do	1,129,086	776,805	1,189,464	960,613	791,182	335,077
Barley .... do	5,251,750	5,032,308	4,240,239	3,366,041	3,354,981	2,404,538
Total	89,192,849	84,044,858	100,179,101	92,748,837	96,945,053	85,173,979

Products.	1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.
Flour .... barrels	2,625,883	2,285,113	2,955,197	2,634,838
Wheat .... bushels	24,206,370	23,184,349	16,574,058	14,361,950
Wheat and flour .... bushels	37,335,785	34,609,914	31,350,043	27,536,140
Corn .... do	28,341,150	26,443,884	48,668,640	45,629,035
Oats .... do	12,916,428	10,279,134	13,030,121	11,271,642
Rye .... do	699,583	310,592	1,447,917	1,433,976
Barley .... do	3,107,297	1,868,206	4,716,360	2,687,932
Total	82,400,243	73,511,730	99,213,081	88,558,725

MILWAUKEE.

Flour.—The receipts of flour from other points during 1876 at Milwaukee amounted to 2,082,688 barrels, an increase compared with 1875 of 638,887 barrels, or over 44 per cent. The number of barrels manufactured was 647,581, a decline of 98,545 barrels, or 13 per cent., from the figures of 1875. The aggregate of receipts and manufactures of 1876 was 2,730,269, an increase of 540,342 barrels, or nearly 25 per cent., over the previous year. The total shipments amounted to 2,654,028 barrels, an increase of 490,682 barrels, or nearly 23 per cent. The deficiency of the wheat crop of 1876 in the region around Milwaukee had no perceptible effect upon the milling operations of the city till about the close of the year, when the depletion of interior stocks, especially of good wheat, began to appear. This deficiency in raw material indicated an enforced decline in the aggregates manufactured and marketed at least before the receipt of the crop of 1877. A comparatively small proportion of the flour from other points was for sale in the Milwaukee market, but was mostly received only for transshipment. Prices were generally steady and affected less than usual by the fluctuations of the wheat market, closing at an advance of 25 cents to 50 cents per barrel over the rates prevailing at the beginning of the year. Superfine spring brands opened and closed at $3 to $4 per barrel, running as low as $2.50 during the last weeks of summer. Spring extras advanced gradually, but without reaction, from $4.25 to $5.50 at the beginning to $4.87 to $5.75 at the close of the year. Fancy springs showed scarce a ripple of variation, ranging from $6 to $8.25. Winter extras gradually rose from $5.50 @ $6.50 to $5.75 @ $6.75. The latter ranged somewhat higher than extra State flour in the New York market, the quotations being carefully made on the same days.

Wheat.—The wheat trade of Milwaukee shows a very heavy decline, the receipts of 1876 amounting to 18,174,817 bushels, a decrease of 9,703,910 bushels, or nearly 35 per cent., from the receipts of 1875. The shipments were 16,804,394 bushels, a decline of 5,876,626 bushels, or 26 per cent., from the previous year. The deficiency occurred entirely within the latter half of the year. Unfavorable reports of the prospects of the crop began to tell upon the receipts even a month before harvest, and the subsequent confirmation of these reports by the results of the harvest produced a very marked deficiency. The receipts of the crop of 1876 during that year were only 7,083,777 bushels, against 14,302,942 in the previous year. The crop of 1876 was saved in excellent condition, and of its receipts at Milwaukee during the closing months of the year 12.14 per cent. were graded as No. 1, 54.26 per cent. as No. 2, 28.36 per cent. as No. 3, and the remainder, 5.24 per cent., as rejected. Of the receipts of the preceding crop of 1875, 26.72 per cent. graded as No. 1, 41.50 per cent. as No. 2, 26.89 per cent. as No. 3, and 4.89 per cent. as rejected. The relative quality of the receipts of the last twelve crops is shown in the following table:

Crop of—	No. 1 spring.	No. 2 spring.	No. 3 spring.	Rejected.	Crop of—	No. 1 spring.	No. 2 spring.	No. 3 spring.	Rejected.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1865	77	15.60	....	7.40	1871	28.09	68.99	2.82	0.10
1866	10.80	50.70	28.80	9.70	1872	23.40	69.40	7	0.20
1867	60.20	34.30	4.80	0.70	1873	29.5	64.3	5.90	0.23
1868	37.30	57.70	3.90	1.10	1874	35.67	57.31	6.60	0.42
1869	34.00	56	9.30	0.70	1875	26.72	41.50	26.89	4.89
1870	30.10	66.50	3.20	0.20	1876	12.14	51.26	28.36	5.24

The amount of wheat left over from 1875 was 3,266,966 bushels, which, added to the receipts, 18,174,817 bushels, made a total of 21,441,783 bushels handled during 1876. Of this aggregate 16,804,394 bushels were shipped to other points, and 2,914,214 bushels ground into flour by the city mills, leaving a balance at the close of the year of 1,723,175 bushels. No. 2 spring-wheat opened at 98½ @ 99 cents per bushel, and gradually rose, with a few minor reactions, to $1.03 @ $1.08½ in June.

During the summer it ranged much lower, going down to 89⅞ @ 91½ cents at the close of July. With the incoming crop, however, prices steadily rose, reaching \$1.26¾ @ \$1.27 December 30. The same grade of wheat was uniformly about 2 or 3 cents per bushel higher than in Chicago. A still greater difference is noted in the quotations of Milwaukee and Chicago No. 2 wheat in the New York market. This is attributed by Milwaukee statisticians to the higher requirements and more strict execution of their system of grading.

Corn.—The receipts of corn during 1876 were 798,458 bushels, against 949,605 in 1875, and 1,313,642 in 1874; shipments 96,908 bushels in 1876, 226,895 in 1875, and 556,563 in 1874. Nearly all the receipts of 1876 were taken for consumption in the city and at neighboring points. The decline in the corn trade is somewhat remarkable, in view of the immense yield of this crop for the past ten years and the marked increase of its production west of the Mississippi and in Wisconsin. Prices were comparatively steady during the year, opening at 46 cents per bushel and closing at 44½ cents; the maximum, 52 cents, was in the middle of May, and the minimum, 42 cents, at the close of January. These prices ranged from 3½ to 26 cents below those of 1875, and from 8 to 40 cents below those of 1874. The amount in store at the beginning of the year, left over from 1875, was 24,481 bushels, which, with the receipts, 798,458 bushels, made the amount handled during the year 822,939 bushels. Of this amount 716,381 bushels were taken for local consumption and 96,908 shipped to other points, leaving a surplus of 9,650 bushels.

Oats.—Receipts 1,745,673 bushels, against 1,643,132 in 1875; shipments 1,377,560 bushels, against 1,160,450. The abundance and cheapness of corn reduced somewhat the local consumption of oats. The receipts of the crop of 1875 during the first half of the year were of a superior quality, but the crop of 1876 was one of the poorest ever handled at Milwaukee. A very large proportion of the receipts weighed less than 28 pounds per bushel, and a very small part over 30 pounds. Prices opened at 31½ cents per bushel and closed at 33 cents, ranging from 5 to 30 cents below 1875. The surplus of 1875 in store at the begining of the year amounted to 66,568 bushels, which, added to the receipts, 1,745,673 bushels, made the total amount handled during the year 1,812,241 bushels. Of this amount local trade and consumption absorbed 301,372 bushels, and 1,377,560 bushels were shipped to other points, leaving a surplus at the end of the year of 133,309 bushels. Besides these aggregates, a considerable trade by farmers delivering with their own teams considerably swelled the local consumption, but of this class of receipts no account was taken.

Rye.—The receipts were 354,859 bushels, an increase of 124,025 bushels over 1875; shipments 220,964 bushels, a gain of 122,041 bushels. The crops of 1875 and 1876 marketed at Milwaukee were both large and of good quality, especially the former. The prices were steady during 1876, opening at 69 and closing at 72 cents, with a very narrow range of variation. Quotations were from 4 to 45 cents lower than in 1875. The surplus left over from 1875 was 10,622 bushels, which, added to the receipts, made the total amount handled during the year 365,481 bushels. Of this amount 220,964 bushels were shipped abroad, and 93,513 bushels taken for local consumption, leaving a surplus at the close of the year of 51,004 bushels.

Barley.—The receipts of barley in 1876 amounted to 1,857,208 bushels, an increase over 1875 of 570,623 bushels. The shipments were larger than in any former year, amounting to 1,235,481 bushels, against 867,970 in 1875, and 464,837 in 1874. The crop of 1875 was considerably damaged by rains during harvest; that of 1876 was saved in a much better condition, but was somewhat smaller in yield than its predecessor. Considerable quantities of old barley remained in hands of dealers up to harvest, and holders found some difficulty in disposing of it. The market was generally in favor of buyers and against holders. This made the profits of handling this crop very meager at best, while in many instances heavy losses were incurred. From the beginning of the year till the incoming of the new crop the tendency of the market was to lower prices, the resultant decline amounting to 30 cents per bushel. During the fall months prices occasionally rallied, but the improvement was not permanent, and the year closed upon a dull and declining market. Prices were at their maximum, 97 cents per bushel, at the begining of the year, and closed out at 80 cents, reaching the minimum of 60 cents in July; they ranged from 4 to 50 cents lower than in 1875. The amount in store at the beginning of the year was 167,510 bushels, which, added to the receipts, made a total of 2,297,329 bushels handled during the year. Of this amount, 1,235,481 bushels were shipped abroad and 822,735 bushels taken by the city brewers, leaving a surplus at the end of the year of 239,113 bushels.

The following table shows the flour and grain movements at Milwaukee during the last five years:

Products.	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Flour .... barrels..	834, 202	1, 231, 986	1, 254, 821	1, 805, 200	1, 616, 338	2, 217, 579
Wheat .... bushels..	13, 618, 959	11, 570, 575	28, 457, 937	24, 994, 266	25, 628, 143	22, 255, 380
Wheat and flour .. bushels..	17, 789, 969	17, 730, 505	34, 732, 042	34, 020, 266	33, 709, 833	33, 343, 275
Corn .... do....	2, 140, 178	1, 601, 412	921, 391	197, 920	1, 313, 642	556, 563
Oats .... do....	1, 597, 726	1, 338, 028	1, 763, 058	990, 525	1, 403, 869	726, 039
Rye .... do....	469, 573	209, 751	376, 634	255, 928	254, 522	74, 879
Barley .... do....	1, 447, 078	938, 725	1, 209, 474	688, 455	1, 683, 472	464, 837
Total	23, 393, 524	21, 818, 421	39, 002, 599	36, 153, 094	37, 795, 358	35, 165, 593

Products.	1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.
Flour .... barrels..	1, 443, 801	2, 163, 346	2, 082, 688	2, 654, 028
Wheat .... bushels..	27, 878, 727	22, 661, 020	18, 174, 817	16, 804, 394
Wheat and flour .... bushels..	35, 097, 732	33, 497, 750	28, 588, 257	30, 065, 034
Corn .... do....	949, 605	226, 895	798, 458	96, 908
Oats .... do....	1, 643, 132	1, 160, 450	1, 745, 673	1, 377, 560
Rye .... do....	230, 834	98, 923	354, 859	220, 964
Barley .... do....	1, 286, 585	867, 970	1, 857, 208	1, 235, 481
Total	39, 207, 888	35, 851, 988	33, 344, 455	32, 995, 947

PEORIA.

Flour.—The receipts of flour by river and rail amounted to 129,331 barrels in 1876, against 97,734 barrels in 1875. The city mills manufactured 200,000 barrels, an increase of 40,000 over the previous year. Receipts and manufactures in 1876, 329,331 barrels; in 1875, 257,734 barrels; total increase of receipts and manufactures, 71,597 barrels. Shipments in 1876, 178,512 barrels, against 134,919 in 1875. But few transactions in flour occur on 'change.

Wheat.—The receipts of 1876 were 677,647 bushels; of 1875, 831,039 bushels. The decrease in the receipts is attributed by local statisticans to the decreased yield of the wheat region dependent on the Peoria market. The deficiency is less in proportion than at other points. While the yield was below what was anticipated, the quality averaged well. The sales were principally to millers, the price varying in proportion to the quality and condition of the samples offered. Sales are uniformly by sample. The shipments of 1876 were 155,210 bushels, against 349,020 bushels in 1875. The falling off in the shipments being greater than in the receipts, shows an increased surplus left for manufacture by the city mills. Most of the sales on 'change were to millers for domestic manufacture. Prices of No. 1 winter opened at $1.12 @ $1.25 per bushel in January, attained its maximum, $1.47 @ $1.50, in March, and fell to $1.10 @ $1.12 in September, after which no quotations are reported. No. 2 winter opened at $1.10, rose to $1.28 @ 1.37 in the beginning of April, and closed the year at $1.15 @ $1.20. No. 1 spring received but little notice; No. 2 opened at 80 @ 90 cents, and closed at its maximum, $1.20 @ $1.26; No. 3 spring opened at 75 @ 82½ cents, and closed at $1.09 @ $1.15.

Corn.—The crop of the corn region dependent on the Peoria market was, on the whole, of fair yield and of better quality than in 1875. This accounts for the increased receipts, amounting to 7,662,695 bushels, against 6,206,300 in 1875, and constituting the heaviest supply ever received in the city in any one year. The shipments were 5,367,050 bushels, against 4,211,340 in 1875. Prices ruled much lower than in 1875, the maximum price of high mixed in store being 47 cents per bushel, rarely falling below 42 cents, except in the early part of the year, when a few sales were made at 35 cents.

Oats.—The receipts of oats during 1876 were 3,418,810 bushels, against 3,981,115 bushels in 1875. Shipments of 1876, 3,236,050 bushels, against 4,169,025 bushels in 1875. The crop of the neighboring region was poor and unsatisfactory both in quantity and quality, much of it falling considerably below the standard weight. Prices ranged from 24½ cents per bushel to 32½ cents for No. 2 in store.

Rye.—The rye-crop of the neighboring country being unusually abundant and of good quality, the receipts at Peoria showed a considerable increase, amounting to 669,135 bushels in 1876, against 609,985 in 1875. Shipments, 589,330 bushels in 1876, against 442,255 in 1875. At the opening of the year No. 2 in store stood at 66 cents per bushel, declined to 48 cents in August, rallying gradually to 67 @ 68 cents at the close of the year.

Barley.—The barley crop of 1876 was also abundant around Peoria, though somewhat damaged by rains in harvest, rendering the most of this grain unfit for brewing; hence prices were low, and as sales were by sample, no definite report of prices was recorded. Receipts, 714,090 bushels in 1876, against 439,938 in 1875. Shipments, 271,740 bushels, against 263,990.

SAINT LOUIS.

The flour and grain trade of Saint Louis during 1876 was the largest ever known, showing an aggregate of receipts 25 per cent. greater than those of 1875, and 11½ per cent. greater than those of 1874, the maximum of previous years. This is attributed in great part to the improved facilities in transportation and the reduced tariff of railway freights eastward. The merchants of Saint Louis have long urged the chronic grievance of unjust discrimination on the part of railway companies against the interests of that city. Although the terminus of fifteen railroads, Saint Louis has been treated as a way station. But this discrimination has finally been removed through the energetic associated efforts of the mercantile interest so far as the lines running eastward are concerned, and the same benefit is expected to result from the influences brought to bear upon the southern roads. The Mississippi River remained open during the year up to December 3, and steamer freights were reduced to a point which threatened at times to ruin the river-carrying trade. These are some of the changes to which may be attributed the great enhancement of the flour and grain trade in 1876.

Flour.—The flour trade shows a decline in all its branches. The receipts from other points were 1,071,434 barrels, a reduction of 228,947 barrels compared with 1875; 1,441,944 barrels were manufactured, or 42,877 barrels less than the previous year; 254,596 barrels were shipped by Saint Louis merchants from country mills direct to eastern markets, or 50,125 barrels less than in 1875. The total number of barrels thus received, manufactured, and shipped was 2,767,974, a decline of 321,949 barrels compared with 1875.

The decline in the receipts is greatest in the spring-wheat brands from the North. This is supposed to be due to the general adoption of the "new process" in the northwestern spring-wheat region, especially to the west of the Mississippi River. The receipts of this class of flour amounted to only 65,958 barrels in 1876, against 142,393 barrels in 1875. To a great extent, however, this falling off was compensated by an increase in the receipts of brands made of low-grade and rejected winter-wheat. The receipts from Ohio, Indiana, and Illinois also declined, on account of the short crops in those States and the inferior quality of the wheat harvested. Receipts by the southern roads also declined, but those from the West slightly increased.

The falling off in city manufacture is largely due to the destruction by fire of the Anchor Mills, the largest in the city, which in 1875 produced 186,867 barrels. These mills were not rebuilt till the close of the year. There are now in the city twenty-five flouring-mills, with an aggregate capacity for the production of 10,350 barrels per day, or 3,239,550 per annum. Allowing each mill sixty days in each year for repairs, the milling capacity of Saint Louis may be approximately stated at 2,500,000 barrels per annum. Less than half this capacity was used during 1876, for a variety of reasons. The wheat-crop of 1875 was injured before and after harvest by incessant rains in the wheat region tributary to Saint Louis manufacture. Business depression also restricted trade to an unusual degree during the first half of 1876, and produced very unsatisfactory results. But the crop of 1876, constituting the greater part of the wheat ground in the latter half of the year, was of excellent quality and secured in good order, but heavy rains left the wheat marketed in the earlier part of the season too tough for good grinding, except at the rate of two-thirds the usual daily production. The flour produced during this period of enforced slow grinding proved to be of excellent quality, which induced large purchases by eastern dealers, especially in New England. Toward the close of the year it was not unusual to find the product of both city and country mills sold ahead for two to four weeks. This demand, in part, resulted from the threatening aspects of the European eastern question and the probabilities that only the sword could disentangle its complications. But in November eastward railroad-freights made a rapid advance, which caused a corresponding advance in prices and a consequent decline in purchases. Several causes conspired at the close of the year to enhance the price of wheat, and the shrinking of the margin of manufacturing profit caused the mills to reduce their product. The same causes operated to reduce the amount shipped directly from country mills by Saint Louis dealers. The stock on hand January 1, 1876, and left over from 1875, was 161,880 barrels, making the whole amount handled during the year 2,929,854 barrels. Of the shipments, 2,217,578 barrels were direct from the city and 254,596 barrels from country points, as before stated; 319,898 barrels were taken for city consumption, leaving on hand, December 31, 137,782 barrels. Of the shipments, 1,205,129 barrels were sent southward, against 1,440,680 in 1875, and 978,689 eastward, against 1,006,475 the previous year; down-river steamers took 768,304 barrels and up-river steamers 46,881. The heaviest railroad shipment, by the Indianapolis and Saint Louis Railroad, was 368,980 barrels, an aggregate nearly equaled by the Saint Louis, Iron Mountain and Southern, and by the Chicago, Alton and Saint Louis Road. In spite of the diminution in receipts and manufactures, the trade was unusually satisfactory both to millers and traders. The reduction is believed to be only temporary, while the business has been placed on a more profitable basis than in former years. An increased manufacture in years to come is confidently predicted.

The total amount of flour handled by Saint Louis millers and dealers during the last eight years was as follows:

	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
Received	1,310,555	1,491,626	1,428,408	1,259,933	1,296,457	1,683,898	1,300,381	1,071,434
Manufactured	1,068,592	1,351,773	1,507,915	1,294,798	1,420,287	1,573,202	1,481,821	1,441,944
Sold direct from country mills	297,860	407,561	364,043	440,631	324,891	228,789	304,721	254,596
Total	2,677,007	3,250,960	3,300,366	2,995,362	3,041,635	3,485,889	3,089,923	2,767,974
Shipments	2,172,761	1,790,739	2,676,525	2,247,040	2,506,215	2,981,760	2,480,877	2,217,578

The stocks of flour left in store at the close of each of the last eleven years were as follows: 1866, 53,678 barrels; 1867, 52,690 barrels; 1868, 51,686 barrels; 1869, 70,321 barrels; 1870, 88,126 barrels; 1871, 151,683 barrels; 1872, 132,302 barrels; 1873, 58,848 barrels; 1874, 117,261 barrels; 1875, 161,880 barrels; 1876, 137,782 barrels.

These figures show that while the operations in flour have not very greatly varied in volume, the amount manufactured has steadily increased. Over two-thirds of the wheat received at Saint Louis is ground by her own mills. She still retains unimpaired her ascendency as the greatest flour-manufacturing center in the world.

The prices of flour were remarkably uniform during the year. Winter family opened at $6.50 to $7.50, and closed the year about the same, reaching a maximum of $7 to $8 in April, and falling to $6 @ $6.85 in September. Extra opened at $4.25 @ $4.50 and closed at $4.60 @ $5.10. It fell to $3.10 @ $3.90 in June, and rose gradually to its maximum at the close of the year.

Wheat.—The trade in wheat shows a marked increase, the receipts during 1876 being 8,037,574 bushels, against 7,604,265 bushels in 1875. Saint Louis merchants also shipped direct from country points 64,350 bushels. There were left over from 1875 772,866 bushels, making a total handled during the year of 8,874,790 bushels. Of this aggregate, 2,630,007 bushels were shipped direct to other points, 64,350 bushels from points outside the city, and 5,669,477 bushels ground by the city mills into flour, leaving a surplus at the close of the year of 510,956 bushels. The supply of wheat from the West shows a marked increase. The supply from that quarter rose from 2,830,707 bushels in 1875 to 3,862,346 in 1876. From the South receipts fell off about 700,000 bushels, and from Southern Illinois and points on the Ohio River about 100,000 bushels. But from railroads running through Northern and Central Illinois the receipts increased from 1,104,273 bushels to 1,613,048. The east and west zone, of which Saint Louis may be called the center, greatly increased its contributions, while the territory to the north and south fell off. The crop of 1875 in Missouri fell short of its predecessor, being 11,160,000 bushels, against 15,385,000 in 1874. The crop of 1875 was saved in poor condition, but that of 1876, covering the receipts of the last half of the year, was generally satisfactory, though the proportion of No. 2 wheat was smaller than was anticipated at harvest. The export demand was unusually great, causing a shipment of 2,630,007 bushels, or about 60 per cent. greater than in 1875. The city mills converted into flour 5,669,477 bushels. Over half the shipments were by the Toledo, Wabash and Western Railroad, and less than 200,000 bushels, north and south, by river.

The market for red winter-wheat No. 2 opened January 3 at \$1.41½ @ \$1.42 per bushel. It gradually declined, with a few feeble reactions, to \$1.38 @ \$1.39 at the close of the year. No. 3 opened at \$1.27, and went down to 95 cents in July, but rallied slowly, reaching \$1.33½ @ \$1.34 at the end of the year.

Corn.—The great increase in the grain trade is found in corn, of which the receipts in 1876 were 15,249,909 bushels, against 6,710,263 bushels in 1875, and 6,991,677 bushels in 1874. This increase was mostly by the western railroads and the Missouri River, which together brought 12,095,646 bushels in 1876, against 2,337,342 bushels in 1875. The Missouri, Kansas and Texas Railroad increased its freight from 18,407 bushels in 1875 to 1,147,390 bushels in 1876. The receipts by eastern railroads and the Illinois River fell off 1,274,350, while the northern lines of rail and river declined over a million bushels. Besides the city receipts, the amount shipped by Saint Louis dealers direct from points in the country amounted to 687,447 bushels. There were from 1875 412,598 bushels, making the total amount handled during the year 16,349,954 bushels. Of this aggregate 12,728,849 bushels were shipped to various points, the leading lines of shipment being the Ohio and Mississippi Railroad, which took 4,133,057 bushels; the Toledo, Wabash and Western road taking 2,865,798 bushels; the New Orleans steamers taking 2,379,982 bushels; the Indianapolis and Saint Louis road taking 1,662,905 bushels, &c. The city mills ground into corn-meal 1,711,812 bushels, and other branches of local consumption absorbed 668,774 bushels, leaving a surplus at the end of the year of 553,072 bushels. The corn-crop of Missouri in 1875 was very large, being estimated at 128,000,000 bushels, having been a comparative failure in 1874. The corn-meal manufactured amounted to 427,953 barrels in 1876; 480,557, in 1875; 451,577, in 1874; 422,534, in 1873; 264,722, in 1872; 213,418, in 1871; 165,231, in 1870; and 107,877, in 1869. This branch of manufacture, though exhibiting some diminution of results in the last year, is regarded as on the advance in real prosperity, and as promising a considerable enlargement in the years to come. Of hominy and corn-grits, the mills turned out 19,004 barrels in 1876; 19,631, in 1875; 20,488, in 1874; 26,573, in 1873; 13,109, in 1872; 12,615, in 1871; 13,002, in 1870; and 8,910, in 1871. The receipts of corn-meal from without amounted in 1876 to 17,763 barrels, being about half of the receipts of 1874 and one-third of those of 1872. This trade is declining.

Corn No. 2 mixed opened on the 3d of January at $37\frac{1}{2}$ @ $38\frac{1}{4}$ cents; rose to its maximum quotations, $48\frac{1}{4}$ @ $48\frac{1}{2}$ cents, in April, and then, with some fluctuations, fell to 39 @ $39\frac{1}{2}$ cents at the close of the year. Corn-meal, city kiln-dried, ranged with little variation during the year from $2.10 to $2.55 per. barrel.

Oats.—The oats trade shows a considerable decline in 1876, the receipts being only 3,660,912 bushels, against 5,006,850 bushels in 1875. There were also shipped direct from country points 8,360 bushels; the surplus left over from 1875 was 89,078 bushels, making the total amount handled during the year 3,758,350 bushels. Of this amount 1,932,982 bushels were shipped abroad, 1,662,805 were taken for local consumption, and 154,202 were left over at the close of the year. The decrease in receipts was found mostly in the North and West; eastern and southern supplies were slightly in advance of last year. Nearly all the exports went South, only 107,206 bushels being sent eastward. The crop of 1875 was light in quantity and weight throughout the West, and very unsatisfactory to both buyers and sellers.

Prices showed no great fluctuations; No. 2 mixed opening at $34\frac{1}{2}$ @ 35 cents at the beginning of the year and closing at $32\frac{1}{2}$ @ 33 cents, with a fall to 29 cents about the end of July.

Rye.—The receipts of rye were 399,826 bushels, against 275,200 in 1875. There were also shipped from points in the country 345 bushels. Adding 26,589 bushels, the surplus remaining over from 1875, the total amount handled was 426,760 bushels. Of this amount 304,192 bushels were shipped to other points, and 71,269 were ground in the city mills, leaving a surplus at the close of the year of 50,954 bushels. Of rye flour there were manufactured in Saint Louis 23,310 barrels in 1876, 19,303 in 1875, 21,432 in 1874, 19,475 in 1873, 14,060 in 1872, 19,307 in 1871, 8,558 in 1870, and about 15,000 in 1869. Prices of rye No. 2 opened at the beginning of the year at 67 cents per bushel and closed at $70\frac{1}{2}$ cents, the lowest point being 59 cents, in July and August. Rye-flour was very uniform in price, being quoted at $4.25 @ $4.75 per barrel on the 1st of January, and $4.50 @ $5 on the 1st of December; the minimum, $4 @ $4.50, was during July and August.

Barley.—The barley trade was larger than during any previous year, the receipts reaching 1,492,985 bushels. The surplus left over from 1875 was 117,815 bushels, making the total amount handled during the year 1,610,800. The receipts were considerably in advance of those of 1875, which were 1,175,337 bushels. Of the receipts 223,680 bushels were shipped to other points, and 1,187,434 bushels taken for city consumption, leaving a surplus at the end of the year of 199,686 bushels. Of the receipts 493,845 bushels were from the North, being grown mostly in Minnesota; 458,783 bushels were brought from the East, a small proportion coming from Canada; a little came up the Mississippi, and 441,716 bushels from the West. The receipts from Minnesota, both in quantity and quality, surpassed those of any former year, excelling even the Canada barley. The fair weather of October and good prices prompted the farmers to market their stocks with great freedom. Brewers also purchased large supplies for storage, filling their bins almost to their utmost capacity. This caused a slack demand after November 1 for all inferior grades. The crops of Kansas were abundant, but of inferior quality. Iowa barley was scarce and poor. In the latter part of September Texas sent some good winter-barley to this market. California barley was of better quality and lower price than in 1875. The amount of beer manufactured was 477,123 barrels, and of ale 1,996 barrels.

The flour and grain movements at Saint Louis for the last five years were as follows:

Products.	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Flour..............barrels..	1, 259, 933	2, 247, 040	1, 296, 457	2, 506, 215	1, 683, 898	2, 981, 760
Wheat............bushels..	6, 007, 987	918, 477	6, 185, 038	1, 210, 286	8, 255, 221	1, 938, 841
Corn.................do....	9, 479, 387	8, 079, 739	7, 701, 187	5, 260, 916	6, 991, 677	4, 148, 556
Corn-meal..........barrels..	51, 207	234, 938	39, 278	358, 736	34, 595	402, 871
Flour and wheat...bushels..	12, 307, 652	12, 153, 677	12, 667, 323	13, 741, 361	16, 674, 711	16, 847, 641
Corn and corn-meal...do....	9, 684, 215	9, 019, 491	7, 858, 299	6, 695, 860	7, 130, 057	5, 760, 040
Oats.................do....	5, 467, 800	3, 467, 594	5, 359, 853	3, 215, 206	5, 296, 967	3, 027, 663
Rye..................do....	377, 587	150, 208	356, 580	206, 652	288, 743	166, 133
Barley...............do....	1, 263, 486	87, 566	1, 158, 615	125, 604	1, 421, 406	227, 418
Total................	29, 100, 740	24, 878, 536	27, 400, 670	23, 984, 683	30, 811, 884	26, 028, 895

Products.	1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.
Flour....................................barrels..	1, 300, 381	2, 480, 877	1, 071, 434	2, 217, 578
Wheat....................................bushels..	7, 604, 265	1, 562, 453	8, 037, 574	2, 630, 007
Corn..do....	6, 710, 263	3, 523, 974	15, 249, 909	12, 728, 849
Corn-meal................................, barrels..	31, 706	420, 399	17, 768	383, 242
Flour and wheat..........................bushels..	14, 106, 170	13, 966, 838	13, 394, 744	13, 717, 897
Corn and corn-meal.........................do....	6, 837, 087	5, 205, 570	15, 320, 981	14, 018, 817
Oats..do....	5, 006, 850	2, 877, 035	3, 660, 912	1, 932, 983
Rye...do....	275, 200	134, 960	399, 826	304, 192
Barley......................................do....	1, 171, 337	146, 330	1, 492, 985	223, 680
Total..	27, 396, 644	22, 330, 733	34, 269, 448	30, 197, 569

SAN FRANCISCO.

Flour.—The flour trade and manufacture of San Francisco has rapidly increased during the last few years. The receipts of the calendar year 1876 were 560,881 barrels, against 513,586 barrels in 1875. The barrel on the Pacific slope contains 2 centals, or 200 pounds, 4 pounds larger than the barrel used on the Atlantic slope or in the Mississippi Valley. The exports by sea for 1876 were 508,143 barrels, the declared value of which was $2,560,759; the export of 1875 was 497,163 barrels, valued at $2,476,151. From the way in which the statistical records are kept, it will be easier to give the receipts and exports by "harvest years" than by calendar years. The harvest year closes June 30 of each calendar year, beginning with July 1 of the preceding year. A consolidated statement of the receipts and exports of flour and wheat will be found below.

Flour in the San Francisco market is arranged mostly in three grades: superfine, extra-superfine, and family. Superfine and lower grades are the staple export to China, Japan, and the Pacific islands. Different grades of extra-superfine are sent to England and to Central and South America. Family flour, especially its finer grades up to "gilt-edged," is mostly taken for home consumption and for export to the United Kingdom. Of the 508,143 barrels exported during the calendar year 1876, 213,621 barrels went to England against 254,066 barrels in 1875;

267,456 in 1874, 245,708 in 1873, and 6,091 in 1872. This direct British export has rapidly increased, and promises to become a permanent feature of the trade. China and Japan took 192,104 barrels in 1876, 121,174 in 1875, 144,188 in 1874, 135,457 in 1873, and 115,058 in 1872. These are the largest items of export. The coast-trade to New York has nearly ceased, only 520 barrels having been sent by that route, against 11,215 in 1873. In the local terminology of the market, New York, Great Britain, and Australia are designated as casual, and other countries as regular, customers. In 1876 the casuals took 220,415 barrels, and the regulars 287,728; in 1875 the casuals took 263,118, and the regulars 234,035; in 1872 the casuals took only 31,238 barrels, while the regulars took 215,850 barrels. The subsequent equalization of the figures shows a tendency of some of the casuals, especially Great Britain, to become regular customers.

The prices of flour during 1876 were remarkably uniform; quotations of superfine made at the beginning of each month ranged from $4 to $5 per barrel; extra-superfine, from $4.50 to $5.50; family and fancy, from $5 to $6.50, the maximum being in May and the minimum during the last four months of the year. The "gilt-edged" flour, made by the Golden Age, Golden Gate, and Vallejo Starr Mills, ranged from $7 to $7.50 per barrel. It should be remembered that on the Pacific coast business is regulated by the specie standard, and the above prices represent gold values.

Wheat.—The California wheat-crop of 1876 was the largest ever raised in the State, being estimated by local authorities at 22,000,000 centals, or over 36,000,000 bushels. The season, on the whole, was favorable to shippers, the immense crop having attracted a large number of ships for its transportation. The receipts at San Francisco during twenty-one and a half harvest years will be found below.

The receipts of the calendar year 1876 were 10,636,846 centals, or 17,726,076 bushels. Yet of this immense supply there were left over in the State at the close of the year only 3,640,727 centals, or 6,067,868 bushels, equal to only one-sixth of the crop of 1876; a considerable portion of this surplus was Oregon wheat. The delay of the regular winter rains at the close of the year caused the impression of a short crop in 1877, and to a considerable degree maintained the tone of prices, which had been raised by the prospect of a general European war. Low freights also enhanced the shipping demand, and the Pacific coast farmers disposed of their immense yield at very good prices. The market opened in January at $1.95 to $2 per cental, but began to decline in the spring, reaching $1.60 to $1.65 in July, the new crop bringing only $1.50 to $1.57½. In September these rates began to advance, reaching by the end of the year $2.15 to $2.25. The quantity sold for shipment during the year was 11,000,000 centals, or over 18,000,000 bushels. The special feature of the trade was the immense shipment to Europe; England took over 15,000,000 bushels, Belgium nearly 1,000,000, France over 250,000.

Corn.—The receipts of 1876 were 214,215 centals, or 357,025 bushels, against 161,213 centals, or 268,688 bushels, in 1875. This cereal is but of limited growth on the Pacific coast. The crop of 1876 was unusually large and prices fell in consequence as low as $1 per cental, but rose again to $1.17½ to $1.25 before the close of the year.

Rye.—This grain is also of limited culture on the Pacific coast. The receipts at San Francisco during 1876 were 20,184 centals, or 33,640 bushels, against 16,423 centals, or 27,372 bushels, in 1875. The market opened in July at $1.50 to $1.52 per cental, and closed in December at $1.75 to $1.80.

Oats.—The receipts of oats in 1876 were 344,972 centals, or 574,953 bushels, against 346,898 centals, or 578,163 bushels, in 1875. The market in July, with the advent of the new crop, was weak, closing at $1.20 @ $1.75 per cental, having reached $1.50 @ $1.85 in August. With subsequent fluctuations, the year closed with quotations at $2.05 @ $2.50.

Barley.—This crop ranks next to wheat in the San Francisco grain-trade, as it does in the cereal production of California. The crop of 1876 was the largest ever raised in the State; its abundance ran down prices to an unprecedentedly low figure. The receipts of 1876 were 1,907,953 centals, or 3,179,922 bushels, against 1,023,471 centals, or 1,705,785 bushels, in 1875. The receipts were nearly double and the shipments more than double those of the previous year. Toward the close of the year there was a rise in prices, which partially compensated the low rates previously prevailing. California brewing-barley is now shipped to all parts of the civilized world, and the growing demand has made barley-growing one of the most promising agricultural industries of the Pacific coast. The market opened in July at 90 cents per cental, and closed in December at $1.15 @ $1.40, having had several reactions during the intervening months. The exports of 1876 amounted to 357,887 centals, or 586,478 bushels, against 126,188 centals, or 210,313 bushels, in 1875. Of the exports, 124,446 centals, or 207,408 bushels, were sent to foreign countries, 179,139 centals, or 298,565 bushels, to New York by sea, and the remainder eastward by rail. The declared value of the shipments for 1876 was $414,481, against $215,984 in 1875.

The receipts and maritime exports of flour, wheat, oats, and barley for twenty-one and a half harvest years were as follows:

Years.	Flour, barrels.		Wheat, bushels.		Wheat and flour consolidated, bush.		Oats, bushels.		Barley, bushels.	
	Receipts.	Exports.	Receipts.	Exports.	Receipts.	Exports.	Receipts.	Exports.	Receipts.	Exports.
1856-'57	38, 127	36, 511	566, 717	37, 035	757, 352	210, 890	262, 240	13, 950	759, 705	110, 613
1857-'58	35, 456	5, 387	405, 087	6, 335	582, 367	32, 270	310, 065	179, 432	1, 062, 613	237, 687
1858-'59	68, 554	20, 577	721, 670	205	1, 061, 440	103, 090	533, 747	364, 412	1, 299, 783	493, 060
1859-'60	91, 467	58, 926	1, 641, 710	636, 277	2, 098, 745	931, 107	261, 497	151, 137	915, 488	115, 410
1860-'61	113, 779	197, 181	3, 601, 205	2, 519, 873	4, 170, 100	2, 535, 778	525, 130	194, 112	1, 129, 092	565, 893
1861-'62	106, 567	102, 652	2, 268, 697	1, 419, 740	2, 801, 522	1, 923, 000	586, 055	257, 642	1, 018, 712	314, 362
1862-'63	159, 588	144, 883	3, 107, 753	1, 739, 420	3, 905, 693	2, 463, 835	295, 175	66, 643	720, 338	83, 015
1863-'64	160, 602	152, 363	3, 076, 863	1, 785, 487	3, 579, 873	2, 547, 302	506, 740	151, 810	1, 018, 572	67, 115
1864-'65	134, 735	91, 479	879, 802	42, 282	1, 553, 477	499, 677	456, 622	5, 610	730, 720	23, 200
1865-'66	181, 498	279, 554	3, 678, 597	1, 732, 525	4, 586, 087	3, 130, 295	571, 737	189, 943	1, 728, 682	583, 317
1866-'67	300, 749	465, 337	8, 332, 243	6, 060, 317	9, 835, 988	8, 387, 002	547, 463	148, 885	1, 216, 853	236, 923
1867-'68	201, 186	423, 189	8, 386, 610	6, 339, 630	9, 392, 549	8, 455, 575	369, 685	9, 475	1, 064, 867	52, 245
1868-'69	223, 350	453, 920	10, 077, 250	7, 290, 873	11, 194, 000	9, 559, 473	390, 830	36, 557	1, 014, 980	152, 003
1869'-70	186, 517	352, 962	10, 287, 725	8, 106, 485	11, 220, 310	9, 871, 295	498, 572	23, 262	1, 254, 030	500, 870
1870'-71	123, 513	196, 219	7, 371, 215	5, 953, 077	7, 988, 780	6, 934, 172	506, 922	22, 045	1, 169, 398	230, 013
1871-'72	139, 982	270, 079	3, 986, 110	2, 340, 637	4, 686, 020	3, 691, 032	597, 552	19, 512	1, 320, 330	27, 847
1872-'73	222, 279	263, 645	17, 968, 158	16, 371, 117	19, 079, 553	17, 689, 372	331, 242	9, 062	1, 635, 047	378, 212
1873-'74	469, 533	644, 710	13, 049, 792	12, 122, 068	15, 397, 367	15, 343, 618	465, 667	46, 067	1, 878, 983	406, 263
1874-'75	461, 845	482, 551	16, 346, 293	14, 655, 590	18, 655, 518	17, 068, 345	509, 740	95, 038	2, 072, 762	303, 570
1875-'76	457, 365	445, 143	10, 995, 480	10, 227, 448	13, 282, 305	12, 453, 163	389, 933	5, 168	1, 903, 590	340, 227
July 1, '76, to Jan. 1, 1877.	289, 265	296, 629	14, 327, 653	13, 385, 207	15, 773, 978	14, 868, 352	281, 918	3, 137	2, 146, 418	419, 860

RECAPITULATION.

The comparative receipts and shipments of flour and grain at the foregoing points may be tabulated as follows:

Flour, barrels.

Cities.	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	3, 042, 907	1, 202, 792	3, 546, 568	1, 655, 331	4, 017, 207	2, 462, 723
Boston	1, 586, 017	217, 586	1, 795, 272	231, 361	1, 890, 487	287, 718
Philadelphia	987, 450	113, 036	954, 680	142, 386	915, 636	....
Baltimore	1, 175, 967	282, 553	1, 312, 612	359, 566	1, 539, 237	474. 758
Cincinnati*	582, 930	410, 501	765, 469	560, 829	774, 916	551, 774
Chicago	1, 532, 014	1, 361, 328	2, 487, 376	2, 303, 490	2, 666, 679	2, 306, 576
Milwaukee	834, 202	1, 231, 986	1, 254, 821	1, 805, 200	1, 616, 338	2, 217, 579
Saint Louis†	1, 259, 933	2, 247, 040	1, 296, 457	2, 506, 215	1, 683, 898	2, 981, 760
San Francisco‡	....	247, 088	....	479, 418	....	535, 695

Cities.	1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.
New York	3, 941, 331	1, 953, 667	4, 051, 665	1, 914, 183
Boston	1, 637, 972	271, 170	1, 836, 985	268, 093
Philadelphia	922, 190	160, 748	970, 781	192, 473
Baltimore	1, 546, 905	453, 000	1, 389, 538	426, 094
Cincinnati	597, 578	473, 460	636, 504	396, 217
Chicago	2, 625, 883	2, 285, 113	2, 955, 197	2, 634, 838
Milwaukee	1, 443, 801	2, 163, 346	2, 082, 688	2, 654, 028
Saint Louis	1, 300, 381	2, 480, 877	1, 071, 431	2, 217, 578
San Francisco	513, 586	497, 163	560, 581	508, 143

* Commercial years ending August 31.

† Receipts do not include home manufacture, which in 1871 amounted to 1,294,798 barrels; in 1872, to 1,294,798 barrels; in 1873, to 1,420,287 barrels; in 1874, to 1,581,000 barrels; in 1875, to 1,424,821 barrels; in 1876, to 1,441,944 barrels.

‡ Barrels contain 2 centals, or 200 pounds, each. The shipments of San Francisco include only exports by sea.

Wheat, bushels.

Cities.	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	16, 238, 433	13, 299, 320	35, 559, 870	27, 801, 829	41, 817, 215	33, 541, 740
Boston	402, 426	151, 860	880, 747	486, 128	1, 362, 017	1, 062, 366
Philadelphia	4, 160, 800	412, 761	4, 372, 800	1, 938, 310	5, 471, 700	....
Baltimore	2, 456, 100	88, 025	2, 810, 917	1, 158, 097	6, 456, 834	3, 556, 848
Cincinnati	762, 144	323, 405	860, 454	412, 722	1, 221, 176	783, 990
Chicago	12, 724, 141	12, 160, 046	26, 266, 562	24, 455, 657	29, 764, 622	27, 634, 587
Milwaukee	13, 618, 959	11, 570, 575	28, 457, 937	24, 994, 266	25, 628, 143	22, 255, 380
Saint Louis	6, 007, 987	918, 477	6, 185, 038	1, 210, 286	8, 255, 221	1, 938, 841
San Francisco	....	10, 118, 971	....	15, 293, 266	....	13, 424, 450

Cities.	1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.
New York	34, 214, 768	26, 193, 693	27, 042, 164	24, 358, 295
Boston	1, 035, 109	784, 941	504, 767	112, 915
Philadelphia	5, 950, 800	3, 302, 054	4, 485, 000	2, 989, 704
Baltimore	4, 400, 670	2, 016, 430	3, 945, 247	1, 659, 861
Cincinnati	1, 135, 388	600, 622	1, 052, 952	558, 252
Chicago	24, 206, 370	23, 184, 349	16, 574, 058	14, 361, 950
Milwaukee	27, 878, 727	22, 681, 020	18, 174, 817	16, 804, 391
Saint Louis	7, 604, 265	1, 562, 453	8, 037, 574	2, 630, 007
San Francisco	13, 324, 088	12, 508, 333	17, 726, 076	16, 613, 235

Wheat, including flour, reduced to bushels.

Cities.	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	31,452,968	19,313,280	53,292,710	36,078,484	61,903,259	45,855,380
Boston	8,332,511	1,239,790	9,857,107	1,642,933	10,814,452	2,500,956
Philadelphia	9,098,050	977,941	9,146,200	2,650,240	10,049,880	....
Baltimore	8,335,935	1,500,790	9,373,977	2,955,927	14,261,819	5,930,632
Cincinnati	3,676,794	2,375,910	4,687,799	3,216,867	5,095,756	3,542,869
Chicago	20,384,211	18,966,686	38,703,442	35,973,107	43,098,017	39,167,437
Milwaukee	17,789,969	17,730,505	34,732,042	34,020,266	33,709,833	33,342,275
Saint Louis	12,307,652	12,153,677	12,667,323	13,741,361	16,674,711	16,847,641
San Francisco	....	11,354,411	....	17,690,356	....	16,102,925

Cities.	1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.
New York	53,921,423	35,962,028	47,300,489	33,928,210
Boston	9,224,969	2,140,791	9,689,692	1,453,380
Philadelphia	10,161,750	4,105,794	9,338,905	3,951,869
Baltimore	12,224,295	4,311,430	10,892,937	3,790,331
Cincinnati	4,623,278	2,967,922	4,235,472	2,539,337
Chicago	37,335,785	34,609,914	31,350,043	27,536,140
Milwaukee	35,097,732	33,497,750	28,588,257	30,074,534
Saint Louis	14,106,170	13,966,838	13,394,744	13,717,897
San Francisco	15,892,018	14,994,148	20,528,981	19,153,950

Corn, bushels.

Cities	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	40,800,939	25,652,602	24,576,345	15,416,787	29,329,000	26,447,807
Boston	5,090,755	1,673,769	3,558,363	162,729	3,303,641	380,254
Philadelphia	8,137,380	3,462,473	8,233,400	2,002,368	5,954,700	....
Baltimore	9,045,465	5,157,235	8,330,449	6,003,618	9,355,467	5,959,757
Cincinnati	1,892,866	246,632	2,259,544	324,183	3,457,164	658,718
Chicago	47,366,087	47,013,552	38,157,232	36,754,943	35,799,638	32,705,224
Milwaukee	2,140,178	1,601,412	921,391	197,920	1,313,642	556,563
Saint Louis	9,479,387	8,079,739	7,701,187	5,260,916	6,991,677	4,148,556
San Francisco	....	....	....	....	....	....

Cities.	1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.
New York	28,488,707	12,955,525	26,899,162	16,877,251
Boston	5,346,310	1,551,776	9,330,435	4,521,241
Philadelphia	7,130,000	4,601,586	20,261,675	16,790,691
Baltimore	9,567,141	6,989,807	24,684,230	20,953,724
Cincinnati	3,695,561	595,915	4,115,564	1,028,325
Chicago	28,341,150	26,443,884	48,688,640	45,629,035
Milwaukee	949,605	226,895	798,458	96,905
Saint Louis	6,710,263	3,523,974	15,249,909	12,728,849
San Francisco	268,688	....	357,025	....

Oats, bushels.

Cities.	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	12, 442, 127	32, 718	11, 235, 420	49, 573	10, 792, 919	122, 528
Boston	2, 725, 641	....	3, 363, 364	....	3, 037, 269	....
Philadelphia	5, 830, 400	....	5, 980, 565	....	4, 705, 000	....
Baltimore	1, 959, 161	....	1, 255, 072	....	1, 149, 188	....
Cincinnati	1, 169, 053	230, 963	1, 529, 979	324, 718	1, 372, 464	216, 660
Chicago	15, 061, 715	12, 255, 537	17, 888, 724	15, 694, 133	19, 901, 235	10, 561, 673
Milwaukee	1, 597, 726	1, 338, 028	1, 763, 058	990, 525	1, 403, 889	726, 039
Saint Louis	5, 467, 800	3, 467, 594	5, 359, 853	3, 215, 206	2, 296, 967	3, 027, 663
San Francisco	....	31, 781	....	17, 891	....	132, 256

Cities.	1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.
New York	10, 636, 078	138, 508	12, 251, 265	624, 431
Boston	2, 833, 544	....	2, 622, 150	....
Philadelphia	3, 820, 400	33, 800	4, 484, 000	861, 176
Baltimore	977, 514	....	810, 212	....
Cincinnati	1, 323, 380	193, 242	1, 441, 158	321, 755
Chicago	12, 916, 428	10, 279, 134	13, 030, 121	11, 271, 642
Milwaukee	1, 643, 132	1, 160, 450	1, 745, 673	1, 377, 560
Saint Louis	5, 006, 850	2, 877, 035	3, 660, 912	1, 932, 983
San Francisco	578, 163	8, 928	574, 953	6, 202

Rye, bushels.

Cities.	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	491, 851	623, 355	995, 417	1, 069, 140	592, 114	641, 661
Boston	13, 989	....	33, 335	....	34, 273	....
Philadelphia	320, 940	....	270, 600	....	210, 191	....
Baltimore	90, 938	....	100, 519	....	118, 634	....
Cincinnati	357, 309	110, 464	426, 660	61, 577	385, 934	117, 349
Chicago	1, 129, 086	776, 805	1, 186, 464	960, 613	791, 182	335, 077
Milwaukee	409, 573	209, 751	378, 634	255, 923	284, 522	74, 879
Saint Louis	377, 587	150, 208	353, 580	206, 652	288, 743	166, 133
San Francisco	....	....	....	....	....	....

Cities.	1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.
New York	301, 654	205, 898	1, 627, 007	1, 336, 423
Boston	27, 878	....	34, 594	....
Philadelphia	187, 550	....	679, 100	431, 223
Baltimore	74, 529	....	112, 160	....
Cincinnati	336, 410	93, 245	500, 515	178, 403
Chicago	699, 583	310, 552	1, 447, 917	1, 433, 976
Milwaukee	230, 834	98, 923	354, 859	220, 964
Saint Louis	275, 200	134, 960	399, 826	304, 192
San Francisco	27, 372	....	33, 640	....

Barley, bushels.

Cities.	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	3, 964, 411	17, 402	2, 444, 206	40, 040	2, 770, 000	3, 560
Boston	539, 038	....	332, 849	....	418, 615	....
Philadelphia	730, 380	....	1, 066, 392	....	1, 236, 392	....
Cincinnati	1, 177, 306	26, 984	1, 228, 245	37, 456	1, 084, 500	90, 688
Chicago	5, 251, 750	5, 032, 308	4, 240, 239	3, 366, 041	2, 354, 981	2, 404, 538
Milwaukee	1, 447, 078	938, 725	1, 209, 474	688, 455	1, 083, 472	464, 837
Saint Louis	1, 263, 486	87, 566	1, 158, 615	125, 604	1, 421, 406	227, 418
San Francisco	....	314, 559	....	465, 875	....	379, 636

Cities.	1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.
New York	4, 710, 598	110	6, 779, 532	67, 958
Boston	593, 539	....	789, 689	....
Philadelphia	1, 652, 700	....	1, 329, 200	....
Cincinnati	1, 109, 693	82, 723	1, 551, 944	232, 556
Chicago	3, 107, 297	1, 868, 206	4, 716, 360	2, 687, 932
Milwaukee	1, 286, 585	867, 970	1, 857, 208	1, 235, 481
Saint Louis	1, 171, 337	146, 330	1, 492, 985	223, 680
San Francisco	1, 705, 785	210, 313	3, 179, 922	586, 478

All grains, including flour, reduced to bushels.

Cities.	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	89, 196, 926	46, 221, 478	93, 390, 492	53, 198, 360	106, 102, 639	73, 876, 508
Boston	17, 068, 086	....	17, 926, 202	....	17, 996, 402	....
Philadelphia	24, 117, 150	....	24, 697, 157	....	22, 436, 163	....
Baltimore	19, 431, 499	....	19, 060, 017	....	24, 699, 250	....
Cincinnati	8, 264, 328	2, 990, 953	10, 122, 227	3, 964, 801	11, 395, 818	4, 626, 275
Chicago	89, 192, 849	84, 044, 888	100, 179, 101	92, 948, 837	96, 945, 053	85, 173, 979
Milwaukee	23, 393, 524	21, 818, 421	39, 002, 599	36, 153, 094	37, 795, 358	35, 165, 593
Saint Louis	29, 700, 740	24, 878, 536	27, 400, 670	23, 984, 683	30, 811, 884	26, 028, 895

Cities.	1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.
New York	91, 686, 000	49, 976, 097	95, 610, 563	53, 568, 157
Boston	18, 299, 702	....	22, 476, 560	....
Philadelphia	22, 952, 400	....	36, 092, 880	....
Baltimore	21, 988, 069	....	36, 499, 539	....
Cincinnati	11, 088, 322	3, 938, 047	11, 844, 653	4, 300, 376
Chicago	82, 400, 243	73, 511, 736	99, 213, 081	88, 558, 725
Milwaukee	39, 207, 888	34, 852, 078	35, 851, 988	33, 344, 455
Saint Louis	27, 396, 644	22, 330, 733	34, 269, 448	30, 197, 569

LIVE-STOCK MARKETS.

NEW YORK.

The trade of 1876 was not satisfactory either to western shippers or to wholesale butchers in the city, several of the latter having been compelled to suspend operations during the year. The causes of disturbance have not been abated, nor have apprehensions of future trouble been allayed by the developments of the year. What is called the "carrying process" is still operative to a serious extent. This process consists in selling to obtain money to pay for previous purchases. The solid substantial men of the market are demanding an abatement of this nuisance. The abuses of the credit system have been felt in this market, considerably affecting the normal relations of the trade. It is hoped that in the regular development of business these abuses will disappear. By means of refrigerating-steamers transporting slaughtered animals, a large increase of the export trade has been secured, thus enlarging the demand for live stock at this point. The receipts of all classes of animals during 1876 shows increase, except milch-cows and swine. The steady expansion of the trade within ten years, and especially since the close of the civil war, still continues to be one of its marked features.

The receipts of different kinds of farm-animals for the past nine years are shown in the following table:

Animals.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.
Beeves	293, 101	325, 761	353, 026	380, 934	425, 775	412, 711	454, 033	453, 060	477, 276
Cows	5, 382	4, 826	5, 050	4, 636	5, 089	4, 791	3, 676	5, 034	3, 967
Calves	82, 935	93, 984	116, 457	121, 937	115, 180	116, 615	104, 719	117, 580	125, 594
Sheep	1, 400, 623	1, 479, 563	1, 463, 878	1, 391, 677	1, 179, 518	1, 306, 715	1, 165, 353	1, 228, 530	1, 247, 820
Swine	976, 511	961, 308	839, 625	1, 334, 492	1, 922, 777	1, 985, 388	1, 774, 228	1, 388, 511	1, 282, 171

Cattle.—The receipts of 1876 show an increase of 24,216, but this does not fully indicate the increased beef consumption, as the receipts of dressed beef from the West have also greatly enlarged. An important export trade in dressed beef, which was inaugurated during 1875, has grown to unexpected proportions. Refrigerating-steamers have been fitted up, and toward the close of the year averaged 1,000 carcasses per week from New York and half as many from Philadelphia. The total number shipped from New York during the year was 22,500, the weekly average at the beginning of the year being much smaller than at its close. If this number had been thrown on the home-consumption market, it would have created great disturbance, by increasing the supplies beyond the utmost limits of the demand. The average price of beeves of all grades during the year was $9.95 per cental, or $1.25 less than the average of 1875. Prices reached their maximum in January, but declined gradually till May, when a reaction began, but it was again followed by depression. The arrival of holiday stock at the close of the year caused a steady enhancement. The January range of prices was $7.50 to $13.50 per cental, and the average $10.70; February range, $7.50 to $13.50, average $10.25; March range, $8.25 to $13, average $10.25; April range $8.25 to $13, average $9.94; May range, $7.50 to $12, average $9.95; June range, $7 to $11, average $9.50; July range, $7.50 to $11, average $9.60; August range, $6.25 to $10.50, average $9.14; September range, $6.50 to $11.25, average $9.43; October range, $6.75 to $11, average $8,96; November range, $6.75 to $11, average $9.51; December range, $7 to $12.50, average $9.55. Milch-cows fell off 1,067 from the number marketed during the previous year. The shipment of milk from the interior, either fresh or artificially condensed, is superseding the use of cows in the city, which, in too many cases, are fed upon distillery slops, and produce an unhealthy and even poisonous milk. This branch of the cattle trade has been for some years declining. Prices have a comparatively narrow range. Calves were marketed in large numbers, the increase over the preceding year being 8,014. The figures in the above table show only the live calves sent to this market. A large number of dressed carcasses are also imported, adding very materially to the amount of veal marketed. The veal trade is annually increasing, but the supplies are almost entirely for city consumption. The greatest supply is during May and June, when the prices run lowest. At the opening of 1876 prices ranged from $4 to $10.50 per cental, but gradually fell to $3.50 @ $7 during the midsummer, after which a gradual rise was noted, which continued till the end of the year, the closing quotations being $4 @ $9.50.

Cattle products.—Barreled beef: Receipts, 103,205 barrels and tierces, against 45,596 in 1875; exports, 119,778 barrels and tierces, against 86,881. *Butter:* Receipts, 1,306,475 packages, against 1,084,309 in 1875; exports, 107,151 centals, against 42,341 in 1875. *Cheese:* Receipts, 2,184,288 packages, against 2,321,705 in 1875; exports, 949,656 centals, against 921,137 in 1875. *Tallow:* Receipts, 67,448 packages, against 26,779 in 1875; exports, 585,636 centals, against 414,309 in 1875.

Sheep.—The number of sheep and lambs marketed during 1876 was 1,247,820, an increase of 19,290 over 1875. Sheep in the New York market have two elements of value, one in the weight and market-price of their fleeces, and one in the quantity of mutton in the carcass. During the early part of the year, when wool was low and of dull sale, sheep were not very profitable stock for dealers or producers. The mutton demand seemed to be subject to very rigid limitations, so that when a surplus was thrown upon the market it could not be easily disposed of by any ordinary reduction of prices. Lambs are usually marketed about the middle of April, the first arrivals being sold at 15 cents per pound, or, without weighing, at $8 or $9 per head. The arrivals of full-grown sheep are unshorn up to May 1, after which they are mostly denuded of wool. In 1876 prices during the first four months ranged from $4 to $8.50 per cental. They then began to decline, ranging during summer and fall from $3.50 to $6.50, and closing the year at $4 @ $7.50. An attempt was made in a small way to create a demand for American mutton in the British markets. The refrigerating-steamers engaged in the beef export began toward the close of the year to stow sheep carcasses in the smaller spaces of the cooling-rooms, and thus about 2,000 dressed sheep were sent across the water. In this way it is hoped that a considerable mutton export will be inaugurated, which may grow into a permanent trade. The sheep traffic during the year was, on the whole, quite unsatisfactory.

Sheep products.—Wool: The receipts of wool during 1876 were as follows: Foreign carpet, 40,110 bales, equal to 16,221,842 pounds; foreign clothing, 3,188 bales, equal to 1,511,817 pounds; California, 27,494 bales, equal to 15,121,700 pounds; Texas, 11,451 bales, equal to 3,435,300 pounds; New Orleans, 21,431 bales, equal to 6,429,300 pounds; other southern, 1,454 bales, equal to 541,200 pounds; interior and western, 19,181 bales, equal to 3,836,200 pounds; total, 124,309 bales, equal to 47,097,459 pounds; total for 1875, 129,335 bales, equal to 49,924.216 pounds; total for 1874, 123,246 bales, equal to 40,583,881 pounds. The exports are insignificant. The stock left over at the close of 1876 was 7,912,000 pounds; of which 1,108,000 pounds were foreign, and the remainder domestic.

Swine.—The swine trade, during 1876, continued to manifest the same declining tendencies which had characterized it during 1875. The total number marketed was 1,282,171, a decrease of 106,370. For many years the number of marketed animals showed a tendency to increase, reaching the maximum, 1,985,389, in 1873; each subsequent year has presented a falling off. The preparation of hog products for foreign shipment has been annually prosecuted on an increasing scale at various points in the West, especially Chicago, interfering with the live-hog trade of New York. An increasing trade in dressed carcasses, however, in some measure compensates the decline. Prices ruled at \$9.25 @ \$11.50 during the first four months of the year, and subsequently fell to \$6.50 @ \$7.75 in October. The closing quotation of the year was \$8 @ \$8.25.

PHILADELPHIA.

The receipts of all kinds of farm-animals at Philadelphia during 1876 were in advance of the figures of 1875. This increased supply was doubtless caused in part by the increased demand for fresh meat created by the great Centennial Exposition; but the increased permanent population of the city and of its suburban towns requires a corresponding enlargement of the supply of animal-food. The market was mostly one of consumption; comparatively few of the receipts were for transmission to other markets. The facilities for handling live stock at this point have been greatly enhanced within a year or two. The West Philadelphia stock-yards have been fitted up in a style of accommodation equal to any in the country. The North Philadelphia Stock-yard, on the line of the North Pennsylvania Railroad, was started during 1876, and before the year closed the sales had attained the figures of 1,000 head of cattle, 1,500 sheep, and 900 hogs per week. The supplies of western cattle were larger than in 1875. Cattle from Texas were received in increased numbers and of greatly improved quality. The number of beef-cattle received was 178,000 head, against 141,000 head in 1875. Prices ruled low throughout the year; prime beeves opened at \$7.12½ @ \$7.50 per cental on the 1st day of January, and on the 1st day of December were quoted at \$6.12½ @ \$6.50, the minimum, \$5.75 @ \$6.25, being on the 1st of October; fair to good beeves opened at \$5.50 @ \$7 and closed at \$5.12½ @ \$6, reaching as low as \$4.62½ @ \$5.50 on the 1st day of October; common stock averaged about \$3.50 @ \$5.50. The receipts of cows were 12,750, against 11,830 in 1875 and 18,010 in 1874. Sheep were in increased numbers, the receipts being 548,850 head, against 491,500 in 1875. Prices opened moderately and closed very low, ranging from \$4.50 @ \$8 per cental in January to \$1 @ \$5.75 in November and December. Of hogs, 289,900 were received during 1876, against 243,300 in 1875. Prices of these animals were also low, falling from \$10 @ \$12 per cental in January to \$7 @ \$8 in December, with a maximum of \$12.50 @ \$13.75 in April.

The receipts of different kinds of farm-animals during thirteen years were as follows:

Years.	Beeves.	Cows.	Sheep.	Swine.
1864	99,850	7,920	295,000	140,400
1865	96,450	6,540	306,000	136,300
1866	100,500	10,830	512,000	122,500
1867	90,150	11,464	368,500	175,500
1868	90,400	9,314	417,800	191,900
1869	99,486	8,085	536,500	176,200
1870	117,903	8,835	682,900	189,500
1871	125,333	11,150	790,200	199,610
1872	134,850	12,302	749,500	210,376
1873	165,860	18,405	756,750	344,300
1874	167,130	18,010	757,040	339,590
1875	141,000	11,830	491,500	243,300
1876	178,800	12,750	548,850	289,900

The later years show a large increase upon the earlier, though 1875 fell off from the very high figures of 1873 and 1874, in consequence of the general decline of trade resulting from the disastrous financial crisis of 1873. The number of cattle in 1876 was greater than in any former year; the number of cows greater than any other year except 1872 and

1873; sheep, though increasing, have not equaled the high figures of the first few years of this decade; swine are also recovering their previous high aggregates.

BALTIMORE.

Cattle.—The annual receipts of beef-cattle at Baltimore for the last ten calendar years were as follows: 1867, 55,713 head; 1868, 75,891; 1869, 91,000; 1870, 89,021; 1871, 88,386; 1872, 92,292; 1873, 94,664; 1874, 130,946; 1875, 113,379; 1876, 109,854. Of the receipts of 1876, the city and neighboring butchers took about 70,000 head; a considerable number were taken by farmers of the neighboring counties for stock cattle; the residue were shipped eastward. The comparative prices per cental of all grades of cattle on the 15th of each month of the last three years were as follows:

Months.	1874.	1875.	1876.
January	$4 00 to $6 50	$4 00 to $5 50	$1 00 to $5 25
February	4 00 to 6 50	4 00 to 5 25	4 00 to 5 00
March	4 50 to 6 75	5 50 to 6 50	4 75 to 5 75
April	4 25 to 6 50	5 50 to 6 50	4 62 to 5 62
May	4 37 to 6 75	5 00 to 6 25	4 50 to 5 50
June	5 50 to 7 00	6 00 to 7 00	4 75 to 5 62
July	4 50 to 6 50	5 50 to 6 50	4 50 to 5 50
August	5 50 to 6 50	5 00 to 6 00	3 75 to 4 75
September	4 50 to 6 00	3 50 to 4 75	3 75 to 4 50
October	4 62 to 5 25	4 00 to 5 25	3 25 to 4 12
November	4 75 to 6 50	4 00 to 5 25	3 75 to 4 75
December	4 50 to 6 50	3 87 to 4 75	3 25 to 4 37

Cattle products.—*Butter.*—No record of receipts has been kept. The supplies of "glades" butter were a fair average, and with a sharp competition among buyers, very good prices were obtained and but little was left over unsold. Receipts of good and fair stock have not been equal to the demand. Prime "Glades" was quoted at 24 to 26 cents per pound during the first eight months of 1876. Subsequently a slight fluctuation was noted, but prices fell into their old routine.

Cheese.—The market for cheese tended downward from January to September, but subsequently a sharp reaction was felt, causing an advance of 4 cents per pound by the end of the year. For prime eastern factory, the year opened at $12\frac{1}{2}$ @ $13\frac{1}{2}$, declined to $10\frac{1}{2}$ @ $11\frac{1}{2}$ in midsummer, but rose in the middle of December to 14 @ 15. Prime western factory ranged about 1 cent per pound lower all the year.

Swine.—Receipts of hogs for seven calendar years: 1870, 300,000 head; 1871, 307,436; 1872, 400,874; 1873, 392,734; 1874, 357,547; 1875, 277,496; 1876, 247,462. The receipts of 1876 fell behind about 30,000, but this is not to be wondered at, considering the unsatisfactory condition of the hog trade throughout the country during a large part of the year. The entire receipts were required by the city butchers for home consumption. The prices per cental of live hogs on the 15th of each month for the past five years were as follows:

Months.	1872.	1873.	1874.	1875.	1876.
January	$6 00 to $7 25	$5 50 to $6 00	$7 50 to $7 87	$9 25 to $9 75	$10 00 to $10 50
February	6 50 to 7 26	6 25 to 6 85	7 37 to 8 75	9 50 to 10 50	10 00 to 10 75
March	6 50 to 7 25	7 00 to 7 75	7 00 to 7 87	9 25 to 10 00	11 00 to 11 37
April	6 00 to 6 75	7 50 to 8 50	7 50 to 8 37	11 00 to 12 00	10 50 to 11 50
May	5 50 to 6 50	7 00 to 7 37	7 00 to 8 00	10 00 to 11 50	9 75 to 10 75
June	5 75 to 6 25	6 25 to 7 25	7 50 to 8 25	9 75 to 10 50	8 50 to 9 00
July	6 00 to 6 50	6 75 to 7 25	8 50 to 9 25	9 50 to 10 50	9 50 to 10 00
August	6 50 to 7 25	7 25 to 7 50	8 00 to 10 50	10 25 to 11 25	9 00 to 9 75
September	7 25 to 7 50	6 75 to 7 25	8 00 to 10 50	10 00 to 11 50	8 00 to 8 50
October	6 50 to 7 00	6 00 to 7 00	9 50 to 9 75	10 00 to 10 62	8 00 to 8 75
November	5 75 to 6 50	5 25 to 6 00	8 25 to 9 00	9 50 to 10 25	7 25 to 8 25
December	5 00 to 5 50	7 00 to 7 50	9 00 to 9 50	9 00 to 9 75	7 00 to 7 75

Swine products.—Of western pork, produced mostly during the winter packing season of 1874–'75, Baltimore received during 1876 132,578,840 pounds, against 140,000,000 in 1875, 124,000,000 in 1874, 111,568,000 in 1873, and 100,000,000 in 1872. Of lard, the foreign exports of 1876 amounted to 12,268,709 pounds, of which 6,055,039 went to Bremen, 2,585,982 to Liverpool, 3,068,275 to South America, and 559,403 to the West Indies. The total export of 1875 was 8,520,006; of 1874, 11,129,169; of 1873, 11,596,004; of 1872, 12,622,649; of 1871, 4,876,760; of 1870, 1,791,360; of 1869, 1,864,140. Of bacon, the exports of 1876 amounted to 5,482,000 pounds, against 1,130,210 pounds in 1875. Of barreled pork, 14,874 barrels were exported, against 17,864 in 1875. Prices of mess pork opened at $21 @ $21.25 in the middle of January, rose to $23 in March, and gradually fell to $17.50 at the close of the year.

CINCINNATI.

Cattle.—The receipts of cattle during the commercial year ending August 31, 1876, were 243,503 head, an increase over the preceding twelve months of 16,053, or 7 per cent.; shipments, 98,322, a decline of 5,116 head, or nearly 5 per cent. The quality of the animals marketed, on the whole, was an improvement upon the previous year, but during the summer an unusual amount of poor stock was offered for home consumption. The supplies of Texas cattle are constantly becoming more abundant and of better quality, so that the better kinds of this stock are gaining advantage over the medium grades of native cattle. The market was well supplied, and buyers ordinarily had very little difficulty in obtaining satisfactory terms. The United Railroads Stock-yards have resulted in a great benefit to this trade, and buyers from distant localities have been attracted. The trade of the Ohio Valley seems to be largely concentrating at this point. But while buyers have had ample reasons for satisfaction generally, sellers have found the business exceedingly dull and unsatisfactory, especially from early spring to the close of the commercial year. Feeders also found little or no profit in the year's business. The usual animation of the spring market was wanting, and prices declined; the market became very dragging and unsatisfactory. The low rates of the later summer months were maintained with little variation. The market for fair to medium cattle opened at $3.50 @ $4.50 per cental and closed at $3 @ $4, with an occasional fitful reaction against this downward tendency.

The annual receipts and shipments of all kinds of cattle, together with the annual average prices per cental of prime beeves during the last nineteen commercial years, were as follows:

Commercial years.	Receipts.	Shipments.	Average prices.	Commercial years.	Receipts.	Shipments.	Average prices.
			Per cental.				*Per cental.*
1857–'58	29, 566	17, 115	$3 78	1867–'68	87, 459	43, 315	$7 27
1858–'59	43, 100	23, 615	4 88	1868–'69	107, 813	40, 185	5 62 1-2
1859–'60	43, 182	20, 593	3 90	1869–'70	107, 167	54, 681	5 85
1860–'61	40, 585	19, 357	3 30	1870–'71	125, 771	53, 278	5 05
1861–'62	37, 004	23, 467	3 24	1871–'72	169, 855	76, 866	4 73 1-2
1862–'63	31, 915	16, 739	3 96	1872–'73	149, 629	53, 385	4 99 1-6
1863–'64	39, 152	14, 903	5 74	1873–'74	199, 426	79, 551	3 90
1864–'65	54, 424	19, 070	7 45	1874–'75	227, 450	103, 438	4 30 7-10
1865–'66	79, 503	31, 300	7 55	1875–'76	243, 503	98, 322	3 95 6-10
1866–'67	91, 496	43, 079	7 27½				

The average gross weight per head of cattle received at the stock yards during the last commercial year was 965.24 pounds, against 944.63 in 1874–'75, and 952.22 in 1873–'74.

Cattle products.—Butter: Dealers found the last commercial year unsatisfactory. During the fall and winter prices were low and the market sluggish. Holders were so anxious to get rid of their stocks, that early in March it was discovered that the country was generally bare of all grades of butter. The Northwest and other outside districts were drawn upon to supply the deficiency, and prices steadily advanced almost up to the appearance of new butter in May, which came in with a good demand, choice Central Ohio bringing 25 @ 26 cents per pound and common 18 @ 20. Buyers, however, became cautious and prices began to recede until, in the middle of July, choice Central Ohio brought only 14 @ 17 cents, the demand from the South having given way; but by the close of August this class of butter had advanced to 18 @ 20. The average price of this grade for the whole year was 23.16 cents per pound, against 25$\frac{1}{3}$ in 1874–'75 and 27 in 1873–'74. The quality of butter marketed in Cincinnati is constantly improving, a result traceable mostly to the creameries of Northeastern Ohio. The distinction between Western Reserve and Central Ohio is fast fading away, as the latter is closely approximating the market qualities of the former. Creamery butter sustains its price better than other kinds under a strong competitive demand from the eastern cities. The idea of refrigerating butter-cars has been started among the market-men of Cincinnati, and would doubtless greatly benefit the butter trade of this city. The receipts and shipments are still indicated in the unmeaning general term "packages" instead of "pounds," which renders it impossible to give the real movement of the trade. The annual average price of choice Central Ohio during nineteen commercial years was as follows: 1857–'58, 15 cents; 1858–'59, 19; 1859–'60, 14$\frac{1}{3}$; 1860–'61, 13$\frac{1}{6}$; 1861–'62, 12$\frac{1}{2}$; 1862–'63, 11$\frac{1}{2}$; 1863–'64, 29; 1864–'65, 35; 1865–'66, 36$\frac{1}{3}$; 1866–'67, 26$\frac{1}{2}$; 1867–'68, 36$\frac{1}{2}$; 1868–'69, 32$\frac{7}{8}$; 1869–'70, 28$\frac{1}{3}$; 1870–'71, 24$\frac{5}{8}$; 1871–'72, 20; 1872–'73, 23; 1873–'74, 27; 1874–'75; 25$\frac{1}{3}$; 1875–'76, 23$\frac{1}{6}$.

Cheese.—The cheese business shows an increased receipt and shipment, the former embracing 183,745 boxes, and the latter 128,214 boxes. The receipts increased 10,601 boxes, or 6 per cent.; the shipments 9,927 boxes, or nearly 9 per cent. The annual average prices of factory cheese for the last six commercial years were as follows: 1870–'71, 13$\frac{3}{4}$ cents per pound; 1871–'72, 14$\frac{1}{2}$; 1872–'73, 14$\frac{1}{2}$; 1873–'74, 14$\frac{3}{4}$; 1874–'75, 14; 1875–'76, 11.4 cents. The manufacture of cheese during the season was very large. Pasturage was very luxuriant during the milking season and cheese factories more numerous than during the previous year. The market was supplied with a good class of cheese, but the demand was only fair.

Tallow.—The trade presented no very remarkable feature during the year. In the fall of 1875 a temporary foreign demand depleted the stocks in the country, but the effect was soon lost sight of. Prices were somewhat higher than during the previous year, but the receipts show a falling off, being 28,009 tierces, against 33,397; the shipments were 5,490 tierces, an increase of 1,686. Prime city-rendered tallow was quotable at the beginning of the year at 8$\frac{7}{8}$ cents per pound, but under the stimulus of the foreign demand before alluded to it advanced to 9 to 9$\frac{1}{2}$ in October. After November, prices shrunk until the close of the year. The average of this class of tallow for the year was 8.77 cents per pound, against 8$\frac{1}{2}$ in 1874–'75, 7.4 in 1873–'74, and 8.4 in 1872–'73.

Hides.—Heavy competition during the year rendered the margin of profits in hides very narrow, and consequently gave rise to great dissatisfaction among dealers. The receipts of dry hides were not equal to previous years, but green hides show a considerable increase. The increase of facilities of transportation has increased the number of green hides marketed, and tanners are annually taking a larger number of the latter. A large part of the Texas hides received at this market are now green, while the dry hides from the region penetrated by the Union Pacific Railroad are being replaced by green ones. The latter also come from the regions around Lake Superor. Many light hides are shipped from the West by way of Cincinnati to Boston. Dry flint hides averaged 14.3 cents per pound, against 17.5 cents the previous year. The receipts by river and rail were 188,808 pieces, and 272,521 pounds, against 177,525 pieces, and 213,812 pounds the previous year; shipments, 144,214 pieces and 40,300 pounds, against 128,961 pieces and 102,720 pounds.

Sheep.—Receipts 355,848 head, an increase of 82,746, or 30 per cent.; shipments, 278,320, an increase of 106,313, or nearly 62 per cent. The quality of the animals marketed was about equal to those of the previous year. The demand was fair and prices somewhat lower. At the opening of the year prime stock was quoted at $4.25 per cental, gross, with a gradual advance to $6, the maximum, in March; then a decline commenced, and the minimum, $3.75, was reached in July; the year closed at $4. The average quotation for the year was $4.75 per cental, gross, against $4.89 in 1874–'75 and $4.50 in 1873–74. The receipts and shipments of sheep during the last nineteen commercial years were as follows:

Years.	Receipts.	Shipments.	Years.	Receipts.	Shipments.	Years.	Receipts.	Shipments.
1857–'58	17, 896	4, 363	1864–'65	47, 023	5, 815	1870–'71	134, 892	51, 109
1858–'59	29, 064	6, 025	1865–'66	73, 229	13, 177	1871–'72	187, 522	68, 541
1859–'60	25, 069	6, 724	1866–'67	91, 987	21, 052	1872–'73	131, 633	62, 755
1860–'61	22, 041	6, 000	1867–'68	73, 097	19, 809	1873–'74	240, 161	101, 975
1861–'62	27, 453	7, 433	1868–'69	117, 548	31, 353	1874–'75	273, 102	172, 007
1862–'63	25, 900	4, 745	1869–'70	90, 205	35, 581	1875–'76	355, 848	278, 320
1863–'64	35, 223	4, 077						

The average gross weight per head of sheep at the stock-yards was 80.9 pounds, against 81.04 the previous year.

The above figures show a great increase both in the consuming and the distributive trade. Cincinnati has become one of the leading sheep-markets of the country, being surpassed in the extent of its business only by New York and Chicago.

Sheep products— Wool.—The business of the commercial year 1875–'76 was more satisfactory than that of any previous year. The receipts and shipments show smaller aggregates; but this is from a decline in the through shipments, which do not properly belong to the business of this point. The year opened with a fair demand, which continued till November, when the market became depressed, and decline, dullness, and doubt characterized the winter trade. Large auction sales of woolen goods unsettled values, so that it was difficult to make quotations. Prices went down to 8 and 10 cents per pound, and even then were mainly nominal. Manufacturers whose necessities compelled them to keep their machinery in motion purchased sparingly, and only for immediate consumption. Several large eastern manufacturers failed and involved some western traders in their fall, though none of these were in Cincinnati. This state of things, inducing great caution, resulted in low prices for the raw material. In May, Ohio fleece, washed, paid the producers only 27 @ 28 cents per pound, a decline of 10 cents from the opening of the commercial year. During the war this fleece had commanded $1, and so late as 1871–'72 brought 75 cents. But these low prices induced an enlargement of manufacturing enterprise, and its increased consumption reacted upon prices, which had greatly stiffened up at the approach of July. This continued to the close of the year, the advance in fleece-washed wool being 7 @ 8 cents over spring prices. Tubwashed and unwashed manufacturing did not present so marked an advance. The demand has steadily been for better grades of wool, and the range between high and low grades was broader than usual. The whole trade had an improved tone, an increased inquiry for wool and more liberal purchases. The general impression was that the wool market had passed the dead-point of depression, and that the business was gaining a firmer footing than for many years. The receipts of the year were 14,242 bales, against 14,668 the previous year; shipments 11,870 bales, against 14,260. The large decline in the shipments indicates an increased amount taken for local manufacture.

Swine.—The receipts of live and dressed hogs during the last commercial year amounted to about 880,000, against 920,889 the previous year; shipments 185,206, against 149,464. Of the receipts, 672,055 were weighed at the stock-yards, and their aggregate weight was 169,350,795 pounds, averaging 252 pounds per head. The number weighed in 1874–'75 was 705,637, weighing in the aggregate 180,042,495 pounds, and averaging 255 pounds per head. During the last two commercial years the largest average weight was in January and the smallest in April.

The number of hogs packed during the last six winter-packing seasons, with their average weight and yield of lard per head, were as follows:

Years.	Number packed.	Average gross weight per head.	Average yield of lard per head.	Average cost per cental, gross.	Aggregate weight of hogs packed.	Aggregate cost of hogs packed.
		Pounds.	*Pounds.*		*Pounds.*	
1870–'71	481, 560	298. 8	42. 62	....	143, 890, 128	....
1871–'72	630, 301	259. 2	41. 02	$4 36. 4	162, 283, 049	$7, 949, 362
1872–'73	626, 305	304. 9	45. 67	3 92. 3	190, 960, 394	7, 491, 276
1873–'74	581, 253	280. 7	39. 7	4 58. 2	163, 232, 506	7, 341, 953
1874–'75	560, 164	278. 25	41. 77	6 99. 17	155, 864, 126	10, 897, 584
1875–'76	563, 359	273. 68	37. 8	7 27. 53	154, 185, 385	11, 217, 469

During the year business was very unsatisfactory to all concerned. During the winter packing season hogs commanded prices which operators considered as incompatible with profitable investment, and hence some remained out of the market during the whole season. Prices in September and October ranged from $7 to $8.50 per cental, but fell slightly at the opening of the winter packing season. Fair to good hogs were then quotable at $7.10 @ $7.30 per cental gross, which exceeded the average of the preceding winter. Prices advanced, with occasional hesitation, till nearly the end of the season, closing at $7.40 @ $7.90, which were considerably below the highest figures reached. The average of the prices during the year was $7.27.53 against $5.99.17 the previous year.

During the summer packing season of 1875, embracing part of the last commercial year, the Cincinnati operators packed 118,783 hogs, with a total weight of 27,931,258 pounds, and averaging 235.14 pounds per head. In 1874, there were summer packed 136,153 hogs, with an aggregate gross weight of 31,626,076 pounds, and an average gross weight per head of 232.28.

Hog products.—Barreled pork.—From lack of uniformity in the details of the reports of past years, it would be difficult to give a comparative view of the production of pork in its various forms in Cincinnati. During the last commercial year 36,735 barrels of mess pork were reported, against 38,262; of other kinds of barreled pork 6,994 were produced, against 5,970 the previous year, but this last amount is evidently too small, as in that year no note was made of several kinds of pork product. The receipts of barreled pork during the last commercial year amounted to 6,063, the smallest within a half century. The receipts of 1847–'48 were 69,828 barrels, but ever since that time this branch of trade has been declining. The shipments of last year were 53,518 barrels, somewhat larger than last year, but bearing a very small proportion to the great export trade of former years, which in 1847–'48 amounted to 196,186 barrels. The average price of mess pork during the last commercial year was $20.92.1, against $20.46.8 the previous year, and $16.68.5 in 1873–'74. During the last twenty-one years the maximum average price, $32.75, was in 1864–'65; minimum, $10.70, in 1861–'62.

Lard.—The product of lard last commercial year amounted to 64,312 tierces, 405 barrels, and 7,653 kegs, against 70,343 tierces, 243 barrels, and 6,699 kegs the previous year. The receipts of lard were 13,951,721 pounds, against 11,586,129 the previous year; shipments 35,157,200 pounds, against 30,855,878. The average price of prime steam winter was 12.24 cents per pound, against 13.72 the previous year; of kettle winter 13.27 cents, against 14.45. During the last twenty-one years the maximum quotation, $21\frac{1}{4}$ cents, was in 1865–'66; minimum, $7\frac{1}{2}$, in 1861–'62.

Pork and bacon.—Receipts of last year 25,244,229 pounds, against 25,530,475 pounds the previous year; shipments, 91,797,010 pounds, against 96,222,139.

CHICAGO.

The total value of all kinds of live stock received at the Union Stock-yards of Chicago during 1876 was $111,185,660, against $117,533,941 in 1875, a decline of nearly $5\frac{1}{2}$ per cent. This decline is not the result of a decline in business, but of a general shrinkage of values. The number of animals marketed during 1876 was greater than in any former year.

Horses.—The monthly receipts and shipments for the last four years were as follows:

Months.	1873.		1874.		1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
January	627	467	688	604	453	562	152	200
February	2,135	1,078	2,538	2,376	1,222	1,141	726	617
March	4,253	3,989	3,838	3,690	2,784	2,781	1,607	1,522
April	2,913	2,801	2,739	2,672	2,083	1,835	1,230	1,224
May	2,666	2,663	1,603	1,607	1,376	1,497	930	883
June	2,737	2,276	1,807	1,508	1,150	1,096	790	696
July	1,104	984	804	839	648	715	445	440
August	1,073	1,002	853	760	416	414	464	299
September	1,340	1,254	838	888	431	424	953	381
October	779	609	1,251	1,223	293	223	497	373
November	422	370	423	256	271	260	244	156
December	240	227	206	185	172	151	121	108
Total	20,289	18,540	17,588	16,608	11,329	11,109	8,159	6,839

This branch of the live-stock trade shows a marked decline during the years under consideration, the numbers being reduced nearly two-thirds since 1873.

Cattle.—The number of cattle received during the year was 1,096,745, an increase of 19 per cent. over 1875; the shipments were 797,724, an increase of 14½ per cent. The monthly receipts and shipments of the last six years were as follows:

Months.	1871.		1872.		1873.		1874.		1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
January ...	30, 708	16, 639	44, 990	33, 047	50, 520	30, 564	59, 438	44, 771	64, 951	43, 694	71, 062	45, 771
February ..	43, 299	28, 782	41, 087	36, 146	45, 019	35, 509	52, 775	43, 719	58, 142	41, 113	79, 938	56, 835
March	44, 752	39, 578	53, 705	43, 170	63, 836	56, 477	72, 542	59, 935	80, 149	65, 314	100, 972	78, 115
April	48, 144	43, 522	58, 393	52, 474	84, 249	68, 531	77, 346	66, 733	92, 374	82, 888	97, 796	88, 717
May	59, 217	49, 455	71, 700	67, 039	81, 602	80, 261	77, 373	72, 993	80, 736	72, 170	115, 140	97, 301
June	52, 564	44, 637	63, 449	52, 335	85, 380	68, 818	89, 274	68, 728	90, 481	70, 384	92, 739	74, 972
July	50, 041	39, 754	58, 439	41, 928	73, 207	54, 505	65, 118	48, 299	65, 471	52, 624	89, 765	70, 644
August	50, 583	36, 007	64, 463	47, 211	67, 731	49, 726	73, 308	50, 541	85, 948	61, 924	90, 176	65, 279
September .	53, 175	38, 528	66, 744	43, 179	65, 394	44, 301	73, 761	45, 854	82, 495	55, 294	101, 816	73, 308
October	37, 981	22, 759	64, 957	34, 388	63, 845	34, 162	85, 193	50, 161	84, 763	62, 301	88, 604	54, 244
November .	42, 781	20, 378	55, 884	32, 468	37, 712	23, 351	65, 530	37, 643	72, 003	42, 462	90, 646	52, 537
December ..	29, 805	21, 393	40, 799	26, 105	42, 933	27, 976	52, 308	38, 552	63, 330	43, 342	78, 091	40, 001
Total ..	543, 050	401, 432	684, 610	509, 490	761, 428	574, 181	843, 966	627, 929	920, 843	696, 534	1, 096, 745	797, 724

The cattle trade of 1876 was by far the largest on record, and was steady and uninterrupted during the year. The immense corn-crop of 1875, far exceeding the demand of the market for this grain, induced northwestern farmers to go extensively into stock-feeding. A sufficient number of hogs could not be obtained for its consumption, and hence cattle-feeding was resorted to for the disposal of the surplus. Hence, during the fall months of 1875, a larger number of cattle were got together upon farms dependent upon the Chicago market than ever before known. November and December of that year were remarkably mild, and the grass continued green and fresh to an unusually late period. It soon became apparent that an immense beef-production was going forward, and that the supply of cattle would be unprecedentedly large. The Chicago market verified these indications by the receipt of a very large number of cattle in January, a month in which transactions are usually limited. Prices for the season opened at \$2.75 @ \$6 per cental, but gradually receded till at the beginning of April the best cattle in the market commanded only \$4.75. In the first week of May prices rallied to \$5 @ \$5.25 for choice animals, but they gradually fell off till in the closing months of the season the maximum was quoted at \$4.60 @ \$4.75. Toward the close of the year another rally is noted, bringing up the highest grade of beeves to \$5 @ \$5.50. Lower grades did not shrink so heavily. While choice and extra beeves averaged at least \$1 per cental lower than in 1875, the decline in the less valuable stock was only 50 @ 75 cents. A large number of consumers were driven by financial considerations to the use of cheaper beef than they had been accustomed to.

The largest number ever marketed here during any single month, 115,140, was in May, 1876, while every month indicated a great advance upon the corresponding month of 1875. All the States and Territories supplying this market except Texas showed a greater or less increase, especially the regions west of the Missouri River. Colorado, Wyoming, Montana, Utah, Oregon, and the Indian Territory greatly enlarged their quotas of supply. These extreme western cattle, which at first were suspiciously regarded under the name of "half-breeds," rapidly grew in favor and began to supersede the natives of the same weight and flesh, with ordinary feeding. The bulk of these far-west receipts was taken by local butchers and packers, either for home consumption or for export as beef.

Cattle products.—Beef.—The excess of receipts of cattle over shipments amounted to 299,021, against 224,309 in 1875. Of this aggregate, about 70,000 head were taken by the beef packers and pressers. A direct export of dressed beef from Chicago to Europe had been inaugurated in 1874, and had increased its operations during 1875, but it still was largely of an experimental character. During 1876 this business developed a permanent relation to the demands of the English market, and became one of the established features of Chicago trade. A large amount of capital has been invested in sea-going vessels with refrigerating apparatus, and orderly methods have been introduced into the business which have greatly secured its success. Among the precautions for the delivery of the beef in good order in the English markets is the inclosing of each quarter in cotton-sheeting, thus protecting it from dirt in handling. On the day following the arrival of the vessel at Liverpool the cargo is shipped by rail to London, the largest meat-consuming market in the world. A considerable amount of dressed beef, embracing last season 60,000 carcasses, was shipped to the manufacturing towns of New England and New York. Some of this is from the smaller towns and rural districts of the Northwest, which is sent to Chicago for shipment eastward. This trade somewhat interferes with the business of the city butchers.

During the last eleven years the numbers of cattle annually packed at this point were as follows: 1865-'66, 27,172; 1866-'67, 25,996; 1867-'68, 35,348; 1868-'69, 26,950; 1869-'70, 11,963; 1870-'71, 21,254; 1871-'72, 16,080; 1872-'73, 15,755; 1873-'74, 21,712; 1874-'75, 41,192; 1875-'76, 75,000. The heavy increase in the slaughter of beeves at Chicago is due especially to the development of the canned beef trade, which is supposed to absorb at least four-fifths of the beef annually packed here. This new article has found its way to many points in Europe, and Chicago packers claim a fair average profit from their operations. The can-packers do not slaughter their own cattle, but procure dressed carcasses either from wholesale firms in the city or from parties at neighboring points. The regular barrel-packing business is on the decline, as the business can be more profitably carried on nearer the base of supply of the raw material, and hence it is pursued more largely in the far West. Only one firm in Chicago during 1876 pursued the old method of barreling. Of barreled beef, the receipts during 1876 amounted 36,162 barrels, against 26,949 in 1875; 36,670 in 1874; 7,158 in 1873; 14,512 in 1872; 53,289 in 1871; 20,554 in 1870, and 1,478 in 1869; showing a very irregular supply from other points. The shipments amounted to 72,004 barrels in 1876, 60,454 in 1875, 72,562 in 1874, 33,938 in 1873, 39,911 in 1872, 89,452 in 1871, 65,369 in 1870, and 48,624 in 1869, showing a great fluctuation in the dispatching trade. The prices of mess beef at the beginning of each month in 1876 ranged from \$8.50 @ \$9 in March to \$10.75 @ \$11 from May to October, falling to \$9.50 @ \$9.75 at the close of the year. Extra mess ranged about \$1 per barrel higher.

Tallow.—Receipts 5,305 tons, against 3,259 in 1875, 3,374 in 1874, and 4,203 in 1873; shipments 6,209 tons, against 3,701 in 1875, 4,051 in 1874, and 5,787 in 1873.

Sheep.—The receipts of sheep were 364,095 head, a decline of 54,843 from the receipts of 1875; the shipments were 195,925, or 44,679 fewer than in 1875.

The monthly recepts and shipments for six years were as follows:

Months.	1871.		1872.		1873.		1874.		1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
January	35,111	17,576	42,069	23,235	39,751	20,787	29,173	15,621	58,162	41,898	50,249	33,803
February	43,608	25,512	41,803	25,348	27,729	24,728	41,586	27,545	42,571	27,924	45,201	30,607
March	42,213	29,321	38,170	29,495	31,061	23,020	34,866	26,630	50,985	36,702	39,334	27,295
April	23,379	13,084	24,771	17,328	75,570	12,798	26,106	19,233	41,952	30,359	29,386	20,491
May	23,337	8,557	16,389	5,945	21,030	8,653	20,218	11,319	16,476	6,006	17,745	9,839
June	22,667	6,496	13,776	3,493	20,262	5,506	17,538	5,501	16,639	3,228	15,956	5,252
July	19,022	5,214	13,819	2,471	17,697	784	16,035	2,991	12,626	982	13,874	2,821
August	25,471	6,917	18,777	3,937	19,921	1,152	21,926	6,879	24,386	9,371	19,051	5,204
September	27,732	7,264	22,452	5,622	16,794	1,975	23,268	6,768	28,286	9,346	25,946	10,889
October	18,632	4,397	48,290	7,349	27,871	5,472	30,837	11,657	31,916	16,721	36,341	18,305
November	19,144	3,697	24,343	7,417	18,506	4,566	30,765	14,229	40,667	20,488	33,673	15,449
December	15,737	7,029	25,552	13,376	17,042	5,794	46,353	32,182	54,282	37,579	37,339	15,970
Total	316,053	135,064	330,211	145,016	333,234	115,235	338,655	180,555	418,948	240,604	364,095	195,925

The sheep trade during the year was remarkable for its steadiness. During the first half of the year there was a strong healthy demand for shipment, but with the close of the spring season and after shearing time the shippers generally withdrew, leaving the market to the local butchers. This reacted upon the supply, which fell off, with a partial fitful revival at different times in the closing months of the year. The character of the receipts became perceptibly lower as the year drew to its close, especially the increasing import from Texas. Prices opened at \$5 @ \$5.50 per cental in January, and advanced to \$6 for choice sheep. During the subsequent months extra grades rose to \$7.75 in May, but a subsequent reaction carried prices down as low as \$4.12½ for the best in market on the 1st day of December.

Swine.—Receipts 4,190,006, an increase of 277,886 over the previous year. The shipments were 1,131,635, a decline of 451,008.

The monthly receipts and shipments at the Union Stock-yards during the last six years were as follows:

Months.	1871.		1872.		1873.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
January	300,697	26,530	361,935	78,377	561,245	95,237
February	139,342	47,724	268,236	104,668	378,760	163,140
March	97,058	75,387	170,785	144,209	271,626	224,194
April	71,632	63,086	169,149	145,151	292,903	225,715
May	137,521	111,524	265,259	196,451	261,361	217,914
June	197,499	166,513	254,714	206,940	245,860	189,586
July	165,831	134,391	212,030	172,934	244,550	201,682
August	118,975	98,187	219,406	198,077	234,145	188,776
September	164,749	125,561	214,728	186,010	239,512	191,241
October	161,212	131,370	229,304	175,241	325,716	196,569
November	386,766	113,643	373,963	132,381	616,201	156,926
December	456,831	67,490	513,114	95,195	665,771	146,577
Total	2,398,113	1,161,406	3,252,623	1,835,634	4,337,750	2,197,557

Months.	1874.		1875.		1876.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
January	457,088	146,435	508,347	135,509	446,061	48,294
February	303,341	163,950	421,833	127,532	360,444	74,959
March	238,728	202,317	240,797	147,778	211,389	105,756
April	311,945	245,945	259,569	171,505	226,602	94,026
May	328,838	265,140	272,887	164,090	307,250	127,890
June	310,072	238,396	299,051	165,184	369,581	125,188
July	231,416	183,450	290,137	157,781	261,564	125,529
August	205,904	147,355	190,788	111,378	224,006	111,736
September	261,123	168,628	165,919	119,181	278,999	106,833
October	350,812	242,350	301,255	135,073	392,946	100,800
November	727,407	203,437	491,393	94,428	569,195	71,218
December	531,705	119,928	470,134	53,204	541,969	39,406
Total	4,258,379	2,327,361	3,912,110	1,582,643	4,190,006	1,131,635

The excess of receipts over shipments was 3,058,371, or 728,904 greater than the excess of 1875. This is accounted for by the great increase in summer packing during the summer of 1876. Feeders and shippers, on the whole, were satisfied with their share of the trade, as they found all through the year a good demand for their stock. The year opened, however, under no bright promise. Two months of the winter packing season had passed, and the supply of hogs had shown a material falling off, compared with the corresponding months of the previous season. Reports of immense losses from cholera in prominent swine-raising districts were rife in the market, creating the impression of a short supply. These reports had elevated prices during November and December, 1875. January opened at high figures, in spite of a combination of buyers to reduce them to a normal level, the range being from $6.70 to $7.25 per cental. The upward pressure continued through the month, working the quotations slowly up to $7.50. The unwillingness of buyers to pay such prices caused a reduced stock, the receipts of January falling 62,286 short of January, 1875. February, the closing month of the winter packing season, brought no reaction against the pressure. The receipts fell off 61,389 short of February, 1875, and prices advanced to $7.90 @ $8.50. By the close of the season it seemed evident that the number packed in the West in 1875–'76 would fall largely short of the previous season. The final footings showed a reduction of 686,041. In March an effort was made by packers to keep up the price of hogs by keeping their establishments running after the close of the winter season at from half to three-fourths of their capacity. The object of this movement, it was suggested, was to prevent a fall of prices in barreled pork until they had marketed their product. The receipts for the month fell 29,408 short of March, 1875, making a decrease for the first quarter of the year of 153,083; prices ranged from $7.90 to $8.40. Packers continued to operate in this way to sustain their high figures for winter-packed pork through the first ten days of April, and until it was found that consumers showed a determination to take less of the high-priced pork, which began to decline, causing a decline in the price of hogs, which continued, until at the close of June quotations were $6 to $7.10. The receipts of April compared with the previous year fell off 32,967; but May and June increased respectively 34,363 and 70,530, making the net increase for the second quarter 71,926, and reducing the net decline for the first two quarters to 81,157. During the last half of July receipts fell off considerably, and prices temporarily rose to $6.50 to $6.70; but during August and September hogs arrived in increased numbers, and prices of all grades ranged from $6 to $8.75. Receipts fell off 28,573 in July, but increased 33,218 in August and 113,080 in September, making the net increase of the third quarter 117,715, and the net increase of the first three quarters 36,568. October opened with a steadiness of prices which it did not maintain. A full supply at the first caused a fall of 25 to 30 cents per cental, but receipts began to fall off and prices again rallied. In November the winter packing season re-opened, but many packers had continued operating all through the intervening months and their movements had a regulating influence upon the houses that had suspended operations during the summer. Prices for packing-hogs during the month ranged from $5.70 to $5.90. The trade of December was remarkable for steadiness, with a strong tendencey to high prices toward the close, caused by a falling off in the receipts. The arrivals increased 91,691 in October, 77,802 in November, 71,825 in December; during the fourth quarter, 241,318; during the year, 277,886.

The average gross weight per head of hogs received during the year was 239 pounds, against 233¾ pounds in 1875, and 218 pounds in 1874. The monthly average weights per head during the last five years were as follows:

Months.	1872.	1873.	1874.	1875.	1876.
January	286⅛	289⅞	252¾	261	281
February	263⅞	269⅞	211¾	251	262
March	227¾	221⅓	201¾	217	220
April	225⅓	213	197¾	206½	217
May	223	217¾	199¼	210	228
June	227½	230	203. 7	218	233
July	231	231¾	297. 9	223	234
August	233⅓	235½	208¼	222	242
September	257½	241. 6	209⅓	230	246
October	264⅛	252¼	221¾	239	256
November	272	267¼	244	256½	262
December	283¼	270¼	253¼	271	270
General average	263	246. 6	218	233¾	239

From the above tables it appears that during the present decade the largest annual receipt was in 1873, and the largest average weight per head in 1872. The very great receipts of 1874, being of comparatively light weight, did not yield a net product in proportion to their numbers. The largest amount of live pork marketed in any one year was 1,069,689,150 pounds, in 1873; the next largest aggregate, 991,411,434 pounds, was in 1876. The total value of the hogs packed in 1876 was $48,974,000, an increase of $9,224,000 over 1875.

Hog products.—Pork.—Receipts of 1876, 43,911 barrels; 1875, 58,270; 1874, 40,381; 1873, 43,758; 1872, 121,023. Shipments, 1876, 315,448 barrels; 1875, 311,170; 1874, 233,764; 1873, 191,144; 1872, 208,664. The city product of the winter packing-season of 1875–'76 was 263,430 barrels; 1874–'75, 261,675; 1873–'74, 195,917; 1872–'73, 102,986; 1871–'72, 152,012; 1870–'71, 148,050; 1869–'70, 118,599.

Summary.—The annual receipts of cattle, sheep, and swine during eleven years were as follows:

Years.	Cattle.	Sheep.	Swine.	Total.
1866	393, 007	207, 987	961, 746	1, 562, 740
1867	329, 188	180, 888	1, 696, 738	2, 206, 814
1868	324, 524	270, 891	1, 706, 782	2, 302, 197
1869	403, 102	340, 072	1, 661, 869	2, 405, 043
1870	532, 964	349, 853	1, 693, 158	2, 575, 975
1871	543, 050	315, 053	2, 380, 083	3, 238, 186
1872	684, 075	310, 211	3, 252, 623	4, 246, 909
1873	761, 428	291, 734	4, 337, 750	5, 390, 912
1874	843, 966	333, 655	4, 258, 379	5, 435, 997
1875	920, 843	418, 948	3, 912, 110	5, 251, 901
1876	1, 096, 745	364, 095	4, 190, 006	5, 650, 846

SAINT LOUIS.

Horses and mules.—The receipts of horses and mules were 22,721 in 1876, against 27,516 in 1875, and 27,175 in 1874. The shipments were 26,301 in 1876, 28,675 in 1875, and 30,202 in 1874. It will be noticed that in each of the three years the shipments are more numerous than the receipts. This apparent discrepancy is explained by the fact that the receipts are confined to rail and steamer and take no account of the animals brought into the city from the immediate neighborhood. The range of prices per head for all grades on the first day of each month for the past four years was as follows:

Months.	1873.		1874.		1875.		1876.	
	Horses.	Mules.	Horses.	Mules.	Horses.	Mules.	Horses.	Mules.
January	....	....	$30 to $175	$60 to $200	$40 to $180	$75 to $200	$20 to $200	$80 to $200
February	....	....	30 to 165	50 to 200	40 to 180	75 to 200	25 to 200	80 to 200
March	$50 to $200	$85 to $200	30 to 165	50 to 200	40 to 180	75 to 200	25 to 200	80 to 200
April	50 to 200	85 to 200	30 to 165	50 to 200	40 to 180	75 to 200	25 to 200	80 to 170
May	40 to 200	85 to 175	30 to 165	50 to 200	40 to 180	75 to 180	25 to 200	80 to 170
June	40 to 225	85 to 200	40 to 170	65 to 200	40 to 180	75 to 200	25 to 250	85 to 185
July	40 to 230	85 to 200	40 to 200	70 to 190	40 to 180	75 to 180	25 to 250	85 to 185
August	40 to 225	90 to 225	40 to 200	75 to 200	40 to 180	75 to 200	25 to 250	85 to 185
September	40 to 225	90 to 225	40 to 180	75 to 200	40 to 180	75 to 200	25 to 250	85 to 185
October	40 to 225	75 to 225	40 to 170	75 to 200	40 to 200	85 to 200	25 to 250	85 to 185
November	25 to 175	65 to 175	40 to 170	75 to 200	25 to 200	80 to 200	25 to 250	85 to 185
December	40 to 200	65 to 225	40 to 170	75 to 200	20 to 200	80 to 200	25 to 250	85 to 185

This trade is mostly with the South, and is not very remunerative, as its declining aggregates indicate. The largest source of supply is Western Missouri and Kansas, full half the receipts coming from that region. A large number come down the Mississippi River on steamers. Illinois furnishes about 10 per cent. of the whole, and a few come from Ohio, Indiana, and Kentucky.

Cattle.—The receipts of cattle amounted to 349,043 head, an increase of 4 per cent. over 1875, but not equal to 1874. Shipments 220,430, an increase of nearly 2 per cent.

The aggregate receipts and shipments of the last twelve years were as follows.

Years.	Receipts.	Shipments.	Years.	Receipts.	Shipments.	Years.	Receipts.	Shipments.
1865	94,307	46,712	1869	124,565	59,867	1873	279,678	180,662
1866	103,259	24,462	1870	201,422	129,748	1874	360,925	226,678
1867	74,146	26,799	1871	199,527	130,018	1875	335,742	216,701
1868	115,352	37,277	1872	263,404	164,870	1876	349,043	220,430

The above figures show a rapid augmentation of the cattle trade of Saint Louis, especially since the immense production of Texas and the southern trans-Mississippi region began to find its way to the eastern markets through the Pacific railroads. The maximum receipts are noted in 1874, but the reaction of 1875 was partially compensated by the increased receipts of 1876. The new transportation arrangements with the east-bound railways will inure to the advantage of this trade, as well as to the flour and grain movement, and it is believed that both receipts and shipments will go on increasing in the future.

The following table shows the range of prices per cental at the beginning of each month for the last six years:

Months.	1871.	1872.	1873.	1874.	1875.	1876.
January	$2 50 to $6 25	$2 25 to $5 50	$1 50 to $6 00	$1 50 to $6 50	$2 60 to $6 00	$2 40 to $6 25
February	2 50 to 6 50	3 25 to 5 75	1 50 to 6 00	1 50 to 6 25	2 00 to 6 00	2 00 to 6 00
March	2 75 to 6 50	3 50 to 6 75	1 50 to 6 37½	1 75 to 6 00	2 00 to 6 00	2 00 to 5 50
April	2 75 to 6 50	3 50 to 6 75	1 75 to 6 62½	2 00 to 6 25	1 75 to 6 25	2 00 to 5 50
May	2 62½ to 6 60	4 37½ to 6 50	2 00 to 6 12½	2 75 to 6 00	1 50 to 6 75	2 00 to 4 50
June	3 00 to 6 75	2 50 to 6 50	1 75 to 6 00	2 00 to 6 25	1 50 to 6 75	2 00 to 4 50
July	2 00 to 5 00	1 75 to 6 50	1 75 to 5 60	1 25 to 6 25	1 50 to 6 75	2 00 to 4 75
August	1 75 to 5 60	1 75 to 6 25	1 75 to 6 50	2 00 to 6 00	1 50 to 6 75	2 00 to 4 90
September	1 25 to 4 75	1 75 to 5 75	1 50 to 5 30	1 90 to 5 75	1 75 to 6 25	2 00 to 4 90
October	1 50 to 4 50	1 25 to 6 00	1 40 to 5 00	1 75 to 5 75	2 00 to 6 25	2 00 to 4 90
November	2 25 to 5 00	1 50 to 6 00	1 25 to 5 00	1 00 to 5 50	2 25 to 5 50	2 00 to 4 90
December	1 50 to 4 75	1 37½ to 5 50	1 25 to 5 00	1 75 to 5 75	2 25 to 6 12	2 00 to 4 90

Cattle products.—Beef.—The trade in barreled beef is small, the receipts of 1876 comprising only 12,869 barrels and tierces; shipments 17,202; the excess of shipments shows that beef-packingin the city about covers home consumption, with a small surplus for export.

Butter.—Receipts 125,309 packages, against 110,074 in 1875, 74,937 in 1874, 64,607 in 1873, and 51,250 in 1872. It is still a matter of regret to the general statistician that this unmeaning designation should be used, rendering it impossible even to estimate the quantity of butter marketed at Saint Louis. Supposing that these packages average from year to year about the same weight, the report indicates a gradual increase in the trade. The majority of the receipts, 67,725 packages, come from the East, by the Vandalia and Terre Haute Railway. A very small portion comes from Missouri and the territory westward. The shipments are too small for notice in the city statistics, the receipts being almost entirely absorbed by the home demand.

The range of prices per pound of butter of good to choice grades at the beginning of each month of the last six years was as follows:

Months.	1871.	1872.	1873.	1874.	1875.	1876.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	20 to 32	23 to 26	20 to 28	25 to 32	25 to 33	20 to 30
February	15 to 29	19 to 33	20 to 28	27 to 37	23 to 33	16 to 30
March	15 to 30	19 to 37	20 to 32	27 to 37	23 to 33	18 to 30
April	15 to 30	20 to 40	25 to 35	27 to 34	18 to 33	25 to 35
May	15 to 29	18 to 25	15 to 22	20 to 30	15 to 28	22 to 26
June	12 to 20	16 to 20	15 to 22	20 to 30	15 to 28	13 to 20
July	12 to 20	15 to 19	14 to 29	18 to 28	14 to 28	13 to 18
August	14 to 20	16 to 24	16 to 24	20 to 28	16 to 28	13 to 20
September	14 to 21	16 to 30	19 to 27	20 to 28	18 to 28	13 to 20
October	18 to 26	20 to 33	20 to 30	25 to 36	20 to 28	20 to 30
November	17 to 27	18 to 30	18 to 32	26 to 36	20 to 30	18 to 30
December	14 to 20	20 to 29	24 to 30	26 to 36	20 to 30	17 to 28

Cheese.—The receipts of cheese during 1876 amounted to 83,905 boxes, against 69,013 in 1876, 80,579 in 1874, 58,790 in 1873, and 84,345 in 1872; the shipments of 1876 were 24,536 boxes, against 52,045. Allowing 65 pounds per box, the receipts amounted to nearly five and a half million pounds. The great mass of these receipts was from the States north of the Ohio River; a considerable share was from the Middle States; very little came from the region west of the Mississippi.

The range of prices at the beginning of each month of the last six years was as follow:

Months.	1871.	1872.	1873.	1874.	1875.	1876.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	15½ to 16½	14¼ to 15	14¾ to 15	13¼ to 14	13 to 13½	13 to 14
February	15½ to 24	14½ to 15	14½ to 15	15 to 16¼	13 to 13½	12½ to 14
March	15 to 24	16½ to 17	15 to 16	15 to 16¼	13 to 13½	12½ to 14
April	15½ to 23	18½ to 22	15 to 15¼	16 to 18½	13 to 13½	12½ to 14
May	17 to 27	17 to 19	15 to 15¼	16 to 18½	13 to 13½	12½ to 14
June	14½ to 16	13 to 13½	15 to 15¼	16 to 18½	13 to 13½	12½ to 14
July	12 to 20	11½ to 12½	15 to 15¼	16 to 18½	13 to 13½	12½ to 14
August	10½ to 12	10½ to 11	10½ to 11	16 to 18½	13 to 13½	12½ to 14
September	9¼ to 10	12½ to 13½	13 to 14	16 to 18	13 to 13½	12½ to 14
October	13½ to 14	14¼ to 15¼	13 to 14	13 to 14	10 to 13½	12½ to 14
November	14 to 15¼	15½ to 16	13½ to 14½	13 to 13½	12½ to 14	12½ to 14
December	14½ to 15	14¾ to 15	13¼ to 14	13 to 13½	13 to 14	12½ to 14

The steadiness of these prices, especially during 1875 and 1876, is especially remarkable. The quotations represent the better factory brands of both eastern and western manufacture. Formerly a considerable amount of western cheese was marked with counterfeit eastern brands and sold as eastern cheese, but the rising character of the western manufacture has gradually removed the motives to this fraud.

Hides.—The receipts of hides during 1876 amounted to 21,261,245 pounds, against 19,851,947 pounds in 1875 exports 29,520,487 pounds, against 32,457,805 pounds in 1875. The course of the market during the last year was very remarkable, on account of the singular interplay of supply and demand. At the beginning of the year large supplies of both hides and leather created a very dull market, and the impression was widely disseminated that the business had been overdone. This lasted during the winter, spring, and summer; but in September reports came from the great consuming markets of the world that the general stocks of both hides and leather had been greatly reduced. A sudden demand from all quarters electrified the trade, and a wild speculative excitement took possession of the market, which did not culminate till in December. Some classes of stock rose to prices fully 50 per cent. greater than those of spring and summer. Light dry flint hides, for instance, rose from 13 cents per pound in June to 21 cents in December. At the close of December there was a decline of about 5 per cent. from the maximum quotations, and since the year closed a still further decline is noted. Commercial authorities are still undecided whether this reaction is permanent or transitory. As it hinges to a considerable extent upon the political complications in Europe, the question is likely to remain for some time an open one. The hide trade of Saint Louis is becoming quite important. The excess of shipments over receipts indicates a very considerable number of hides thrown upon the market by city butchers in excess of the demand of the home leather manufacture.

Sheep.—The sheep trade shows a marked increase, the receipts being 157,831 head in 1876, against 125,679 in 1875, 114,913 in 1874, and 86,434 in 1873; shipments 67,886 in 1876, 37,784 in 1875, 35,577 in 1874, and 18,902 in 1873. The great mass of the receipts was from Missouri and the regions west and southwest. Three-fourths of the shipments were eastward by rail, a few southward, and the remainder to neighboring localities. The increased production of the trans-Mississippi region is shown by the rapid enlargement of the Saint Louis trade.

The range of prices per cental on the first day of each month for the last four years was as follows:

Months.	1873.	1874.	1875.	1876.
January	$4 60 to	$3 75 to $5 00	$2 25 to $4 75	$2 75 to $4 90
February	3 00 to $5 25	..... to 4 50	2 25 to 4 75	2 75 to 5 50
March	3 00 to 5 25	..... to 5 00	2 50 to 5 00	2 75 to 5 50
April	3 00 to 6 00	2 50 to 5 60	4 00 to 6 25	2 75 to 5 50
May	3 50 to 6 75	4 25 to 6 10	3 75 to 6 25	2 75 to 5 25
June	3 00 to 6 50	4 00 to 6 00	3 75 to 6 25	3 75 to 5 25
July	2 50 to 4 25	2 50 to 6 00	3 75 to 6 25	3 75 to 5 25
August	4 25 to	2 50 to 6 00	3 75 to 6 25	2 50 to 4 50
September	3 20 to 3 50	2 00 to 4 25	2 85 to 4 25	2 50 to 4 50
October	2 90 to 4 12½	2 25 to 4 25	2 85 to 4 25	2 50 to 4 50
November	3 00 to 3 62½	2 50 to 5 25	3 00 to 4 75	2 50 to 4 50
December	1 75 to 4 25	2 25 to 4 75	2 75 to 4 90	2 50 to 4 50

Sheep products.—*Wool.*—The wool trade of Saint Louis during 1876 was quite satisfactory to dealers. Efforts have been made of late years to provide facilities for marketing and storing this commodity. The result has been that this trade has risen from comparative insignificance to aggregates surpassed by only one or two eastern cities. The clip of 1876 found a stagnant and comparatively demoralized market, the wool manufacture being in a very depressed condition; 15 per cent. of the looms were idle, and the remainder, with very few exceptions, were running either on short time or at a dead loss. Woolen goods were a drug in the market, and were selling below cost of production. Bankruptcies, in which creditors realized but small percentages on their claims, were of frequent occurrence, while several important mill properties were sold under the hammer by legal process at less than one-fourth of their value. The prospect of marketing any great proportion of the clip with the slack demand then prevailing was gloomy indeed, unless producers would accept of prices low enough to warrant an extensive export to foreign countries. Samples of the better grades were sent to England and Germany for comparison with the ruling grades in those countries, and for designating the limit of safety in purchase of supplies for those markets. Eastern dealers were also solicited to send orders, but they generally declined, alleging that the wool interest was in a more demoralized condition than even in 1860, when unwashed wools sold as low as 16 @ 17 cents per pound, and tub-wools 25 @ 27. Supposing that the conditions producing the depression were of a permanent character, they expected to hold the dictation of prices; but Saint Louis dealers, knowing that ruling rates were below cost of production, believed that sooner or later those causes of depression would be removed, and that trade would resume its normal course. They made extensive purchases at market-rates, almost exclusively for cash, and accumulated quite extensive stocks during the period of low prices. The wisdom of this policy demonstrated itself as the season passed on. About the close of June, eastern operators appeared in the Saint Louis market, purchasing at a slight advance upon opening prices. In spite of all efforts to mask their operations, the real state of the general markets soon became known, holders became firmer, and prices went up. During the remainder of the season an active, steady demand caused a brisk movement of stocks. In May unwashed wool was quoted at 20 @ 21 cents, and the best tub-washed brought only 31 @ 33; but in October unwashed had reached 29 @ 34 and tub washed 42 @ 48, an advance of 25 @ 40 per cent. upon the opening figures. The receipts amounted to 6,025,108 pounds, against 4,249,307 pounds in 1875, 4,963,417 in 1874, 3,956,212 in

1873, and 3,756,212 in 1872; the shipments in 1876 were 5,887,979 pounds; in 1875, 3,756,518.

The range of prices per pound of wool of all grades at the beginning of each month of the last six years was as follows:

Months.	1871.	1872.	1873.	1874.	1875.	1876.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	30 to 48	42 to 70	30 to 60	29 to 52	28 to 54	20 to 52
February	30 to 48	42 to 75	33 to 60	30 to 51	28 to 54	20 to 46
March	32 to 51	40 to 78	28 to 60	32 to 52	28 to 54	20 to 46
April	33 to 51	45 to 78	18 to 54	33 to 53	28 to 55	20 to 46½
May	33 to 53	45 to 70	18¼ to 50	28 to 50	28 to 55	26 to 45
June	27 to 58	40 to 70	18 to 52	28 to 50	28 to 55	26 to 37
July	41 to 64	40 to 70	18½ to 47	27 to 51	28 to 55	27 to 37½
August	42 to 60	40 to 65	18½ to 48	27 to 51	30 to 53	20 to 36
September	42 to 68½	36 to 62	18 to 51	27 to 52	30 to 51	20 to 36
October	43 to 69	30 to 55	17¼ to 47	27 to 53	27 to 50	24 to 40
November	42 to 70	30 to 55	13½ to 47	27 to 53	25 to 50	24 to 40
December	42 to 68	36 to 62	15 to 46	28 to 54	30 to 50	24 to 40

The stock of wool left over at the close of 1876 was 460,000 pounds, of which 275,000 pounds were from Colorado and New Mexico, 25,000 pounds unwashed Texas, 90,000 pounds of other unwashed, tub-washed 45,000 pounds, pulled 25,000 pounds.

The wool business of Saint Louis is mostly on a cash basis. Regular connections with mills in the East have been established, and arrangements have been made for keeping stocks for the constant supply of western mills, which are annually depending more and more upon the Saint Louis market for supplies. Dealers encourage the marketing of unwashed wool.

Swine.—The receipts of 1876 were 877,160 head, an increase of nearly 40 per cent. over 1875, but still below the maximum receipts of 1874. The shipments were 232,876 head, an increase of over 80 per cent. compared with 1875, though but little over half of the aggregate of 1874. The receipts of the last twelve years were as follows: 1865, 99,663; 1866, 217,622; 1867, 298,241; 1868, 301,560; 1869, 344,848; 1870, 310,850; 1871, 633,370; 1872, 759,076; 1873, 973,512; 1874, 1,126,586; 1875, 628,569; 1876, 877,160. Shipments for the same twelve years: 1865, 17,869; 1866, 13,365; 1867, 28,627; 1868, 16,277; 1869, 39,076; 1870, 17,156; 1871, 113,913; 1872, 188,700; 1873, 224,873; 1874, 453,710; 1875, 126,729; 1876, 232,876. Over two-thirds of the supply of 1876 was from Missouri and the regions west and south. A large adjacent section of Illinois on the east contributed considerable numbers, with a few from the north. Of the shipments, all were sent eastward by rail except about 2 per cent., which were taken mostly to local points near Saint Louis. A few were shipped southward.

The following table shows the monthly movement of hogs, as purchased by packers, butchers, and shippers, during 1876, together with their average weight per head and value per cental:

Months.	Taken by packers.		Taken by butchers.		Taken by shippers.		Total.		Average value per cental of the whole.
	Number.	Average weight per head.	Number.	Average weight per head.	Number.	Average weight per head.	Number.	Average weight per head.	
		Pounds.		*Pounds.*		*Pounds.*		*Pounds.*	
January	95, 365	276. 64	13, 900	274. 9	24, 870	229. 4	134, 135	270. 4	$7 14
February	39, 533	278. 4	7, 692	275. 6	16, 760	228. 7	63, 985	271. 7	7 54
March	19, 783	229. 6	5, 276	245. 6	15, 033	210. 4	40, 092	236. 8	7 89
April	11, 451	230. 1	3, 561	240. 2	24, 421	203. 7	39, 433	227. 9	7 31
May	18, 940	228. 35	7, 035	251. 3	24, 980	196. 2	50, 955	239. 6	6 38
June	16, 565	221. 35	5, 875	233. 4	28, 061	198. 5	50, 501	228. 7	5 40
July	14, 372	218. 55	5, 081	241. 65	22, 236	179. 3	41, 689	226. 35	5 70
August	9, 240	226. 7	4, 619	237. 4	22, 564	187. 8	36, 423	229. 15	6 08
September	14, 111	237. 2	7, 893	242. 1	22, 043	183. 10	44, 047	226. 45	5 88
October	26, 696	235. 6	11, 674	255. 62	16, 889	191. 25	55, 259	231. 4	5 61
November	113, 414	269. 6	12, 540	280. 4	6, 625	188. 20	132, 579	272. 35	5 72
December	177, 281	268. 45	14, 324	277. 75	11, 610	199. 10	203, 215	270. 85	5 96

The grand total of the above figures shows 892,213 hogs, weighing, as a whole, 228,585,386.25 pounds, or 114,293 tons, with an aggregate value of $14,566,729.21. The average weight per head was 256.28 pounds, and the average price per cental $6.38.

The range of prices per cental for hogs at the beginning of each month of the last four years was as follows:

Months.	1873.	1874.	1875.	1876.
January	$3 30 to $3 70	$2 81 to $5 37½	$4 00 to $6 00	$6 00 to $7 50
February	3 85 to 4 25	4 90 to 5 65	4 50 to 7 00	5 75 to 7 25
March	4 25 to 5 00	4 90 to 5 30	5 00 to 7 25	7 40 to 8 10
April	4 60 to 5 50	5 00 to 5 25	5 00 to 7 25	7 50 to 8 50
May	4 95 to 5 35	4 50 to 5 45	.... to 8 00	7 20 to 7 55
June	4 35 to 4 60	4 80 to 5 60	6 60 to 8 00	5 40 to 5 90
July	3 90 to 4 25	5 00 to 6 00	6 00 to 8 00	5 50 to 5 75
August	4 00 to 4 40	5 50 to 7 25	6 00 to 8 00	6 10 to 6 50
September	4 00 to 4 50	4 00 to 7 50	6 00 to 8 00	6 10 to 6 35
October	.... to 4 00	4 50 to 7 25	6 00 to 8 00	5 50 to 6 25
November	3 70 to 4 25	3 25 to 6 25	5 25 to 7 25	5 50 to 6 25
December	4 00 to 4 25	5 50 to 7 50	6 90 to 7 00	5 50 to 6 25

Swine products.—The receipts for sixteen years and the shipments for twelve years of leading preparations of swine flesh were as follows:

Years.	PORK.		BACON AND CUT MEATS.		LARD.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
	Barrels.	*Barrels.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1861	116, 445	....	54, 277, 390	....	12, 252, 734	....
1862	51, 187	....	40, 340, 850	....	11, 592, 940	....
1863	34, 256	....	49, 387, 870	....	9, 501, 930	....
1864	71, 550	....	45, 291, 770	....	9, 057, 250	....
1865	66, 822	109, 702	34, 781, 570	64, 910, 870	6, 391, 030	9, 569, 830
1866	56, 740	92, 595	31, 278, 150	49, 897, 050	5, 004, 870	7, 462, 230
1867	92, 071	138, 226	47, 623, 450	70, 095, 130	7, 229, 670	14, 318, 210
1868	85, 127	130, 268	46, 753, 300	58, 229, 270	5, 941, 650	12, 945, 490
1869	78, 236	120, 002	47, 225, 140	75, 755, 450	7, 778, 410	13, 322, 900
1870	77, 398	115, 236	44, 494, 770	77, 501, 130	6, 215, 150	15, 507, 840
1871	88, 442	131, 732	57, 804, 350	123, 665, 060	10, 093, 460	30, 750, 470
1872	60, 207	114, 329	63, 434, 860	147, 141, 960	11, 288, 890	33, 943, 860
1873	57, 476	105, 876	50, 071, 760	184, 392, 770	8, 981, 820	37, 156, 810
1874	55, 453	90, 343	52, 104, 380	133, 486, 380	6, 877, 560	27, 112, 270
1875	46, 547	95, 503	51, 556, 146	165, 809, 598	6, 732, 320	24, 145, 176
1876	45, 632	86, 141	50, 290, 716	106, 803, 076	6, 067, 325	29, 292, 879

Of the above receipts, the majority were from east of the Mississippi River, except lard, the greater portion of which was from the west. Of the shipments, nearly nine-tenths of the pork, bacon, and cut meats went south. A little over half the lard went eastward; the larger portion of the latter was shipped to eastern markets for export to foreign countries.

Winter pork-packing.—The number of hogs winter-packed at Saint Louis during the last sixteen seasons, together with their average net weight per head, and the average net yield of lard per head, for six years, were as follows:

Seasons.	Number.	Average net weight per head.	Seasons.	Number.	Average net weight per head.	Average yield of lard per head.
		Pounds.			*Pounds.*	*Pounds.*
1861–'62	89,093	224.5	1869–'70	211,316	190.5	....
1862–'63	175,750	207	1870–'71	305,600	216	....
1863–'64	244,600	179	1871–'72	419,032	263.15	35.17
1864–'65	191,890	178.5	1872–'73	538,000	260	34.50
1865–'66	123,335	208.91	1873–'74	463,793	261.53	34.18
1866–'67	183,543	222.34	1874–'75	462,246	240	30
1867–'68	237,160	193.91	1875–'76	329,895	268.47	36.56
1868–'69	231,937	189.27	1876–'77	414,747	206.42	32.55

During the summer packing season, from March 1 to November 1, 1876, there were packed at this point 90,351 hogs, averaging 226.43 pounds per head; in 1875, 102,424 hogs, averaging 220 pounds; in 1874, 150,962 hogs, averaging 209 pounds; in 1873, 132,155 hogs, averaging 244.26 pounds; in 1872, 98,720 hogs, averaging 233.63 pounds.

The total number of hogs cut by Saint Louis packers is estimated at over a million. Over half of this outside product is shipped direct to eastern markets, the remainder being brought to the city. The capital invested in pork-packing in Saint Louis is over $7,000,000. The city packers also control a large number of establishments in the rural districts, in which are packed more than double the amount packed in their city houses.

PORK PACKING

IN THE WEST.

Winter packing.—The Cincinnati Price-Current has kept a record of pork-packing in the West for twenty-seven seasons, showing the number of hogs packed in each season, as follows: 1849–'50, 1,652,220 head; 1850–'51, 1,332.867; 1851–'52, 1,182,846; 1852–'53, 2,201,110; 1853–'54, 2,534,770; 1854–'55, 2,124,404; 1855–'56, 2,489,502; 1856–'57, 1,818,486; 1857–'58, 2,210,778; 1858–'59, 2,465,552; 1859–'60, 2,350,822; 1860–'61, 2,155,702; 1861–'62, 2,893,666; 1862–'63, 4,069,520; 1863–'64, 3,261,105; 1864–'65, 2,422,779; 1865–'66, 1,785,955; 1866–'67, 2,490,791; 1867–'68, 2,781,084; 1868–'69, 2,499,873; 1869–'70, 2,635,312; 1870–'71, 3,695,251; 1871–'72, 4,831,558; 1872–'73, 5,400,394; 1873–'74, 5,466,380; 1874–'75, 5,566,226; 1875–'76, 4,880,185; 1876–'77, 5,072,330.

The operations of the last winter season show a gratifying advance upon its predecessor, though the aggregates are not up to the maximum of 1874–'75. The enlarged figures of later years are in part attributable to a more perfect system of statistics, embracing each year a larger number of packing points, but allowing a sufficient margin of increase to this source, a great annual development of the pork-packing business is one of the prominent facts of the times. The business is enlarging in the South, a section hitherto mainly dependent upon the West for its meat supplies. To a large extent the demands of home consumption there are now supplied by home production. This southern packing has not yet assumed any very imposing visible proportions, but the habit of putting up pork on the farm is growing in that quarter, creating an invisible supply, which is felt in lessening the market demand, if it does not add sensibly to the published figures of production. Canada has also enlarged her pork-packing operations to an extent which indicates a hope of supplying her own home demand. The movement for the export of fresh meat to Europe has also assumed great importance, and may result in the pre-occupation of the foreign market at least for a portion of the demand hitherto manifested for winter-packed pork. Our summer-packed pork has found increasing favor in the South, in Canada, and in Europe. All these circumstances indicate a change in the arrangements of production and marketing of preserved pork. The present aggregates cannot be maintained unless an increased consumption can be secured either in markets in which it is now disposed of or new markets be opened. Questions of this character are exercising the minds of intelligent operators, but none seem to apprehend any sudden or abrupt change disturbing the business as it now subsists.

During the past two seasons a new feature of the business has been remarked in the receipt of a considerable number of hogs from Texas. These receipts were mostly at Saint Louis, of which many were stock-hogs. The latter were shipped largely to Iowa, where they are reported to have developed into excellent market animals, being unusually free from diseases and distempers common to hogs raised in many other sections. This Department estimated the number of hogs in Texas at the close of 1876 at 1,144,500 head. The production of swine in that State has greatly increased in numbers and improved in quality. The old "razor-backs" of the generation passing away are giving place to modern improved breeds, especially in Northern Texas, where hogs may be found equal in value to any now raised in the Northern States. There are no regular packing establishments of any magnitude in that State, but farmers generally pack enough to supply their own wants and those of the local markets, and send their surplus to the North and East. If there should arise in the Southwest a shipment of hogs to the general markets of the country analogous to the famous eruption of Texas cattle, it would only realize the sanguine expectation of many leading swine-raisers in Northern Texas. Quite a number of these are propagating on a large scale the best strains of Poland China, Chester white, Berkshire, &c.

Packers entered upon their operations for the last season with the idea that prices must rule lower, and many dealers undertook to make contracts for supplying hogs at prices based upon an original cost of $4.50 to $5 per cental for hogs, but they were unable to buy at any such prices after the winter season fully set in; hence many of them met with serious losses. As the domestic consumptive demand in the hog-raising States was unusually languid in November and December, 1876, and the weather unusually favorable for packing, the high prices offered by packers attracted a large number of hogs, causing the larger part of the business at the interior points to be completed during the first half of the season; but the larger cities, excepting Louisville, Ky., continued operations to the close as actively as the decreasing supply of hogs admitted. This continued activity was based largely upon the liberal foreign export, which netted a loss to the trade, as they went out of the country at prices, on the whole, rather lower than the cost of production. This export was checked by an unfortunate speculative excitement, arising about the middle of January. The center of this speculative movement was Chicago, where it lasted about three weeks. It was followed by a steady decline from the exaggerated figures reached, and the reaction carried prices at the close of the season below the average cost of the season.

Numbers packed.—The following table shows the number of hogs packed during each of the last five winter packing seasons in the States of the West and Northwest:

States.	1872–'73.	1873–'74.	1874–'75.	1875–'76.	1876–'77.
Ohio	885, 827	906, 804	870, 971	819, 602	791, 185
Indiana	610, 966	715, 703	666, 575	575, 433	529, 641
Illinois	1, 834, 611	1, 887, 328	2, 113, 845	1, 915, 830	1, 905, 219
Iowa	325, 417	369, 278	426, 258	361, 746	419, 442
Missouri	894, 334	746, 366	707, 310	556, 143	644, 699
Kansas	40, 885	64, 037	49, 536	30, 725	31, 775
Wisconsin	324, 072	333, 514	269, 468	217, 426	266, 861
Minnesota	24, 550	32, 700	20, 950	18, 750	23, 235
Nebraska	20, 220	29, 085	26, 950	26, 190	46, 190
Kentucky	3[illegible], 456	257, 259	308, 068	263, 748	254, 986
Tennessee	39, 300	26, 577	22, 639	22, 818	50, 770
Michigan	49, 306	71, 549	62, 836	53, 837	86, 899
Miscellaneous*	28, 450	26, 000	20, 820	17, 887	21, 447
Total	5, 400, 394	5, 466, 200	5, 566, 226	4, 880, 135	5, 072, 349
Increase	....	65, 806	100, 026	....	192, 204
Decrease	....	....	....	686, 091	....

*Incuding Pittsburgh, and a few points in the S outhern States.

The States bordering on the Ohio River show a decline from the production of the previous season, but all the others have increased their aggregates. The States west of the Mississippi River and Tennessee show a marked increase, a fact which indicates the future diffusion of the hog-raising business and an increasing percentage of the annual production in the far West and the South. This branch of farm production will in such case only show the same tendencies as the wheat crop, which is annually shifting its center westward while extending itself in the South.

Average net weight.—The average weights per head of the hogs packed during the last five seasons were as follows:

States.	1872–'73.	1873–'74.	1874–'75.	1875–'76.	1876–'77.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Ohio	242. 51	233. 49	222. 73	215. 14	218. 81
Indiana	230. 25	207. 22	208. 8	210. 41	199. 41
Illinois	239. 21	219. 02	213. 76	231. 46	218. 69
Iowa	229. 55	204. 67	198. 67	215. 81	207. 75
Missouri	214. 12	207. 01	189. 74	215. 85	213. 23
Kansas	244. 18	220. 64	171. 63	232. 03	240. 4
Wisconsin	230. 45	210, 89	212. 48	215. 8	226. 67
Minnesota	227. 27	229. 36	237. 46	248. 63	249. 94
Nebraska	246. 71	214. 65	193. 36	218. 57	220. 39
Kentucky	225. 84	213. 87	209. 60	215. 92	222. 52
Tennessee	207. 11	200. 42	192. 39	214. 81	208. 04
Michigan	237. 94	234. 02	234. 27	229. 7	232. 35
Miscellaneous	237. 94	207. 94	197. 08	220. 92	211. 70
General average	232. 43	214. 97	209. 77	217. 71	215. 98

The average weight of 1876–'77 was 215.98 pounds, or 1.73 pounds less than in the previous season. The general average of the last twelve seasons is 218.79 pounds, leaving the average of the last winter season 2.81 pounds short. A marked increase in weight is shown in Kansas, Wisconsin, and Kentucky, and a smaller increase in Ohio, Minnesota, Nebraska, and Michigan; the other States show a decrease, especially Indiana, Illinois, Iowa, and Tennessee. The average weight of Ohio was reduced by the policy of the Cleveland packers choosing only light hogs, and attracting them by special inducements from Chicago and Michigan; the same policy at Indianapolis enhanced the shortage of Indiana.

Average yield of lard.—The average yield of lard per head for the last five winter packing seasons were as follows:

States.	1872–'73.	1873–'74.	1874–'75.	1875–'76.	1876–'77.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Ohio	43.85	39.04	39.66	36.07	36.22
Indiana	33.89	29.66	29.83	32.66	29.69
Illinois	43.21	37.23	36.66	36.85	35.19
Iowa	37.44	33.88	33.52	34.10	33.26
Missouri	36.03	33.86	29.19	36.82	33.88
Kansas	37.50	35.83	25.43	37.7	37.16
Wisconsin	39.55	30.50	31.63	31	30.73
Minnesota	39.36	36.41	29.83	30.6	29.3
Nebraska	39.70	34.59	26.88	39.01	38.1
Kentucky	39.78	29.66	29.79	32.67	33.1
Tennessee	31.21	34.16	29.2	31.87	31.48
Michigan	38.95	38.26	35.15	33.66	32.9
Miscellaneous	38.95	31.03	28.27	33.12	32.05
General average	40.08	35.02	34.20	35.45	34.03

The smaller averages of the last few years are due in part to the fact that the hogs packed are smaller than formerly. At many points only lighter animals are in request. The only States, that increased their average yields during the last season were Ohio and Kentucky; of the other States, the most marked reduction is in Indiana and Missouri, where the average has fallen off nearly 3 pounds per head.

Average cost.—The average cost per cental of hogs packed in the different States was as follows:

States.	1872–'73.	1873–'74.	1874–'75.	1875–'76.	1876–'77.
Ohio	$4 82.59	$5 57.24	$8 64.3	8.96	7.20
Indiana	4 43.96	5 29.63	8 14.96	8.81	7.02
Illinois	4 67.1	5 43.25	8 35.6	8.93	7.42
Iowa	4 31.29	5 19.03	7 87.58	8.24	6.82
Missouri	4 63.3	5 36.63	8 19.1	8.70	7.05
Kansas	4 01.1	4 77.58	7 59	7.66	6.61
Wisconsin	4 72.48	5 72.16	8 56.04	8.76	6.78
Minnesota	4 81	5 68.52	7 28.90	7.72	6.49
Nebraska	3 70	4 64.17	7 22	7.79	7.11
Kentucky	4 88	5 44.45	8 67.51	9.05	6.92
Tennessee	5 13.5	5 72.23	8 81	8.29	6.99
Michigan	4 94.2	5 51.3	8 15.88	8.66	6.74
Miscellaneous	4 94.2	5 58.1	8 64	8.92	7.16
General average	4 65.8	5 43.15	8 33.63	8.82	7.18

The average prices paid by packers were lower in 1876–'77 than in the two seasons immediately previous, but are still greatly in advance of the seasons of 1872–'74. There is a falling off in price in all the States but not greater than is observable in all other branches of production, agricultural or manufacturing, the reduction being only 5 per cent. on the whole. Considering the general reduction of prices, it appears that the price of hogs holds its own in relation to other kinds of merchandise, showing that this branch of production and trade has not been overdone, nor has the supply outstripped a permanent and healthy demand.

Recapitulation.—The following table shows the number of hogs packed, their aggregate net weight, yield of lard, and cost, during the last twelve winter packing seasons:

Seasons.	Number packed.	Average net weight per head.	Aggregate weight.	Average yield of lard per head.	Aggregate yield of lard.	Average cost per cental.	Aggregate cost of hogs.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*		
1865–'66	1, 785, 955	231. 3	413, 091, 391	41. 52	74, 152, 851	....	....
1866–'67	2, 490, 791	232. 14	588, 212, 222	39. 66	98, 801, 376	....	....
1867–'68	2, 781, 084	201	558, 997, 884	29	80, 651, 436	....	....
1868–'69	2, 499, 873	206. 75	516, 848, 742	32. 33	80, 829, 227	....	....
1869–'70	2, 635, 312	205. 75	542, 215, 444	31. 84	83, 908, 334	....	....
1870–'71	3, 695, 251	230. 14	850, 425, 065	40. 19	148, 512, 137	....	....
1871–'72	4, 831, 558	227. 62	1, 099, 783, 385	38. 54	188, 603, 317	....	....
1872–'73	5, 410, 394	232. 43	1, 257, 519, 283	40. 08	216, 845, 385	$4 65. 8	58, 575, 148
1873–'74	5, 466, 200	214. 97	1, 175, 126, 971	35. 02	191, 444, 035	5 43. 15	63, 827, 021
1874–'75	5, 566, 226	209. 77	1, 167, 639, 457	34. 2	190, 380, 607	8 33. 63	97, 337, 928
1875–'76	4, 880, 135	217. 71	1, 062, 456, 021	35. 45	173, 016, 580	8 82	93, 708, 621
1876–'77	5, 072, 339	215. 98	1, 095, 547, 777	34. 03	172, 623, 696	7 18	78, 658, 607

The operations of the last year, compared with its predecessor, show an increase in the number of hogs packed of 192,204 head, or 4 per cent. The reduction in the weight per head of hogs packed has partly neutralized the increased number, the aggregate weight being only 33,067,756 pounds, or a little over 3 per cent. greater than last year. The hogs packed in 1876–'77 were equivalent to only 5,031,890 hogs of the weight of the previous year. The aggregate yield of lard is reduced 402,884 pounds, the average yield per head having fallen from 35.45 pounds to 34.03, a decline of 4 per cent. in one year. The average cost of hogs to the packer fell from $8.82 to $7.18 per cental, a reduction of 18.6 per cent., involving a reduction in the aggregate amount paid for hogs of $15,050,014, or 16 per cent., notwithstanding the increase of the number.

Packing in the principal cities.—Nearly two-thirds of the hogs are packed at six leading cities, viz: Chicago, Cincinnati, Saint Louis, Indianapolis, Milwaukee, and Louisville, The numbers packed at these points during the last five winter seasons were as follows:

Packing points.	1872–'73.	1873–'74.	1874–'75.	1875–'76.	1876–'77.
Chicago	1, 425, 079	1, 520, 204	1, 690, 348	1, 592, 065	1, 618, 084
Cincinnati	626, [illegible]05	581, 253	560, 164	563, 359	523, 576
Saint Louis	538, 000	463, 793	462, 246	329, 895	414, 747
Indianapolis	196, 317	295, 766	278, 339	323, 184	294, 198
Milwaukee	303, 500	294, 054	236, 596	223, 147	225, 598
Louisville	302, 246	226, 947	273, 118	181, 972	214, 862
Total for the six cities	3, 391, 447	3, 38[illegible] 017	3, 500, 811	3, 213, 622	3, 291, 065
Other points	2, 008, 947	2, 084, 183	2, 065, 415	1, 666, 513	1, 781, 274
Grand total	5, 410, 394	5, 466, 200	5 [illegible]66, 226	4, 880, 135	5, 072, 339
Per cent. of the cities	62. 68	61. 87	62. 89	65. 81	64. 88

The per cent. of the packing at these points declined somewhat during the last season, their number having increased but 77,443 head, or 2 per cent., while the number packed at other points increased 114,761 head, or about 7 per cent. This relative increase of the other points is in part attributable to the increased number of those points from which statistics are gathered.

The average net weight and yield of lard per head, per cental at those cities during the last three seasons were as follows:

Packing points.	Average weight per head.			Average yield of lard per head.		
	1874–'75.	1875–'76.	1876–'77.	1874–'75.	1875–'76.	1876–'77.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Chicago	212. 42	217. 32	215. 97	37. 3	36. 32	35. 10
Cincinnati	220. 6	218. 95	219. 77	41. 77	37. 8	38. 2
Saint Louis	192	214. 78	206. 42	30	36. 56	32. 55
Indianapolis	196	201	182. 5	29. 5	31	26. 5
Milwaukee	209. 27	215. 15	221. 73	29. 87	32. 4	30. 25
Louisville	208. 56	209. 83	221. 12	31. 15	30. 63	32. 62
General average of the cities	209. 47	215. 13	213. 11	35. 43	35. 47	34. 41
General average of other points	210. 27	222. 69	221. 38	32. 21	35. 41	33. 33
General average of the whole	209. 77	217. 71	215. 98	34. 20	35. 45	34. 03

It will be noted that the hogs packed at Cincinnati during these three seasons show, respectively, the greatest average both of weight per head and of lard per head. The hogs packed at these six cities, although averaging in weight considerably below those packed at other points, show a larger yield of lard.

Pork product.—The amount of barreled pork produced in the six cities, in the interior and in the whole of this pork-packing region, was as follows:

	Six cities.	Interior.	Total.		Six cities.	Interior.	Total.
	Barrels.	*Barrels.*	*Barrels.*		*Barrels.*	*Barrels.*	*Barrels.*
Mess pork	349, 987	138, 782	488, 769	Other kinds	11, 696	7, 795	19, 491
Prime mess	35, 942	21, 829	57, 771				
Extra prime	37, 761	10, 480	48, 241	Total 1876–'77	442, 210	195, 057	637, 267
Clear	2, 226	9, 084	11, 310	Total 1875–'76	363, 555	146, 055	509, 610
Rump	4, 598	7, 087	11, 685	Total 1874–'75	411, 747	157, 721	569, 468

Of the barreled pork, 69.4 per cent. was made at the six cities in 1876–'77, against 71.3 per cent. in 1875–'76, and 72.3 per cent. in 1874–'75. This fact indicates that the interior points are gaining in their proportion of the more elaborate preparations of pork. Of the 442,210 barrels of all kinds made by the six cities in 1876–'77, Chicago claims 290,493 barrels, or 65 per cent.; of the 363,555 barrels made in 1875–'76, Chicago made 263,430, or 72 per cent.; Cincinnati turned out 46,944 barrels in 1876–'77, against 43,729 in 1875–'76; Saint Louis, 47,826, against 32,799; Indianapolis, 1,350, against 1,480; Milwaukee, 44,250, against 33,172; Louisville, 11,297, against 15,945. Chicago, Cincinnati, Saint Louis, and Milwaukee greatly increased their product, but Indianapolis and Louisville declined.

Summer packing.—The number of hogs packed during the summer season, or from March 1 to November 1, of the last three calendar years was as follows:

Packing points.	1874.	1875.	1876.	Packing points.	1874.	1875.	1876.
Chicago	446, 368	728, 781	1, 315, 402	Canton, Ill.	....	[illegible], 720	6, 837
Cincinnati	136, 153	118, 783	121, 173	Charleston, Ill	17, 000	7, 000	....
Saint Louis	150, 962	102, 424	131, 158	Kansas City, Mo.	10, 000	....	16, 754
Indianapolis	204, 426	89, 162	283, 621	Detroit, Mich	10, 000	9, 000	24, 000
Milwaukee	12, 600	2, 632	60, 827	Des Moines, Iowa	....	....	28, 609
				Cedar Rapids, Iowa	73, 839	72, 133	105, 580
Total for five cities	950, 509	1, 041, 782	1, 912, 181	Other points	12, 900	16, 404	10, 263
Cleveland, Ohio	117, 136	106, 304	187, 392	Grand total	1, 200, 404	1, 262, 343	2, 291, 616

During the last summer season the number of hogs packed was nearly double that of the previous season. Summer-cured pork is received with increasing favor in both domestic and foreign markets. The summer of 1876 was one of general depression to holders of winter-cured pork, as the large supply of hogs, induced by the abundant supply of corn, stimulated summer curing, the product of which suffered little or no loss from shrinkage; hence it could be sold at prices entailing a loss on winter-cured pork. These facts rendered the increased aggregates of the winter season of 1876–'77 still more remarkable, and showed the existence of an increased demand for the winter product of the West. The prospects for the summer season of 1877 are very fair, the supply of hogs, from all indications, being about equal to what it was last summer. Operators at various points since the close of the winter season of 1876–'77 find the supplies somewhat in excess of last year.

The average net weight of the hogs packed in the West during the summer of 1876 was 184.03 pounds per head, against 177.32 pounds in 1875, and 164 pounds in 1874. Aggregate net weight, 421,738,051 pounds in 1876, 223,845,720 pounds in 1875, and 196,872,810 pounds in 1874. Average yield of lard, 30.36 pounds per head in 1876 and 29.25 pounds in 1875. Aggregate yield of lard, 69,528,486 pounds in 1876 and 36,923,533 pounds in 1875.

Summer and winter packing.—The results of the summer and winter packing of the five years ending March 1, 1877, may be summarized as follows:

Seasons.	Number packed.			Aggregate net weight.	Aggregate yield of lard.
	Summer.	Winter.	Total.		
				Pounds.	*Pounds.*
1872–'73	505,500	5,410,314	5,915,814	1,353,564,283	232,212,585
1873–'74	1,062,916	5,466,200	6,529,116	1,369,640,599	222,566,195
1874–'75	1,200,444	5,566,226	6,766,670	1,364,512,267	221,880,236
1875–'76	1,262,343	4,880,135	6,142,478	1,286,301,741	208,831,900
1876–'77	2,291,616	5,072,339	7,363,955	1,517,285,282	242,131,910

It will be seen that the production of the last year was the largest on record in regard to the number of animals and their aggregate weight and yield of lard.

IN THE EAST.

Annual receipts.—The receipts of hogs on the seaboard are to a small extent for packing purposes, the larger portion being taken by butchers for the supply of fresh meat. The packing business is rising to some importance in New York and Boston, but it is still on so small a scale and so unsystematized that definite statistics cannot be obtained. The number of live and dressed hogs received at four leading Atlantic cities during the last three years were as follows:

Cities.	1874.	1875.	1876.
Boston	613,874	416,657	431,784
New York	1,877,419	1,443,167	1,293,273
Philadelphia	419,934	325,677	341,860
Baltimore	357,547	299,631	272,462
Total	3,268,774	2,485,132	2,339,384

Of the receipts of 1876, 200,614 were dressed carcasses.

Summer receipts.—The receipts from March 1 to November 1, 1875, and 1876 were as follows:

Cities.	1875.			1876.		
	Live.	Dressed.	Total.	Live.	Dressed.	Total.
Boston	216, 991	16, 362	233, 353	233, 562	6, 638	240, 250
New York	885, 269	6, 097	891, 366	757, 144	7, 222	764, 366
Philadelphia	190, 900	13, 465	204, 365	201, 600	18, 400	220, 000
Baltimore	175, 447	5, 000	180, 447	175, 631	5, 000	180, 631
Total	....	....	1, 509, 531	....	....	1, 405, 247

Winter receipts.—The numbers of live and dressed hogs received at these four cities during the last three winter packing seasons, respectively, were as follows:

Cities.	1874-'75.	1875.			1876.		
	Total.	Live.	Dressed.	Total.	Live.	Dressed.	Total.
Boston	248, 949	100, 199	61, 213	161, 412	126, 762	66, 436	193, 195
New York	687, 425	457, 855	33, 046	490, 901	469, 042	65, 880	534, 922
Philadelphia	117, 260	92, 650	28, 100	120, 750	95, 840	31, 340	127, 180
Baltimore	112, 500	94, 328	15, 000	114, 328	88, 445	20, 000	108, 445
Total	1, 166, 134	....	....	887, 391	....	....	963, 742

For the twelve months ending March 1, 1877, and including the last summer and winter seasons, the receipts of these four cities amounted to 2,368,989 head, against 2,396,922 head received during the previous twelve months.

The increase in the last winter season of 76,351 head was more than counterbalanced by the decline of 104,284 in the receipts of the previous summer season.

At Buffalo, N. Y., the receipt of hogs during the winter season of 1876-'77 was 373,000, against 459,800 the previous season. Of the receipts of 1876-'77, there were shipped 294,850 head, leaving 78,210 head, of which 56,450 head were packed; the shipments of the previous year amounted to 377,500, leaving a net supply of 82,300, of which 60,000 were packed. The receipts of the calendar year 1876 were 1,150,210 head, shipments 936,700, leaving a surplus of 213,510, of which 134,000 were packed. During 1875 the receipts were 1,067,300 and the shipments 907,800, leaving 159,000, of which 142,000 were packed. During the last summer season there were packed here 78,800 head, making 135,250 for the twelve months ending March 1, 1877.

ON THE PACIFIC SLOPE.

A growing demand for prime pork to be exported to China, Japan, the Pacific islands, Russian Asia, and South America is noted in San Francisco. Grain was very abundant in California in 1876, inducing farmers to breed and fatten an increased number of hogs. This caused an enlargement of the packing business of San Francisco from 90,000 hogs in 1875 to 175,000 in 1876. The total number packed in California is estimated at 230,000 in 1876, against 170,000 in 1875, and 390,000 in 1874. California hogs are light, compared with those raised upon the Atlantic slope or in the Mississippi Valley. Those packed at San Francisco in 1876 averaged but 185 pounds gross weight per head and but 15½ pounds per head of lard. The average cost was $6.37½ per cental, gross, in coin. The introduction of the Berkshire breed of hogs is said to have already enlarged the size of market animals, and other improvements in the character of the stock are noted. The average net weight per head in 1875 was 124 pounds, and in 1874 115 pounds. The best hogs came from the corn-raising counties of Los Angeles and Ventura, though some excellent wheat-fed animals were brought from the Sacramento Valley, and some good acorn-fatted hogs from the San Joaquin Valley. The rise in the price of grain seems to indicate a reduced hog-crop for 1877. The amount of barreled pork of all kinds made at San Francisco in 1876 was 5,230 barrels. In Oregon, the packing is mostly done at Portland; estimates of the number packed in 1876 range from 60,000 to 80,000 head. Oregon raises heavier hogs than those indicated by the San Francisco average.

CANADA.

Canadian pork-packing for market is mostly confined to the province of Ontario. The business has been somewhat variable in its extent, but it seems to be growing, though several of the prominent packers of this region have found it profitable to transfer their operations to Chicago. During the last eighteen months the pork-packing facilities of Ontario have been enlarged by the erection of new packing-houses and by the extension of market arrangements generally. As the corn area of Canada is limited and not very productive, and as other kinds of grain bear good prices, Canada farmers cannot be depended upon for a large supply of hogs. Hence the Canadian packers look to the United States for the bulk of their material, especially from Michigan and Illinois; Chicago furnishes a very large proportion of the animals slaughtered. The home demand for bacon and hams is mostly supplied by Canadian farmers, but the production of barreled pork in the Dominion is not adequate to the demand, nor is it of a very high character. Canadian pork is lighter than in the United States, and put up in poorer barrels; hence it is less in favor with lumbermen and other large consuming classes, whose wants are supplied mostly from the Chicago and Cincinnati markets. Canadian packers, however, are improving in their methods and turning out a much better product than formerly. Some of them find greater profit in exporting fresh meat to Europe, and are contemplating a transfer of their capital and enterprise to that trade, but others regard this as a very doubtful policy. During the winter season of 1876–'77 there were packed at 36 different points in Canada 186,198 hogs, an increase of 66,209 head over the previous season. The average net weight of the hogs packed was 203.77 pounds per head. About 30,000 barrels of pork of all kinds were among the results of the season's operations. The number packed during the summer season of 1876 was 54,544, nearly all being at Toronto and Hamilton. The aggregate number packed in Canada during the twelve months ending March 1, 1877, was 244,742.

RECAPITULATION.

The number of hogs packed during the last two summer and winter packing seasons were as follows:

	1875-'76.			1876-'77.		
	Winter.	Summer.	Total.	Winter.	Summer.	Total.
In the West	4,880,135	1,262,343	6,142,478	5,072,339	2,291,616	7,363,955
Buffalo, Albany, and Troy	126,738	88,324	215,062	101,450	82,800	184,250
Pacific slope	85,000	170,000	255,000	105,000	200,000	305,000
Canada	119,989	40,000	159,989	186,198	58,544	244,742
Atlantic slope	887,391	1,509,531	2,396,922	963,742	1,405,247	2,368,989
Grand total	6,099,253	3,070,198	9,169,451	6,428,729	4,038,207	10,466,936
Increase	....	....	....	329,476	968,009	1,297,485

PORK PRODUCT OF WINTER PACKING.

The Cincinnati Price Current estimates the aggregate pork product of the last two winter seasons as follows:

	1875-'76.	1876-'77.
Green sides .... pounds..	424,982,408	438,218,892
Green shoulders .... do....	169,992,963	175,287,556
Green hams .... do....	148,743,843	153,376,612
Total green meats	743,719,214	766,883,060
Sides put into barrels .... pounds..	88,825,900	106,080,700
Sides remaining .... do....	336,156,508	332,138,192
Shoulders put into barrels .... do....	8,000,000	15,000,000
Shoulders remaining .... do....	161,992,963	160,287,536
Sides and shoulders, excluding barreled pork .... do....	498,149,471	492,425,748
Sides, shoulders, and hams, excluding barreled pork .... do....	646,893,314	645,802,360

Exclusive of barreled pork, the production of meats shows a slight reduction, being 1,090,954 pounds less in 1876 than in 1875.

EXPORTS OF HOG PRODUCTS.

During the fiscal year ending June 30, 1876, we exported 327,730,172 pounds of bacon and hams, with a declared value of $39,664,456; 54,195,-118 pounds of barreled pork, valued at $5,744,022; and 168,405,839 pounds of lard, valued at $22,429,485; total exports, 550,331,129 pounds, worth $67,837,963, or about 10½ per cent. of our total domestic export. Deducting from the exports gold and silver coin and bullion, our export of hog products amounts to over 11½ per cent. of the merchandise.

The distribution of this mass of material is very irregular. Europe takes 311,319,716 pounds, or 95 per cent., of the bacon and hams; 15,310,-048 pounds, or 29 per cent., of the barreled pork; and 128,296,831 pounds, or 76 per cent., of the lard; all these are valued at $56,010,651, or 82⅗ per cent. of the whole export of hog products. Of the amount sent to Europe, the United Kingdom took over two-thirds, including 281,176,650 pounds of bacon and hams, 14,272,923 pounds of barreled pork, and 50,-771,281 pounds of lard, valued at $42,053,774. Our next best customers on that continent were Germany, which took 64,886,453 pounds of hog products, valued at $8,295,569; France, which took 13,952,985 pounds, valued at $2,460,777; and Belgium, which took 9,107,248 pounds of bacon and hams, valued at $1,106,128. The Germans and French took most of their quota in lard.

The West Indies took 10,767,183 pounds of bacon and hams, 19,411,909 pounds of barreled pork, and 18,648,373 pounds of lard, all valued at $6.013,110. These islands took more of our barreled pork than any other quarter of the world, absorbing a third of our entire export. It is noticeable that Cuba deals with us almost exclusively in bacon, hams, and lard, while the other islands invest most largely in barreled pork.

South America took 638,739 pounds of bacon and hams, 3,523,571 pounds of barreled pork, and 13,755,713 pounds of lard, all valued at $2,521,030. Our largest customer in this quarter is the United States of Colombia, which took 5,280,002 pounds of hog products, mostly lard, valued at $708,110; next, Brazil took 4,556,733 pounds, nearly all lard, valued at $751,759.

The neighboring countries of North America took 4,742,290 pounds of bacon and hams, 14,440,127 pounds of barreled pork, and 7,019,227 pounds of lard, valued together at $3,051,271. Of this amount Mexico and Central America took about 2 per cent., the remainder going to the different portions of British North America, and especially to the province of Quebec. A small export was sent to Africa and to various islands in the Pacific and Indian Oceans.

COMPARATIVE EXPORTS.

The exports of different items of hog product during the fiscal years of the current decade have been as follows:

Fiscal year—	Pounds.	Aggregate value.	Value per pound.
BACON AND HAMS.			
1870-'71	71, 446, 854	$8, 126, 683	$0 11. 4
1871-'72	246, 208, 143	21, 126, 592	08. 6
1872-'73	395, 381, 737	35, 022, 137	08. 9
1873-'74	347, 405, 405	33, 383, 908	09. 6
1874-'75	250, 286, 549	28, 612, 613	11. 4
1875-'76	327, 730, 172	39, 664, 456	12. 1
LARD.			
1870-'71	80, 037, 297	10, 563, 020	13. 2
1871-'72	199, 651, 660	20, 177, 619	10. 1
1872-'73	230, 534, 207	21, 245, 815	09. 2
1873-'74	205, 527, 471	19, 308, 019	09. 4
1874-'75	166, 869, 393	22, 900, 522	13. 7
1875-'76	168, 405, 839	22, 429, 485	13. 3
PORK.			
1870-'71	39, 250, 750	4, 302, 320	10. 9
1871-'72	57, 169, 518	4, 122, 308	07. 2
1872-'73	64, 147, 461	5, 007, 035	07. 8
1873-'74	70, 482, 379	5, 808, 712	08. 2
1874-'75	56, 152, 331	5, 671, 495	10. 1
1875-'76	54, 195, 118	5, 744, 022	10. 6
TOTAL.			
1870-'71	190, 734, 901	22, 992, 023	12. 0
1871-'72	503, 029, 321	45, 426, 519	09. 3
1872-'73	690, 063, 405	61, 274, 957	08. 9
1873-'74	623, 415, 255	58, 500, 639	09. 4
1874-'75	473, 308, 273	57, 184, 630	12. 1
1875-'76	550, 381, 129	67, 837, 963	12. 3

The above figures indicate a decline from the maximum of quantity exported in 1872-'73, with a considerable reaction during 1875-'76. The aggregate value of the exports of the last-named year exceeded that of any former year.

To meet the increased foreign demand, there has been an enlargement of production both in the visible amount gathered by statisticians and the invisible amounts made for home consumption. The aggregate net weight of hogs packed in the West, including summer and winter packing seasons, was 230,983,541 pounds greater in the packing year last closed than in its predecessor; the amount of lard was 33,320,001 pounds greater. If the same accurate statistics could be gathered of the pork-packing operations of the Atlantic and Pacific slopes, and of Canada, this surplus would be still further increased.

It is well known that vast improvements have been made both in the breeds raised and in the methods of breeding, raising, and fattening animals for market. Many farmers in all parts of the West and some in the South have found it more profitable to grow the new breeds, which will in twelve months, if intelligently managed, produce as much pork as the old breeds do in twenty months. The economic value of time in production is thus better appreciated, and its results are manifesting themselves in increased production and in better margins of profit.

The immense enlargement of exportation of swine products, without any adequate evidence of equivalent decrease in the rate of home consumption, has only been accomplished by increase of average weight, or large increase of numbers in proportion to population. It is easily proved that weight has increased, especially of hogs of equal age; and statistics do not show increase of numbers. One fact should be considered relative to enumerations of swine. Millions advance from pigs to pork between one enumeration and another, making decrease of numbers more apparent than real in comparison with former years.

Notwithstanding the average age of killing is much reduced, the average weight is increased. Mr. Charles Cist, in 1851, made the average weight of hogs killed in Cincinnati 200 pounds; it was about 220 for the past three years, an increase of 10 per cent. He made the numbers for ten years, between 1848 and 1858, slaughtered in that great swine mart 385,000. For five years past the average packed has been 570,949. This is an increase of 48 per cent., and new packing-points have sprung up, not only throughout the West, but in several towns in Ohio.

MARKET PRICES OF FARM

The following quotations represent, as nearly as practicable,

Products.	January.	February.	March.	April.	May.
NEW YORK.					
Flour:					
Superfine, State and western ....bbl.	$4 25 to $4 50	$4 25 to $4 60	$4 25 to $4 60	$4 50 to $4 75	$4 10 to $4 50
Extra State .... .do..	4 80 to 5 90	4 85 to 5 90	4 90 to 5 60	5 10 to 5 65	4 90 to 5 50
Extra to choice western..........bbl.	4 80 to 9 00	4 85 to 9 00	4 90 to 9 00	5 10 to 9 00	4 90 to 9 00
Common to fair southern extras..........bbl.	4 80 to 6 40	4 80 to 6 30	4 80 to 6 25	5 25 to 6 45	5 00 to 6 25
Good to choice southern extras..........bbl.	6 50 to 8 75	6 40 to 8 75	6 30 to 8 75	6 50 to 8 75	6 25 to 8 75
Wheat:					
No. 1 spring ....bush.	1 29 to 1 33	1 31 to 1 38	1 33 to 1 37	1 34 to 1 39	1 26 to 1 30
No. 2 spring..........do..	1 23 to 1 25	1 19 to 1 21	1 24 to 1 27	1 22 to 1 29	1 18 to 1 22
Winter, red, west'n..do..	1 16 to 1 45	1 18 to 1 47	1 22 to 1 47	1 15 to 1 47	1 05 to 1 50
Winter, amber, west.do..	1 16 to 1 45	1 18 to 1 47	1 22 to 1 47	1 15 to 1 47	1 05 to 1 50
Winter, white, west.do..	1 32 to 1 50	1 35 to 1 55	1 35 to 1 50	1 36 to 1 50	1 32 to 1 45
Corn ....do..	66 to 70	57½ to 65½	60 to 70	65 to 68	60¾ to 61½
Oats ....do..	41 to 50	44 to 51½	45½ to 53	42 to 50	41 to 53
Rye ....do..	87 to 95	86 to 89	82 to 88	86 to 97	80 to 95
Barley ....do..	85 to 1 20	84 to 1 18	85 to 1 25	..........1 08	Nominal.....
Hay:					
Baled, first quality ..ton	21 00 to 23 00	21 00 to 23 00	18 00 to 21 00	18 00 to 21 00	20 00 to 22 00
Baled, second qual'y.do..	16 00..........	17 00..........	15 00 to 16 00	15 00 to 16 00	15 00 to 16 00
Beef:					
Mess..................bbl	11 00 to 11 50	10 50 to 11 50	10 50 to 12 00	12 50 to 13 00	12 00 to 12 50
Extra mess..........do..	12 00 to 12 50	12 00 to 12 50	12 50 to 13 50	12 50 to 13 50	13 00..........
Pork:					
Mess..................bbl.	20 75..........	21 25..........	22 65 to 22 80	23 20 to 23 25	21 45 to 21 70
Extra prime..........do..	15 50..........	16 00..........	18 50..........	....	17 50..........
Prime mess..........do..	19 50..........	19 75 to 22 00	20 50 to 21 50	..........21 50	Nominal....
Lard ....lb.	12⅜ to 13¼	12⅝ to 13¼	13¼ to 13⅓	14¼ to 14⅔	13 to 13⅓
Butter:					
Western ....lb	17 to 34	16 to 34	16 to 36	17 to 35	22 to 32
State dairy..........do.	23 to 35	26 to 36	24 to 38	32 to 43	25 to 32
Cheese:					
State factory ....lb	7 to 13¼	7 to 13½	7 to 14	7 to 13¾	6 to 13
Western factory ......do	6 to 12½	6 to 12½	6 to 13	7 to 13	3 to 12¼
Sugar, fair to prime refining ....lb	8 to 8½	7⅞ to 8¼	7⅜ to 7⅞	7½ to 7⅞	7¼ to 7⅞
Cotton:					
Ord'y to good ord'y ...lb	10¼ to 11¾	9½ to 11⅝	9 to 10¾	9¾ to 11½	9⅜ to 10⅞
Low middling to good middling ....lb	12¾ to 14	12¼ to 13¾	11¼ to 13⅝	12½ to 14⅛	11¾ to 12¾
Tobacco:					
Lugs ....lb	7 to 9	6 to 9	5 to 9½	4½ to 7	4½ to 7
Leaf ....do	9½ to 15½	8½ to 12	8 to 12	7 to 10½	7 to 10½
Wool:					
American XXX and picklock ....lb.	48 to 57	50 to 54	50 to 54	45 to 55	45 to 55
American X and XX do	40 to 48	43 to 48	43 to 48	38 to 46	38 to 46
American combing... do	50 to 62	55 to 65	55 to 65	48 to 57	48 to 57
Pulled ....do	20 to 47	27 to 44	27 to 44	25 to 42	25 to 42
California spring clip.do	18 to 33	18 to 32	18 to 32	17 to 30	21 to 30
California fall clip....do	15 to 25	15 to 21	15 to 21	13 to 23	16 to 23
BOSTON.					
Flour:					
Superfine, spring, western..................bbl	4 00 to 4 50	4 00 to 4 50	4 00 to 4 25	4 00 to 4 50	4 00 to 4 25
Com. spring extras ..do..	4 75 to 5 50	4 75 to 5 50	4 75 to 5 25	5 00 to 5 50	4 50 to 5 00
Good to fancy, northwestern spring ....bbl	5 25 to 9 25	5 00 to 9 25	5 00 to 9 25	5 50 to 9 50	5 00 to 9 50
Good to fancy, western winter ....bbl	6 00 to 9 00	6 00 to 9 00	6 00 to 9 00	6 00 to 9 00	6 00 to 9 00
Southern family......do	6 50 to 9 00	6 50 to 9 00	6 50 to 9 00	6 50 to 9 00	6 50 to 9 00
Wheat.................bush.	1 00 to 1 50	1 00 to 1 50	1 06 to 1 55	1 05 to 1 55	1 05 to 1 60
Corn ....do..	65 to 68	64⅓ to 66½	65 to 68	72 to 75	62 to 65
Oats ....do..	42 to 54	43 to 57	43 to 55	44 to 56	42 to 52
Rye ....do..	95 to 1 00	95 to 1 00	95 to 1 00	90 to 95	90 to 92
Barley ....do..	90 to 1 30	90 to 1 30	85 to 1 20	85 to 1 20	85 to 1 20
Hay, eastern and northern....................ton	15 00 to 21 00	20 00 to 21 00	13 00 to 20 00	15 00 to 21 00	15 00 to 21 00
Beef:					
Mess ....bbl	12 00 to 12 50	12 00 to 12 50	12 00 to 12 50	12 00 to 12 50	12 00..........
Extra mess............do	13 00 to 13 50	13 00 to 13 50	13 00 to 13 50	13 00 to 13 50	13 50..........
Family..................do	16 50 to 17 00	16 50 to 17 00	16 50 to 17 00	16 50 to 17 00	15 50 to 16 50
Pork:					
Prime..................bbl	15 00 to 15 50	15 00 to 16 00	18 00 to 18 50	19 00 to 20 00	19 00 to 19 50
Mess...... ....do.	21 50 to 21 75	21 50 to 22 00	23 00 to 23 50	23 75 to 24 00	22 50 to 22 75

PRODUCTS FOR 1876.

the state of the market at the beginning of each month.

June.	July.	August.	September.	October.	November.	December.
$4 00 to $4 90	$3 40 to $4 00	$3 60 to $4 35	$3 50 to $4 25	$4 20 to $4 75	$4 60 to $4 90	$5 00 to $5 30
4 90 to 7 00	4 50 to 5 15	4 40 to 6 50	4 25 to 6 50	5 00 to 6 30	5 20 to 5 65	5 60 to 6 90
4 90 to 9 00	4 50 to 8 75	4 40 to 9 00	4 30 to 8 50	5 00 to 9 50	5 20 to 8 50	6 55 to 8 25
4 90 to 6 15	4 85 to 6 00	4 65 to 5 00	4 50 to 5 90	5 10 to 6 25	5 25 to 6 60	5 40 to 5 80
6 15 to 9 00	6 05 to 8 75	5 05 to 8 50	6 10 to 8 50	6 30 to 8 00	6 65 to 8 75	6 65 to 8 75
1 28 to 1 30	1 20 to 1 30	1 12 to 1 25	1 05 to 1 20	1 18 to 1 30	1 25 to 1 30	1 33 to 1 35
1 16 to 1 22	1 12 to 1 17	94 to 1 12½	98 to 1 10	1 10 to 1 22	1 22 to 1 25	1 28 to 1 32
1 13 to 1 40	85 to 1 45	70 to 1 25	90 to 1 27	1 05 to 1 30	1 22	1 30 to 1 35
1 13 to 1 40	93 to 1 45	70 to 1 25	90 to 1 27	1 05 to 1 30	1 33	1 34 to 1 45
1 35 to 1 50	1 25 to 1 45	1 15 to 1 35	1 14 to 1 28	1 15 to 1 30	1 33 to 1 35	1 34 to 1 45
40 to 59½	56 to 61	54 to 59	50 to 57	56 to 59½	56 to 61½	53½ to 61
32 to 47	34 to 42	35 to 38	35 to 45	30 to 47½	31 to 49	37 to 49
85 to 96	80 to 95	50 to 78	70 to 85	70 to 87	72 to 88	80 to 95
Nominal.....	90..........	Neglected ...	Nominal.....	97½ to 1 25	1 08 to 1 18	80 to 85
17 00 to 20 00	16 00 to 19 00	14 00 to 18 00	14 00 to 18 00	20 00..........	14 00 to 18 00	14 00 to 18 0
16 00..........	13 00 to 14 00	12 00 to 13 00	12 00..........	12 00..........	12 00	12 00 ....
11 00..........	10 00 to 11 00	9 00 to 11 00	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00	10 50 to 11 50
12 00..........	12 00..........	10 00 to 12 00	10 00 to 11 00	10 00 to 11 00	10 00 to 11 00	12 00 to 12 50
18 80 to 19 25	19 75 to 19 85	19 40 to 19 60	16 50 to 16 75	16 70..........	16 00 to 17 00	17 00 ....
....	....	Neglected ...	Neglected ...	....	13 50	....
Nominal.....	19 50..........	Neglected ..	Neglected ...	19 50..........	....	....
10¾ to 11½	11½ to 11¾	11⅛ to 11⅓	9⅜ to 10⅕	9¾ to 10¾	9⅝ to 10	9¾ to 10⅞
16 to 25	16 to 27	13 to 27	14 to 30	18 to 37	19 to 28	16 to 26
19 to 27	18 to 28	22 to 30	22 to 32	29 to 38	21 to 38	24 to 38
8 to 11¾	7 to 11	6½ to 9¾	5 to 10¼	10 to 13¼	9½ to 14	11 to 14¾
8¾ to 10¾	6 to 9¼	6½ to 8¼	7 to 8¼	8 to 11½	11 to 13	10 to 13¾
7 to 8	8 to 8¾	8¼ to 9⅛	9 to 9½	8¾ to 9½	9⅜ to 9¾	9⅞ to 10½
8⅝ to 10⅛	8½ to 10	$8\frac{9}{16}$ to $10\frac{1}{16}$	9⅜ to $10\frac{3}{16}$	$9\frac{3}{16}$ to $10\frac{1}{16}$	9⅝ to 10¼	10½ to 11⅛
11 to 12¾	11 to 12¾	$11\frac{1}{16}$ to 12¾	11 to $12\frac{7}{16}$	$10\frac{9}{16}$ to $11\frac{7}{16}$	10⅞ to 11¾	11⅝ to 12⅝
6 to 8	6 to 8	6 to 8	6 to 9½	5¼ to 9	5 to 8	5 to 8
8 to 10	8 to 10	8 to 15½	9½ to 13½	8 to 13½	8 to 11	8 to 11
46 to 48	46 to 48	38 to 40	35 to 42	46 to 48	48 to 50	48 to 50
38 to 44	38 to 44	30 to 36	30 to 40	32 to 45	36 to 46	36 to 48
48 to 58	48 to 58	45 to 52	40 to 48	41 to 50	48 to 55	48 to 57
25 to 40	25 to 40	25½ to 33	20 to 35	22 to 40	....	....
19 to 25	19 to 25	12½ to 24	12½ to 26	16 to 28	16 to 28	16 to 28
12½ to 16	13 to 16	10 to 15	10 to 16	11 to 21	14 to 22	14 to 22
3 50 to 4 00	3 00 to 3 50	3 00 to 3 50	3 00 to 3 50	4 25 to 4 50	4 25 to 4 75	4 25 to 4 75
4 25 to 5 00	4 25 to 4 75	4 25 to 4 75	4 00 to 4 75	4 75 to 5 50	5 00 to 5 75	5 00 to 5 75
5 00 to 9 25	4 75 to 9 00	4 75 to 8 50	4 75 to 8 25	5 75 to 9 25	5 75 to 9 50	5 75 to 9 25
6 00 to 9 00	5 75 to 8 50	5 75 to 8 00	5 50 to 7 75	6 00 to 8 50	6 00 to 8 50	6 00 to 8 00
7 00 to 9 00	6 50 to 8 75	6 50 to 8 00	6 00 to 7 75	6 50 to 8 50	6 50 to 8 50	6 50 to 8 50
1 10 to 1 60	97 to 1 45	83 to 1 35	90 to 1 30	1 05 to 1 35	1 10 to 1 33	1 20 to 1 42
61½ to 65½	55 to 63	54 to 65	57 to 61	55 to 64	58 to 65	58 to 66
42 to 56	30 to 50	30 to 46	36 to 50	35 to 50	33 to 53	45 to 52
85 to 87½	90 to 95	90..........	75 to 80	75 to 80	75 to 80	85 to 90
85 to 1 20	....	....	Nominal	95 to 1 20	85 to 1 20	95 to 1 20
16 00 to 23 00	16 00 to 21 00	14 00 to 20 00	12 00 to 21 00	12 00 to 20 00	12 00 to 20 00	12 00 to 19 00
11 50..........	10 50..........	10 50..........	10 50..........	10 00..........	11 00	11 00 ....
13 00..........	12 00..........	12 00..........	12 00..........	12 00..........	12 00	13 00 ....
15 00 to 16 00	13 00 to 14 00	13 00 to 14 00	12 50 to 13 00	12 50 to 13 50	12 50 to 13 50	14 00 to 15 00
17 50 to 18 00	17 00 to 17 50	19 00 to 19 50	17 00 to 17 50	16 50 to 17 00	16 00 to 16 50	14 00 to 14 50
21 00 to 21 50	20 00 to 20 50	20 50 to 21 00	17 75 to 18 00	17 75 to 18 00	18 00	17 00 to 17 50

MARKET PRICES OF FARM

Products.	January.	February.	March.	April.	May.
BOSTON—Continued.					
Lard ....lb.	$0 13¼ to $0 14	$0 13¼ to $0 14	$0 13½ to $0 14½	$0 14¾ to $0 15	$0 14 to $0 14¾
Butter:					
New York and Vermont, pound	22 to 32	20 to 33	20 to 34	30 to 38	27 to 30
Western...............lb.	17 to 33	18 to 33	18 to 29	22 to 30	18„ to 28
Cheese:					
New York and Vermont factory ....lb..	10 to 13	10 to 13	10 to 13½	10 to 14	9 to 13
Western factory.....do..	10 to 12½	....	9 to 13½	9 to 13½	8 to 12½
Sugar, fair to good refining, pound	8 to 8¼	8 to 8½	7⅜ to 7⅝	7½ to 7¾	7½ to 7⅞
Cotton:					
Ordinary to good ordinary.................lb.	10 to 12	9½ to 11¼	8¾ to 10¼	9½ to 11½	9¼ to 11
Low middling to good middling ....lb.	13 to 14¼	12¾ to 14	12 to 13½	12½ to 14¼	12½ to 14
Wool:					
Ohio and Pennsylvania, pound	45 to 53	45 to 50	38 to 52½	42 to 47	37 to 48
Michigan ....lb..	42 to 45	42 to 45	42 to 46	40 to 41	33 to 38
Other western ......do..	41 to 45	42..........	....	....	32 to 37
Pulled ....do..	40 to 55	35 to 55	35 to 47	30 to 48	18 to 42
Combing fleece......do..	55 to 65	52 to 60	42 to 65	....	47 to 55
California ....do..	15 to 36	17 to 34	14 to 33	14 to 32	11 to 28
PHILADELPHIA.					
Flour:					
Superfine.............bbl.	4 00 to 4 37½	4 00 to 4 25	3 50 to 4 00	3 50 to 4 00	3 50 to 4 00
Pennsylvania, extra to choice ....bbl.	4 50 to 6 50	4 25 to 6 50	4 25 to 6 50	4 25 to 6 75	4 25 to 6 75
Western, extra to choice barrel	5 50 to 6 37½	4 25 to 6 75	4 25 to 6 60	5 75 to 8 00	5 25 to 7 00
Wheat:					
White ....bush.	1 42 to 1 45	1 45 to 1 55	1 45 to 1 55	1 50 to 1 58	1 50 to 1 55
Amber ....do..	..........1 40	1 41 to 1 42	1 41 to 1 43½	..........1 53	1 50 to 1 55
Red ....do..	1 00 to 1 38	1 20 to 1 40	1 20 to 1 40	95 to 1 52	....
Rye ....do..	88 to 90	86 to 88	83 to 84	81 to 82	1 25 to 1 50
Barley ....do..	70 to 1 35	75 to 1 35	75 to 1 30	75 to 1 25	....
Corn ....do..	56 to 68	52 to 60	54 to 61	60 to 65½	60 to 62
Oats ....do..	43 to 50	40 to 48	38 to 48	43 to 50	42 to 48
Hay:					
Baled, prime ....ton.	22 00 to 24 00	21 00 to 21 50	21 00 to 21 50	21 00 to 21 50	21 00 to 23 00
Common to fair shipping ....ton.	20 00 to 22 00	19 00 to 20 00	19 00 to 20 00	19 00 to 20 00	19 00 to 20 00
Beef:					
Western mess.......bbl.	7 00 to 9 00	7 00 to 9 00	7 00 to 9 00	9 00 to 10 00	9 00 to 10 00
Extra mess..........do..	8 00 to 9 00	8 00 to 9 00	8 00 to 9 00	11 50 to 12 50	11 50 to 12 00
Waithman's city family ....bbl.	16 00..........	16 00..........	16 00..........	16 00..........	16 00..........
Pork:					
Mess..................bbl.	21 00 to 22 00	21 25 to 21 50	22 50 to 23 00	23 50 to 23 75	22 50..........
Prime mess..........do..	19 50 to 20 00	20 00..........	21 00..........	21 00..........	18 50 to 19 00
Prime, (extra).......do..	17 00 to 17 50	17 00 to 18 00	18 00 to 18 50	18 75 to 19 00	18 50 to 19 00
Lard ....lb..	13 to 16	12 to 13	13 to 13⅝	14¼ to 15	13 to 13¾
Butter:					
Choice Middle State.lb..	27 to 38	28 to 38	27 to 38	36 to 44	30 to 36
Choice western......do..	27 to 31	25 to 31	25 to 31	28 to 43	26 to 28
Cheese:					
New York factory...lb..	6¼ to 13¾	11½ to 13¾	11½ to 14	5 to 14	5 to 14
Ohio factory ....do..	5 to 13	 13	 13	4 to 13¼	4 to 12½
Sugar, fair to good refining..................lb.	8 to 8¼	7¼ to 8	7½ to 7¾	7½ to 7	7⅝ to 7⅞
Cotton:					
Ordinary to good ordinary.................lb.	10 to 12⅞	9½ to 11⅝	9 to 10⅞	9¾ to 11⅛	9⅜ to 10¾
Low middling to good middling ....lb.	12¾ to 14⅝	12½ to 13¼	12 to 12⅞	12½ to 14	12⅛ to 13⅝
Wool:					
Ohio and Pennsylvania X to XXX ....lb..	45 to 52	47 to 50	48 to 52½	45 to 48	28 to 43
Other western ......do..	42 to 48	24 to 42	40 to 45	40 to 45	35 to 42
Pulled ....do..	26 to 64	42 to 64	38 to 64	26 to 64	22 to 36
Combing, washed and unwashed............lb..	46 to 66	44 to 62	 66	42 to 65	37 to 60
Tub-washed.........lb..	40 to 54	40 to 54	40 to 52½	40 to 52	40 to 48

PRODUCTS FOR 1876—Continued.

June.	July.	August.	September.	October.	November.	December.
$0 13¼ to $0 13½	$0 12 to $0 12½	$0 12 to $0 12¾	$0 11 to $0 11½	$0 11 to $0 11½	$0 10¾ to $0 11½	$0 10½ to $0 11¼
22 to 25	20 to 25	18 to 24	18 to 28	18 to 33	18 to 33	18 to 33
17 to 24	18 to 22	14 to 22	14 to 30	16 to 33	16 to 33	15 to 33
8 to 12	6 to 10½	6 to 10	6 to 10	10 to 13½	10½ to 13	12 to 14½
7 to 11½	....	4 to 9	5 to 9	8 to 13	8 to 13	9 to 14
7⅝ to 7⅞	8 to 8¼	8¾ to 9⅛	9¼ to 9⅜	8⅞ to 9½	9¼ to 9½	9⅞ to 10½
8⅝ to 10¼	8¾ to 10⅝	8¼ to 9¾	9¼ to 10½	9¼ to 10⅛	9¼ to 10¾	10¼ to 11⅜
10¾ to 13	11¼ to 13	10⅞ to 12⅝	11¼ to 13¼	10¾ to 11½	10⅞ to 12⅛	11⅞ to 13
36 to 45	30 to 43	30 to 40	31 to 45	35 to 50	37 to 52	40 to 52
32 to 36	28 to 34	28 to 34	30 to 36	32 to 40	34 to 40	36 to 42
32 to 35	28 to 34	27 to 32	29 to 34	32 to 38	33 to 40	36 to 42
15 to 40	15 to 40	15 to 38	15 to 40	20 to 40	35 to 42½	20 to 42½
45 to 47	43 to 46	40 to 45	45 to 50	48 to 50	50 to 55	50 to 57½
14 to 28	14 to 27	14 to 27	14 to 30	14 to 30	14 to 30	14 to 30
3 25 to 4 00	3 25 to 4 00	3 25 to 3 50	3 25 to 3 50	3 50 to 3 75	3 50 to 4 00	3 50 to 4 00
4 25 to 6 75	4 25 to 6 50	3 75 to 6 25	3 75 to 6 25	4 00 to 6 50	4 12½ to 6 50	4 12½ to 6 25
5 25 to 8 25	5 00 to 6 50	5 00 to 6 50	5 50 to 6 50	5 75 to 7 00	4 12½ to 7 00	6 00 to 6 75
1 45 to 1 55	1 35 to 1 47	1 25 to 1 25	1 20 to 1 30	1 25 to 1 35	1 30 to 1 40	1 30 to 1 50
1 40 to 1 48	1 30 to 1 47	1 18 to 1 22½	1 20 to 1 25	1 23 to 1 28	1 28 to 1 36	1 42 to 1 45
1 15 to 1 43	80 to 1 38	70 to 1 17	80 to 1 18	1 05 to 1 23	1 20 to 1 29	1 20 to 1 37
80 to 85	75 to 80	60 to 65	60..........	70 to 78	68 to 75	72 to 74
Nominal.....	55 to 95	55 to 1 05	....	....	75 to 85	60 to 95
57 to 59	54 to 58	54 to 60	51 to 57	54 to 59	55 to 58	52 to 59
34 to 43	28 to 40	30 to 47	29 to 40	30 to 42	28 to 41	28 to 41
19 00 to 20 00	14 00 to 15 00	17 00 to 18 00	16 00 to 17 00	14 00 to 18 00	........17 00	16 00 to 17 00
17 00 to 19 00	11 00 to 13 50	14 00 to 16 00	12 00 to 15 00	10 00 to 13 00	10 00 to 13 00	10 00 to 13 00
6 00 to 8 00	6 00 to 8 00	6 00 to 8 00	6 00 to 8 00	6 00 to 8 00	6 00 to 8 00	6 00 to 8 00
10 50 to 11 00	10 50 to 11 00	10 50 to 11 00	10 00 to 11 00	10 00 to 11 00	10 00 to 11 00	10 00 to 11 00
14 50 to 15 00	14 50 to 15 00	13 00 to 13 25	12 50 to 13 00	13 00..........	14 00	14 00 ....
20 50..........	20 50..........	21 00 to 21 50	19 00..........	17 50 to 18 00	16 50 to 17 00	17 25 to 17 50
18 00..........	17 50..........	17 00 to 17 50	17 50 to 18 00	16 00 to 17 00	15 50 to 16 00	15 50 to 16 00
17 00..........	17 00..........	17 00..........	17 00..........	....	16 50 to 17 00	16 50 to 17 00
11¼ to 16½	11½ to 15	10½ to 12	10½ to 14	10½ to 15	10½ to 15	10 to 15
24 to 26	21 to 26	28 to 38	26 to 35	28 to 38	30 to 38	26 to 35
18 to 20	20 to 22	24 to 26	22 to 24	....	....	25 to 27
5 to 13½	7 to 10½	5 to 10½	5½ to 10½	3½ to 11½	14	8½ to 14½
4 to 12	4 to 9	4 to 9	4 to 9	3 to 11¼	...........13½	7 to 13½
7⅝ to 7⅞	8 to 8¼	8¾ to 9	9¼ to 9⅜	8¾ to 9	9⅜ to 9⅝	9⅞ to 10¼
8¼ to 10½	8⅝ to 10	8¼ to 9⅞	8¼ to 9⅞	8¼ to 9½	9¾ to 10	10¼ to 10¾
11½ to 13	11⅝ to 12⅝	11¼ to 12¾	11¼ to 12¾	10¼ to 11¾	10⅞ to 12⅛	11⅝ to 12⅞
28 to 42	40 to 42	34 to 37½	36 to 42	41 to 45	41 to 45	41 to 45
30 to 36	30 to 36	30 to 35	30 to 35	36 to 38	31 to 38	31 to 38
22 to 36	22 to 36	22 to 36	22 to 36	22 to 36	22 to 36	22 to 36
40 to 55	40 to 55	33 to 45	35 to 50	37 to 50	38 to 52	38 to 52
30 to 45	30 to 45	30 to 40	30 to 42	30 to 45	30 to 46	30 to 46

MARKET PRICES OF FARM

Products.	January.	February.	March.	April.	May.
BALTIMORE.					
Flour:					
Superfine .... bbl.	$4 00 to $4 50	$3 75 to $4 50	$3 75 to $4 50	$3 75 to $4 25	$3 50 to $4 50
Extra .... do..	4 75 to 6 25	4 75 to 6 75	4 75 to 7 00	4 75 to 7 50	4 75 to 6 25
Family and fancy ... do..	7 00 to 8 75	5 75 to 8 75	5 25 to 8 75	5 75 to 9 00	5 75 to 8 75
Wheat:					
Red .... bush.	1 15 to 1 38	1 18 to 1 45	1 15 to 1 45	1 45 to 1 50	1 20 to 1 45
Amber .... do..	1 47 to 1 55	..........1 55	..........1 55	1 60 to 1 62	1 52 to 1 55
White .... do..	1 15 to 1 45	..........1 45	..........1 45	1 40 to 1 60	1 40 to 1 50
Rye .... do..	75 to 85	75 to 80	78 to 82	80 to 83	73 to 75
Oats .... do..	40 to 48	43 to 50	40 to 47	40 to 49	39 to 48
Corn .... do..	50 to 62½	55 to 62	53 to 59	59 to 64	53½ to 62
Hay:					
Maryland and Pennsylvania .... ton.	18 00 to 25 00	18 00 to 24 00	18 00 to 24 00	18 00 to 24 00	21 00 to 26 00
Western .... do..	19 00 to 21 00	18 00 to 20 00	....	17 00 to 19 00	20 00 to 23 00
Pork:					
Mess .... bbl.	21 50.........	21 25 to 21 50	22 75 to 23 00	23 00 to 23 50	22 25 to 22 50
Extra prime .... do..	16 75 to 17 00	....	17 25.........	18 00.........	21 25.........
Lard .... lb..	12⅝ to 13½	12¾ to 13½	13½ to 14	14¼ to 14	13¼ to 14
Butter:					
Western .... lb..	18 to 28	17 to 26	18 to 26	18 to 41½	....
Eastern .... do..	18 to 35	.18 to 33	17 to 35	36 to 43	22 to 30
Cheese:					
Western factory ..... lb..	11½ to 13	11 to 12½	11 to 13½	12½ to 14	11 to 13
Eastern factory ..... do..	12 to 13½	12 to 13½	12½ to 14½	11½ to 13½	12½ to 14½
Sugar:					
Fair to good refining .. lb	8 to 8¼	7⅞ to 8 1-6	7½ to 7¾	7½ to 7¼	7½ to 7⅞
New Orleans, grocery grades .... lb	7⅜ to 9	7½ to 8½	·7¼ to 8¼	... .	....
Tobacco:					
Lugs .... lb.	6½ to 11	6½ to 9	6¼ to 9	6¼ to 11	6½ to 9
Leaf, common to medium .... lb.	9 to 11	9 to 11	9 to 11	9 to 14	9 to 11
Cotton:					
Ordinary to good ordinary .... lb	9¾ to 11½	8¼ to 10½	8½ to 10¼	9½ to 11¼	8¾ to 10
Low middling to good middling .... lb	12¼ to 13¼	12 to 13	11½ to 12½	12½ to 13½	11⅛ to 12¾
CINCINNATI.					
Flour:					
Superfine .... bbl	3 75 to 4 00	3 50 to 3 85	3 50 to 3 75	3 50 to 3 90	3 50 to 3 90
Extra .... do..	4 25 to 4 75	4 35 to 4 75	4 25 to 4 60	4 00 to 4 60	4 25 to 4 65
Family and fancy .... do..	5 00 to 6 00	5 15 to 8 00	5 00 to 8 00	4 90 to 7 50	6 50 to 7 75
Wheat:					
Winter red .... bush	1 15 to 1 33	1 15 to 1 37	1 12 to 1 30	1 15 to 1 35	70 to 1 30
Hill, (amber) .... do..	....	....	1 25 to 1 35	..........1 38	1 25 to 1 30
White .... do..	1 15 to 1 48	1 40 to 1 45	1 40 to 1 45	1 38 to 1 45	1 35 to 1 45
Corn .... do..	45 to 47	39 to 44	44 to 46	49 to 51	45 to 51
Rye .... do..	55 to 79	65 to 80	70 to 78	73..........	70 to 75
Barley .... do..	50 to 1 50	50 to 1 15	40 to 1 15	65 to 1 23	30 to 94
Oats .... do..	35 to 44	36 to 43	30 to 40	33 to 43	35 to 43
Hay:					
Baled, No. 1 .... ton	15 00 to 16 00	15 00 to 17 00	15 00 to 18 00	15 00 to 18 00	15 00 to 18 00
Lower grades .... do..	8 00 to 14 00	8 00 to 14 00	8 00 to 14 00	6 00 to 10 00	7 00 to 10 00
Pork, mess .... bbl	19 75 to 20 00	20 50..........	22 25 to 22 45	23 00	20 50 to 21 50
Lard .... lb.	12⅜ to 14¾	12⅛ to 13½	12¾ to 13¾	13⅝ to 14	12 to 13¼
Butter:					
Choice .... lb..	25 to 28	26 to 30	27 to 30	33 to 35	25 to 28
Prime .... do..	24 to 25	22 to 25	25 to 27	 30	20 to 23
Cheese, prime to choice factory .... lb	12 to 13	12 to 13	12 to 13	13 to 13½	12 to 12½
Sugar:					
New Orleans, fair to good .... lb..	7	7½ to 8½	7½ to 8½	7¾ to 8½	8¼ to 8¾
Prime .... do..	8½.........	8¼ to 9	8⅝ to 9	8¾ to 9	8¼ to 9
Cotton:					
Ordinary to good ordinary .... lb	9½ to 10¾	8½ to 10	8 to 9½	9 to 10¼	8¼ to 9¼
Low middling to good middling .... lb..	12 to 13⅛	11⅝ to 13	11 to 12¾	11¼ to 13½	11 to 12¾
Wool:					
Fleece-washed .... lb..	38 to 43	38 to 43	38 to 43	38 to 43	35 to 40
Tub-washed .... do..	43 to 48	43 to 48	43 to 48	43 to 48	38 to 42
Unwashed, clothing . do..	25 to 30	25 to 30	25 to 30	28 to 30	25 to 37
Unwashed, combing . do..	34 to 38	34 to 38	34 to 38	34 to 38	30 to 35
Pulled .... do..	31 to 37	31 to 37	31 to 37	35 to 37	28 to 30

PRODUCTS FOR 1876—Continued.

June.	July.	August.	September.	October.	November.	December.
$3 50 to $4 50	$3 00 to $3 75	$2 75 to $3 75	$2 50 to $3 75	$3 50 to $4 50	$4 25 to $4 75	$4 25 to $4 50
4 75 to 6 25	4 00 to 6 50	4 00 to 5 50	4 00 to 6 75	4 75 to 5 50	5 25 to 6 25	5 25 to 6 75
5 75 to 8 75	7 00 to 8 50	5 00 to 8 00	5 50 to 7 75	5 75 to 8 25	5 75 to 8 50	6 00 to 8 50
1 10 to 1 37	1 20 to 1 30	92 to 1 18	85 to 1 19	1 15 to 1 30	1 10 to 1 35	1 25 to 1 43
1 40 to 1 45	1 33 to 1 35	1 20 to 1 25	1 22 to 1 25	1 33 to 1 38	1 37 to 1 40	1 45 to 1 51
1 20 to 1 35	1 25 to 1 35	1 05 to 1 22	1 10 to 1 25	1 20 to 1 35	1 25 to 1 35	1 20 to 1 45
75 to 80	64 to 65	58 to 63	54 to 56	60 to 65	60 to 68	70 to 75
34 to 42	33 to 45	30 to 41	31 to 37	34 to 45	30 to 36	33 to 40
53 to 57	50½ to 62	44 to 59	50 to 56	53½ to 59	48 to 56½	48 to 57
22 00 to 23 00	16 00 to 20 00	15 00 to 19 00	12 00 to 16 00	19 00 to 20 00	12 00 to 16 00	13 00 to 18 00
15 00 to 19 00	14 00 to 15 00	14 00 to 17 00	....	....	....	....
20 00..........	21 00..........	20 50 to 21 00	18 00..........	18 25..........	17 25 to 17 50	17 25..........
19 00..........	18 50..........	18 50..........	18 00..........	17 00..........	17 00..........	17 00..........
12½ to 13	12¼ to 12¾	12¼ to 12¾	11¼ to 12¼	10½ to 12	10½ to 11½	11 to 11½
13 to 20	13 to 20	13 to 21	15 to 23	16 to 30	25 to 26	22 to 28
13 to 20	12 to 16	12 to 16	16 to 20	22 to 27	26 to 28	22 to 27
11 to 12	....	8 to 10	4 to 9½	10 to 12	7 to 13	9 to 14
10 to 11½	....	10½ to 11	5 to 10	12 to 13¾	12½ to 14	13 to 15
7⅛ to 7⅞	8⅛ to 8⅜	8⅝ to 9	9⅛ to 9¼	8¾ to 9	9⅜ to 9⅝	9¼ to 10
....	....	....	....	....	....	9⅝ to 10⅜
6½ to 11	6½ to 11	6½ to 11	6½ to 9	6½ to 9	6½ to 9	6½ to 9
9 to 11	9 to 11	9 to 11	9 to 11	9 to 11	9 to 11	9 to 11
8 to 9¼	8½ to 9⅝	.... 9¾	.... 10¼	8½ to 9½	9 to 10	9½ to 10⅞
10 to 11¾	10½ to 11¾	10½ to 12	11 to 12¼	10½ to 11⅛	10¼ to 11⅝	11¼ to 12¼
3 50 to 3 75	3 40 to 3 75	2 75 to 3 50	2 75 to 3 50	3 75 to 4 25	4 25 to 4 75	4 25 to 4 60
4 25 to 4 65	4 25 to 4 65	3 90 to 4 25	3 90 to 4 25	4 75 to 5 25	5 25 to 5 50	5 00 to 5 30
6 25 to 8 50	5 00 to 7 50	4 75 to 7 50	4 75 to 6 75	5 40 to 7 00	5 65 to 7 00	5 50 to 5 75
1 15 to 1 30	1 00 to 1 20	85 to 1 05	1 00 to 1 05	1 05 to 1 18	1 20 to 1 25	1 25 to 1 32
..........1 35	1 20 to 1 30	..........1 10	1 05 to 1 10	1 17 to 1 25	1 28 to 1 32	..........1 40
1 30 to 1 40	1 20 to 1 30	..........1 10	1 05 to 1 10	1 17 to 1 25	1 28 to 1 32	..........1 40
38 to 47	48 to 51	40 to 46	40 to 45	47 to 48	34 to 49	40 to 44
65 to 73	60 to 75	45 to 58	45 to 58	60 to 67	55 to 70	70 to 71
Nominal ..	80 to 85	40 to 75	60 to 75	1 00 to 1 15	60 to 1 15	80 to 1 15
32 to 34	22 to 42	20 to 38	20 to 35	28 to 43	28 to 35	28 to 38
16 00 to 18 00	13 00 to 16 00	15 00 to 16 00	15 00 to 16 00	11 00 to 12 00	11 00 to 13 00	11 00 to 13 00
7 00 to 10 00	5 00 to 10 00	8 00 to 12 00	8 00 to 12 00	9 00 to 10 00	9 00 to 10 00	8 00 to 10 00
18 50..........	19 50 to 20 00	18 75 to 19 25	18 75 to 19 25	17 00..........	16 50 to 16 75	15 75 to 16 00
10⅜ to 12½	11 to 13½	10¾ to 13	10⅝ to 13	10½ to 11½	9½ to 10	9¼ to 9¾
18 to 20	17 to 18	25 to 28	25 to 28	20 to 35	20..........	20 to 23
16 to 18	15 to 17	17 to 20	17 to 20	20 to 23	17 to 18	16 to 19
9 to 10	8 to 9	7½ to 8½	7½ to 8½	12½ to 13	12½ to 13	12½ to 13
8½ to 9	8½ to 9	9¼ to 10⅜	9¾ to 10⅝	....	....	8¾ to 9¼
9 to 9¼	9 to 9¼	10¼ to 10½	10¼ to 10½	....	....	9¼ to 10
7½ to 9	8 to 9¼	7¾ to 9	7¾ to 9	8⅝ to 9⅜	8¾ to 9¾	9¼ to 10¾
10¼ to 12	10¼ to 12	10 to 11¾	10 to 11¾	10½ to 10¾	10¼ to 11	11¼ to 12¼
30 to 35	26 to 28	25 to 33	25 to 33	30 to 32	30 to 36	20 to 36
32 to 37	25 to 34	25 to 34	25 to 34	28 to 36	32 to 38	32 to 38
22 to 23	20 to 22	20 to 22	20 to 22	22 to 23	21 to 26	21 to 26
27 to 32	25 to 30	25 to 30	25 to 30	27 to 31	27 to 32	27 to 32
26 to 27	23 to 25	23 to 25	23 to 25	24 to 26	30 to 31	27 to 31

MARKET PRICES OF FARM

Products.	January.	February.	March.	April.	May.
CHICAGO.					
Flour:					
Choice winter extras.bbl.	....	$6 50 to $7 50	$6 50 to $7 50	$6 50 to $7 50	$7 30 to $7 80
Common to good winter extras..............bbl.	....	4 75 to 5 50	4 75 to 5 50	4 75 to 5 50	5 80 to 7 10
Common to good spring extras.............bbl	$4 00 to $4 75	4 00 to 4 75	4 00 to 4 75	4 00 to 4 90	4 30 to 5 10
Choice spring extras.do..	5 00 to 5 25	5 00 to 5 25	5 00 to 5 25	5 00 to 5 25	5 10 to 5 60
Patent springs ....do..	6 50 to 7 25	6 50 to 7 25	6 50 to 7 25	6 50 to 7 25	6 00 to 9 00
Spring superfines....do..	3 00 to 3 50	3 00 to 3 50	3 00 to 3 50	3 00 to 3 50	3 00 to 3 75
Wheat:					
No. 1 spring ....bush.	1 05..........	Nominal....	Nominal.....	Nominal.....	1 12½.........
No. 2 spring.........do..	95½ to 95¾	97⅞ to 98⅜	97½ to 98	1 00½ to 1 00¾	98 to 99½
No. 3 spring.........do..	78½ to 78¾	76 to 77¼	80 to 82	88¾ to 90¾	90 to 90¼
Rye No. 2 ....do..	67 to 67½	67 to 67⅛	61 to 62	64 to 68	62.........
Barley No. 2............do..	79 to 80½	75 to 76	51½ to 53	60..........	62½ to 63
Corn No. 2 ....do..	45..........	40⅛ to 40½	41½ to 42	46 to 47½	45¼ to 46
Oats No. 2..............do..	30 to 34	30⅝ to 30⅞	31⅝ to 31¾	33⅜ to 33½	30¼ to 30½
Hay:					
Timothy ....ton.	11 00 to 13 00	11 50 to 14 00	10 00 to 12 00	11 50 to 13 00	12 00 to 14 00
Prairie...............do..	8 50 to 9 50	7 00 to 9 00	6 00 to 9 00	8 00 to 11 50	9 00 to 11 00
Beef:					
mess ....bbl.	9 50 to 10 00	9 50 to 10 00	8 50 to 9 00	10 50 to 11 00	10 75..........
extra mess ....do..	10 50 to 11 00	10 50 to 11 00	9 50 to 10 00	11 50 to 12 00	11 50 to 11 75
Pork:					
Mess ....bbl.	19 10..........	19 50..........	21 65 to 21 67½	22 35..........	20 45 to 20 60
Prime mess ....do..	17 00..........	17 75.........	19 00..........	22 00..........	20 00..........
Extra prime..........do..	14 25..........	14 50 to 14 75	16 00..........	17 00..........	16 00..........
Lard ....lb.	12⅜ to 12½	12 to 12⅛	12¼ to 13	14..........	12½ to 13
Butter:					
Choice to fancy.......lb.	25 to 32	26 to 32	27 to 33	35 to 40	30 to 35
Medium to good......do	18 to 23	18 to 23	20 to 34	25 to 30	25 to 28
Cheese, prime factory ..do.	12 to 13	12½ to 13½	12¼ to 13½	12 to 13	9 to 11
Sugar, New Orleans, common to prime.........lb.	7⅛ to 9	7 to 8¾	7 to 8¼	7 to 8¾	7¾ to 8¼
Wool:					
Tub-washed ....lb.	44 to 52	44 to 53	44 to 53	44 to 53	44 to 50
Fleece-washed ....do.	39 to 43	39 to 43	39 to 43	40 to 44	38 to 42
Unwashed ....do.	25 to 33	25 to 33	25 to 33	25 to 33	23 to 28
Pulled ....do.	33 to 36	33 to 36	33 to 36	30 to 40	30 to 37
SAINT LOUIS.					
Flour, winter, common to Choice ....bbl.	5 00 to 7 00	4 00 to 7 50	4 00 to 7 50	3 50 to 7 50	3 50 to 7 00
Wheat:					
White winter......bush.	1 00 to 1 30	1 00 to 1 30	1 00 to 1 30	1 00 to 1 35	1 00 to 1 40
Red winter...........do..	1 00 to 1 50	1 03 to 1 60	1 00 to 1 55	1 03 to 1 52	88 to 1 43
Corn ....do..	35 to 44	35 to 41	37 to 43	41 to 46	41 to 50
Rye......................do..	60 to 68	60 to 68	50 to 70	50 to 70	50 to 68
Barley ....do..	80 to 1 30	80 to 1 30	80 to 1 25	70 to 1 15	70 to 1 00
Oats ....do..	30 to 39	32 to 39	32 to 38	31 to 37	31 to 38
Hay:					
Timothy ....ton.	14 00 to 16 50	14 50 to 17 50	14 50 to 17 50	14 50 to 18 50	17 25 to 17 50
Prairie...............do..	8 00 to 10 00	7 00 to 10 00	7 00 to 10 00	7 00 to 10 00	9 25 to 9 75
Beef, mess.............bbl.	14 00 to 14 50	14 00 to 14 50	14 00 to 14 50	14 00 to 14 50	14 60 to 15 50
Pork, mess ....do..	19 50 to 20 50	19 50 to 20 60	22 25 to 22 50	23 00 to 23 50	23 00 to 23 50
Lard ....lb.	15 to 15½	11½ to 13	13½ to 14	11½ to 13	11½ to 13¾
Butter:					
Prime to choice dairy.lb.	28 to 30	25 to 30	25 to 30	30 to 35	25 to 26
Prime to choice country packed ....lb.	20 to 25	16 to 18	18 to 22	25 to 30	22 to 25
Cheese:					
Ohio factory...........lb.	13 to 14	12½ to 13½	12½ to 13½	12½ to 13½	12½ to 13½
New York factory....do.	13 to 14	13 to 14	13 to 14	13 to 14	13 to 14
Wool:					
Tub-washed ....lb.	42 to 50	44 to 46	44 to 46	47 to 48½	42 to 45
Fleece-washed ....do.	38 to 42	38 to 42	38 to 42	38 to 42	33 to 40
Unwashed ....do.	30 to 38	30 to 34	30 to 34	30 to 34	26 to 27
NEW ORLEANS.					
Flour:					
Superfine ....bbl.	3 80 to 4 00	3 75..........	4 00..........	4 00..........	3 75..........
Extra ....do	4 50 to 5 25	4 00 to 5 25	4 25 to 5 50	4 25 to 5 50	4 25 to 5 25
Choice to fancy ....do.	5 50 to 7 50	5 50 to 7 25	5 75 to 7 75	5 75 to 7 50	5 50 to 7 50
Corn, white and yel'w.bush.	54 to 56	52 to 53	53 to 58	55 to 60	57 to 68

PRODUCTS FOR 1876—Continued.

June.	July.	August.	September.	October.	November.	December.
$7 37½ to $7 87½	$7 25 to $7 75	$6 25 to $7 25	$6 25 to $7 25	$6 50..........	$6 25 to $7 25	$6 25 to $7 25
5 87½ to 7 25	5 75 to 7 12½	5 50 to 6 00	5 50 to 6 00	5 50 to $6 00	5 00 to 6 00	5 00 to 6 00
4 50 to 5 00	4 50 to 5 37½	4 75 to 5 00	4 75 to 5 00	5 00 to 5 25	5 25 to 5 50	5 25 to 5 50
5 50 to 5 87½	5 50 to 5 75	5 00 to 5 50	5 00 to 5 00	5 00 to 5 75	5 75 to 6 25	5 75 to 6 75
6 00 to 9 00	6 00 to 9 00	5 75 to 7 50	5 75 to 7 50	5 75 to 7 50	6 00 to 7 50	6 00 to 7 50
3 00 to 4 00	3 00 to 4 00	2 50 to 3 00	2 50 to 3 00	3 00 to 3 50	2 50 to 4 00	3 00 to 4 00
1 04½ to 1 11	1 11..........	....	1 00..........	1 12..........	1 13 to 1 13½	1 15½ to 1 16
1 02¾ to 1 03¾	1 03⅞ to 1 04¼	88 to 89	91⅝ to 98	1 10 to 1 10½	1 11¼ to 1 12	1 13 to 1 13⅞
91¼ to 92¼	88 to 88½	79..........	82 to 85	92..........	1 00 to 1 01	1 05½ to 1 05¾
68 to 68¼	67 to 67½	55½..........	55½ to 56	61..........	60 to 60¼	66..........
55..........	56½ to 57	50..........	73 to 78	85 to 87	79½ to 80	66 to 66¼
44½ to 45	46⅞ to 47	45 to 45½	43¼ to 43¾	46¼ to 47¼	42¼ to 42⅝	43¾ to 44
28¾ to 28⅝	29½ to 30	30½..........	32..........	33½ to 34	31⅞ to 32⅞	32¾ to 32⅞
10 50 to 13 00	9 00 to 12 50	10 00 to 12 50	11 50 to 12 00	10 00 to 11 25	8 50 to 11 50	9 50 to 11 50
9 00..........	7 00 to 9 50	7 00 to 10 50	....	7 00 to 8 00	7 50 to 8 00	7 00..........
10 75 to 11 00	10 75 to 11 00	10 75 to 11 00	10 75 to 11 00	10 75 to 11 00	9 50 to 9 75	9 50 to 9 75
11 75 to 12 00	11 75 to 12 00	11 75 to 12 00	11 75 to 12 00	11 75 to 12 00	10 50 to 10 75	10 50 to 10 75
17 80 to 17 90	19 50 to 19 60	18 42½ to 18 60	16 40 to 16 42	16 20 to 16 50	15 75 to 16 00	15 75 to 15 80
....	18 00..........	19 00 to 19 25	18 00 to 18 25	....	....	12 50 to 12 75
13 00..........	14 00 to 14 50	14 25 to 14 50	13 50 to 13 75	13 50..........	12 00..........	....
10¾ to 11⅛	11¼ to 11½	10.9 to 11 00	9⅞ to 10⅛	9½ to 10½	9¼ to 9¼	9¾..........
19 to 24	18 to 22	21 to 25	28 to 26	27 to 32	25 to 30	28 to 32
15 to 18	14 to 16	15 to 18	17 to 20	20 to 24	17 to 23	17 to 28
9 to 9½	8¼ to 9½	7¾ to 9	7¾ to 8¾	11½ to 12½	11 to 12½	12 to 13
....	....	....	....	....	....	9¾ to 10½
35 to 41	30 to 38	30 to 37	30 to 35	39 to 40	36 to 45	35 to 45
30 to 33	25 to 28	25 to 28	28 to 29	34 to 37	33 to 39	33 to 37
18 to 24	17 to 21	15 to 24	15 to 22	23 to 24	21 to 26	20 to 27
....	....	....	....	....	....	....
3 50 to 6 50	3 50 to 6 50	2 50 to 6 50	2 50 to 6 50	3 25 to 7 00	3 50 to 7 00	3 50 to 7 00
1 10 to 1 40	1 12 to 1 15	1 32 to 1 36	1 20 to 1 30	....	....	....
86 to 1 40	86 to 1 30	63 to 1 30	90 to 1 16	1 03 to 1 17	95 to 1 13½	1 05 to 1 28
39 to 44½	39 to 45	35 to 43	40 to 43	39 to 45	39 to 45	43 to 45
50 to 68	50 to 63	41 to 52	42 to 52	42 to 52	50 to 59	50 to 60
70 to 1 00	30 to 1 00	....	60 to 85	95	45 to 1 15	30 to 1 15
30 to 37	31 to 35	24 to 30	25 to 33	30 to 30½	28½ to 35	25 to 32
15 00 to 19 00	15 00 to 16 00	13 00 to 17 00	11 00 to 12 00	11 00 to 13 00	11 00 to 13 00	11 00 to 13 00
8 00 to 8 50	8 00 to 9 50	7 00 to 9 50	6 00 to 9 00	7 00 to 11 00	7 00 to 11 00	7 00 to 11 00
14 00 to 14 50	14 00 to 14 50	14 00 to 14 50	14 00 to 14 50	13 50 to 14 00	13 50 to 14 00	13 50 to 14 00
23 00 to 23 50	19 00 to 20 50	19 00 to 20 50	17 25 to 18 00	17 50 to 18 00	16 50 to 17 50	16 50 to 17 50
11½ to 13⅝	11½ to 12¼	9½ to 11	9½ to 11	14 to 16	9 to 10	9½ to 10½
18 to 20	14 to 18	18 to 20	18 to 20	26 to 30	26 to 30	22 to 28
13 to 16	13 to 16	13 to 16	13 to 16	20 to 25	18 to 22	17 to 20
12½ to 13½	12½ to 13½	12½ to 13½	12½ to 13½	12½ to 13½	12½ to 13½	12½ to 13½
13 to 14	13 to 14	13 to 14	13 to 14	13 to 14	13 to 14	13 to 14
35 to 37	36 to 37½	35 to 36	35 to 36	33 to 40	33 to 40	33 to 40
36 to 37	34 to 35	34 to 35	34 to 35	....	....	....
26 to 27	27 to 30	20 to 24½	20 to 24½	21 to 31	24 to 31	24 to 31
3 75..........	4 00..........	4 25..........	3 50..........	3 75 to 4 00	5 00..........	4 75..........
4 00 to 5 25	4 25 to 5 50	4 50 to 5 75	3 75 to 5 00	4 25 to 5 50	6 00 to 6 75	5 00 to 6 00
5 50 to 7 25	5 75 to 7 50	6 00 to 7 50	5 25 to 7 12½	5 75 to 7 25	7 00 to 7 50	6 25 to 7 37½
63 to 70	62 to 68	60 to 62	50 to 54	50 to 65	56 to 65	54 to 65

MARKET PRICES OF FARM

Products.	January.	February.	March.	April.	May.
NEW ORLEANS—Continued.					
Oats ....bush	$0 45 to $0 50	$0 45 to $0 49	$0 40 to $0 45	$0 42 to $0 45	$0 32 to $0 44
Hay:					
Choice ....ton	25 00..........	22 00...	25 00..........	20 00	22 00 to 23 00
Prime ....do	18 00 to 22 00	16 00 to 18 00	17 00 to 18 00	14 50 to 16 00	17 00..........
Beef:					
Texas ....bbl	12 00 to 25 00	12 00..........	12 00..........	12 00 to 12 50	12 00 to 12 50
Western ....do	16 00 to 17 00	15 00 to 17 00	15 00 to 16 00	12 00 to 16 00	15 00 to 15 50
Fulton market ....½ bbl	11 50..........	11 50...	11 50..........	11 75 to 12 00	11 75 to 12 00
Pork, mess ....bbl	20 50 to 21 75	21 50 to 22 00	23 00 to 23 75	24 00 to 24 50	22 00 to 22 75
Lard ....lb	12½ to 14¾	12¼ to 14	13½ to 14½	14¼ to 15¼	13½ to 14¾
Butter:					
Choice Goshen........lb	33 to 35	33 to 35	33 to 35	40 to 42	42 to 44
Choice western.......do	25 to 28	25 to 27	25 to 28	30..........	25 to 33
Cheese:					
Choice west'n fac'ry..lb	13 to 13½	12½ to 13	13	12½.........	13 to 13½
New York cream.....do	14 to 15½	14½ to 15	14½ to 15	14..........	15½ to 16
Sugar:					
Fair to fully fair.. ...lb	6¼ to 7	6⅝ to 7⅛	6⅜ to 7⅛	7¼ to 7⅝	7¾ to 8½
Prime to strictly prime, pound	7⅛ to 7⅜	7¼ to 7½	7¼ to 7⅝	7¾ to 7⅞	8¾ to 9
Clarified, white and yellow.................lb	8½ to 9¾	8½ to 9⅝	8⅝ to 9⅞	9 to 10	9¼ to 10¼
Cotton:					
Ordinary to good ordinary................lb	9¼ to 10¼	8⅛ to 10	8 to 9⅝	9 to 10¼	8 to 9¼
Low middling to good middling ....lb	11⅛ to 13¼	11 to 13½	10¾ to 13½	11⅝ to 14⅛	10¾ to 13⅜
Tobacco:					
Lugs ....lb	6 to 8	6 to 8	5½ to 7½	5½ to 7	5 to 7
Low leaf to medium leaf, pound	9 to 14	9 to 14	8 to 10½	8 to 10½	7½ to 10½
SAN FRANCISCO.					
Flour:					
Superfine ....* bbl	4 00 to 5 00	4 50 to 5 00	4 50 to 5 00	4 25 to 5 00	4 25 to 4 50
Extra ....do	5 25 to 5 50	5 25 to 5 50	5 25 to 5 50	5 25 to 5 50	4 75 to 5 25
Family and fancy.... do	5 75 to 6 25	5 75 to 6 00	5 75 to 6 00	5 75 to 6 00	5 50 to 6 50
Wheat:					
California ....cental	1 75 to 2 00	1 75 to 1 95	1 75 to 1 95	1 75 to 2 00	1 50 to 1 90
Oregon..............do..	1 75 to 1 95	1 75 to 1 95	1 75 to 1 90	1 75 to 2 00	1 75 to 1 85
Barley ....do..	1 10 to 1 35	1 20 to 1 35	1 20 to 1 35	1 15 to 1 35	1 10 to 1 25
Oats ....do..	1 85 to 2 05	2 05 to 2 35	2 05 to 2 25	2 10 to 2 50	2 00 to 2 50
Corn ....do..	1 05 to 1 20	1 25 to 1 35	1 15 to 1 25	1 15 to 1 25	1 05 to 1 15
Hay, State ....ton	15 00 to 19 00	13 00 to 18 50	12 00 to 18 00	14 00 to 18 50	12 00 to 19 00
Pork:					
Mess ....bbl	22 00 to 23 00	22 00 to 23 00	22 00 to 23 00	22 00 to 23 00	22 00 to 24 00
Prime mess ....do.	17 50 to 18 00	17 50 to 18 00	17 50 to 18 00	17 50 to 18 00	17 50 to 18 00
Beef:					
Mess .... bbl.	9 00 to 10 00	8 50 to 10 00	8 50 to 10 00	8 50 to 10 00	8 50 to 10 00
Family mess........½ bbl	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00	8 50 to 10 00
Lard ....lb	13½ to 16	13 to 15	13 to 15	13½ to 15	13 to 15
Butter:					
Overland ....do	18 to 25	18 to 25	18 to 25	16 to 18	16 to 18
California....... ....do	30 to 35	25 to 30	25 to 30	25 to 30	25 to 30
Oregon.................do	20 to 25	20 to 22½	20 to 22½	20 to 22½	20 to 22½
Cheese ....do	12½ to 15	12½ to 15	12½ to 15	12½ to 15	12½ to 15
Wool:					
Native. ....do	10 to 15	10 to 15	10 to 15	10 to 15	10 to 15
California ....do	15 to 18	15 to 19	15 to 19	15 to 18	15 to 18
Oregon ....do	18 to 20	18 to 20	18 to 20	16 to 18	16 to 18

LIVE STOCK

NEW YORK.					
Cattle:					
Extra beeves.....cental	12 25 to 12 75	11 50..........	11 50 to 12 25	11 75 to 12 00	11 25 to 12 00
Good to prime......do..	10 75 to 12 00	11 00..........	11 50..........	11 50..........	10 00 to 11 00
Common to fair .....do..	7 75 to 10 50	8 00 to 10 00	9 00..........	9 00..........	8 00 to 9 75
Texans..... ....do..	7 00 to 8 50				8 00 to 9 00
Milch-cows ....head.	50 00 to 85 00	50 00 to 85 00	....	....	50 00 to 80 00
Veal calves.......cental	7 00 to 10 00	7 00 to 10 50	7 00 to 10 50	....	4 50 to 7 00
Sheep ....do..	5 00 to 7 50	5 50 to 7 37	5 35 to 7 37	6 75 to 7 87	6 50 to 8 50
Swine ....do..	....	8 50 to 10 50	10 12½ to 10 50	10 25 to 10 75	None in the market.

* The barrel of flour in San

PRODUCTS FOR 1876—Continued.

June.	July.	August.	September.	October.	November.	December.
$0 40 to $0 43	$0 35 to $0 42	....	$0 33 to $0 40	$0 47 to $0 55	$0 41 to $0 50	$0 45 to $0 47
23 00 to 25 00	22 00 to 23 00	22 00 to 23 00	....	21 00	19 00	18 00 ....
21 00.........	17 00 to 19 00	16 00 to 17 00	16 00 to 17 00	17 50 to 18 00	16 00	13 00 to 14 00
12 00 to 12 50	10 00 to 11 00	10 00 to 11 00	10 00 to 11 00	10 00	10 00	....
14 00 to 15 50	13 00 to 14 50	13 00 to 14 50	13 00 to 14 50	13 00 to 14 00	14 00 to 15 00	12 00 to 15 00
11 75 to 12 00	11 75 to 12 00	11 75 to 12 00	11 00 to 12 00	9 75 to 10 00	9 75 to 10 00	8 00 to 8 50
22 50 to 22 75	21 50.........	20 75 to 21 00	17 25 to 18 00	18 75 to 19 00	17 50 to 18 25	18 37½ to 18 50
13 to 14¼	11¾ to 13¾	12 to 13½	11 to 12½	11¼ to 12	10⅝ to 11⅝	10¼ to 11¼
33 to 35	32.........	30.........	30 to 32	35	34	34 to 35
28 to 30	23 to 25	17 to 18	22 to 23	25	24 to 25	22 to 23
12½ to 13	9 to 11	 9	8½	13 to 14	12½ to 13	12 to 12½
15..........	14½.........	14½ to 15	12½ to 15	15 to 16	15 to 15½	15 to 16
7¾ to 8¼	8 to 8¾	8¾ to 9⅛	10¼ to 10⅝	....	7¼ to 7¾	7½ to 8⅛
8½........	9 to 9⅛	9⅝ to 9¾	10⅞ to 11	....	8 to 8½	8¼ to 8⅞
9½ to 10¼	9¾ to 10½	10½ to 11¼	11 to 11⅝	11 to 11⅝	9 to 10	9½ to 10½
7⅝ to 9½	6⅞ to 8½	7⅞ to 9⅜	8⅝ to 9⅝	8½ to 9⅜	8¾ to 9½	.... 10⅞
10½ to 12¼	10⅝ to 12½	10⅛ to 12¼	10⅜ to 11¾	9⅞ to 10⅞	10¼ to 11¼	11⅜ to 12⅛
5¼ to 7½	5½ to 7½	5½ to 8	5½ to 8	5½ to 8	5½ to 8	5½ to 7½
8½ to 11½	8 to 11½	8 to 12	8½ to 12	8½ to 12	8½ to 12	8 to 11
4 00 to 4 50	4 00 to 4 75	4 00 to 4 25	4 00 to 4 25	4 00 to 4 25	4 00 to 4 25	4 25 to 4 50
4 50 to 5 75	5 00.........	4 50 to 5 00	4 50 to 4 75	4 50 to 4 75	4 50 to 4 75	4 75 to 5 00
6 00 to 6 25	5 25 to 5 75	5 00 to 5 50	5 00 to 5 50	5 00 to 5 25	5 00 to 5 50	5 00 to 5 50
1 50 to 1 75	1 40 to 1 65	1 50 to 1 65	1 50 to 1 55	1 50 to 1 62½	1 50 to 1 75	1 60 to 2 00
1 60 to 1 72½	1 60 to 1 65	1 50 to 1 65	1 50 to 1 55	1 50 to 1 60	1 50 to 1 75	1 60 to 1 95
1 00 to 1 20	80 to 1 15	95 to 1 25	90 to 1 10	90 to 1 10	90 to 1 50	90 to 1 17½
2 25 to 2 50	1 75 to 2 25	1 30 to 1 75	1 40 to 1 87½	1 40 to 1 75	1 40 to 1 75	1 50 to 1 95
1 05 to 1 15	1 05 to 1 15	1 15 to 1 25	1 15 to 1 25	1 15 to 1 25	1 10 to 1 15	1 05 to 1 10
9 00 to 15 00	7 00 to 13 00	8 00 to 13 00	7 50 to 13 00	7 50 to 13 00	7 50 to 13 50	10 00 to 16 00
22 00 to 24 00	22 00 to 24 00	22 00 to 24 00	23 00 to 24 00	23 00 to 24 00	23 00 to 24 00	23 00 to 24 00
17 50 to 18 50	17 50 to 18 50	17 50 to 18 50	17 50 to 18 50	17 50 to 18 50	17 50 to 18 50	18 00 to 20 00
9 50 to 10 00	8 50 to 10 00	8 50 to 10 00	9 00 to 10 00	9 00 to 10 00	9 00 to 10 00	9 00 to 10 00
8 50 to 10 00	7 50 to 10 00	8 50 to 10 00	8 50 to 10 00	8 50 to 10 00	8 50 to 10 00	8 50 to 10 00
13 to 15	13 to 15	13 to 15	13½ to 15	13 to 14	13½ to 15	13 to 14
16 to 18	16 to 18	16 to 18	16 to 18	16 to 18	20 to 22	16 to 18
25 to 30	25 to 28	25 to 28	25 to 40	25 to 45	25 to 45	25 to 45
20 to 22½	20 to 22½	20 to 22½	20 to 25	20 to 25	20 to 25	20 to 25
12½ to 15	12½ to 15	12½ to 15	12½ to 15	12½ to 15	12½ to 15	12½ to 15
9 to 12½	8 to 10	8 to 10	10 to 12	10 to 12	10 to 12	10 to 12
15 to 18	15 to 19	15 to 19	15 to 22	15 to 22	15 to 22	15 to 22
15 to 18	15 to 19	15 to 20	15 to 22	20 to 25	20 to 25	20 to 25

MARKETS.

....	10 25..........	10 50 to 10 75	10 00 to 10 50	9 50 to 10 75	10 00 to 10 25	..........10 75
9 75 to 10 75	10 00 to 10 25	9 50 to 10 25	9 50 to 9 75	8 00 to 9 00	9 25 to 9 50	10 00 to 10 25
8 00 to 9 50	.... 9 00	7 25 to 9 25	8 00 to 9 25	6 00 to 7 50	....	7 75 to 9 00
8 00 to 9 00	....	....	2 75 to 7 50	6 00 to 7 50	6 00 to 7 50	....
....	....	45 00 to 75 00	....	50 00 to 75 00	45 00 to 75 00	40 00 to 70 00
3 50 to 7 00	....	5 50 to 8 50	5 00 to 8 25	5 50 to 9 50	5 00 to 10 00	6 50 to 9 50
4 50 to 7 50	4 75 to 5 75	4 00 to 6 00	4 00 to 6 50	4 00 to 6 75	4 00 to 6 00	4 25 to 6 25
6 90 to 7 00	....	7 00 to 7 25	6 75 to 7 00	6 65 to 7 00	5 69 to 6 12½	5 90 to 6 06¼

Francisco contains 200 pounds.

LIVE STOCK

Products.	January.	February.	March.	April.	May.
PHILADELPHIA.					
Cattle:					
Prime beeves.....cental.	$7 12½ to $7 50	$7 12½ to $7 50	$7 12½ to $7 25	$7 00 to $7 75	$6 75 to $7 00
Fair to good.........do..	5 50 to 7 00	5 50 to 7 00	5 50 to 7 00	5 75 to 6 75	6 00 to 6 50
Common ....do..	3 50 to 5 25	4 00 to 5 25	4 00 to 5 25	4 50 to 5 50	5 00 to 5 25
Sheep..................do..	4 50 to 8 00	5 75 to 7 00	4 50 to 7 00	5 00 to 7 75	4 00 to 7 75
Swine..................do..	10 00 to 11 00	10 00 to 11 50	11 50 to 12 50	12 50 to 13 75	11 00 to 12 25
BALTIMORE.					
Cattle:					
Best beeves ....cental.	5 50 to 6 25	5 87 to 6 50	5 75 to 6 37½	6 12 to 6 50	5 50 to 6 25
First quality.........do..	4 50 to 5 50	4 75 to 5 75	4 75 to 5 75	5 12 to 6 12	5 00 to 5 50
Medium or good quality, cental	3 50 to 4 50	3 75 to 4 75	4 25 to 4 75	4 50 to 5 12	4 50 to 5 00
Ordinary..........cental	3 00 to 3 50	3 00 to 3 50	3 00 to 4 00	3 50 to 4 00	4 00 to 4 25
General average of the market..........cental	4 25..........	4 50..........	4 87½........	5 37..........	5 50..........
Most of the sales....do..	3 75 to 4 75	4 00 to 5 25	4 37½ to 5 25	4 75 to 5 87	5 00 to 6 00
Sheep..................do..	4 50 to 5 50	4 50 to 6 50	4 50 to 7 50	5 00 to 7 50	2 75 to 6 00
Swine..................do..	9 00 to 10 00	9 50 to 10 50	10 75 to 12 00	10 50 to 12 00	9 75 to 11 00
CINCINNATI.					
Cattle:					
Good to prime butchers' steers ....cental	4 50 to 5 50	5 00 to 5 50	4 75 to 5 00	4 75 to 5 25	4 75 to 5 25
Fair to medium ......do..	3 25 to 4 25	4 00 to 4 75	3 50 to 4 50	3 75 to 4 50	3 75 to 4 50
Common ....do..	2 00 to 3 00	2 75 to 3 75	2 75 to 3 25	3 00 to 3 50	2 75 to 3 50
Milch-cows ....head	....	....	....	....	....
Veal calves.......cental.	....	....	....	....	....
Sheep..................do..	3 00 to 6 00	3 25 to 6 00	3 75 to 6 00	4 00 to 6 00	4 00 to 7 60
Swine..................do..	6 50 to 7 30	7 40 to 8 35	7 40 to 8 35	7 25 to 8 60	6 00 to 7 35
CHICAGO.					
Cattle:					
Choice beeves ....cental.	5 25 to 5 75	5 00 to 5 50	5 00 to 5 50	5 00 to 5 50	............5 30
Good beeves..........do..	4 50 to 5 10	4 35 to 4 75	4 00 to 4 75	4 40 to 4 80	4 10..........
Medium...............do..	4 00 to 4 50	4 12½ to 4 25	3 50 to 3 75	4 20 to 4 40	3 50 to 4 00
Inferior natives .....do..	2 50 to 4 00	2 80 to 4 00	3 00 to 3 50	2 50 to 3 50	2 50 to 3 75
Texans ....do..	2 50 to 3 75	....	....	....	....
Sheep..................do..	4 25 to 5 50	4 00 to 5 50	4 00 to 6 00	4 50 to 7 75	4 00 to 6 35
Swine..................do..	5 30 to 7 25	7 25 to 7 80	7 50 to 8 30	8 00 to 8 75	7 25 to 7 65
SAINT LOUIS.					
Cattle:					
Good to choice native steers ....cental.	5 75 to 6 25	5 25 to 6 00	5 25 to 5 50	5 25 to 5 50	4 20 to 4 50
Common to fair natives ....cental.	3 50 to 4 50	3 00 to 4 25	3 00 to 4 25	3 00 to 4 25	3 25 to 4 05
Inferior to common..do..	2 25 to 3 50	2 00 to 3 25	2 00 to 3 25	2 00 to 3 25	2 00 to 3 25
Texans, fair to choice.do..	2 40 to 4 50	3 00 to 4 25	3 00 to 4 50	3 00 to 4 50	3 00 to 3 50
Sheep..................do..	2 75 to 4 90	2 75 to 5 50	2 75 to 5 50	2 75 to 5 50	2 75 to 5 25
Swine..................do..	6 00 to 7 50	5 75 to 7 25	7 40 to 8 10	7 50 to 8 50	7 20 to 7 55
Horses:					
Plugs.................head.	20 00 to 30 00	30 00 to 40 00	30 00 to 50 00	30 00 to 50 00	30 00 to 50 00
Plain..................do..	60 00 to 75 00	60 00 to 75 00	60 00 to 75 00	60 00 to 75 00	60 00 to 75 00
Street-car ....do..	75 00 to 125 00	75 00 to 125 00	75 00 to 125 00	75 00 to 125 00	75 00 to 125 00
Heavy-draught ....do..	115 00 to 125 00	115 00 to 125 00	115 00 to 125 00	115 00 to 125 00	115 00 to 125 00
Good drivers ....do..	100 00 to 125 00	100 00 to 150 00	100 00 to 150 00	100 00 to 150 00	100 00 to 150 00
Extra ....do..	175 00 to 200 00	175 00 to 200 00	175 00 to 200 00	175 00 to 200 00	175 00 to 200 00
Auction horses.......do..	20 00 to 85 00	25 00 to 45 00	25 00 to 45 00	25 00 to 45 00	25 00 to 45 00
Mules:					
14 to 15 hands high.head.	80 00 to 130 00	80 00 to 130 00	80 00 to 130 00	80 00 to 120 00	80 00 to 120 00
15 to 16 hands high ..do..	130 00 to 170 00	130 00 to 170 00	130 00 to 170 00	115 00 to 170 00	115 00 to 130 00
Extra ....do..	175 00 to 200 00	175 00 to 200 00	175 00 to 200 00	175 00 to 200 00	160 00 to 170 00
NEW ORLEANS.					
Cattle:					
Tex'n be'ves, choice.head.	40 00 to 46 00	..........40 00	.... 40 00	..........40 00	40 00..........
First quality ....do..	30 00 to 35 00	30 00 to 35 00	..........35 00	..........35 00	35 00..........
Second quality .....do..	20 00 to 25 00	20 00 to 25 00	..........30 00	..........30 00	30 00..........
Western beeves ..cental	4 00 to 6 50	....	4 00 to 5 00	4 00 to 5 50	4 50 to 5 50
Milch-cows ....head.	40 00 to 90 00	40 00 to 90 00	40 00 to 90 00	..........90 00	40 00 to 90 00
Sheep..................do..	2 00 to 6 00	2 00 to 6 00	2 00 to 6 00	2 00 to 6 00	2 00 to 6 00
Swine..................do..	7 00 to 8 00	6 00 to 8 00	6 00 to 8 50	6 00 to 8 50	6 00 to 8 50
Horses:					
Good-conditioned ..head.	....	150 00 to 200 00	150 00 to 200 00	....	....
Plugs ....do..	....	100 00 to 150 00	100 00 to 150 00	....	....
Common ....do..	....	40 00 to 80 00	40 00 to 80 00	....	....
Mules:					
Well-broken, first class, head	....	225 00 to 275 00	225 00 to 275 00	....	....
Well-broken, sec'nd class, head	....	175 00 to 225 00	175 00 to 225 00	....	....

* The horse-market of New Orleans

MARKETS—Continued.

June.	July.	August.	September.	October.	November.	December.
$6 00 to $6 50	$6 00 to $6 75	$5 87½ to $6 50	$5 87½ to $6 00	$5 75 to $6 25	$6 12½ to $6 25	$6 12½ to $6 50
5 00 to 5 75	5 25 to 5 75	5 25 to 5 75	5 25 to 5 75	4 62½ to 5 50	5 00 to 6 00	5 12½ to 6 00
4 00 to 4 75	4 25 to 5 00	4 50 to 5 12½	3 00 to 5 00	3 00 to 4 50	3 00 to 4 75	3 50 to 5 00
4 00 to 6 75	1 50 to 5 75	2 00 to 5 50	1 00 to 5 75	1 50 to 5 75	1 00 to 5 75	1 00 to 6 12½
10 00 to 10 50	8 75 to 9 25	9 50 to 10 00	9 00 to 9 25	8 75 to 9 25	8 25 to 8 75	7 00 to 8 00
4 75 to 5 75	4 87 to 5 87	5 12 to 5 87	4 87 to 5 50	4 87 to 5 25	4 87 to 5 25	4 87 to 5 25
4 37 to 4 75	4 12 to 4 87	4 12 to 5 00	4 12 to 4 62	4 00 to 4 87	4 00 to 4 75	4 12 to 4 87
4 00 to 4 37	3 75 to 4 12	3 87 to 4 87	3 25 to 4 00	3 25 to 4 00	3 12 to 3 75	3 25 to 4 12
3 50 to 4 00	3 50 to 3 75	3 50 to 3 87	2 50 to 3 00	2 50 to 3 25	2 25 to 3 00	3 00 to 3 25
5 00..........	5 12..........	5 00	4 00..........	3 87..........	3 62	4 50 ....
4 37 to 5 25	4 62 to 5 50	4 50 to 5 50	3 62 to 4 50	3 25 to 4 25	3 12 to 4 25	4 00 to 5 00
4 00 to 5 75	2 00 to 5 00	2 00 to 5 12½	2 50 to 5 00	2 00 to 5 25	2 00 to 4 75	2 00 to 5 50
8 50 to 9 25	8 75 to 9 25	9 00 to 9 75	8 50 to 9 25	7 50 to 8 75	7 00 to 7 87½	7 00 to 7 75
4 25 to 5 00	4 25 to 4 75	4 00 to 4 75	4 00 to 4 75	4 00 to 4 65	3 75 to 4 25	4 25 to 4 40
3 50 to 4 25	3 25 to 4 25	3 00 to 3 75	3 00 to 3 75	2 75 to 3 75	2 50 to 3 50	2 60 to 3 50
2 50 to 3 25	2 25 to 3 00	2 00 to 2 75	2 00 to 2 75	2 00 to 2 50	2 00 to 2 40	2 00 to 2 50
....	....	....	....	....	....	....
....	....	....	....	....	....	....
3 50 to 5 00	3 00 to 4 50	2 25 to 4 25	2 25 to 4 25	2 25 to 4 50	2 25 to 4 50	2 25 to 4 50
5 25 to 6 00	5 90 to 6 25	5 00 to 6 50	5 50 to 6 40	5 00 to 6 15	4 90 to 5 60	5 00 to 5 85
4 75 to 5 00	4 70 to 4 90	4 80 to 5 00	4 85 to 5 10	4 60 to 5 00	4 60 to 4 75	.... 5 00
4 40 to 4 65	4 35 to 4 60	4 60 to 4 70	4 50 to 4 75	4 25 to 4 50	4 10 to 4 40	....
4 25 to 4 65	4 00 to 4 25	4 25 to 4 40	4 00 to 4 40	3 25 to 4 00	3 30 to 4 00	2 80 to 3 50
2 50 to 4 15	2 00 to 3 75	2 00 to 3 60	2 00 to 3 50	1 50 to 2 00	1 75 to 2 90	2 25 to 2 50
....	2 50 to 4 00	2 40 to 3 60	2 50 to 3 50	2 10 to 3 00	2 25 to 3 25	....
3 00 to 5 50	3 25 to 4 65	2 50 to 4 75	3 00 to 4 50	2 75 to 4 50	3 00 to 4 25	3 25 to 4 12½
5 80 to 6 35	6 00 to 6 40	6 20 to 6 80	6 20 to 6 40	5 00 to 6 30	4 25 to 6 00	5 50 to 6 00
4 45 to 4 50	4 60 to 4 75	4 50 to 4 00	....	4 50 to 4 90	4 50 to 4 00	4 50 to 4 90
3 25 to 4 25	3 25 to 4 25	3 25 to 4 25	4 50 to 4 90	3 25 to 4 25	3 25 to 4 25	3 25 to 4 25
2 00 to 3 25	2 00 to 3 25	2 00 to 3 25	2 00 to 3 25	2 00 to 3 25	2 00 to 3 25	2 00 to 3 25
3 00 to 4 00	3 00 to 4 00	3 00 to 4 00	3 00 to 4 00	3 00 to 4 00	3 00 to 4 00	3 00 to 4 00
3 75 to 5 25	3 75 to 5 25	2 50 to 4 50	2 50 to 4 50	2 50 to 4 50	2 50 to 4 50	2 50 to 4 50
5 40 to 5 90	5 50 to 5 75	6 10 to 6 50	6 10 to 6 35	5 50 to 6 25	5 50 to 6 25	5 50 to 6 25
30 00 to 35 00	30 00 to 35 00	30 00 to 65 00	30 00 to 65 00	30 00 to 65 00	30 00 to 65 00	30 00 to 65 00
45 00 to 55 00	45 00 to 55 00	50 00 to 90 00	50 00 to 90 00	50 00 to 90 00	50 00 to 90 00	50 00 to 90 00
75 00 to 125 00	75 00 to 125 00	75 00 to 125 00	75 00 to 125 00	75 00 to 125 00	75 00 to 125 00	75 00 to 125 00
115 00 to 125 00	115 00 to 125 00	100 00 to 130 00	100 00 to 130 00	100 00 to 130 00	100 00 to 130 00	100 00 to 130 00
175 00 to 225 00	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00
175 00 to 250 00	225 00 to 250 00	225 00 to 250 00	225 00 to 250 00	225 00 to 250 00	225 00 to 250 00	225 00 to 250 00
25 00 to 45 00	25 00 to 45 00	25 00 to 45 00	25 00 to 45 00	25 00 to 45 00	25 00 to 45 00	25 00 to 45 00
85 00 to 120 00	85 00 to 120 00	85 00 to 120 00	85 00 to 120 00	85 00 to 120 00	85 00 to 120 00	85 00 to 120 00
115 00 to 150 00	115 00 to 150 00	115 00 to 150 00	115 00 to 150 00	115 00 to 150 00	115 00 to 150 00	115 00 to 150 00
175 00 to 185 00	175 00 to 185 00	175 00 to 185 00	175 00 to 185 00	175 00 to 185 00	175 00 to 185 00	175 00 to 185 00
40 00..........	..........40 00	40 00..........	40 00..........	40 00..........	35 00 to 45 00	35 00 to 45 00
35 00..........	..........35 00	35 00..........	35 00..........	35 00..........	.... 35 00	.... 35 00
30 00..........	..........30 00	30 00..........	30 00..........	30 00..........	25 00 to 30 00	25 00 to 35 00
4 50 to 5 50	4 00 to 5 50	4 50 to 5 50	....	....	....	....
40 00 to 90 00	40 00 to 90 00	40 00 to 90 00	40 00 to 90 00	40 00 to 90 00	40 00 to 90 00	50 00 to 100 00
2 00 to 6 00	2 00 to 6 00	2 00 to 6 00	....	2 00 to 6 00	2 00 to 6 00	2 00 to 6 00
6 00 to 8 50	6 00 to 8 50	6 00 to 8 50	....	6 00 to 8 00	5 00 to 7 00	5 50 to 7 00
150 00 to 200 00	(*)	(*)	150 00 to 200 00	150 00 to 200 00	150 00 to 200 00	....
100 00 to 150 00	....	....	100 00 to 150 00	100 00 to 150 00	100 00 to 150 00	....
40 00 to 80 00	....	....	40 00 to 80 00	40 00 to 80 00	40 00 to 80 00	....
225 00 to 275 00	....	....	190 00 to 225 00	175 00 to 225 00	175 00 to 200 00	....
175 00 to 225 00	....	....	175 00 to 200 00	175 00 to 200 00	100 00 to 150 00	....

is closed during July and August.

INTERNATIONAL STATISTICS.

The International Statistical Congress at St. Petersburg in 1872 confided to the French government statistical corps the preparation of a code of international statistics of agriculture. The work was immediately inaugurated by sending direct inquiries to the statistical authorities of Europe and America. Replies to these inquiries, embodying more or less full statistics of 1873, were received from the United Kingdom, Norway, Hungary, Saxony, Würtemberg, Baden, Hesse-Darmstadt, Saxe-Weimar, Saxe-Altenburg, Holland, and Belgium. The French government gave authoritative and efficient aid to the work, whereby a very thorough census of the agricultural resources of the republic was secured. Returns embracing statistics of an earlier date were received from several other countries, while of still others only published documents of several years' standing were accessible. The dates of these data will be found in one of the tables given below. Statistics of the United States were received from the Statistical Division of the Department of Agriculture.

As was expected, great embarrassment was found in the differences of national manners, customs, and methods of investigation. The pressure of difficulties arising from these sources caused the inquiries to be confined to four leading and essential points, upon which alone it was deemed practicable to attain results of even approximate value and reliability. These points are, first, acreage, both cultivated and uncultivated; second, product compared with area; third, farm-animals; fourth, systems of exploitation, processes of culture, and agricultural implements. The following abstract embraces the first three of these heads:

The original report is in French, rendering necessary not only translation and subsequent condensation and re-arrangement, but also a reduction from French weights and measures to our own. If an international system of weights and measures—the metric, if no other should be deemed practicable or preferable—could be established, it would relieve much of the tribulation of statisticians in work upon international statistics.

AREA.—The following table shows the date of the official returns or other information from which the statistics were compiled, the population and national areas of the different states and the proportion of productive and unproductive land.

Population and areas.

Countries.	Date of official data.	Population.	Total national area.	Land under tillage.	Other productive lands.	Total productive lands.
			Acres.	*Acres.*	*Acres.*	*Acres.*
Great Britain	1873	26, 787, 337	57, 623, 333	18, 317, 276	15, 281, 530	33, 598, 806
Ireland	1873	5, 337, 261	20, 811, 357	5, 283, 928	10, 742, 811	16, 026, 739
Denmark	1871	1, 784, 741	9. 448, 691	3, 434, 925	3, 013, 274	6, 448, 199
Norway	1873	1, 763, 000	78, 663, 021	1, 570, 631	20, 015, 910	21, 586, 541
Sweden	1872	4, 297, 972	110, 629, 417	6, 257, 567	47, 996, 670	54, 254, 236
Russia	1870	71, 730, 980	1, 268, 890, 822	....	....	....
Finland	1870	1, 832, 000	93, 371, 255	1, 931, 659	55, 797, 438	57, 729, 097
Austria	1871	20, 394, 980	71, 180, 173	22, 273, 312	43, 892, 694	66, 166, 006
Hungary	1873	15, 509, 445	80, 027, 559	27, 966, 121	41, 935, 140	69, 901, 261
Switzerland	1868	2, 669, 147	10, 234, 802	....	....	....
Prussia	1867	24, 656, 078	85, 788, 437	....	....	....
Bavaria	1873	4, 852, 026	19, 360, 648	7, 666, 407	9, 524, 886	17, 191, 293
Saxony	1873	2, 556, 244	3, 704, 070	1, 863, 328	1, 561, 560	3, 424, 888
Würtemberg	1873	1, 818, 539	4, 803, 571	2, 093, 593	2, 481, 978	4, 575, 571
Baden	1873	1, 461, 562	3, 774, 358	1, 498, 969	1, 984, 293	3, 483, 262
Hesse-Darmstadt	1873	852, 894	2, 072, 512	1, 043, 620	889, 012	1, 932, 632
Saxe-Weimar	1873	286, 183	880, 700	498, 665	312, 315	810, 980
Saxe-Altenburg	1873	141, 122	326, 558	190, 579	120, 241	310, 820
Holland	1873	3, 716, 002	8, 123, 200	2, 437, 033	3, 263, 053	5. 700, 086
Belgium	1873	5, 253, 821	7, 278, 872	3, 926, 704	2, 007, 087	5, 933, 791
France	1873	36, 102, 921	130, 733, 581	64, 984, 190	45, 209, 091	110, 193, 281
Portugal	1865	4, 011, 908	22, 508, 508	4, 551, 400	6, 449, 571	11, 000, 971
Spain	1857	16, 262, 422	125, 223, 666	....	....	....
Italy	......	26, 801, 154	64, 080, 565	....	....	....
Greece	1867	1, 457, 894	11, 766, 143	....	....	....
Turkey	1868	8, 700, 000	89, 957, 183	....	....	....
Servia	1868	1, 338, 500	10, 762, 876	....	....	....
Roumania	1873	4, 500, 000	29, 893, 638	8, 656, 770	11, 518, 343	20, 175, 113

In the above classification, lands under tillage, or regular plow-culture, whether in a system of rotation or otherwise, constitute the first grand division, which includes cereals, farinaceous crops, (such as pease, beans, and potatoes,) grass crops, and all others, together with land in fallow. The other grand division of productive lands, not subjected to regular or periodical plow-breaking, includes orchards, vineyards, pastures, and woods and forests. A wide range of difference is found in the proportions of productive area in different countries. The states of the German Empire represented in the above table have utilized nearly the whole of their respective territories in some form of production, their proportion of waste land varying from 4 to 11.3 per cent. of the whole. At the other extreme, as might be expected, are those bleak, inhospitable northern regions, Finland, Sweden, and Norway. The two former have about half, and the latter nearly three-fourths, of their territories entirely unproductive. It is remarkable that Portugal, in a bright southern climate, has less than half her area occupied with any sort of production. This is partly due to the very large surface covered by her mountain ranges. Great Britain utilizes but 58 per cent. of her territory in agricultural production, and 28 per cent. of her agricultural lands are unused, leaving about 14 per cent. for sites of cities and towns, lakes, streams, roads, &c. France and Belgium utilize in agriculture five-sixths of their lands, including mountains and rivers. Austro-Hungary lose only from 10 to 12 per cent., Holland nearly a third, and Ireland nearly a fourth of their respective areas.

Of lands under tillage, the states showing the largest proportion, in descending order, are Saxe-Altenburg, Saxe-Weimar, Belgium, and

Hesse-Darmstadt, each of which has over half her territory under plow-culture; France and Würtemberg showing nearly the same proportion. At the other extreme, Norway and Finland show but 2 per cent., and Sweden 5½ per cent., under tillage.

The preceding table enables the reader to make comparisons with the total productive area of each state. The French statisticians have also compared the different classes of actually-productive lands with the total agricultural area, much of which in every country is unutilized. This area is the residue after deducting all the space occupied by lakes, rivers, roads, buildings, &c. The data from which this deduction is made are not given, but the following table gives the estimated proportion which the different branches of culture bear to the residue of lands that remain after the deduction. It will be noticed that cereals and farinaceous crops are placed under one general head. English commercial authorities include pease and beans among the cereals by a very wide construction of the meaning of that term. Industrial crops are those which constitute the basis of some specific manufacture, such as sugar-beets, colza, flaxseed, &c. The "market and kitchen garden crops" are the French *cultures potagères et maraichères.*

Distribution of the agricultural territory.

Countries.	Lands under tillage.						Other productive lands.				Total productive lands.	Per cent. of agricultural territory unoccupied.
	Cereals and farinaceous crops.	Market and kitchen garden crops.	Industrial crops.	Artificial meadows and annual forage crops.	Fallow lands.	Total.	Natural prairies and pasturages.	Vines.	Woods and forests.	Total.		
	Pr. ct.	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*
Great Britain	21.3	0.1	0.2	15.9	1.5	39	27.9	......	4.7	32.6	71.6	28.4
Ireland	15.3	......	0.7	12.5	0.1	28.6	56.3	......	1.7	58	86.6	13.4
Denmark	40.1	0.2	0.3	0.9	8.6	50.1	37.7	......	6.4	44.1	94.2	5.8
Norway	0.7	......	......	1.3	0.1	2.1	1.9	......	24.0	25.9	28.0	72.0
Sweden	3.4	0.1	0.1	1.6	0.8	6.0	4.8	......	41.5	46.3	52.3	47.7
Finland	1.4	0.1	0.1	......	0.7	2.3	5.6	......	61.3	66.9	69.2	30.8
Austria	26.1	0.5	0.1	4.5	0.2	31.4	28.3	0.8	32.6	61.7	93.1	6.9
Hungary	26.5	......	1.1	1.0	7.3	35.9	25.4	1.4	27.1	53.9	89.8	10.2
Bavaria	28.7	0.9	1.1	4.9	6.4	42.0	19.6	0.3	32.2	52.1	94.1	5.9
Saxony	33	1.5	1.4	13.5	2.8	52.2	14.7	0.1	28.9	43.7	95.9	4.1
Würtemberg	31.5	0.4	1.9	6.6	4.7	45.1	20.3	1.0	32.2	53.5	98.6	1.4
German duchies	30.5	0.5	2.8	11.6	2.3	47.7	14.5	1.1	33.2	48.8	96.5	3.5
Holland	23	0.8	2.2	6.1	0.7	32.8	37.0	......	7.2	44.2	77.0	23.0
Belgium	43.7	2.3	4.3	7.2	2.0	59.5	13.8	......	16.8	30.6	90.1	9.9
France	31.7	1.0	1.8	6.3	9.9	53.7	15.0	5.3	17.0	37.3	91.0	9.0
Portugal	13.5	0.6	1.0	0.1	8.3	23.5	22.7	2.5	8.1	33.3	56.8	43.2
Roumania	25.3	1.5	0.8	......	1.7	29.3	21.3	0.8	16.9	39.0	68.3	31.7

A still further general comparison is made of the different classes of culture, with the total area actually productive, including the two general classes of lands under tillage and other productive lands. The following table indicates the percentage of the whole productive area in each kind of culture. It will be seen that Belgium, France, Great Britain, Saxony, and Denmark have more than half their productive area under the plow, while Finland, Norway, and Sweden only range from 3.3 per cent. to 11.4 per cent. In these latter, the proportion of woods and forests ranges from eight-tenths to nine-tenths of the whole, while in Ireland they occupy but 2 per cent. Belgium holds the palm in cereal and farinaceous plants, which occupy 48½ per cent. of her productive lands; Denmark comes next, with 46.2 per cent., followed by France, 38.2, Roumania 37, &c. Ireland shows the largest proportion, 65 per cent., of natural prairies and pastures, and Norway the smallest, 6.7 per cent. Great Britain stands at the head of the list in meadows and annual forage plants which occupy 22.2 per cent. of the whole; Ireland and Saxony give over 14 per cent. to this class of crops, and the German duchies 12 per cent.; in Denmark the proportion falls to 1 per cent. Portugal has the largest proportion, 14.6 per cent., of fallow land; France the next, 10.9 per cent.; Ireland the smallest, 0.1 per cent. France has the largest proportion in wine-lands, 5.8 per cent., and Portugal next, 4.6 per cent.

Distribution of the lands actually productive.

Countries.	Lands under tillage.						Other productive lands.			
	Cereals and farinaceous crops.	Market and kitchen garden crops.	Industrial crops.	Artificial meadows and annual forage crops.	Fallow lands.	Total.	Natural prairies, orchards, and pastures.	Vines.	Woods and forests.	Total.
	Pr. ct.	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*
Great Britain	29.8	0.1	0.2	22.2	2.1	54.4	39.0	......	6.6	45.6
Ireland	17.7	......	0.8	14.4	0.1	33.0	65.0	......	2.0	67
Denmark	46.2	0.2	0.3	1.0	9.1	53.2	40.0	......	6.8	46.8
Norway	2.5	......	......	4.6	0.4	7.5	6.7	......	85.8	92.5
Sweden	6.5	0.2	0.2	3.0	1.5	11.4	9.2	......	79.4	88.6
Finland	2.1	0.1	0.1	......	1.0	3.3	8.1	......	88.6	96.7
Austria	28.0	0.5	0.1	4.9	0.2	33.7	30.4	0.8	35.1	66.3
Hungary	29.5	......	1.3	1.1	8.1	40.0	28.4	1.4	30.2	60.0
Bavaria	30.5	1.0	1.2	5.2	6.8	44.7	20.8	0.3	34.2	55.3
Saxony	34.4	1.5	1.5	14.1	2.9	54.4	15.3	0.1	30.2	45.6
Würtemberg	31.9	0.4	1.9	6.7	4.8	45.7	20.6	1.0	32.7	54.3
German duchies	31.6	0.5	2.9	12.0	2.5	49.5	15.0	1.2	34.3	50.5
Holland	29.8	1.0	2.9	7.9	0.9	42.5	48.1	......	9.4	57.5
Belgium	48.5	2.6	4.8	8	2.2	66.1	15.3	......	18.6	33.9
France	38.2	1.1	1.9	6.9	10.9	59.0	16.5	5.8	18.7	41.0
Portugal	23.7	1.1	1.7	0.2	14.6	41.3	39.9	4.6	14.2	58.7
Roumania	37.0	2.2	1.2	......	2.5	42.9	31.2	1.2	24.7	57.1

It will be seen that Ireland devotes 79.4 per cent. of her productive area to grass, including artificial and spontaneous growth. The other states, in descending order, stand as follows: Great Britain, 61.2 per cent.; Holland, 56; Denmark, 41; Portugal, 40.1; Austria, 35.3; Roumania, 31.2; Hungary, 29.5; Saxony, 29.4; Würtemberg, 27.3; German duchies, 27; Bavaria, 26; France, 23.4; Belgium, 23.3; Sweden, 12.2; Norway, 11.3; Finland, 8.1.

Finally, comparison is made of each branch of culture in the general class to which it belongs. The following table shows the percentage of each general class employed in the different subordinate classes included in it. It will be seen that Roumania and Austria give the largest proportions of their tilled lands, 86.3 and 83.3 per cent., to cereals and farinaceous crops. Roumania stands first in market-garden crops, Belgium in industrial crops, and Norway in meadow and annual forage crops. Of other productive lands, Ireland has nearly the whole in natural pasture, orchards, &c., and Norway nearly 93 per cent. in woods and forests.

Distribution of the lands in classes of culture.

Countries.	Lands under tillage.						Other productive lands.			
	Cereals and farinaceous crops.	Market and kitchen garden crops.	Industrial crops.	Meadows and annual forage crops.	Fallow lands.	Total.	Natural prairies, orchards, and meadows.	Vines.	Woods and forests.	Total.
	Pr. ct.	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*
Great Britain	54.8	0.2	0.4	40.8	3.8	100	85.5	......	14.5	100
Ireland	53.7	......	2.4	43.6	0.3	100	97.0	......	3.0	100
Denmark	80	0.4	0.5	2.1	17.0	100	85.5	......	14.5	100
Norway	33.2	......	......	61.3	5.5	100	7.2	......	92.8	100
Sweden	57	1.8	1.7	26.3	13.2	100	10.4	......	89.6	100
Finland	63.7	3.0	3.0	......	30.3	100	8.3	......	91.7	100
Austria	83.3	1.4	0.3	14.4	0.6	100	45.9	1.2	52.9	100
Hungary	73.8	......	3.2	2.7	20.3	100	47.3	2.4	50.3	100
Bavaria	68.3	2.2	2.7	11.6	15.2	100	37.6	0.5	61.9	100
Saxony	63.2	2.8	2.8	25.9	5.3	100	33.6	0.2	66.2	100
Würtemberg	69.8	0.9	4.2	14.6	10.5	100	37.9	1.9	60.2	100
German duchies	63.8	1.0	5.9	24.2	5.1	100	29.7	2.4	67.9	100
Holland	70.1	2.4	6.8	18.6	2.1	100	83.7	......	16.3	100
Belgium	73.4	3.9	7.3	12.1	3.3	100	45.1	......	54.9	100
France	64.7	1.9	3.2	11.7	18.5	100	40.3	14.1	45.6	100
Portugal	57.4	2.7	4.1	0.5	35.8	100	68.1	7.8	24.1	100
Roumania	86.3	5.1	2.8	......	5.8	100	54.6	2.1	43.3	100

The following tables show the aggregate acreage in the different classes of culture:

Countries	Lands under tillage.						Other productive lands.			
	Cereals.	Farinaceous crops.	Other crops.	Meadow and annual forage crops.	Fallow lands.	Total.	Natural meadows, pastures, orchards, &c.	Vines.	Woods and forests.	Total.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Great Britain	8, 585, 837	1, 428, 543	116, 636	7, 478, 784	707, 476	18, 317, 276	13, 094, 359		2, 187, 171	15, 281, 530
Ireland	1, 918, 068	916, 284	129, 584	2, 306, 772	13, 319	5, 283, 928	10, 421, 370		321, 441	10, 742, 811
Denmark	2, 551, 329	193, 761	37, 508	65, 249	587, 078	3, 434, 925	2, 578, 301		434, 973	3, 013, 274
Norway	410, 103	87, 724	4, 142	988, 440	49, 422	1, 570, 631	1, 482, 660		18, 533, 250	20, 015, 910
Sweden	3, 078, 497	487, 301	149, 107	1, 729, 770	812, 992	6, 257, 566	4, 908, 099		43, 088, 571	47, 996, 670
Finland	1, 167, 348	49, 422	72, 403	24, 711	617, 775	1, 931, 659	4, 645, 668		51, 151, 770	55, 797, 438
Austria	15, 943, 386	2, 609, 054	392, 797	3, 213, 905	114, 170	22, 273, 312	20, 121, 839	553, 302	23, 217, 554	43, 892, 695
Hungary	19, 682, 304	1, 026, 640	800, 646	786, 929	5, 669, 602	27, 966, 121	19, 782, 754	1, 050, 469	21, 101, 916	41, 935, 140
Prussia	24, 336, 285									
Bavaria	4, 465, 217	768, 208	379, 152	881, 394	1, 172, 436	7, 666, 407	3, 595, 252	54, 769	5, 874, 865	9, 524, 886
Saxony	944, 168	235, 829	102, 385	482, 102	98, 844	1, 863, 328	524, 113	4, 221	1, 033, 226	1, 561, 560
Würtemberg	1, 253, 006	210, 073	109, 206	302, 912	218, 396	2, 093, 593	942, 710	44, 455	1, 493, 813	2, 481, 978
Baden	745, 381	205, 596	90, 839	422, 558	34, 595	1, 498, 969	598, 006	51, 893	1, 334, 394	1, 984, 293
Hesse-Darmstadt	504, 568	141, 110	106, 836	265, 503	25, 603	1, 043, 620	271, 821	24, 155	594, 037	890, 012
Saxe-Weimar	272, 925	53, 862	7, 081	68, 323	96, 474	498, 665	83, 790	400	228, 125	312, 315
Saxe-Altenburg	116, 839	24, 721	18, 096	27, 293	3, 630	190, 579	26, 421		93, 820	120, 241
Holland	1, 236, 390	466, 220	225, 013	454, 312	55, 098	2, 437, 033	2, 733, 059		529, 994	3, 263, 053
Belgium	2, 389, 784	483, 499	512, 483	482, 282	133, 173	3, 926, 704	903, 938	717	1, 102, 432	2, 007, 087
France	37, 106, 847	3, 704, 616	4, 519, 609	7, 635, 610	12, 017, 508	64, 984, 190	18, 175, 796	6, 382, 150	20, 651, 146	45, 209, 091
Portugal	2, 578, 628	32, 959	308, 888	24, 711	1, 606, 215	4, 551, 400	4, 388, 674	504, 104	1, 556, 793	6, 449, 571
Spain	7, 311, 760	503, 118								
Greece	376, 541	400								
Roumania	7, 221, 563	248, 766	692, 221		494, 220	8, 656, 770	6, 287, 007	252, 260	4, 979, 076	11, 518, 343

Area in cereals.

Countries.	Wheat and spelt.	Meslin.	Rye.	Barley.	Oats.	Maize.	Buckwheat.	Millet and small grains.	Total.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Great Britain	3,502,043	....	51,646	2,343,591	2,688,557	....	....	....	8,585,837
Ireland	168,529	....	8,402	231,048	1,510,089	....	....	....	1,918,068
Denmark	140,522	....	612,430	752,148	916,350	....	49,271	80,607	2,551,329
Norway	11,861	....	32,866	123,555	222,399	....	....	49,422	410,103
Sweden	....	....	....	....	....	....	....	....	3,078,497
Finland	4,942	....	654,842	271,821	222,399	....	988	12,356	1,167,318
Austria	2,301,368	....	4,908,178	2,648,476	4,631,360	732,740	586,611	131,650	15,912,386
Hungary	5,520,470	632,641	3,508,255	2,314,697	2,905,294	4,474,394	126,174	209,379	19,682,304
Prussia	4,196,034	....	10,070,486	3,356,819	6,712,946	....	....	....	24,336,285
Bavaria	1,043,513	....	1,454,193	837,364	1,116,326	1,898	4,011	7,912	4,465,217
Saxony	197,809	....	466,722	176,298	86,202	....	17,137	....	944,168
Würtemberg	536,611	49,032	100,996	240,510	321,579	4,408	393	77	1,253,006
Baden	274,292	49,422	103,786	153,208	130,968	7,413	1,482	24,810	745,381
Hesse-Darmstadt	120,745	9,919	145,743	131,408	90,699	447	1,715	892	504,568
Saxe-Weimar	46,009	....	84,998	68,230	73,688	....	....	....	272,925
Saxe-Altenburg	11,234	....	44,514	22,062	36,029	....	....	....	116,839
Holland	214,837	....	487,803	112,512	257,410	....	163,829	....	1,236,390
Belgium	859,656	88,582	714,113	107,784	567,720	....	52,968	....	2,389,784
France	17,214,718	1,243,403	4,726,228	2,762,865	7,864,167	1,497,469	1,674,482	123,515	37,106,847
Portugal	618,721	....	987,982	172,895	29,638	769,392	....	....	2,578,628
Spain	7,311,760	....	2,961,811	3,182,040	....	1,531,659	....	....	14,987,270
Greece	376,541	....	10,814	117,713	10,235	181,006	22,907	128,897	848,113
Roumania	2,451,593	....	256,277	874,826	245,235	3,158,293	11,352	223,957	7,221,563

Area in other crops.

Countries.	Farinaceous plants.		Textile plants.		Oleaginous plants.		Other industrial plants.			
	Pease, beans, &c.	Potatoes.	Hemp.	Flax.	Colza.	Poppy, &c.	Sugar-beet.	Hops.	Tobacco.	Madder, chicory, &c.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Great Britain	906, 152	522, 391		14, 579			544	83, 289		445
Ireland	12, 850	903, 434		129, 543						
Denmark	87, 637	106, 124	111	11, 757	4, 295			875	311	6, 289
Norway	13, 390	78, 334								
Sweden	133, 439	353, 901	40, 526					4, 942	4, 942	4, 942
Finland		49, 422	21, 251	13, 591					494	
Austria	489, 517	2, 119, 537								
Hungary	108, 607	918, 033	241, 861	35, 006	151, 864	1, 618	155, 499	4, 970	118, 833	
Bavaria	122, 569	645, 638	110, 619		29, 013			43, 632	13, 465	8, 721
Saxony	17, 137	218, 692		15, 150	35, 663					
Würtemberg	26, 977	183, 096	18, 422	16, 166	23, 325	7, 003	10, 323	12, 108	914	1, 989
Baden	7, 908	197, 688	16, 803	2, 669	12, 827	2, 595	5, 560	4, 399	22, 240	4, 448
Hesse-Darmstadt	23, 289	118, 521	1, 710	7, 814	13, 539	1, 256	70, 854	82	3, 262	10
Saxe-Weimar	12, 212	41, 650		655	4, 213		1, 236			
Saxe-Altenburg	5, 338	19, 383			5, 441		3, 560			
Holland	136, 303	329, 917	2, 765	54, 053	42, 676	7, 785	36, 152	521	3, 904	12, 788
Belgium	59, 959	423, 542	7, 208	140, 964	65, 269		44, 663	9, 788	4, 186	12, 143
France	797, 377	2, 907, 239	236, 044	216, 644	415, 676	115, 136	626, 140	8, 718	36, 716	26, 935
Portugal		32, 959								
Spain		503, 118								
Greece		400								
Roumania	247, 110	1, 656	12, 941	6, 188	217, 924				4, 942	

The acreage in forage, artificial grasses, and natural grasses amounts to 79.4 per cent. of the entire productive area in Ireland; 61.3, in Great Britain; 56, in Holland; 41, in Denmark; 40.1, in Portugal; 35.3, in Austria; 31.2, in Roumania; 29.5, in Hungary; 29.4, in Saxony; 27.6, in Würtemberg; 27, in the German duchies; 26, in Bavaria; 23.4, in France; 23.3, in Belgium; 12.2, in Sweden; 11.3, in Norway; and 8.1, in Finland.

PRODUCTION.—The average annual production of cereals of all sorts in Europe is estimated at 5,153,808,000 bushels, of which 1,657,392,000 bushels, or nearly a third, are assigned to Russia; 766,260,000 bushels, or nearly 15 per cent., to Germany; 709,500,000 bushels, or nearly 14 per cent., to France; 567,600,000 bushels, or over 11 per cent., to Austria-Hungary. The production of the United States in 1873 is set down at 1,586,442,000 bushels, an aggregate nearly equal to that of Russia.* Europe produces a little over 17 bushels *per capita* of her population; the United States, in 1873, about 39¾ bushels *per capita*. The average ratio *per capita* of the different countries of Europe is given as follows: Roumania, 40.8 bushels; Denmark, 33½; Russia, 23; Prussia, 22¾; France, 19½; Hungary, 19¼; Bavaria, 18½; Sweden, 15.6; German duchies, 14.5; Belgium and Spain, 13.9; Austria and Würtemberg, 13.3; Ireland and Turkey, 13; Finland, 12.5; Great Britain, 11.9; Saxony and Servia, 10.7; Holland, 9; Norway and Greece, 8.8; Italy and Portugal, 7.9; Switzerland, 5.9.

Estimating the average consumption at 15.6 bushels *per capita* for food, seed, and various manufactures, Europe produces about enough to meet her own demand, except in wheat and some other breadstuffs, which exhibit a considerable deficiency to be supplied by importation. Spain, Italy, and France raise a larger proportion of wheat than any other grain. Finland, Switzerland, and Germany, of rye; Scandinavia and Germany, of barley; Ireland, Hungary, and North Germany, of oats. Maize holds first rank in Roumania, Servia, and Portugal; buckwheat has but little importance, except in Holland and France. Oats is the leading crop of Europe, followed by wheat and rye.

Of potatoes, Ireland produces 23 bushels *per capita;* the German Empire, 18.1; Holland, 14.5; Belgium, 11.6; France, 10.2; Scandinavia, 9.9; Austria-Hungary, 8½; Russia and Finland, 4½; Great Britain, 3⅛; Italy, 1.1; Portugal, 0.85; Spain, 0.28. In the other states this culture is still more insignificant.

It is estimated that in Europe 1,223,195 acres are, on an average, annually devoted to what in this country is best known as market-garden crops, producing a great variety of alimentary and other vegetable plants, averaging in value, in 1862, about $88,800,000 per annum, or from $79 to $97 per acre.

The "industrial plants," including colza, flax, hemp, sugar-beet, hops, and tobacco, are grown to a considerable extent in those countries in which a varied culture is pursued. Roumania produces 88¾ bushels of colza per hundred of her population; Belgium, 34½; Holland, 27; France,

---

* This was correct for 1873, but the figures lead to a grevious misunderstanding of our real production. The years 1873 and 1874 were seasons of low yield, much below an average; of the two subsequent years, 1875 was characterized by a medium yield of corn, and 1876 by a large yield, the rate of production of other grains being scarcely an average in either year; but the aggregate product of cereals exceeded that of the two preceding years by more than 500,000 bushels per annum.

The average estimated production of 1873–'76 inclusive is 1,873,100,179 bushels, which is 286,658,179 more than the above estimate founded on the product of 1873. This would give 43 bushels to each inhabitant.

22; Hungary, $20\frac{3}{4}$; Germany, $14\frac{1}{2}$; Denmark, $4\frac{1}{2}$. This plant is a species of cabbage, raised for its seed, from which a kind of lamp-oil is expressed. The largest proportion of hemp is raised in Hungary, amounting to 61 pounds *per capita;* Germany averages 50; Finland, $43\frac{1}{2}$; France, $32\frac{1}{2}$; Sweden, $20\frac{3}{4}$; Roumania, $12\frac{3}{4}$; Belgium, $8\frac{3}{4}$. In flax Ireland takes the lead, producing 13.9 pounds *per capita;* Belgium, 10.14; Holland, $7\frac{1}{4}$; France, 3, &c. France is the great sugar-beet country of Europe, her crops averaging 531 pounds *per capita;* next Holland, 260 pounds; Belgium, 233 pounds; Hungary, $88\frac{2}{3}$; Germany, 74.3. Of hops, Germany and Great Britain each average about $4\frac{1}{6}$ pounds *per capita;* France less than 2, &c. Tobacco-culture is limited in Europe, yet Hungary produces 5 pounds *per capita*, and Germany $4\frac{1}{2}$; smaller products are noted in Denmark, Sweden, Finland, Holland, Belgium, France, and Roumania.

YIELD OF CROPS.—The following tables present the returns of agricultural production in Europe:

Aggregate yield of cereals.

Countries.	Wheat and spelt.		Maslin.		Rye.		Barley.	
	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Great Britain		104, 572, 354				1, 779, 426		91, 513, 013
Ireland	3, 871, 032				178, 510		8, 385, 154	
Denmark		2, 743, 557				9, 143, 698		17, 276, 495
Norway		276, 535				826, 624		3, 731, 970
Sweden	2, 455, 429				15, 985, 926		12, 574, 379	
Russia	221, 714, 919				616, 954, 569		124, 255, 047	
Finland	53, 922	87, 978			9, 024, 840	11, 431, 464	4, 994, 880	6, 212, 382
Austria	35, 945, 699				74, 407, 428		46, 234, 017	
Hungary		69, 741, 730		10, 172, 028		65, 272, 201		33, 495, 519
Switzerland	2, 145, 528				8, 684, 680		1, 430, 352	
Prussia	73, 731, 406				173, 485, 733		86, 742, 609	
Bavaria	21, 626, 587				24, 550, 562		17, 501, 814	
Saxony		5, 338, 707				12, 274, 827		5, 811, 012
Würtemberg	7, 274, 135	21, 449, 672	709, 526	778, 362	1, 635, 485	1, 855, 870	5, 358, 653	5, 883, 478
Baden	4, 347, 248	4, 630, 765	658, 416	805, 992	1, 263, 478	1, 752, 181	3, 343, 164	4, 134, 966
Hesse-Darmstadt	278, 138	4, 714, 889	193, 660	266, 567	2, 259, 660	3, 130, 050	3, 179, 908	3, 622, 130
Saxe-Weimar	792, 611	686, 929			1, 757, 136	1, 561, 899	1, 989, 665	1, 567, 200
Saxe-Altenburg	425, 019	408, 672			1, 175, 846	1, 175, 846	886, 818	836, 143
Holland	5, 238, 650	5, 318, 798			8, 137, 443	9, 368, 221	4, 699, 546	4, 781, 600
Belgium	24, 682, 369	23, 991, 263	2, 034, 383	2, 034, 383	13, 367, 392	18, 123, 888	3, 565, 090	3, 787, 910
France	237, 998, 666	295, 654, 462	17, 843, 360	21, 998, 669	58, 971, 844	74, 667, 825	53, 163, 763	57, 452, 339
Portugal	5, 684, 696	8, 171, 749			6, 240, 450	8, 396, 595	1, 985, 663	2, 839, 498
Spain	117, 563, 372				25, 511, 775		58, 471, 962	
Italy	107, 381, 080				8, 740, 887		13, 321, 218	
Greece	5, 102, 894				123, 009		2, 059, 506	
Turkey	40, 867, 200				10, 216, 800		25, 542, 000	
Servia	4, 086, 720				510, 840		3, 065, 040	
Roumania		33, 787, 161				5, 887, 264		20, 094, 345

Aggregate yield of cereals—Continued.

Countrie	Oats. Year of the inquiry.	Oats. Average year.	Maize. Year of the inquiry.	Maize. Average year.	Buckwheat. Year of the inquiry.	Buckwheat. Average year.	Millet and small grains. Year of the inquiry.	Millet and small grains. Average year.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Great Britain		123, 248, 640						
Ireland	57, 058, 502							
Denmark		27, 564, 583				622, 456		2, 592, 116
Norway		9, 633, 196						1, 844, 700
Sweden	31, 945, 516				9, 754		4, 782, 467	
Russia	590, 746, 010						106, 075, 292	
Finland	4, 852, 980	5, 066, 232			18, 831	18, 831	141, 900	141, 960
Austria	91, 486, 937		11, 416, 496		8, 151, 925		1, 859, 711	
Hungary		41, 374, 609		76, 105, 136		1, 3[illegible]4, 175		3, 359, 905
Switzerland	5, 212, 736							
Prussia	227, 434, 922							
Bavaria	25, 897, 914		48, 822		49, 744		136, 309	
Saxony		3, 969, 845				295, 223		
Würtemberg	9, 269, 232	9, 565, 541	81, 513	93, 234	5, 886	6, 769	1, 144	1, 320
Baden	3, 188, 777	3, 339, 191	162, 617	164, 320	24, 180	27, 585	572, 720	398, 909
Hesse-Darmstadt	2, 729, 146	2, 812, 481	8, 168	90, 921	22, 451	24, 225	28, 789	19, 054
Saxe-Weimar	2, 538, 874	1, 904, 156						
Saxe-Altenburg	1, 903, 390	1, 862, 012						
Holland	11, 116, 821	11, 307, 622			2, 722, 051	3, 199, 944		
Belgium	21, 777, 248	24, 124, 478			1, 064, 568	1, 320, 064		
France	192, 677, 482	199, 592, 269	25, 310, 283	27, 462, 829	27, 591, 765	32, 490, 219	1, 736, 944	1, 950, 311
Portugal	568, 449	544, 624	15, 826, 946	11, 928, 983				
Spain			24, 626, 036					
Italy			51, 048, 408				20, 428, 764	
Greece	200, 028		3, 242, 937		263, 083		1, 480, 244	
Turkey	3, 065, 040		30, 650, 400				2, 043, 360	
Servia	510, 840		5, 108, 400		1, 021, 680			
Roumania		8, 449, 464		108, 731, 613		227, 318		7, 201, 822

Aggregate yield of farinaceous and industrial crops.

Countries.	Pease, beans, &c.		Potatoes.		Tobacco.		Sugar-beets.		Hops.	
	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Pounds.*	*Pounds.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Great Britain		28, 098, 754		86, 293, 261				6, 063		56, 441
Ireland	354, 182		124, 509, 304							
Denmark		1, 409, 099		14, 625, 690		277, 797				585
Norway		180, 199		18, 847, 584						
Sweden	1, 587, 911	2, 605, 284	41, 185, 189	44, 704, 176		4, 409, 480				2, 205
Russia			326, 906, 518							
Finland			7, 180, 140	7, 095, 060		440, 948				220
Austria	5, 617, 335		178, 429, 626							
Hungary		1, 746, 261		126, 520, 764	82, 698, 474	80, 577, 635	742, 247	686, 571	864	864
Switzerland										
Prussia	17, 110, 125		569, 720, 471							
Bavaria	2, 942, 591		59, 778, 270			19, 942, 435				23, 857
Saxony		328, 680		41, 304, 494						
Würtemberg	371, 789		19, 850, 584		977, 904	1, 223, 611	68, 403	114, 013	8, 102	8, 535
Baden		108, 979		20, 433, 600	51, 590, 916	47, 622, 386	46, 136	39, 735	3, 924	3, 140
Hesse-Darmstadt	379, 197		15, 251, 565		5, 471, 283	4, 332, 565	521, 770	420, 448	56	55
Saxe-Weimar	188, 332	168, 306	7, 175, 173	5, 261, 894			11, 023	13, 229		
Saxe-Altenburg	91, 951	79, 691	3, 339, 161	2, 671, 353			25, 399	22, 229		
Holland	3, 866, 298	3, 810, 341	50, 203, 594	53, 309, 455	8, 122, 011	7, 071, 483	420, 541	475, 766	339	242
Belgium	1, 473, 631	1, 466, 741	81, 233, 283	60, 803, 411			597, 562	613, 666		5, 414
France	12, 583, 996	13, 755, 297	341, 726, 216	374, 216, 236	38, 036, 615		8, 536, 213	9, 598, 989	5, 537	5, 100
Portugal				3, 785, 041						
Spain			6, 356, 016							
Italy			29, 696, 734							
Greece			18, 390							
Roumania		7, 095, 000		380, 292						

Average yield per acre.

Countries.	Wheat and spelt.		Maslin.		Rye.		Barley.		Oats.		Corn.		Buck-wheat.	
	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
Great Britain		29.9				34.5		39		45.9				
Ireland	23				21.2		36.3		37.8					
Denmark		19.5				14.9		23.0		29.9				12.6
Norway		23.3				25.1		30.2		38.8				
Sweden														
Russia														
Finland	10.9	17.8			13.8	17.5	18.4	22.9	21.8	22.5			18.9	18.9
Austria	15.6				15.2		17.5		19.8		15.6		13.9	
Hungary		12.6		16.1		18.6		14.5		14.2		17.1		10.3
Switzerland														
Prussia	17.6				17.2		25.8		33.9					
Bavaria	*29.2				16.9		20.9		23.2		25.7		12.4	
Saxony		27				26.3		33		46.1				17.2
Würtemberg	*11.5	16.6	14.5	16.1	16.2	18.4	22.3	24.5	28.8	29.7	18.5	22.5	14.9	17.2
Baden	15.8	16.9	13.3	16.3	12.2	16.9	21.8	27.1	24.3	25.5	21.9	22.2	16.3	18.6
Hesse-Darmstadt	20.6	39.0	19.5	26.9	15.5	21.5	23.7	26.9	30.1	31	18.3	20.3	13.1	14.1
Saxe-Weimar	14.9	17.2			18.4	20.7	23	29.3	25.8	34.5				
Saxe-Altenburg	29.9	28.7			26.4	26.4	40.2	37.9	52.8	51.7				
Holland	24.3	21.8			16.7	19.2	41.8	42.5	43.2	43.9			16.7	19.5
Belgium	28.7	27.9	23.3	23.2	18.7	25.4	33.1	35.1	38.4	42.5			20.1	24.9
France	13.8	17.1	14.4	17.7	14.8	15.8	19.2	20.8	24.5	25.4	16.9	18.4	16.5	19.4
Portugal	9.5	13.2			6.9	8.5	11.5	16.4	19.2	18.4	20.6	15.5		
Spain	16.1				8.6		18.4				16.1			
Greece	13.5				11.5		19.4		19.5		17.9		11.5	
Roumania		13.8				23		23		34.5		34.5		19.5

Countries.	Millet and small grain.		Pease, beans, &c.		Potatoes.		Tobacco.		Sugar-beets.		Hops.	
	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.	Year of the inquiry.	Average year.
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Lbs.	Lbs.	Tons.	Tons.	Tons.	Tons.
Great Britain				31		165.4				11.14		0.89
Ireland			27.6		137.8							
Denmark		32.1		16.1		137.8		892				0.67
Norway		37.3		19.2		240.6						
Sweden			11.8	19.5	116.9	126.3		892				0.45
Russia												
Finland	11.5	11.5			145.3	201	446	892				
Austria	13.8		18.4		84.2							
Hungary		16.8		16.1		137.8	705	677	4.77	4.41	0.17	0.17
Switzerland												
Prussia			18									
Bavaria	17.2		15.8		105.8			1,481				0.54
Saxony				19.2		200.2						
Würtemberg	14.9	17.2	13.8		108.4		1,070	1,335	6.68	11.13	0.67	0.71
Baden	24.1	16.1		13.8		103.4	2,360	2,182	8.30	7.13	0.89	0.67
Hesse-Darmstadt	32.3	21.4	16.1		129.8		1,766	1,265	7.43	5.45	0.67	0.66
Saxe-Weimar			13.8	15.5	126.3	172.3			8.92	10.70		
Saxe-Altenburg			17.2	14.9	172.3	137.8			7.13	6.25		
Holland			28.4	27.9	152.2	161.6	1,913	1,972	12.98	13.00	0.64	0.46
Belgium			24.6	24.5	191.8	143.6		1,177	13.38	13.80		0.56
France	14	15.7	15.7	17.2	117.5	128.4	1,035	972	13.60	15.33	0.63	0.52
Portugal						114.8						
Spain					126.3							
Greece	11.5				45.9							
Roumania		32.2		28.7		229.7		1,338				

* Only wheat.

Average quantity of seed sown per acre.

Countries.	Wheat and spelt.	Maslin.	Rye.	Barley.	Oats.	Maize.	Buckwheat.	Millet, &c.	Pease, beans, &c.	Potatoes.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
Denmark	2.9	......	2.9	3.0	4.2	......	1.5	3.6	3.2	17.2
Norway	3.2	......	2.4	4.4	6.8	......	......	5.5	3.7	35.6
Finland	2.5	......	2.5	3.8	4.8	......	0.7	5.7	......	26.7
Hungary	1.4	1.4	1.4	1.7	2.2	0.2	1.4	0.3	1.6	10.6
Bavaria	2.4	......	3.1	3.3	4.6	......	......	......	2.6	......
Saxony	2.4	......	3.2	3.2	5.6	......	1.7	......	3.2	25.8
Saxe-Weimar	2.9	......	3.2	3.1	4.1	......	......	......	2.9	17.2
Saxe-Altenburg	2.6	......	2.3	3.0	4.0	......	......	......	2.6	13.8
France	2.5	2.4	2.4	2.4	2.8	0.8	1.1	0.5	2.1	14.1
Roumania	2.9	......	2.9	3.4	3.4	0.3	0.7	0.3	0.6	23.0

FARM-ANIMALS.—The number of domestic animals in twenty-eight European states is given at 379,031,705, of which 31,573,663 are horses, 4,136,031 asses and mules, 89,678,248 cattle, 194,026,236 sheep, 42,686,493 swine, and 16,931,034 goats. The sheep surpass in number all other classes, amounting to 51.1 per cent. of the whole; cattle 23.7 per cent., swine 11.3 per cent., horses 8.3 per cent., goats 4.5 per cent., mules and asses 1.1 per cent. The proportion of horses is especially large in Russia, amounting to 16.7 per cent. of the whole number of farm-animals in that country. In Finland the proportion is 10.6 per cent. The lowest ratio, 1.5 per cent., is found in Portugal, and the next lowest, 1.8 per cent., in Spain. The last-named country has the largest proportion of mules and asses, amounting to 6.1 per cent. of the whole number of farm-animals; next stand Italy, 4.9; Portugal, 3.6; Greece, 3.3; France, 1.5. Of cattle, the largest proportion, 52.7 per cent., is found in Bavaria; next Würtemberg, 49.1; Saxony, 46.9; Switzerland, 44.7; Sweden, 44; Holland, 43.4; German duchies, 42.4; Belgium, 42; gradually sinking to the minimum, 3.8, in Greece. Great Britain gives the most of her attention to sheep, which constitute 73.5 per cent. of her farm-animals; in Spain the proportion is 60.2; in Roumania, 59.1; in Hungary, 54.6; in Prussia, 54; in Norway, 53.3; in France, 52.5; in Portugal, 52; the minimum, 14.9, is in Saxony. The German duchies have the largest proportion of swine, 23.7 per cent.; next Saxony, 22.4; Belgium, 21.4; Greece, 2. No goats are reported in the British isles or Denmark. In Greece they constitute 46.7 per cent. of the total live stock; in Portugal, 18 per cent.; in Switzerland, 16.9 per cent.; in Spain, 12.2 per cent.; and so on down to 2.4 per cent. in Roumania.

Taking all the states together, there are for each 1,000 inhabitants 112 horses, 15 asses and mules, 318 cattle, 6,878 sheep, 151 swine, and 6 goats. Russia, Denmark, Finland, and Hungary stand at the head of horse-owning states; Spain, of mules; Ireland, Denmark, Bavaria, Finland, Norway, and Würtemberg, of cattle; Spain, Great Britain, Roumania, Denmark, Hungary, and Norway, of sheep; Hungary, Spain, Denmark, and the German duchies, of swine; Greece stands at the head of the goat-owning states; next, with a wide interval, comes Spain, and then Portugal.

Belgium has the largest number of horses for her territory, being nearly equaled by Great Britain; Denmark, Holland, Hungary, Prussia, and Ireland following next in order. Spain has the largest number of mules; Great Britain the largest number of sheep, the German duchies and Belgium the largest number of swine, and Greece the largest number of goats. The proportions will be found in the tables below.

Farm-animals.

Countries.	Horses.	Asses.	Mules.	Cattle.*	Cows.	Sheep.	Swine.	Goats.
Great Britain	2, 201, 100	....	....	6, 002, 100	2, 253, 899	29, 495, 900	2, 519, 300	....
Ireland	532, 100	....	....	4, 142, 400	1, 526, 500	4, 482, 000	1, 042, 244	....
Denmark	316, 570	....	....	1, 238, 898	807, 513	1, 842, 481	442, 421	....
Norway	149, 167	....	....	953, 036	675, 006	1, 705, 394	96, 166	290, 985
Sweden	438, 090	....	....	2, 026, 330	1, 265, 387	1, 636, 201	382, 811	124, 673
Russia	16, 160, 000	....	....	22, 770, 000	....	46, 432, 000	9, 800, 000	1, 700, 000
Finland	251, 820	....	....	997, 960	686, 896	921, 745	190, 326	30, 639
Austria	1, 337, 023	31, 351	11, 625	7, 425, 212	3, 831, 136	5, 026, 398	2, 551, 473	979, 104
Hungary	2, 158, 819	30, 480	3, 266	5, 279, 193	2, 052, 488	15, 076, 997	4, 443, 279	572, 951
Switzerland	105, 792	....	....	992, 895	....	445, 400	304, 191	374, 481
Prussia	2, 278, 721	8, 774	934	8, 612, 150	5, 057, 440	19, 624, 758	4, 278, 531	1, 477, 335
Bavaria	351, 639	168	60	3, 066, 263	1, 557, 286	1, 342, 190	872, 098	193, 881
Saxony	115, 792	86	26	647, 972	421, 785	206, 833	301, 369	105, 847
Würtemberg	96, 970	174	25	946, 228	480, 092	577, 290	267, 350	38, 305
Baden	70, 220	149	21	660, 405	376, 821	170, 556	371, 389	82, 074
Hesse-Darms'dt	40, 813	450	18	284, 049	169, 588	130, 410	133, 987	78, 670
Saxe-Weimar	13, 167	26	6	112, 296	59, 307	212, 874	78, 141	40, 282
Saxe-Altenburg	8, 892	1	3	57, 428	34, 406	30, 771	37, 550	11, 362
Holland	253, 393	3, 466		1, 469, 937	908, 433	898, 715	611, 004	146, 169
Belgium	283, 163	11, 849		1, 242, 445	738, 732	586, 097	632, 301	197, 138
France	2, 742, 708	402, 168	303, 775	11, 721, 459	5, 938, 818	25, 035, 114	5, 755, 656	1, 794, 837
Portugal	79, 716	137, 950	50, 690	520, 474	162, 593	2, 706, 777	776, 868	936, 869
Spain	680, 373	1, 298, 334	1, 021, 512	2, 967, 303	....	22, 468, 969	4, 351, 736	4, 531, 228
Italy	477, 906	498, 766	219, 456	3, 473, 934	1, 374, 696	....	1, 553, 582	1, 690, 478
Greece	69, 787	61, 051	29, 637	109, 904	....	1, 200, 000	55, 776	1, 339, 538
Turkey	....	....	....	....	....	....	....	....
Roumania	426, 859	6, 128	606	1, 842, 786	555, 060	4, 786, 317	836, 944	194, 188

* Including cows.

Proportions of different kinds of farm-animals.

Countries.	Horses.	Asses and mules.	Cattle.	Sheep.	Swine.	Goats.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Great Britain	5. 2	......	15. 0	73. 5	6. 3	......
Ireland	5. 2	......	40. 6	44. 0	10. 2	......
Denmark	8. 2	......	32. 3	48. 0	11. 5	......
Norway	4. 7	......	29. 9	53. 3	3. 1	9. 0
Sweden	9. 5	......	44. 0	35. 5	8. 3	2. 7
Russia	16. 7	......	23. 5	47. 9	10. 1	1. 8
Finland	10. 6	......	41. 7	38. 5	7. 9	1. 3
Austria	7. 9	. 2	42. 7	28. 9	14. 7	5. 6
Hungary	7. 8	. 2	19. 2	54. 6	16. 1	2. 1
Switzerland	4. 7	......	44. 7	20. 0	13. 7	16. 9
Prussia	6. 3	......	23. 8	54. 0	11. 8	4. 1
Bavaria	6. 0	......	52. 7	23. 0	15. 0	3. 3
Saxony	8. 2	......	46. 9	14. 9	22. 4	7. 6
Würtemberg	5. 0	......	49. 1	30. 0	13. 9	2. 0
German duchies	5. 1	......	42. 4	20. 8	23. 7	8. 0
Holland	7. 5	......	43. 4	26. 6	18. 1	4. 4
Belgium	9. 6	. 5	42. 0	19. 9	21. 4	6. 6
France	5. 7	1. 5	24. 6	52. 5	12. 0	3. 7
Portugal	1. 5	3. 6	10. 0	52. 0	14. 9	18. 0
Spain	1. 8	6. 1	8. 0	60. 2	11. 7	12. 2
Italy	3. 2	4. 9	23. 4	46. 8	10. 4	11. 3
Greece	2. 4	3. 3	3. 8	41. 8	2. 0	46. 7
Roumania	5. 4	......	22. 7	59. 1	10. 4	2. 4
All tho states	8. 3	1. 1	23. 7	51. 1	11. 3	4. 5

Number of different kinds of farm-animals to each 1,000 inhabitants.

Countries.	Horses.	Asses and mules.	Cattle.	Sheep.	Swine.	Goats.
Great Britain	78	......	224	1.118	94	......
Ireland	100	......	776	840	195	......
Denmark	178	......	694	1,032	248	......
Norway	85	......	541	967	54	165
Sweden	102	......	471	381	89	29
Russia	225	......	317	647	137	24
Finland	139	......	545	503	4	17
Austria	67	2	364	246	125	48
Hungary	139	2	340	972	286	37
Switzerland	40	......	372	167	114	140
Prussia	92	......	331	796	173	60
Bavaria	72	......	632	277	180	40
Saxony	45	......	253	81	118	40
Würtemberg	53	......	520	317	147	21
German duchies	49	......	406	199	227	77
Holland	68	1	395	242	164	39
Belgium	54	2	236	112	120	38
France	76	19	325	694	159	50
Portugal	20	47	130	676	194	233
Spain	42	143	182	1,384	263	279
Italy	18	27	130	261	58	63
Greece	48	64	75	818	38	913
Roumania	95	2	409	1,064	186	43
All the states	112	15	318	687	151	60

Number of each class of animals per square kilometer. *

Countries.	Horses.	Mules.	Cattle.	Sheep.	Swine.	Goats.
Great Britain	9.1	....	25.7	125.5	10.8	....
Ireland	6.3	....	49.2	53.2	12.4	....
Denmark	8.3	....	32.4	47.1	11.7	....
Norway	0.5	....	3.0	5.3	0.3	0.9
Sweden	1.0	....	4.5	3.5	0.8	0.2
Russia	3.1	....	4.4	9.0	1.9	0.3
Finland	0.7	....	2.6	2.4	0.5	0.1
Austria	4.5	0.1	24.7	16.7	8.4	3.2
Hungary	6.6	0.1	16.3	46.5	13.7	1.7
Switzerland	2.5	....	24.0	10.7	7.3	9.0
Prussia	6.5	....	24.5	56.5	12.3	4.2
Bavaria	3.4	....	39.1	17.1	11.1	2.5
Saxony	7.7	....	43.1	13.8	20.1	7.0
Würtemberg	4.9	....	48.7	29.7	13.7	2.0
German duchies	4.6	....	38.9	19.0	21.7	7.4
Holland	7.7	0.1	44.7	27.3	18.6	4.4
Belgium	9.6	0.4	42.2	19.9	21.4	6.7
France	5.1	1.3	22.1	47.3	10.9	3.4
Portugal	0.9	2.0	5.7	29.7	8.4	10.3
Spain	1.1	4.5	5.8	44.3	8.6	8.9
Italy	1.3	2.4	11.8	22.6	5.2	5.7
Greece	1.4	2.0	2.3	25.2	1.2	28.1
Roumania	3.5	0.2	15.2	39.5	7.0	1.6
	0.4	0.4	9.5	20.5	4.5	1.8

* 2.59 square kilometers make one square mile.

RELATIONS WITH SOUTH AMERICA.

This country has yet had little intercourse with sister republics of South America. It seems strange that countries so sparsely settled and so rich in agricultural resources should obtain any portion of their breadstuffs from nations thousands of miles away. As they become settled in the future, we cannot expect to furnish their bread-supply, but there always will be peculiar products of our agriculture, and extended products or manufactures, which might be profitably exchanged for such of their tropical products as we cannot produce. The balance of trade is already fearfully against us. It must eventually furnish a profitable outlet to the goods of our agricultural-implement makers, which trade should be cultivated assiduously. With this view, it is deemed desirable to present some fragmentary glimpses of the agricultural status of these countries, and especially the trade relations between us, particularly the exchanges of agricultural products.

BRAZIL.

The trade of Brazil, so far as this country is concerned, is quite too one-sided. Secretary Fish, in his last report on commercial relations with foreign countries, says that in 1875 Brazil sent to this country productions exceeding $42,000,000 in value, and received about one-sixth of that amount. The total value, as officially reported, of our exports to Brazil in 1876 was $7,253,218.

The following are the main items of this export:

Breadstuffs of all kinds	$3,940,398
Lard, 4,486,402 pounds	743,073
Cotton manufactures	585,299
Iron and its manufactures	377,551
Wood and manufactures of	282,817
Drugs, chemicals, and medicines	152,847
Steel and its manufactures	80,644
Paintings and engravings	72,755
Books and publications	58,845
Paper and stationery	51,203
Other exports	907,856
Total	7,253,218

Of these minor exports there were of agricultural implements, $8,211; living animals, $3,823; fruits, $8,329; bacon and hams, beef, butter, and cheese amounting to $7,093.

Coffee, the great staple production of Brazil, is largely consumed in the United States, and is steadily increasing in quantity produced. The amount received in 1873 from Brazil was $30,861,906; in 1874 it amounted to $37,342,692, and in 1875 to $35,099,274. This exportation is entirely from the ports of Rio de Janeiro and Santos. Total quantity in 1875 was over $229,701,637. The chief article imported from the United States is flour. The annual exports to the United States amount to more than $42,500,000, (nearly $44,000,000 in 1875,) while the imports do not exceed $7,500,000. Sugar, coffee, cocoa, and wood, in the list of 1875, figure up nearly $40,000,000, while the agricultural imports from the United States are comparatively insignificant. The want of sufficient facilities for cheap and rapid transportation keep the United States far behind Great Britain in the Brazilian trade. The cotton-trade amounts to $40,800,000, which goes entirely to Europe, Great Britain getting the lion's share.

The trade of 1875 was distributed, by ports of entry, as follows:

Ports.	Imports.	Exports.
Bahia	$793, 641 95	$587, 147 94
Ceara	33, 350 00	
Maranham	94, 000 00	23, 230 51
Maceio		112, 000 00
Para	300, 000 00	2, 782, 452 66
Pernambuco	873, 500 00	2, 374, 464 55
Rio de Janeiro	5, 200, 000 00	35, 086, 166 00
Rio Grande del Sul		
Santos	200, 000 00	1, 621, 204 00

The quantities and market values of several products of the rural industry of the United States, imported into Rio Janeiro last year, were:

Flour, 317,410 barrels	$2, 793, 208
Kerosene, 110,285 cases	463, 197
Spirits of turpentine, 2,600 cases	26, 000
Rosin, 3,845 barrels	14, 611
Pitch-pine, 7,943,000 feet	364, 170
White pine, 4,674,000 feet	222, 600
Lard, 85,705 kegs	784, 160
Total	4, 667, 946

ARGENTINE REPUBLIC.

The agriculture of the Argentine Republic is not prosperous. With a rich soil, almost entirely unoccupied, the importation of wheat, eggs, butter, and cheese increases. The wild state of the country, the insecurity of life and property, the contempt of the native for tillage of the soil, leaves little to rural enterprise beyond the breeding of cattle. Foreigners are the only tillers of the soil. The following table of imports illustrates this strange and unfortunate condition of affairs:

Articles.		1873.	1874.	1875.
Wheat	kilograms	1, 044, 929	2, 550, 405	4, 887, 451
Flour	kilograms	1, 013, 822	7, 450, 721	10, 922, 739
Indian corn	kilograms		60, 685	60, 675
Corn-meal	kilograms	115, 549	131, 886	255, 081
Butter	kilograms	11, 796	65, 674	76, 000
Potatoes	kilograms		713, 703	
Cheese	kilograms	655, 072	758, 454	1, 031, 721
Eggs	dozen	5, 831	2, 148	24, 188

The farm-products exported are mainly corn and hay; but corn-meal, requiring mills and millers, is imported. The quantity sent out is as follows:

	1873.	1874.	1875.
Indian corn	1, 653, 101	3, 862, 439	222, 616
Hay	1, 876, 248	2, 241, 362	3, 551, 560

A plague of locusts has of late years devastated portions of the interior provinces. While the subtropical forests of the entire eastern slope of the Cordilleras of the Andes exhibit wonderful arboreal resources, the present inhabitants of that region make little use of them, even importing the commonest furniture from the United States or Europe. Consul E. L. Baker gives the following statement of value of imports of wood and its products:

Kinds.	1870.	1871.	1872.	1873.	1874.	1875.
Timber for building	$1,675,193	$1,240,591	$1,693,090	$2,941,301	$2,008,757	$1,267,486
Timber for veneering	....	....	....	....	17,988	17,271
Timber for cabinet-work	58,244	42,518	20,067	137,274	48,171	87,771
Timber, planed	....	....	....	....	46,621	67,122
Other timber	55,504	55,693	112,580	230,769	58,309	86,066
Furniture	563,760	363,601	515,865	948,201	752,268	546,258

Of this amount the United States furnished as follows:

Kinds.	1870.	1871.	1872.	1873.	1874.	1875.
Lumber for building	$1,482,542	$996,275	$1,518,054	$2,769,059	$1,907,175	$1,092,616
Lumber for cabinet-work	15,945	19,671	6,437	97,311	23,901	30,031
Lumber for veneering	....	....	....	....	1,858	3,714
Lumber, planed	....	....	....	....	15,075	22,227
Other timber	21,160	6,941	28,468	43,822	26,976	41,110
Furniture	126,900	71,113	125,027	274,299	214,418	126,872

The native woods most used are *Quebracho colorado*, very hard and brittle, the word meaning break-ax, worth in Rosario $120 per 1,000 feet; *Quebracho blanco*, less hard, used for cart-wheels and boat-building; *Algarroba*, softer and lighter, worth $100; cedars from the mountain districts, $125. Foreign lumber has supplanted the use of native woods for building purposes as far as Cordova, after paying $22 ocean freight, $6 import duty, and $10 railway freight, besides profits of importer. The extension of railways into the interior is cheapening transportation, and may ultimately reduce the price of lumber. There are no portable saw-mills for cutting lumber. The exportation of lumber should be a profitable business.

Lumber is beginning to be a prosperous industry among the forests of the Grand Chaco, bordering on the Parana River, and cargoes have been sent to English and French ports.

The provinces of Tucuman, Salta, Jujuy, and Corrientes are well adapted to the production of sugar, cotton, rice, and tobacco, which are already the bases of flourishing industries, and the olive is suited to all except the more southern locations. The climate of Tucuman is said to be similar to that of Louisiana, and cane will reproduce itself for fifteen or twenty years after planting. There are now forty-two sugar establishments in that province, with an aggregate capital of upward of $250,000. It is 1,000 miles in the interior, and is now in railroad communication with Buenos Ayres. Experiments in coffee-growing there are also very promising.

Consul Baker reports a popular estimate of 20 bushels as the average yield of wheat. Some Europeans are credited with obtaining 25 to 27 bushels. The yield of oats is said to be good, but maize and potatoes are inferior to the growth of the United States. Alfalfa is the great hay-producer, affording three or four crops each season. Dried and baled, the surplus finds a ready market in Brazilian ports. It sells for about $15 per ton.

Immigration is fostered, and is very active of late, so that Buenos Ayres is becoming rather cosmopolitan than Argentine. It is almost entirely from Southern Europe, Italians largely, French, Spanish, and Swiss; nearly all Catholics. About three in a thousand of the foreigners in the interior are from the United States; some intend to settle there, others to get cheap land in a mild climate and get rich and return. They are generally intelligent, energetic, and independent. They generally find the climate agreeable, with an average temperature of 68° F. Less mortality is reported among foreigners than natives, on account of better habits.

Consul T. B. Wood, at Rosario, says of stock-raising in his district, that it is conducted in the style of three hundred years ago, except that very recently importations of fine foreign stock have been made—horses, cattle, sheep, and Angora goats. Primitive practices prevail: a horse-cart has no shafts, but a stout short neap, the end of which is tied with rawhide to a ring on one side of the girth. The saddle consists of a broad girth, with two large rings, two huge pads to protect the back of the horse, and several layers of leather, sheep-skins, &c.—a seat by day and a bed by night. This style of saddle, to the value of $160,000, has been exported from Rosario in a year. The ox-yoke is a simple bar of wood lashed to the horns. So absorbing is this industry that 75 per cent. of the exports of this place are made up of hides, hair, skins, leather, hide-cuttings, horns, bones, bone-ash, and tallow. Prices of milch-cows are $10 to $15; working-oxen, $20 to $25; beeves, $10 to $18; working-mules, $20 to $35; working-horses, $10 to $25; sheep, $1 to $1.50; goats, $1 to $1.30.

Mr. Wood reports further of the agriculture of this district:

Fruits of all kinds are retailed by count. Thus, strawberries sell for 5 to 15 cents per dozen. Cherries are dearer; grapes cheaper. Other small fruits are unknown, save as imported from Europe in glass bottles. Peaches thrive all over the country. Some of the estancias have orchards on them that seem like small forests, yet there is no exportation of the fruit, and in the retail market they sell for 75 cents to $1 per hundred, in the height of their season, and at all other times are cheaper, as imported from the United States in cans, than as offered in the markets.

Tomatoes, though indigenous in this country, are almost always cheaper in imported cans than in the markets.

Though the consumption of bread in the country is relatively very small, yet it is only within the last five years that this consular district has produced wheat enough for its own demands. The profitable exportation of the small surplus has given a stimulus to wheat-growing, so that at present it outvalues all other crops combined. But this is not strange, considering that little or no grain is fed to animals, so that the production of other crops has but little stimulus. The wheat crop of 1874 in this province was reckoned at $2,500,000. In prices it varies from $2 to $4 per hundred pounds.

Corn is beginning to receive an impulse from its successful exportation to the adjacent countries and to Europe. It ranges in price from $1 to $2 per hundred pounds.

The native mode of cultivation is very primitive. Ditches and hedges serve to fence in the small fields. The plow most used consists of a heavy block of hard wood that runs in the ground, pointed off so as to serve as a share, and a long beam mortised obliquely into this at one end, and tied at the other end to the rude ox-yoke. A short upright handle arising from the share-block is used to steady it in the ground or lift it out.

Thrashing is accomplished by the tramping of animals, and winnowing by means of the wind. The transportation most usually is in rude one-horse carts, with large wheels, and hitched as before described, or in ox-carts that are still ruder, with still larger wheels, and some of which are made entirely of wood and rawhide, *without a particle of iron.* Tires of hide answer surprisingly well in a country like this, whose soil is entirely destitute of stones or gritty sand, and they have the advantage of shrinking and swelling with the wood-work by the absence or presence of moisture.

UNITED STATES OF COLOMBIA.

This tropical country lies on the equator, and includes an area of 455,673 square miles. It has a population of less than seven to the square mile, about three millions in all. Scarcely a tenth of the surface is under cultivation. As the altitude rises to the regions of perpetual snow on the summit of the Andes, the temperature varies from intense tropical heats to delightful coolness. The immense plain of Bogota, 37 by 68 miles in extent and 8,700 feet high, has a mean and comparatively unvarying temperature of 57° F. The soil is of sandstone origin, and quite productive. The people are divided into seven classes: *Gachupines*, or people born in Europe; *Creoles*, descendants of Europeans; *Mestizos*, descendants of whites and Indians; *Mulattoes*, from whites and negroes; *Indians*, copper-colored natives, and *African negroes.* The lower classes of the interior are Indians or Mestizos, who are ignorant and superstitious, docile and kind, mildly vicious, but not disorderly or dangerous. The chief industries of these people are agriculture, cattle-raising, and mining. The processes of agriculture are rude; there is no attempt at rotation of crops; farm-machinery is very rough and primitive; wooden plows of the old Roman pattern are used for scratching the surface of the soil. Yet, owing to almost inexhaustible fertility of the soil, crops are abundant for home consumption. Cattle-breeding is somewhat improved by the introduction of foreign stock on the table-lands of the Andes. Swine are scarce, and of very poor appearance. Coffee is demanding some attention in States of Santander and Cundinamarca, where the product has reached 12,900,000 pounds of quite good quality. Tobacco is also grown, not of superior quality, but salable in Europe for the manufacture of spurious Havana cigars. Cacao, cotton, and indigo are also grown, but not extensively or for exportation.

Of the total exports from the republic in year ending May 31, 1874, valued at $10,189,852, the agricultural exports were: coffee, $975,353; cotton, $249,048, and tobacco, $2,360,883; in all, $3,585,284. Better means of cheap and rapid transportation are one important need to stimulate an increased attention to this industry. The principal agricultural shipments during the year ending September 30, 1875, at the port of Panama were:

Articles.	Receipts.		Shipments.	
	Value.	Whence.	Value.	Whither.
Cocoa	$100,000	Ecuador and Mexico	$100,000	United States, Mexico, and Europe.
Coffee	1,400,000	Mexico and Central America.	1,400,000	United States and Europe.
Cotton	1,100,000	South and Central America and Mexico.	1,100,000	United States and Europe.
Flour	75,000	United States and Chili	75,000	Colombia, South and Central America and Mexico.
Sugar	40,000	Colombia, South and Central America.	40,000	Consumed on the isthmus.
Tobacco	50,000	Colombia, Central America, and Cuba.	50,000	United States, England, and Germany.
	2,765,000		2,765,000	

Total amount of goods entered and cleared, $13,443,000.

The total foreign commerce of 1875 is thus reported:

Countries.	1874.		1875.	
	Imports.	Exports.	Imports.	Exports.
Great Britain	$4, 956, 381	$3, 343, 933	$2, 964, 976	$3, 351, 821
France	1, 906, 870	1, 674, 874	2, 056, 325	1, 541, 212
United States	806, 644	1, 556, 506	767, 473	1, 469, 973
Germany	676, 442	2, 635, 769	602, 783	3, 122, 530
All others	2, 872, 507	478, 710	547, 471	483, 492
Total	11, 218, 844	10, 189, 852	6, 949, 023	9, 984, 028

The chief articles imported were cloths, food-products, salt, wines and liquors, and metal manufactures; the exports were mainly gold and silver dust and bars, tobacco, cinchona bark, vegetable ivory, and fine woods, these articles comprising seven-tenths of the exports.

The principal items of domestic exports from the United States of North America to the United States of Colombia were as follows:

	Value.
Total exports	$3, 946, 442
Agricultural implements	59, 550
Beer and wine	1, 496
Billiard tables and apparatus	19, 851
Blacking	1, 512
Books, pamphlets, maps, &c	43, 727
Breadstuffs and bread: bread and biscuit, 200,960 pounds; flour, 44,275 barrels	312, 683
Brooms and brushes of all kinds	1, 153
Candles, tallow and other, 141,978 pounds	26, 806
Carriages, carts, and parts of	36, 712
Clocks	19, 685
Coal of all kinds, 23,679 tons	104, 292
Copper and manufactures of	1, 033
Cordage, rope, and twine of all kinds, 105,149 pounds	16, 859
Cotton and manufactures of	103, 347
Drugs, chemicals, and medicines not otherwise specified	278, 981
Earthen and stone ware and fancy articles	5, 882
Fruit	24, 775
Glass and glass ware	35, 839
Gold and silver and manufactures of	60, 885
Hay, 103 tons	2, 226
Hemp and manufactures of	4, 015
Hops, 9,629 pounds	1, 052
Ice, 2,854 tons	7, 561
India rubber and gutta-percha, manufactures of	10, 902
Iron and manufactures of	407, 419
Steel and manufactures of	274, 195
Junk and oakum	4, 278
Lamps	5, 457
Leather and manufactures of	24, 731
Lime	1, 259
Marble and stone	6, 674
Matches	65, 516
Mathematical, philosophical, and optical instruments	3, 280
Musical instruments	11, 556
Naval stores	1, 991
Oils—mineral, refined	53, 960
Animal oils	3, 659
Vegetable oils	1, 082
Ordnance stores	203, 392
Paints and painters' colors	22, 038
Paintings and engravings, paper and stationery	72, 113
Perfumery	12, 418

Printing presses and type	$5,315
Provisions, lard, 4,682,355 pounds	874,200
Quicksilver, 18,738 pounds	11,840
Rice and salt	9,392
Scales and balances	2,026
Sewing-machines	90,227
Soap, pounds	139,480
Spirits from grain	12,390
Sugar and molasses	119,292
Tallow	3,355
Tin	1,235
Tobacco and manufactures of, leaf, 76,712 pounds	128,306
Trunks and valises	10,335
Watches, wax, and wearing-apparel	22,289
Wood and manufactures of	147,958
All manufactured articles not enumerated	6,052

URUGUAY.

Our exports to Uruguay in 1876 amounted to $1,126,123. While we import seven-eighths of all the sugar used in this country, our largest export-product to Uruguay is refined sugar, amounting to $490,434. Wheat is next in value. The list is mainly as follows:

	Value.
Total exports to Uruguay	$1,126,123
Agricultural implements	32,796
Horned cattle	
Bread and biscuit, 4,289 pounds	265
Wheat, 444 bushels	733
Other small grain	89
Wheat flour, 17,160 barrels	126,240
Books, maps, &c	1,552
Brooms and brushes of all kinds	100
Carriages, railroad-cars, and clocks	1,964
Coal of all kinds, 396 tons	2,638
Cotton and manufactures of	29,227
Drugs, chemicals, and medicines	19,925
Fruits of all kinds	845
All manufactures of iron	9,336
All manufactures of steel	31,173
Lamps	3,194
Naval stores	14,275
Mineral oils, 379,775 gallons	73,818
Ordnance stores	11,200
Perfumery	12,624
Provisions	74,737
Spirits of turpentine, 13,710 gallons	6,203
Starch, 1,432,374 pounds	68,160
Sugar, refined, 4,498,277 pounds	490,434
Molasses, 234 gallons	117
Tobacco and manufactures of, leaf, 146,532 pounds	33,590
Varnish	1,617
Wood and manufactures of	75,139

CHILI.

Effort is made by the Chilian government to induce immigration, but results are not very apparent. Consul Williamson, at Valparaiso, deems Chili the most desirable country for emigrants of any in South America, particularly as regards climate; yet warns his countrymen not to emigrate there, on account of the insecurity of life and property and the notorious immunity from punishment enjoyed by criminals. The inducements offered are as follows: A free passage to their lands in the provinces of Valdivia and Osorno; 125 acres of land for the head of the family, and 40 acres additional for each child; a house built for him, two oxen, one milch-cow, and the necessary agricultural implements. After a certain number of years a clear title is given him to the land on payment of $1.25 per acre and the value of the goods advanced. Yet few are reported as having settled on the societies' lands. Improved methods and results in agriculture by these and all available means are much needed.

The shipments to the United States from the port of Valparaiso for the year ending September 30, 1876, were:

Nitrate of soda	$602,834 22	Hides	$2,242 39
Sheep's wool	243,677 01	Straw hats	1,537 00
Goat-skins	27,351 65	Quicksilver-flasks	1,151 06
Coal	16,147 02	Quaillar bark	1,050 22
Walnuts	8,183 42	Chinchilla skins	960 37
Rags	8,985 06	Miscellaneous	185 06
Total			914,305 08

PERU.

Very little progress is made in agriculture in this country, the inhabitants having little inclination to give it their attention and labor. The agricultural productions exported are very inconsiderable in amount, as the few figures below would intimate, representing the trade in them with the United States in 1875: Cacao, $129.71; wool, $1,295.94; raisins, $32.69; tea, $2,743.78; sugar, $418.22; total, $4,620.34. The cotton of Peru is sold in Great Britain. The total general exports to the United States from Callao in 1875 were $876,718.89 for the year ending September.

The great articles of export are guano, of which that sent to the United States in 1875 amounted in value to $468,951, and nitrate of soda, which came to the United States to amount of $764,736.

Scarcity of labor prevents the extension of the culture of cotton and sugar. It is estimated that at no distant day the export of guano from Peru must cease. The new deposits are of inferior quality. The trade in nitrate of soda is making great extensions.

Our principal domestic exports to Peru were, last year, as follows:

	Value.
Total value	$1,176,922
Agricultural implements	4,195
Blacking	2,082
Bread and breadstuffs: flour, 11,329 barrels	84,041
Brooms and brushes	3,565
Candles	1,388
Carriages, carts, railroad-cars, and clocks	94,445
Cordage: rope and twine	25,005
Cotton and manufactures of	57,772
Fruits	2,022
Gas-fixtures	2,783
Gold and silver, and manufactures of	175,200
Hemp and manufactures of	6,073
Iron and manufactures of	84,352
Steel and manufactures of	7,219
Junk and oakum	2,295
Lamps	3,866
Leather and manufactures of	3,753
Musical instruments	3,720
Naval stores	1,982
Mineral oils, refined	46,735
Animal oils	3,548
Paintings, engravings, paper, and stationery	2,072
Perfumery	31,793
Provisions	117,874

	Value
Quicksilver, 141,166 pounds	83,774
Scales and balances	$4,931
Sewing-machines	5,210
Spirits of turpentine	1,241
Tallow	4,143
Tobacco and manufactures of	29,572
Trunks and valises	1,840
Wearing-apparel	43,389
Wood and manufactures of	215,276

VENEZUELA.

The total exports to the United States during the year ending September 30, 1875 were—

From port of Maracaibo	$3,227,975 53
From port of Puerto Cabello	1,332,952 38
	4,560,927 91

This is a decrease, compared with 1874, of $1,937,940.66.

The agricultural exports to the United States the same year appear in the following statements:

Coffee, from Maracaibo	$3,113,027 23	
from Puerto Cabello	958,530 82	
		$4,071,558 05
Cacao, from Maracaibo		33,561 99
Cotton, from Puerto Cabello		22,073 65
Sugar, from Maracaibo	$13,030 29	
from Puerto Cabello	30,982 78	
		44,013 07
Wool, from Maracaibo	1,304 96	
from Puerto Cabello	190 51	
		1,495 47
Total		4,172,702 23

The principal articles of domestic exports to Venezuela for the year ending June 30, 1876, were:

	Value.
Total export	$3,424,278
Agricultural implements	710
Animals, living	6,128
Beer, ale, porter, cider, and wine	12,906
Bells and billiard tables and apparatus	4,309
Books, pamphlets, maps, &c	6,755
Breadstuffs: flour, 107,818 barrels; corn, 46,377 bushels	788,696
Brooms and brushes of all kinds	6,213
Candles, tallow, and other, 199,431 pounds	28,665
Carriages, and parts of	45,544
Clocks	3,784
Coal of all kinds	2,218
Copper and manufactures of	6,909
Cordage: rope and twine of all kinds, 577,551 pounds	65,846
Cotton: and manufactures of	126,950
Drugs, chemicals, and medicines	110,825
Earthen and stone ware and fancy articles	8,094
Fruits: apples, green, 1,582 bushels	10,028
Gas-fixtures and glass ware	6,811
Gold and silver and manufactures of	616,387
Hemp and manufactures of, and hops, 2,440 pounds	5,581
Ice, (690 tons,)	2,422
India rubber and gutta-percha	1,564
Iron and manufactures of	204,553
Steel and manufactures of	54,023
Junk and oakum	2,552

	Value.
Lamps	$7,565
Leather and manufactures of	13,190
Lime and cement	1,106
Manures	630
Marble and stone, and manufactures	19,572
Musical instruments	4,165
Naval stores	12,103
Mineral oils, refined, 294,102 gallons	52,730
Animal oils, 1,660 gallons	2,009
Vegetable oils, 4,674 gallons	4,273
Ordnance stores	55,759
Paints and painters' colors	13,584
Paintings, engravings, paper, and stationery	39,473
Perfumery	9,242
Plated ware	4,092
Printing presses and type	11,766
Provisions	467,737
Quicksilver	2,124
Scales and balances	7,599
Sewing-machines	58,208
Soap	17,131
Spirits of turpentine	2,343
Starch	1,489
Sugar and melasses	38,045
Tallow	221,050
Tin and manufactures of	2,697
Tobacco and manufactures of, leaf, 81,412 pounds	82,822
Trunks and valises	1,810
Varnish	1,729
Watches, wax, and wearing-apparel	3,597
Wood and its manufactures	109,598
Wool and its manufactures	1,986
All other	17,515

ECUADOR.

The chief production of Ecuador, cacao, has steadily increased in quantity since 1840. In 1874 the increase had amounted to over 100,000 quintals, or nearly doubled, though its quality is not equal to that from Caraccas, Venezuela, which sells for nearly double, and the latter is inferior to that produced in Guatemala, though there the supply is so limited as to be consumed at home.

In 1874, 247,493 quintals were exported, of which 2,349 quintals came to the United States.

The agricultural exports for five years, from 1870 to 1874, are shown in the following table, in quintals:

Years.	Cacao.	Cotton.	Rice.	Coffee.	Tamarinds.
1870	243,144	2,008	325	2,964	458
1871	172,422	1,926	9,462	3,847	427
1872	187,238	3,537	3,023	6,304	214
1873	245,969	1,653	437	6,844	771
1874	247,493	4,371	1,673	11,322	957

It is shown that in 1874 the exportation of coffee was nearly double that of the year previous.

The exportation of cotton has nearly quadrupled in the last year. During the war in the United States the culture flourished, but has since declined. Excellent long staple can be produced, but the cost of labor and transportation hinders the cultivation. The production of coffee has nearly doubled in the past year, and it promises to rival cacao, the great staple of Ecuador.

CONCLUSION.

There are many investigations the results of which might appear here were the resources of the Division adequate to the supply of necessary data. Neither is the clerical force sufficient for the requisite office work.

Among these is one relative to the statistics of fruit-growing, the area in different species, the rate of yield and price obtained, preferred varieties in different parts of the country, and other important facts very little known. An immense collection of facts and estimates has been received, condensed, and tabulated, but there are gaps to be filled and statements to verify, and scarcely anything in the national census, and with slight exceptions in State enumerations, with which to make comparison. Believing that approximate correctness should be reached, before publication, it is withheld for further elaboration and extension.

There is also an important work commenced designed to show the diversity of systems and crops in the several States, the proportionate area in each, and rate of production and comparative profit. We are already able to present a fair idea of the relative area in a few principal crops, but it is exceedingly difficult to obtain accurate information of the minor crops, so various in kind and so fluctuating in area cultivated and quantity produced, and of which there is scarcely an attempt at complete enumeration in a single State. Of course there must be some latitude in estimating what is never fully reported in any country, but the difficulties in this country are peculiar, from the breadth of our domain, the wide range of latitude and elevation, and consequent variety of production, including everything grown in temperate and subtropical climates. In the next volume something in this direction will probably be presented.

Another point of inquiry has been the changes in kind and volume of production, caused by westward emigration, settlements of virgin tracts of territory, depreciation of rate of yield by irrational modes of culture, and the varying measure of foreign demand for food products. The movement of population westward across the continent has been one of the wonders of modern times. A single illustration will attest the industrial importance of this hegira. Not only is the volume of wheat of to-day more than threefold greater than twenty-eight years ago, but the *increase* of that portion of it grown beyond the Mississippi is greater than the entire crop of 1849. Five per cent. only was then produced west of the Mississippi; and in 1876, a year of comparative failure in the Northwest, it was 40 per cent. Dividing the country into three sections, the first including the Atlantic coast States, with Pennsylvania, and the Virginias to the Ohio River, and the second and third section separated by the Mississippi River, we find more than half of the wheat grown in the first in 1849, the percentages of each section changing rapidly, as follows:

Section.	1849.	1859.	1869.	1876.
Atlantic coast	51.2	30.7	20	19.6
Central belt	43.3	54.6	49	40.8
Trans-Mississippi belt	5.5	14.7	31	39.6

The first section has now a little more than one-third of its former proportion; even the second, which was swept with so heavy a wave of immigration in the first decennial period, exhibits a declining percentage, while the third has eight times its former prominence, even in a year of low production of spring wheat, and promises to make the proportion 9 to 1 in 1877, or 45 per cent. A few years more will find a preponderating weight of wheat production beyond the "Father of Waters."

Comparing relative quantities rather than proportions of the crop, we find that the Atlantic coast has held its own, and little more; the central belt produces three times as much; the trans-Mississippi belt, more than twenty times as much. The figures are as follows:

Section.	1849.	1859.	1869.	1876
Atlantic coast	51, 657, 020	53, 294, 137	57, 476, 371	56, 489, 500
Central belt	43, 522, 646	94, 458, 609	140, 877, 070	118, 122, 000
Trans-Mississippi belt	5, 306, 278	25, 352, 178	89, 392, 185	114, 745, 000
Total	100, 485, 944	173, 104, 924	287, 745, 626	289, 356, 500

That the wheat crop, with a smaller volume and a more active foreign demand, should make so rapid extension is less strange than the nearly equal rate of acceleration of the immense volume of our great natural crop, maize. With less than an increase of 100 per cent. in population, this crop has more than doubled. The quantity produced has actually decreased in the East, it has doubled in the Central States, and is seven times as large beyond the Mississippi. The proportions of the whole crop produced by the three sections are (nearly) as follows:

Section.	1849.	1859.	1869.	1875.
Atlantic coast	30	24	20	14
Central belt	58	55	53	51
Trans-Mississippi belt	12	21	27	35

The East has declined continuously and hopelessly; the center has held a determined struggle, yielding only inch by inch; the West has trod the track of destiny with accelerated step.

The clerical force of the Division consists only of the Statistician, two assistants, and five other clerks employed in recording, tabulating, &c. Translations of French and German form another branch of the primary work in the presentation of foreign statistics. What with direction of this necessary drudgery and its revision when done, and not a little of actual participation in it, there is little time left for philosophic deduction, the elucidation of great truths involved in the figures, and the presentation in clear and fitting terms of the whole subject for the instruction and guidance of the people. The two assistants, Messrs. E. C. Merrick and R. Parkinson, have rendered essential aid in the work of compilation.

With an expression of regret that a greater progress of statistical inquiry is debarred by limitation of facilities, and a pardonable pride in whatever of beneficent accomplishment has been made under adverse circumstances, this report is respectfully submitted.

J. R. DODGE,
Statistician.

HON. FREDERICK WATTS,
Commissioner.

OFFICIAL EUROPEAN CORRESPONDENCE.

AGRICULTURE IN ITALY.

The Department of Agriculture is indebted to the Secretary of State for a copy of a dispatch from Hon. C. C. Andrews, the minister of the United States at Stockholm, on the subject of agriculture in Italy, based upon observations made by him in a recent visit to that country. Mr. Andrews's visit was specially to the valley of the Po, comprising the famous provinces of Piedmont and Lombardy, constituting one of the most extensive areas of the wheat-production of the country, which, on account of its fertility, is called the "Kidney of Piedmont." Mr. Andrews's dispatch, in addition to the valuable information it affords respecting the agriculture of Italy, contains some very entertaining sketches of the general character and peculiar habits of the farming population of the country. The following extracts will be found interesting:

Owing to the almost perfect flatness of the land in the valley of the Po, the general appearance of the country would be somewhat monotonous were it not enlivened by the beautiful chain of the Alps and their more distant towering summits. Both at Turin and Milan the range of mountains, as seen to the north, and always in winter covered with snow, does not seem to be many miles distant. The descent of their lower slopes by rail, in the early morning, and with so rapidly changing view, was very interesting. There were many thin chestnut forests, but scarcely any other trees. By the use of terraces, and stone-bottomed drains, every patch of land appeared to be saved to husbandry that could possibly be cultivated. Rye appeared to be considerably cultivated; and there were also many small vineyards. The dwellings were quite simple. At the time of my visit the ground in the whole valley of the Po was perfectly free from snow, and one could thus in winter obtain perhaps as correct an impression of the capability of the soil as could be acquired in summer, because in summer the view is much obstructed by the foliage of the many mulberry and willow trees. On getting down into the level part of Piedmont, there were two features of its agriculture which were different from what is to be seen anywhere north of the Alps; first, that Indian corn is a leading crop; and, second, the peculiar shape—the narrow oval ridges or beds—in which the ground is left when sown with wheat. At this time these wheat-fields, with their verdant winter growth, somewhat resembled the well-hoed fields of sweet-potatoes as they appear in our Southern States, say in August, or like one of our unplowed corn-fields run to grass. The corn, whose low-cut stubble still remained, instead of being planted in hills, as in our Northern States, appeared to have been sown in rather close rows, which had been sharply ridged by the plow. These were features which struck me as approaching Turin. During the trip to Fossano I had an opportunity to notice other peculiarities of the country. As a great deal of the land was in winter-wheat, and as all of the grass-land—except that upon which manure had lately been spread—appeared in an almost spring garb, much of the surface was green. For the purpose of irrigation the land is traversed by narrow channels of running water, so as to form fields of from two to six acres. Along either side of these channels are willow-tress, in some places a few feet, in others some rods, apart. They are a common feature of the country along the banks of all the ditches and canals. Their sprouts, which grow out from the tops of the trees, are sometimes used for making baskets; but generally they are allowed to grow three years, and are then cut for fuel, In good soil a sprout grows to the length of 10 feet the first year. The second year it will have grown to the length of 15 feet, and when cut the third year its diameter will be 3 inches. The trunks of the trees are straight, and from 15 to 20 feet in height. In many fields are also mulberry-trees in rows about a hundred yards apart. In the richest soil they have a diameter of 2 feet, and, like the willows, the tops of their trunks, from repeated cutting of the limbs, have an overgrown and knobbed appearance. The grape-vines were covered with cornstalks for protection from the frost. They are not here festooned upon the trees, as is the practice farther south, but are trained upon poles, which in winter are stored for safety in the farm-yard. By the road-side were thorn-hedges, and occasionally some wild blackberry bushes, but no fences anywhere. I occasionally saw men at work trimming the hedges and the willows, and that was the only farm-work which was being done. The hauling out of manure, usually done in winter, seemed to be finished. This, however, was going on actively near Vercell. The carriage-roads, which are macadamized, and excellent, have an elevation of a couple of feet above the adjoining fields. There is generally running water on either side, and sometimes willow or poplar trees. Farm-houses, with rather gloomy looking plastered walls and projecting eaves, were frequently to be seen, but very seldom any handsome villas or chateaus. The soil is composed of clay, mixed with loam, and, being moist, had a dark-brown color.

Our little excursion to the homes of the farmers extended four miles, and was favored with sunshiny weather. We seemed to be almost surrounded by the Alps, which appeared to be only a dozen miles distant, or at any rate so near that I could see the glistening of their snowy sides in the sunlight. The prospect was interesting in winter and must be charming in summer. I was struck with the indication of so little local travel, considering we were in the neighborhood of a large town. Neither in going nor coming did we meet a single vehicle, and only one person, I think, afoot. There was the same frequency of willow and mulberry trees that I have before mentioned. There appeared to be a farm-house to about every hundred acres. We visited several, and had an opportunity to see the farmers and their families at home in their every-day dress and employment. Their manners are courteous and friendly, neither obsequious nor familiar. I really could not see that the men were much employed, but most of the women were spinning flax. The general appearance of the premises was unattractive. It is, perhaps, owing to the fact that the farmers are not owners of the farms, but only rent them, that nothing is done for ornamentation or in the way of taste. The ground being flat about the houses, with little or no drainage, and no paved or graveled walks, and the surface being neither raked nor swept, but half covered with straw, gives a sort of barn-yard aspect to the whole surroundings. In order to exclude the fowls, of which there are a good many at every farm-house, the kitchen-garden is inclosed with twigs of irregular height, and, being small and pen-like, rather mars than ornaments the view. A pile of brush was pointed out as the only wood for fuel. Occasionally there are some fruit-trees in the vicinity. As two or three forty-acre farms may be supplied with one set of buildings, there are of course many farming implements and some carts and wagons, and these are generally well sheltered in the different sheds. A peculiarity of the dwellings is that they adjoin, and are under the same roof with the barn or stable. They are plainly, but rather massively, built of brick, two stories high, the walls plastered on the outside, and of a light color. The upper story, which is reached by outside stairs, is frequently reserved for the family of the proprietor, in case they should wish to come for a few days in the summer. Not uncommonly some of the upper rooms are used for storing grain. The kitchen adjoins the stable, there being a brick wall between and a door. The ceiling, as well as the walls of the stable, is of brick, being massively arched over, and about 9 feet high. The windows of the stables have four moderate sized panes, with iron bars outside. The loft for hay over the stable is open toward the yard, and brick pillars extend up from the stable wall to support the roof, which projects over a good deal, and affords shelter to corn-fodder and other things which may be placed underneath.

It is the custom of the country for the farming people in winter to live in the stable with the cattle for the animal warmth, and in entering the dwellings we, as a matter of course, were first taken into the stable. As I took particular notice of a stable which was rather more crowded than the others, and where, close by the cows, a chair was kindly offered me by the wife of one of the farmers, I will try and give a description of it. Though on entering the sight was extremely novel, yet what most impressed me was the heated and stifled atmosphere, as was the case indeed in all of the stables. The temperature must have been as high as 70° Fahr., and it immediately occurred to me whether or not many of the cattle epidemics and diseases have not originated from such high and bad temperature in stables. At this farm were three families; that of the father and principal farmer, who occupied quarters in the dwelling proper, and those of two of his sons, who lodged in the stable. On the left, as we went in from the yard, the wives of the two brothers were sitting in a corner of the stable, near the kitchen door and a window, at work, with their infants in cradles by their sides, and there was a child running about. Near them was a double bed, and between the bed and the door we entered by was a large crib for receiving the hay from the loft. On the right of the door was another double bed, and then farther to the right, on the same side, were several large and fat calves from six to twelve months old, and at the farther end of the stable was a pen containing eight large black fat hogs. On the opposite side from which we entered were a dozen or more of cows, and in one corner a mare. The cattle were all tied. No especial pains appear to be taken to keep the stable tidy. It appeared like any ordinary farmer's stable. The kitchens usually have large open fire-places, and, like most of the basement rooms, brick floors of dingy color. A plain table in the center, a wood-box in the corner, a sort of stone range for cooking near the fire-place, a dresser with plates and other crockery standing on the shelves, and a cupboard beneath, some old-fashioned wardrobes against the walls, comprise the furniture of the kitchen. In none of these farm-houses did I see a newspaper or a book, or, if I remember right, a pot of flowers or plant of any kind.

As another example of the way animal warmth is availed of, I would mention that in a stable I visited near Vercell, which was quite clean and had no cattle, there were fifteen women sitting tidily dressed and spinning flax. I at first thought they were having a party, but was told they had come together to keep warm. This was at the extensive wheat, dairy, and rice farm skillfully carried on by Mr. Malinverni, and where, too, I had the pleasure of seeing a school taught by a woman. At that farm thirty families are employed; and most of the buildings, fronting upon and inclosing a large yard, are the remnants of a feudal castle.

There is nothing peculiar in the appearance and dress of the farming people. That of the women is respectable and simple. The small farmers and their hired laborers, where they have any, dress cheaply and alike. They do not wear the blue cotton blouse or frock, so common in Southern Italy, in France, and in Switzerland; but instead, when going to town, or on particular occasions, a cotton satinet jacket of light-brown color. Their every-day dress in winter consists of a coarse knit shirt of wool, or wool mixed with cotton-shirts, with calico cuffs to the sleeves four or five inches wide, and under that a plain cotton shirt, a woolen vest, hemp draws, blue cotton trousers, leather shoes with thick wooden soles, an ordinary felt hat, and a colored cotton handerchief about the neck.

The diet of the farming workmen in the country about Fossano was stated to be as follows: In the morning, a piece of bread, with a bit of garlic or onion; at 11 a. m. plain Indian corn-meal pudding, boiled, with perhaps enough preserved grapes or fruit to flavor it; and for supper, vegetable soup, either of cabbage or beans, and some bread, occasionally a little wine of the country. At harvest-time, salad and oil form a part of the diet. It is considered that a workman consumes four pounds of bread per day. A farmer in fair circumstances kills every year a fat hog weighing, say, 300 pounds, of which a quarter is reserved for family use, the fat part being salted, the lean made into sausages, and the lard saved for wheel-oil.

In the neighborhood of Vercell, one of the principal rice districts, breakfast, before 8 o'clock, consists of corn-bread, though sometimes made of rice and rye-meal, with a piece of cheese, and sometimes coffee, which is becoming popular with the working class. Dinner at 12, of rice-soup, containing beans or cabbage, and bread; sometimes a piece of sausage or fried eggs; after sundown, supper of boiled corn-meal pudding or porridge.

Around Milan the breakfast, taken at 9 a. m., consists of bread of mixed wheat and corn and porridge of corn-meal. At noon, soup of rice, beans, and pork, with bread; after sunset and the work is done, supper, the same as the breakfast. In the best instances one gets meat or poultry once a week, and some wine on Sunday, sometimes cheese.

The wages of farm-workmen near Milan are nominally (at the farm I visited) 1 franc and 14 centimes per day, but as they were furnished with soup once a day and a percentage on the crops, the whole pay is considered equivalent to 2½ francs a day in summer; in winter 2 francs a day. About Vercell the wages at harvest-time are 3 francs a day, in winter 1 franc a day, and average 1¼ francs per day. Generally in Piedmont wages vary from a franc and a half to 3 francs a day, according to the season. I was informed in Lombardy that as a rule the laborers do not lay up anything; that there were no unions or aid societies in the country, though such exist in the towns.

With respect to ownership, taxes, &c., I would remark that in Piedmont there are many peasants who own from one to two acres of land, and sometimes up to ten acres; but the greater part of the soil is owned by large proprietors. I was told that no land is exempt from taxation, though considerable is owned by religious bodies. There are eighteen classes of land, of which the best is taxed, including state, provincial, and local taxes, 30 francs per acre, and the poorest 6 francs per acre. Wild or pasture land is taxed 3 or 4 francs an acre. As a general rule, in both provinces, the proprietor does not cultivate the land himself, but lets it out to a farmer, receiving from the latter half the crop as rent. The farmer furnishes everything except one-third of the seed. However, the terms of the contract must often depend on the quality of the soil. There is no trouble in dividing the crop, although many proprietors imagine they do not get their full half. They realize, on an average, an income from their lands of scarcely 4 per cent.

The system of culture and of rotation of crops is not everywhere the same in the valley of the Po. The most fertile land is never left in fallow. Above Turin the rotation is usually Indian corn one year, then wheat two years, followed with clover one year. Around Milan the rotation is, first, white bearded wheat, sown in November, with clover sown the following February. The wheat is harvested in July; the next month some clover is cut, and then cattle are allowed to feed in the field. The second year four crops of clover are cut, the land having been periodically overflowed. In the succeeding winter the ground is manured, and clover is cut the third year. The fourth year the ground is plowed once, harrowed four times, sown with hemp in March, and rolled. The hemp is cut in June, during which month the ground is again plowed once, harrowed once, and planted with Indian corn, which is harvested in October.

The ground is then plowed again, harrowed once, sown in November with wheat, which is harrowed in. The soil about Milan is easy to work, only one pair of oxen being required to draw the plow, while toward Mantua, on account of the stiffness of the clay, five pairs are required.

In the rich rice district of Vercell a three-years' course is the more common, but the best cultivators, including Mr. Malinverni, follow a six-years' rotation, as follows: First year, wheat, (which was sown the preceding October, after the harvest of rice, and after deep culture and manuring at the rate of one cwt. of guano per acre.) Clover having been sown in the wheat in the spring, a fair crop of this is cut in August, after the wheat crop. Second year, the clover is liberally manured, irrigated, and cut three times. Third year, Indian corn manured with guano. Fourth, fifth, and sixth years, rice. The rice-fields are inundated five months. There is a depth of 4 inches of water till the grain is up, then the quantity of water is lessened. Some sorts of rice grow to a height of 4 feet, others less. It costs 20,000 francs a year to supply a rice-farm of 600 acres with water. The rice-crop is gathered in September, the harvest sometimes running into October.

In the country above Turin it is a practice to plow twice after a crop of wheat—once at the time of manuring and again at the time of sowing—and but once after a crop of Indian corn. In preparing the soil for hemp, it is usual there in the autumn to cover the ground with heaps of stubble and brush, in such number as 300 heaps to an acre, and to burn them slowly. This is called half manuring. In spring some manure is added, the ground plowed, and the hemp sown in April. Among the smaller farmers on hilly land the rotation is: wheat two years, manured each year with stable-manure; the third year, rye, with clover to a part of it. Timothy is not used in the Po Valley.

I have before referred to the peculiar rigid appearance of the wheat-fields. This formation comes from a plowing with a view to draining. The furrows are turned so that with the subsequent harrowing and use of a wooden smoother the ground is left in oval ridges or beds a foot high, and from 2 to 3 feet wide. The ditch between is scarcely wide enough to place the foot. What is striking about the ridges is their remarkable regularity and precision. Occasionally, however, and apparently on the better-cultivated farms, the drains are in some cases 10 feet, in others 30 feet, apart—the plowing in such case being done as in the country north of the Alps.

In selecting seed-wheat the more careful farmers sift it in three different sieves, reserving for seed the medium-sized and heaviest grains. This is done at the time of thrashing. As a prevention against insects, the seed is washed in lime-water just before sowing, which is usually broadcast. Only a few of the rich people as yet use sowing-machines. Indeed, it would not be practicable to use them on fields ridged as above described.

The wheat is harvested in the last half of June, and is all reaped by hand. It stands in the fields in sheafs four days, is then brought and piled under a shed, and soon thrashed. Thrashing-machines are being introduced, yet the usual way of thrashing is by cattle drawing a heavy roller over the wheat on the ground at the farm-yard. The yield varies from 17 to 30 bushels per acre.

The accidents to which the wheat-crop is liable are principally hail-storms. These destroy the wheat-crop about once every ten years, and near Turin as often as once every five years. In such case, "forty-day" Indian corn is planted, or millet is sown, though millett is getting out of use. There are companies for insuring against injury to crops by hail-storms. Rust, sometimes called mildew or blight, may occur once in the course of ten years. A small, yellow, glazed worm, about an inch in length, occasionally destroys, say, two acres out of one hundred by eating the seed. This worm, "jebus," changes its form and returns after three years.

I was assured that the best wheat-culture in Italy is in the vicinity of Parma; also that it is in no province the practice to hoe the wheat, as was the custom in the old Roman Republic, and as is the practice still in Japan.

Owing to the advantages of the system of irrigation called *Marcita*, and the profits of the dairy, half the land in the neighborhood of Milan is continually in grass. On the 1st day of February last I saw, on a farm two miles from that city, men mowing grass which was about a foot high, and which was being carted to the stable and fed to the cows fresh. Nine crops of grass are cut from the same ground in a year! This system of overflowing, by which such results are obtained, and which has contributed so much to the wealth denoted by such splendid cities as Turin and Milan, has been in use in the valley of the Po ever since the art was brought by the Crusaders from the East. A thorough system of overflow exists for a radius of about 10 miles southward and eastward of Milan. I visited the stable and dairy-rooms of this farm. There were seventy-four milch-cows, all of Swiss breed, which were fed with fresh grass twice and with hay once a day. The men tending the cows and having care of the milk wore nothing but sandals, and a garment around the middle of the body, such as might answer for swimmers. The brick floors of the cheese and milk rooms were not in the strictest order as to cleanliness. The large copper kettles for heating the milk were, however, well polished. The cheeses are sold in Milan for 3 francs a kilogram.

While in Northern Italy the large Swiss breed of cows is used for the dairy, the native

Italian breed is used for beef. This latter race is of a light-brown cream-color, and is very docile. The cows of this breed are yoked and worked. They give only milk enough for the nurture of their calves, which are allowed to take milk for several months and till they are fit for large veal. I was told that veal fattened on milk of cows fed on overflowed grass is not of so clear color and does not bring so high a price as that produced from natural grass.

I do not deem it my place to draw conclusions or to offer criticism with respect to the social and economic bearing of the facts and matters above stated. While they disclose some things contrary to our American notions, they also show two great merits in Italian agriculture: One is, that the Italians have the most complete system of irrigation in Europe, if not in the world; the other is, that they do not, in Northern Italy at least, let the soil degenerate.

AGRICULTURE OF SPAIN.

In a letter from the legation of the United States at Madrid, under date of March 28, 1877, the minister plenipotentiary of the United States, Hon. Caleb Cushing, writes to Hon. William M. Evarts, Secretary of State, concerning the agriculture of that country, as follows:

SIR: It has been my purpose for some time to communicate to you my impression of the agriculture of Spain, and its productions, as compared with those of the United States; and I avail myself of a period of comparative leisure to perform this duty.

Although, as a general rule, the climate of Spain is warmer and drier than that of the United States, yet the inequalities of its surface enable it to produce analogous or identical objects in one part or another of the peninsula.

The northern provinces of Galicia, Asturias, Vizcaya, Alava, Guipuzcoa, Navarre, and parts of Aragon and Catalona are more or less mountainous, and with sufficient rain to be well wooded, and to produce all the crops of the temperate zone, including as fruits apples, pears, and peaches, as well as grapes and maize, wheat and other cereal grains. They also raise many neat-cattle, being able to contribute to the supply of England.

The eastern and southern provinces possess a semi-tropical climate, and produce, especially on irrigated lands, oranges, lemons, figs, rice, carobs, silk, cotton, sugar, and especially grapes for consumption as fruit or for the fabrication of wine and brandy.

The central provinces, by reason of their elevation and their comparative aridity, have a more limited range of production, chiefly wheat, oats, beans, garbanzos, and potatoes, with some pasturage, the wheat being quite equal to the best of the United States. In these provinces, also, the grape flourishes, producing excellent wines, largely consumed in the country, but entering less into exportation than the wines of the southern and eastern provinces.

Of trees, in addition to the fruit-trees already mentioned, the most prevalent are the olive and the cork-oak, which spread over a large part of the country, and, with fruits, wines, and wheat, compose the most available objects of agricultural exportation to other parts of Europe and to America.

The domesticated animals, including birds, are substantially the same as ours, but with difference in use and distribution. Oxen and horses are used for draught, but more largely and universally mules and asses.

Sheep extensively, and, to a certain degree, goats, are among the staple productions of the central provinces. I observe that the milk of goats and sheep, and even of asses, as well as of cows, enters considerably into consumption at Madrid.

In the methods of culture in Spain, nothing has occurred to me to recommend for adoption in the United States. On the contrary, in the use of machinery, and in the scientific relations of agriculture, we are already in advance of Spain. Nor does Spain produce many objects of cultivation which are not abundantly produced in the United States. Several of these exceptional objects, however, merit consideration. They are:

1. The olive-tree, (*Olea Europæa.*) This tree is commercially valuable for its fruit, and even for its wood, and although the dampness and variableness of temperature in parts of our country may not be favorable to its growth; still it might flourish in many parts of the Southern and Western States.

2. The cork-oak, (*Quercus suber.*) This tree possesses great permanent commercial value, while the production at present is chiefly confined to Spain and Northern Africa. It deserves trial in the drier regions of the United States.

3. Algarroba, Carob tree, (*Ceratonia siliqua.*) The long succulent pods of this tree are not without value as forage.

4. The *garbanzo*, chick-pea, (*Cicer arietinum,*) is of the pea family, but larger and more nutritious than the ordinary pea. It is very widely cultivated, is very cheap, and as an article of food it is, perhaps, more extensively used in this country than any other

vegetable production except wheat. For its productiveness and its intrinsic value, it well deserves trial in the United States.

5. There is a variety of capsicum, called *pimento dulce*, sweet pepper, which figures much among the minor objects of seasoning for the table, and would find favor if cultivated by our market-gardners.

6. Esparto, (*Stipa tenacissima.*) This plant grows abundantly in the Mediterranean provinces, in situations where almost nothing else will grow. Its fiber, of great tenacity, is in universal employment for the fabrication of mats, floor-coverings, cordage, sandals, baskets, and other objects of domestic use. The floor-coverings made of it, found in every house in Spain, are cheaper and better than those which we import in such great quantities from the East Indies.

These observations, cursory as they are, will suffice to call attention to some of the objects of agricultural industry, which, while common in Spain, are little, if at all, cultivated in the United States.

I have the honor to be, very respectfully, your obedient servant,

C. CUSHING

JUTE-CULTURE.

By Professor S. Waterhouse,
Washington University, Saint Louis, Missouri.

The recommendations of the Department of Agriculture first attracted my attention to this fiber, and the personal observations of a revisit to India have only confirmed my sense of its national importance.

Jute has been cultivated in India for hundreds of years, but it is only within the last half century that it has entered largely into the commerce and industries of foreign nations. In the culture of jute, a warm, humid climate is essential to success; but the physical characteristics of the soils in which the plant flourishes greatly vary. It thrives with an almost equal luxuriance upon highlands or alluvial bottoms. It will grow upon comparatively dry uplands or in flooded valleys. But it prefers a high, moist, sandy loam. Alluvial mold, in which there is a liberal admixture of sand, is favorable to its growth; but a very dry or a very sandy soil is not adapted to this tillage.

The land intended for this crop is usually broken up in the fall. With unwearied industry, the natives plow the land over and over again—in some instances as many as twenty times—until the soil has been thoroughly pulverized, deeply exposed to sun and air, and richly manured. The seed is sown broadcast, from 20 to 30 pounds to the acre.

The time of sowing varies with the conditions of soil and climate. In the northeastern provinces of Bengal, where nearly all of the jute of India is raised, the seed is sown in February, March, and April. In the vicinity of Calcutta, the seed is often planted as late as July. Sometimes two crops are raised in a season, but this is too exhausting to the soil. After the jute has come up, it is carefully thinned and then left, without much further tillage, to ripen. It matures in twelve or fifteen weeks. The plant sometimes grows to the height of 20 feet, but its average height is 10 or 12 feet, and the diameter of the butts varies from half an inch to an inch and a half. One variety which is extensively cultivated has a smooth white bark and wide-spreading branches. In the northern provinces of Bengal, the average yield is from 2,000 to 3,000 pounds an acre; in the neighborhood of Calculta, it is from 500 to 1,000 pounds. In the north of the Bengal Presidency, the quantity of seed raised per acre is 1,000 or 1,100 pounds; in the south, it is 1,400 or 1,500 pounds. The jute is cut while the plant is in flower, because the fiber is then more glossy and less woody. The seed ripens one month after flowerage, and the fiber has then become so woody as to lose much of its commercial value. After cutting, the jute is usually kept two or three days, till the leaves fall off, and then it is immersed in water. The period of submersion varies, according to the temperature and character of the water, from three or four days to a month. The methods of steeping practiced by the natives are various. The fiber prepared in clear running water is strong, white, and glossy; the process, however, lasts for several weeks. But when the jute is soaked in stagnant water, although the disintegration is usually effected within ten days, yet the fiber is apt to be weaker and more discolored. But in either case the action of the water is to loosen the fibrous bark from the woody stalk. The natives test the jute from day to day, and when they find that the bark is ready for removal, they enter the water and withdraw the stems by a succession of jerks. Their reason for effecting this separation in the water is that the soft and even pressure of the fluid prevents the rupture of the fibers. After its removal the inner bark is stripped of its rind, freed from all woody adhesions, thoroughly washed, and immediately dried. It then readily separates into minute fibers, and is ready for the market or for domestic spinning.

In the provinces where jute is raised the distaff is in every hovel. The Mohammedans, deterred by some religious scruple, restrict themselves to the manufacture of cotton; but all Hindoos of the industrial classes, robust men, in the intervals of other employments; children, too young for severer tasks; the aged, too infirm for hard work; invalids, incapable of active exertion; and even the despised Hindoo widow, whose social degradation and misery powerfully appeal to the sympathies of Christendom for relief, engage in the spinning and weaving of jute. The manufacture of this staple, utilizing the leisure hours of the strong and the dexterous handicraft of the weak, affords occupation to the myriads; but wages are so extremely low and the competition of industries so limited, that jute-yarn and gunny-cloth can be purchased almost as cheaply as an equal weight of the crude material. No portion of this substance is wasted. The leaves and ashes are used for manure, the stalks for baskets and fuel, the seed for oil and oil-cake, the roots for fuel and paper, and the silky floss which escapes from the fibers in the process of manufacture is wrought into hats.

Till recently the government of India has never fostered the cultivation of jute; but without its patronage this industry has, within the last half century, risen to a world-wide importance. In 1828 the total foreign sale of jute was less than 40,000 pounds, worth $300. Now, Calcutta, which is the great point of distribution, exports immense quantities of this staple to Bombay, Madras, Ceylon, Burmah, Singapore, Penang, Java, Australia, Brazil, the west coast of South America, France, Great Britain, and the United States. Only about one-fourth of the crop is reserved for domestic consumption. According to the fashion of the different countries, pepper, coffee, sugar, rice, cotton, soda, lime, the matte and regulus of the precious metals, and many other articles of commerce, go to market in a dress made of gunny-cloth.

The statistics of the development of the jute-culture in India are impressive and suggestive. In 1862, India exported 10,000,000 pounds of fiber and rope and 300,000,000 yards of gunny-cloth. In 1863, Great Britain employed more than 30,000 spindles in spinning 80,000,000 pounds of Indian jute. Recently this staple has risen to the dignity of the fourth place in the exports of India; only cotton, opium, and rice exceed it in commercial importance. Some of the Indian factories are immense. There is an establishment at Barnagpoor, near Calcutta, which employs more than 4,500 workmen and annually manufactures more than 30,000,000 pounds of jute. In 1872, the total exportation of Indian jute was 700,000,000 pounds, of which Great Britain received upward of 395,000,000 pounds. In the same year more than 900,000 acres were devoted to the cultivation of jute in India; and in the thirteen provinces in which jute is principally raised, out of a population of 15,725,000, more than 1,350,000 were wholly or partially engaged in this occupation. These figures conclusively show the vast magnitude and importance of this industry to India. Other statistics will illustrate the value of this staple to an exclusively manufacturing community.

Nearly half a century ago some sagacious Scotchmen engaged in the manufacture of jute. Their humble experiment has developed into a success that has enriched Scotland and promoted the commerce of the world.

At first many difficulties arrested their progress. Much of the fiber was discolored by the tannic acid of the bark through improper methods of preparation; and it was only after years of persistent effort that a successful process of bleaching was discovered.

Again, the fiber stubbornly resisted the action of dye-stuffs, and over this difficulty chemical science has yet only partially triumphed. Jute can now be dyed, but the colors are not fast. Still the variety of tints now imparted to jute permits it to be combined with other materials in cheap imitation of many valuable fabrics.

Jute is mixed with cotton, linen, and silk. It is a material part of twilled stair-carpeting and low-priced broadcloth. In combination with other textiles, it imitates the gloss of Irish linen, the luster of French silk, the beauty of Turkish rugs, and the splendor of Axminster, Kidderminster, Brussels, and Venetian carpets. Single or mixed, it enters into the manufacture of a thousand articles of commerce. In 1872, there were in Dundee about one hundred jute-mills, employing upward of 20,000 workmen, and manufacturing more than 180,000,000 pounds of jute annually. In the same year nearly 50,000,000 gunny-bags—most of which were made in Dundee—were exported from Great Britain. Of the 300,000,000 pounds of jute that were manufactured in the United Kingdom in 1876, 200,000,000 pounds were woven in the mills of Dundee. The annual value of the flax, hemp, and jute manufactured in Dundee is now $15,000,000. The jute factories of Dundee have created a flourishing city, given employment to thousands of workmen, diffused prosperity throughout a large community, promoted the commerce of Scotland in the importation of the raw material and the exportation of the manufactured product, and facilitated the movement of the cotton and grain crops of the world.

What has been so successfully accomplished in Dundee can be done with a still grander success in the United States.

We not only can spin and weave the fiber, but we can also raise it.

We not only can derive the profits of making the fabrics, but we can also enrich ourselves by the twofold economies of the growth and manufacture of the staple.

Under the auspices of the Department of Agriculture, experiments in the culture of jute have been successfully tried in South Carolina, Florida, Georgia, Louisiana, and Texas. These trials conclusively established the fact that, wherever in the Southern States there is a hot, damp climate, and a moist soil of sandy clay or alluvial mold, jute can be profitably raised. It is probable that much of the land now devoted to the growth of cotton, rice, and sugar-cane would yield larger returns if applied to the culture of jute. The plant matures in this country in about the same time that it does in India. The April plantings were cut in July, and the June plantings were cut in September. Some of the stalks reached the height of 15 feet, and in some instances the fiber was, according to the judgment of experts, superior in strength to that of India.

The yield was in several cases at the rate of 3,500 pounds to the acre. These facts, so familiar to the Department of Agriculture are here repeated for the information of those who have not seen the results of the experiments inaugurated by it. The trials that have been made strengthen hope into an assurance that jute can be successfully cultivated in the Gulf States and in Southern California.

The conditions of soil and climate and the practical tests of experiment are here so favorable as seriously to alarm the government of India. The official report of an Indian commission appointed by the state has expressed a grave apprehension of American competition in the culture of jute.

It is to be hoped that the enterprise of the South will prove that this apprehension was well grounded.

The economic importance of this culture to the United States is incalculable.

No country in the world is capable of deriving so vast a benefit from this industry as our own. The magnitude of our grain and cotton crops is unparalleled in other lands.

In 1870 the quantity of cereals and vegetables produced in the United States, and requiring to be sacked before they could be sent to market, was largely more than 1,500,000,000 bushels. Ultimately this vast mass was handled in bulk by elevators, barges, canal-boats, railroads, and steamships; but before it could be brought from the various points of production to these facilities of transportation it had to be inclosed in bags. If it were necessary to renew these bags every year, it would now cost the United States $100,000,000 annually for its grain, pulse, and potato sacks. This calculation is based upon the assumption that all the bags are made of jute. If the material were cotton, flax, or hemp, the expense would be still greater. But as the sacks last several years, the annual cost is not probably one-fifth of the above aggregate. In 1876, the cotton-crop of the United States was about 4,500,000 bales, and at the ruling rates the cost of the gunny-cloth in which this cotton was sent to market was not less than $3,900,000.

Unlike the grain-sacks, the jute baling cannot be used a second time, and therefore a wholly fresh supply is necessary every year. Our native production of fibers is greatly inadequate to meet the demand. In 1868, the United States paid $23,000,000 for imported flax, hemp, and jute. In 1870, the cost of imported fibers was more than $30,000,000 in gold. The quantity of jute alone imported in 1870 was upward of 19,000,000 pounds. Yet these figures, although large, but imperfectly indicate the demand which there would be for jute if it were a domestic production. The cheaper fiber would, of course, be substituted for the more costly wherever it was possible, and accordingly jute, in consequence of its comparative inexpensiveness, would supplant hemp and flax in the manufacture of carpets and many other fabrics. For bagging and cotton-baling, jute has already almost entirely superseded the use of the other fibers. But possibly it will be found better, in order more fully to meet the varying needs of commerce, to interweave jute with cotton, flax, and hemp; and in that event the introduction of jute, instead of depressing, would stimulate the culture of these fibers. But the vast need of our country for grain-sacks, cotton-bale covers, and a cheap warp for a woof of other textile materials will create a correspondingly vast demand for home-grown jute. It will indicate a lack of southern enterprise if American jute does not yet rise to a textile importance second only to that of American cotton.

Heretofore the agriculture of the South has been restricted to the production of a very few staples. This narrow limitation of southern industry is an essentially false policy. The South has made the grave mistake of confining its activities almost exclusively to one pursuit. But no country can realize its highest possibilities of material greatness by following a single employment. The urgent need of the South to-day is a wide range of industries. It ought to superadd manufactures to a larger variety of agricultural productions. Then the competition of the different occupations would impart activity to business, give more employment to labor, create better local markets, raise the price of agricultural and manufactured products, increasing the profits of workmen, planters, and manufacturers, and promote the well-being of the entire community.

The introduction of the growth and manufacture of jute presents a new opportunity for diversifying the industries of the Southern States. If the experiments which have been already tried in the South are a safe guide, then the profits of jute-culture would amply reward the American planter.

According to the estimates of practical experience, jute-butts can be produced in the United States for 3 cents a pound in currency, and the fine fiber for 8 cents. The average price of Indian butts in this country is 3 or 4 cents a pound in gold, and the fine yarn is worth 8 or 10 cents a pound in gold. Nor is the difference between the cost of Indian and American jute the only source of profit.

There is a relative economy in the cultivation of this plant. According to southern testimony, it is four times as productive as cotton or flax, while at the same time it takes not more than one-tenth as much labor to raise it. In the manufacture of hemp and flax there is a loss of 15 or 20 per cent. of the material, while the loss in working jute is only about 9 per cent. In our markets jute-bags are worth from ¼ to ½ a cent. a yard more than flax-bags. Hemp rots much quicker than jute does. The superior cheapness and durability of jute are rapidly displacing flax and hemp in low-priced manufactures.

There are also important incidental advantages of this tillage. The vigorous, luxuriant growth of the jute almost exterminates weeds from the soil in which it is sown, while the bitterness of its juice repels the attacks of insects. It has been found that cotton-fields surrounded by a belt of jute were exempt from the depredations of the caterpillar, while unprotected fields in the same neighborhood suffered from its ravages.

The profits of the domestic manufacture of jute are not unworthy of the attention of capitalists. Eighteen hundred and seventy was a year of exceptionally high prices. In that year the profit on the home manufacture of 19,000,000 pounds of jute was more than $2,000,000. Of jute fiber, butts, and rejections,* the total consumption in the United States in the last three years was over 300,000,000 pounds. At present, the average cost of jute-butts, delivered in Saint Louis, is 3 or 3½ cents, gold, per pound, and the ruling rate of the jute-baling manufactured in this city is now 12½ cents a yard in currency. From these data practical men will be able to form just estimates of the cost and profits of this manufacture. Imported gunny-cloth, generally of an inferior quality, now commands an average price of 9 or 10 cents a yard in currency; but domestic bagging, although somewhat more expensive, is, in consequence of its better quality and make, usually preferred. The home manufacture of jute-baling has already become an important industry. In 1876 the mills of Saint Louis alone manufactured 6,000,000 yards of

* These are technical terms. In the language of trade, "jute-butts" are sections, 12 or 15 inches in length, of the lower end of the plant. These coarser portions are made into heavy baling and bagging. The "fiber" is the long silky yarn, which is woven into finer fabrics; and the "rejections" are parts of the "fiber," which, in consequence of being stained, tangled, or woody, are unfit for delicate manufactures. "Rejections" are commonly worked up with the butts.

jute-bagging. The domestic growth of jute would not only benefit the producers and manufacturers, but it would also impart prosperity to other industries. It would afford an inexhaustible supply of cheap material to the paper-makers. The root-fiber and other refuse portions of the plant, and the worn-out baling, sacks, and carpets, can now be converted into a smooth, strong, white paper. During the last five years about 170,000,000 pounds of jute were made into paper in the United States. The newspapers of the United States ought actively to promote an undertaking the success of which would so greatly redound to their own advantage.

It is a costly improvidence to pay other nations for staples and products which we can raise and manufacture as cheaply as they can. For all imported jute fabrics we are now paying the cost of production in India, the freight to England, the expense of manufacture, the transportation to the United States, and the commissions of all the factors and insurance-agents through whose hands the goods have passed. Millions of dollars are now annually paid to foreigners for labors that ought to be performed by Americans. We are heedless of the lessons of public economy. A diversity of employments and an industrial independence of other countries will most efficiently promote the welfare of our own people. It is the true policy of the United States to introduce and naturalize the industries of the Old World and to foster the common wealth of the nation by paying to American handicraft the millions which are now the rich reward of European skill. The English government finds it very difficult to introduce improved machinery or scientific methods into the agriculture of India. The inert masses resist innovation with a conservatism born of centuries of stagnation. The traditional implements and processes of an earlier age are still used in the tillage of India. The plows and harrows and the machines for spinning and weaving are of the rudest description. The natives are too poor to buy improved tools and too ignorant to use the better methods. They have not analyzed their soils, ascertained the best succession of crops, tested the different systems of fertilization, or improved their primitive processes of preparing and manufacturing their staples. In fine, their labor is unintelligent, and therefore ineffective and unthrifty.

An industrial comparison of our Southern States with India greatly encourages our hopes of success in this new industry. The labor of the South is far more intelligent than that of India, and it is constantly under skillful guidance. The southern planters will not follow an antediluvian style of agriculture. In India, the best soil is usually devoted to raising jute for the market, and the poorer land is left for the production of jute-seed. The natural consequence of this course is the deterioration of the seed. In the United States, on the contrary, a portion of the best land has been reserved for seed, and the result is a signal improvement in the quality of the seed. American jute-seed is one-sixth heavier than that of India. The broadcast sowing of Bengal is uneven and wasteful. Our patent drills, saving 10 or 15 pounds of seed to the acre, do the work with far greater rapidity and equality of distribution. The efficiency of our agricultural machinery will more than neutralize the seeming advantage which India possesses in the cheapness of its manual labor. It would take tens or hundreds of Indian hands to do the work of one American machine.

It will be strange, indeed, if the mechanical ingenuity which in some departments of manufacture has triumphed over the cheap skilled labor of Europe, and enabled the United States profitably to export to the great centers of industrial art watches, cutlery, agricultural implements, coarse domestics, and some finer fabrics, cannot win a far greater victory over the unskilled hand-labor of India. It is high time for a general introduction of the culture of jute in our Southern States. Every step in the progress of naturalization should be attended by intelligent experiment. Tests of every kind of soil and treatment will result in better seeds, a larger yield, a rotation of crops that will be least exhausting to the soil, machines for the cheap and rapid removal of the bark of the plant, and processes of steeping that will separate the fiber without destroying its strength, color, or gloss. Then the new enterprise, giving employment to home labor and activity to domestic capital, will quicken the revival of our languishing industries, aid the South in regaining its material prosperity, and enrich the nation by the economy of millions which have heretofore been paid to foreign lands.

SALT AND FRESH WATER MARSH HAY.

By A. B. Allen, *of New York*.

There are doubtless some millions of acres of salt and fresh water marsh lands bordering the Atlantic and Pacific coasts of North America, and, in addition, large areas of fresh-water marsh on the borders of lakes and rivers in the interior.

The grasses of salt marshes were soon found by settlers near them to be valuable for both pasture and hay, and they have constantly been pretty generally utilized for these purposes; but the taller and coarser grasses, and particularly the sedges of the fresh-water marshes, so far as I can learn, have hitherto been almost entirely neglected. This herbage, while green and growing, is so unpalatable to horses and cattle, they will not graze it unless in a state of half-starvation, and the idea of cutting and curing it for hay has been usually considered preposterous by our farmers.

Having come into the possession, a few years since, of some marshes of the above kinds near the Jersey sea-shore, and, soon after this, owing to an excessive drought prevailing mostly through the months of May and June, I found that I should be short the coming winter in upland hay for my stock—moreover, it rose, directly after harvesting, to the high price of $40 per ton and salt-marsh hay to $20 per ton, about double the prices they usually command here—under these circumstances I made up my mind to experiment the coming winter for fodder with what was considered the most worthless of all the various kinds of herbage growing on the fresh-water marshes of this region, which I had hitherto cut and cured only for stable-bedding and the mulching of fruit-trees, shrubs, and strawberries.

I should remark here that this kind of herbage which I made use of is not a grass, but one of the *Cyperaceæ*, (sedge family,) called *Scirpus pungens*, and containing, as it is said, very little of either starch or sugar.

In order to keep my stock in fine condition, I have always been in the habit of feeding more or less bran and meal of various sorts even with the best of upland hay, and I knew it would be still more necessary to do this with the coarse sedge I had selected for my experiment. Moreover, in order that domestic animals digest and make available all possible nutriment contained in hay, straw, sedge, or cornstalks fed to them, it is necessary that they should have other food mixed with these, abounding largely in nitrogenous substances. Cotton-seed, linseed, and Indian meal are, perhaps, the most suitable for this purpose.

I had been in the habit of giving my horses and cattle from seven to twenty pounds of good upland hay per day, according to their size and kind, together with two to twelve quarts of ground feed. The proportions generally of this ground feed were in measure as follows: 3 parts Indian meal, 1 part cotton or linseed meal, 4 parts wheat-bran. Thus, if the ration happened to be four quarts, three pints would be Indian meal, one pint cotton or linseed meal, and four pints bran. For horses these rations were of an equal quantity morning, noon, and night; for cows, morning and night only.

Enough of the sedge was passed through a hay-cutter to fill a peck measure, and every time an animal was fed this was sprinkled with water, the ration of meal and bran added to it, and all then well mixed up together. During the day each animal had as much of the loose sedge as it would eat up clean, which was not more in quantity than they had usually consumed of upland hay. All were stabled and bountifully bedded. Each animal had a lump of Liverpool rock-salt constantly in its feed-box to lick at pleasure. In addition to this, each was given, once a week, a gill of wood-ashes and a tablespoonful of sulphur. I never had stock winter better or come out in finer condition in the spring than my animals then did, and the same has been the case every subsequent season when thus fed. The horses traveled at the same pace as before and did the same amount of work, and the cows gave just as much milk, which made as much and as fine a quality of butter as when fed on an equal quantity of upland hay.

Another lot of stock I have since tried with salt-marsh hay alongside of those on sedge; both in other respects were treated in the same manner, and they came out in the spring in like condition. One farrow cow in the sedge lot averaged within a fraction of seven pounds per week of best quality of family butter from the time she was taken up from pasture in autumn till turned out again the following spring. The only difference I made in the quantity of ground feed when salt hay and sedge were foddered was to add one more measure of linseed or cotton-seed meal to the ration per day. For example, if the ration was one pint or one quart per day with upland hay, then I doubled this with the sedge, but did not increase either the Indian meal or bran. The reason I did not make this addition with Indian meal was because the former contains a greater proportion of nitrogenous substance than the latter.

Reckoning 8 per cent. for interest and taxes on the value of the marsh, together with the labor of cutting, curing, and storing the sedge in the barn, it cost only $5 per ton. The additional cost of the extra linseed or cotton-seed meal taken to feed with the sedge over that of upland hay was about $1 per ton, making the whole cost, say, $6. This proved a saving that winter of $34 per ton in the cost of hay. As upland hay has since been worth on an average here only $20 per ton, the gain between feeding that and sedge during the latter time was only $14 per ton. Every one now, from the above data, can make his own calculations as to the economy of feeding coarse marsh hay or sedge, as it will depend entirely on the relative value with him between this and upland hay and the cost of meal and bran. Straw of all kinds, and corn-stalks, may be utilized in the same economical manner, and thus feeding them would considerably increase the percentage on the income of all grain-growing farmers.

My marshes are so low as to be overflowed whenever an easterly wind blows strong enough to bring in a sufficiently high tide from the ocean or bays to cast the fresh water back from the mouths of rivers emptying into them. The sediment of this fresh river-water is more or less fertilizing, and adds to the annual growth of the various kinds of herbage natural to them.

It would be an injury to dike and drain these meadows I am now speaking of, as the soil is a poor hungry sea sand or gravel, with a thin coat of overlying muck, formed from the decayed herbage which has been grown upon them for past ages. They would not produce, drained, near so well as now, subject as they are to the overflow of fresh water, as I have ascertained from some experiments made on parts of a meadow for several years past, and have therefore let it go back to sedge again. If the soil were sufficiently deep and rich, then it would be better, probably in most cases, to dike, drain, and seed them with red-top, or some other of the cultivated grasses.

In conclusion, to encourage others in making experiments with coarse herbage for fodder, I would refer to the furze, gorse, or whin, *Ulex Europæus*, (as it is known by all these different names,) which is frequently made use of for this purpose in Europe. When full grown, it is so high and thick, and armed with so many thorns, it makes an impenetrable hedge, as I have frequently seen it in England. Even the poet warns us against coming in contact with it then, for he says—

> Approach it not,
> For every blossom has a troop of swords
> Drawn to defend it.

This furze, before hardening its stalks, is cut and passed through rollers, like sugar-cane, which bruise or crush it so fine that it can then be mixed with other substances and profitably fed to domestic animals. It is said to be particularly beneficial for increasing the flow of milk in cows, and it also adds to the flavor of the butter made from it.

But to return to the waste products of our own country. Why may we not, when necessity or economy demands, resort to the coarse flag growing in swamps, and the rough stiff rush of otherwise barren sandy lands, and utilize these? The broom-sedge, also, covering thousands upon thousands of acres of old-field at the South?

I well recollect, years ago, that the cotton-seed left after ginning the snowy staple was considered a nuisance on the plantation, and it was a great trouble with the growers to learn how they could be most easily rid of it. At length they found out that it made a highly valuable manure; then, decorticated and ground, a still more valuable meal for stock-feeding. Now, mix this with broom-sedge, which makes good hay if cut before the seed ripens, and from these two, which southern planters formerly were so anxious to get clear of as nuisances, and they probably have one of the best composite forages that our country can produce.

The moose, the elk, and the deer thrive, and even get fat, on lichen, moss, shrubs, and the bark and smaller branches of trees. Perhaps the time may come when even these may be profitably utilized as forage for domestic animals, as browse has already long been by the settlers of forest lands.

CATTLE-FEEDING IN NEW YORK.

By Prof. E. W. Stewart, *Lake View, N. Y.*

The new method of exporting dressed beef to Europe, and the success that seems likely to attend this enterprise, give new interest to the subject of cattle-feeding wherever the circumstances are adapted to that industry.

Should one visit the interior cities and large towns of New York with a view of inspecting the character of the cattle raised in the State, expecting there to find a full representation, he would be greatly surprised to find that most of these cattle were raised from 300 to 1,000 miles outside its borders. He might thence infer that New York is not adapted to cattle-raising, or that it cannot compete with the cheaper and fresher soils of the West in the production of beef. It is true that the fresher and cheaper soils of the West have an advantage in requiring so much less capital and furnishing the grain for fattening at one-half the nominal price, but this advantage is merely temporary, and more specious than real. The fact that land and food are cheap comparatively in the West leads to wastefulness and loss in feeding, and these western advantages ought to be fully counterbalanced by a better system in the East.

The true cause of the deficiency of beef-production, as compared with consumption, in the interior towns of New York, may be found in the neglect to adopt a better system. That system of feeding which produces a steer of 1,400 to 1,600 pounds at twenty-four to 30 months will enable the New York farmer to compete most successfully in his home market with beef of western growth; but if it takes four years to grow an animal of that weight, the cost will exceed the market-price of the product. It thus happens that those farmers who have not improved upon the old system of slow growth regard beef-production as unprofitable, and have substituted for it grain-raising or other marketable crop. The average farmer is so conservative of the ways in which he has been educated, that he seldom attempts to improve his processes, but when they become unprofitable, abandons the business as hopeless. If, in his opinion, some crop will bring more ready money on sale than can be made by stock-raising, he raises and sells the crop, without a serious thought as to the effect of this policy upon the future condition of the land. Early maturity—a system securing marketable maturity at twenty-four to thirty months, with a live weight of 1,200 to 1,600 pounds—will bring success to beef-production in New York.

England has greatly increased her meat-production during this century, and at the same time has doubled her wheat-yield per acre. Grain and stock raising must go together when it is proposed to keep up the fertility of the soil. Germany has increased her meat-production while devoting so large a proportion of her land to beet-sugar culture. Even the refuse of the beet, after sugar extraction, will feed more cattle than the same land devoted to grain-crops; so, likewise, the lands of New York, now devoted to indifferent grain-raising, with little stock, would produce more grain by doubling the stock.

PRESENT CONDITION OF CATTLE-FEEDING IN NEW YORK.

I cannot report much general advancement among cattle-feeders of New York beyond the system of twenty-five years ago; for, as already stated, most of those who found cattle-raising unprofitable abandoned it for other agricultural products, instead of attempting to improve the system. The general system may be summed up in this manner: The calves are allowed to suckle the dam six to ten days, and are then fed upon a mixture of new and skim milk for a short time, when they are reduced to skim-milk or whey alone, in cheese districts. The skim-milk, if given in sufficient quantity, will grow a fine calf in connection with grass; but it is usually given in such scanty measure, that the calf makes a very slow growth, and at ten to twelve weeks is often turned into an indifferent pasture. These ordinary skim-milk calves reach a weight of 250 to 300 pounds at six months, and 350 to 450 pounds at one year old. If fed upon whey alone, they will scarcely reach the former figure, even with grass, because whey is only one element of food, (sugar,) and the calves are so poorly nourished while young that they do not thrive when they come to rely upon grass. The second year the animals reach a live-weight of from 550 to 800 pounds, and at the end of the third year 850 to 1,100 pounds; averaging rather under than over 1,000 pounds at three years old. During the fourth year they are prepared for market by a little extra pasture together with ten to twenty bushels of corn, and reach a weight of 1,100 to 1,400 pounds at the end of the fourth year; the average is not over 1,250 pounds. This is an average daily gain of only eight-tenths of a pound per day. They are kept in a sort of store condition until the last year, and it may well be supposed they do not then readily take on the fattening habit after being kept so long in an unthrifty state. This system is called by those who practice it "a healthy, natural growth." But the market is always dull for this "natural growth," and consequently these animals are sold for 20 per cent. less per pound than those that make a rapid growth and reach 1,400 to 1,600 pounds at two and a half years old. The ordinary market-price of these four-year-old animals is about 5 cents per pound, live weight, or $62.50. This pays the feeder an average of only 4.42 cents per day for four years—certainly very little encouragement—and we can easily see why farmers abandon so hopeless a business. But, however discouraging this statement may be, it is as favorable an exhibit as can be truthfully given of the general system of cattle-feeding in New York.

FEEDING CATTLE RAISED BY OTHERS.

Another branch of our system consists in purchasing steers from two and one-half to three and one-half years old, and feeding these a single season. This class of feeders have studied the question of the cost of adding to the live weight of cattle more thoroughly than the farmer who raises them.

Here the first difficulty that confronts the feeder is the general unthrifty condition of these steers. They have, in a majority of cases, been kept in such a state of suspended growth as to lessen the normal capacity of the digestive system and the powers of assimilation in the secretory vessels. It thus requires from one to two months before these animals enter upon a stage of thrifty growth, and this time and the food eaten are practically sacrificed, as compared with animals in a thrifty state.

Feeders of experience, therefore, seek animals whose organs are all in an active state, and capable of assimilating large quantities of food. Such animals may be made to gain rapidly in weight and quality. They prefer to buy even very thrifty two-year-olds in preference to older and heavier animals that have been grown by the slow method. Some years since, when almost every farmer grew a few steers for sale, those who had skill in feeding made a practice of buying a lot for fattening each year.

The now venerable John Johnston, near Geneva, N. Y., was a conspicuous instance of this mode of feeding. Being a Scotchman and conversant with good farming in his native land, he placed a much higher value upon the manure made from fattening cattle to enable him to raise large crops than his neighbors. He was willing, therefore, to take the chances of success in this mode of feeding. Mr. Johnston began this system of feeding more than forty years ago, and he has stated lately that he often fed out 45 tons of oil-cake in a year. He had seen the good effects of this food in starting thrift in lean animals, and to his free use of oil-cake is to be attributed the greater success that attended his feeding of both cattle and sheep. Wheat was his principal crop, although he was successful in the yield of Indian corn on his rather heavy soil, sometimes reaching 75 to 80 bushels per acre. He regarded his land too valuable for grass, except in the rotation; consequently his fodder was principally straw and corn-stalks. In the hands of most feeders this refuse fodder would have led to failure in cattle-feeding, but the intelligent farmer will now see that a small quantity of oil-cake would supply all the missing constituents (muscle-forming and fat-producing elements) in straw and corn-fodder, and render this as well-balanced food as good meadow hay.

Corn has too much starch and too little nitrogenous matter to feed alone with straw. When Mr. Johnston put up a lot of three-year-old steers to feed he began with two pounds of oil-cake and three to five pounds of corn-meal, and this was increased gradually to four pounds of cake and eight to ten pounds of corn-meal. He also avoided the too common practice of feeding a single food, however good it may be in itself. He gave hay once a day, and sometimes bran and pea-meal as a change. He found, practically, that his steers did better to have a few hours each day in the yard and sunshine than when kept constantly in stable.

From numerous experiments, however, it is found to depend more upon the habits of the animals than upon the simple fact of confinement. Those steers that have been reared in a wild state, or never stabled, feel the confinement irksome, and must be broken to the stable gradually. This is why feeding western steers in New York is often unsuccessful when they are kept in stable several months. A sudden change of habit is nearly always hurtful. But steers that have been stabled from calfhood during cold weather will do better if kept wholly in stable for a period of several months while finishing them for the butcher.

Mr. Johnston found that he could put on from $1\frac{1}{2}$ to 3 pounds per head per day, depending upon breed and thrift when put up to feed. Good grade short-horns would, occasionally, make something more than 3 pounds per day for 150 days; but this rate of gain was exceptional. His average might be considered as reaching $2\frac{1}{8}$ pounds per day. He usually made a gain in price of about 2 cents per pound between the purchase-price in the fall and sale-price in spring. From this came his profit. He purchased some time in October and sold in March, if the price was favorable. If the steers weighed 1,000 pounds at the time of purchase, and the price was $4 per hundred, they cost $40 per head; and at the end of one hundred and fifty days would weigh 1,318 pounds, and would bring, at 6 cents per pound, $79.08, having gained in value $39.08, or nearly doubled. He fed of oil-cake an average of about $3\frac{1}{2}$ pounds per day, or 525 pounds per head; of corn-meal, 8 pounds, or 1,200 pounds; of hay, 8 pounds, or 1,200 pounds. Counting these at rates of recent years would give: oil-cake, $9.18; corn-meal, $12; hay, $6; in all, $27.18. This would leave $11.90 to pay for his straw and labor. This is not intended as an accurate statement of his gains for any one year, but only as an approximate statement of his results. His cattle were often purchased much lower, and the oil-cake for $12 to $18 per ton, and other feed in proportion.

Mr. Johnston was an excellent judge of stock; knew what animals would feed well, how to feed them, and last, but not least, how to sell them. Besides, he proceeded upon the wise plan of making all the manure he could, no matter how small the margin of direct profit in feeding. He got his pay abundantly in the crops produced from the manure. He has paid less attention to warm stables in feeding than is generally considered requisite to the greatest economy; but this may be explained in the fact of his feeding cattle raised often without stables, and too great a change in the habit of animals is not conducive to rapid fattening. Mr. Johnston has been the best example of success in feeding cattle raised by others with only common care, and fed by him with only common appliances, but with much skill in the selection of food and its proper proportion in the ration. Another example of a different style of feeding may be useful.

In 1870 we visited Mr. Otis S. Lewis, of Orleans County, New York, who had for several years adopted the plan of buying about the 1st of December, in the Buffalo cattle-yards, thrifty bullocks from the West, averaging 1,200 to 1,300 pounds. He selected, as far as he could, cattle that had been handled, so that they might take kindly to a warm stable. These were put up and fed about one hundred days. The daily ration was made up of 5 pounds of clover-hay, 15 pounds of straw, 9 pounds of corn-meal, and one-half bushel of swede turnips, pulped and mixed with the short-cut hay and straw, and then all thoroughly steamed together. Sometimes 4 pounds of wheat-middlings was substituted for so much of the corn-meal. This ration came out of the steam-box with a most savory and appetizing smell, and the cattle eat it with a great relish. He bought cattle in good condition, requiring only a short time to finish them for first-class beef. His lot of 25 head at this time cost 6 cents per pound and averaged 1,250 pounds per head. At the end of one hundred days they averaged 1,550 pounds per head, having gained 3 pounds per day. They sold at $7\frac{3}{4}$ cents, and brought an average price of $120.12; and, costing $75 per head, gave an increase of $45.12. He estimated the cost of food, besides straw, at $20 per head, and the actual cost of labor at $4, leaving $20.12 to pay for straw and profit. He was able to raise turnips at 7 cents per bushel, but estimated them as worth for feeding 12 cents per bushel. In other years the cost and sale price were different, but the result nearly similar. Those cattle were fed in a warm stable, and not let out until sold. This ration seemed to have the same effect upon the cattle as the most succulent grass, and produced a gain almost equal to the most favorable pasturage at the best season. Mixing pulped turnips with the other food, and steaming, diffused the odor through the whole mass. It is a great point in fattening to render the food so very palatable that the animal is tempted to eat to the limit of its digestion.

AN EXPERIMENT.

I will give an experiment of my own, many years ago, in feeding a lot of forty head of small two-and-a-half and three-and-a-half year old steers. They had been raised by various parties in an adjoining county, and few of them had made a respectable growth for their age, but were all in a healthy state, and, as we thought, good selections to experiment upon and determine how long it takes to change the habit of unthrifty animals and put all the secretory vessels into active work, so that full rations may be digested and assimilated. An animal that has had scanty nutrition usually possesses a small capacity for digestion, and it is a slow process to change this stunted habit to one of thrift. The average weight of this lot was only 850 pounds, although some two-thirds of them were three and a half years old. They cost only $2 per hundred, or $17 per head. We put them in comfortable quarters on the 3d of December. After making all reasonable allowance for their condition, we thought the price would permit the trial of an experiment without loss, but we discovered in the end that the estimate was a very close one. We began by feeding a daily ration of 2 pounds oil-meal, 2 pounds bran, and 2 pounds corn-meal per head, mixed with 2 bushels of short-cut straw, and all well cooked together. This was given in two feeds, morning and evening, with about 3 pounds of hay at noon. This was found to be a full ration at first, and after cooking came to them in a most savory condition. They soon took it with greediness. Those steers that had previously enjoyed shelter began to show a marked improvement over the others in three weeks, but at the end of thirty days the lot, on weighing, were found to have gained only an average of 10 pounds in weight. The gain in weight does not, however, represent the whole of the real gain. A lean animal gradually loses a proportion of the water in the fluids of its system before it begins to increase in weight when fed upon grain. This loss of sap is replaced with fatty matter. Lean flesh holds 50 per cent. more water than fat meat. So lean animals, when put up to feed upon grain, may be making good progress for a time without any increase in weight. But when animals are fed properly they are always in a condition to lay on fat in due proportion. Ten of these steers had gained in thirty days 25 pounds each, and ten had gained nothing in weight. The next thirty days the ration was increased 2 pounds of bran and 2 pounds of corn-meal per day. The increase in the ration was made to correspond with the increasing wants of the steers. This additional 4 pounds of grain could now be digested and assimilated. The next thirty days showed a marked improvement in most of the lot, but especially in those that had gained most in the first period. Ten had gained $1\frac{1}{2}$ pounds per day, 20 had gained $\frac{3}{4}$ pound per day, and 10 only $\frac{1}{3}$ pound per day; an average of only 25 pounds per head. The ration for the next thirty days was increased by 2 pounds of corn-meal and 2 pounds to the noon ration of hay, and, besides, one gallon of cheap molasses was used in the water for wetting the straw, &c., for the steamed ration. This was but a small amount of sweet to be diffused through 90 bushels, but it added so decidedly to its flavor as to become at once apparent. The steer[illegible] now nearly all of them got into a thriving condition, and during the period of thirty days the gain was much more rapid. The best ten gained $2\frac{1}{4}$ pounds each per day; twenty gained $1\frac{1}{4}$ pounds, and ten only $\frac{3}{4}$ pound; an average of $41\frac{1}{4}$ pounds each for the lot. The first ninety days had only produced an average gain per head of $76\frac{1}{4}$ pounds.

To show the risk of loss in feeding such animals, we will see how the account stands at the end of ninety days:

DR.

40 head of steers, 34,000 pounds, at 2 cents	680 00
Oil-meal, 7,200 pounds, at 1¾ cents	126 00
Bran, 12,000 pounds, at ¾ cents	90 00
Corn-meal, 14,400 pounds, at 1 cent	144 00
Hay 13,200 pounds, at $\frac{6}{10}$ cents	79 20
30 gallons molasses, at 30 cents	9 00
	1,128 20

CR.

By 40 steers, 37,050 pounds, at 3 cents	1,111 50
Apparent loss, besides labor	16 70

Cattle and beef at this time were very low, and it will be perceived that the first ninety days had lost us all our apparent good bargain; but these animals were now better worth 3 cents per pound than 2 cents ninety days before. They were now, most of them, ready to make a thrifty gain with the same good food and care. The ration of the last thirty days was continued for the next sixty days. Everything now seemed favorable, and at the end of this period the leading ten head had gained 3 pounds live weight per day, twenty head had gained 2½ pounds each per day, and ten head two pounds per day. Here was an average gain of of 2½ pounds per head, or 150 pounds in sixty days; a remarkable gain, considering their condition at the beginning. At this period twenty head, averaging 1,150 pounds, were sold at 4 cents per pound, or $920.

The account now stands:

40 head, 3,705 pounds, cost	$1,128 20
Expense of keep last 60 days	390 00
	1 518 20
By 20 steers sold, 23,000 pounds, at 4 cents	920 00
By 20 steers on hand, 20,050 pounds, 3¼ cents	651 62
	1,571 62
Showing an apparent gain of	53 42

The reader will have observed that this expense account does not reckon the 32 tons of straw fed, which at any price would absorb more than the apparent profit. But straw is seldom taken into the account, the manure made from it being considered an equivalent. The reader will also pardon the effort to show a little profit in this case, as it is evidently a desperate one, and requires strategy.

Another point that tells in its favor is the high price of grain, compared with the then low price of beef. But under these discouraging circumstances, suppose the class of cattle had been better, had been as good as these were after ninety days' feeding, and the price paid had been 50 per cent. higher, or 3 cents per pound, the reader will see that by feeding them ninety days, with a gain of 2½ pounds each per day, there would have been a substantial profit upon everything fed, leaving the manure for the labor. And I should be quite willing to take a contract to feed cattle in the most comfortable stable, furnish all the material, and take all the labor requisite to the most approved method of feeding, asking in return payment only for the food furnished, finding the profit wholly in the manure.

A few years later I fed ten head of three-year-old steers for one hundred days, keeping an accurate account of the daily ration, their increase every thirty days, and for the whole period. They were largely of short-horn blood, (sired by a seven-eighths blood bull,) had been well raised, as that term is generally understood, and accustomed from calfhood to be handled and stabled. They averaged 1,210 pounds, and cost 4½ cents, or $54.45 per head. Being in a thrifty condition, and accustomed to good shelter, they took most kindly to their new quarters when put up November 20. Regarding this as a favorable lot of steers for rapid fattening, we gave the following combined ration, made by grinding together 10 bushels of corn, 560 pounds; 8 bushels of oats and pease grown together, 384 pounds; and 1 bushel of flax seed, 56 pounds; making 1,000 pounds. This is the proportion, and, when evenly mixed and ground fine, furnishes a fattening ration so complete that little improvement can be made upon it. At the time mentioned this ration cost $1.10 per 100 pounds. The first two weeks 10 pounds of this was mixed with 2½ bushels of cut-straw, and all well steamed together, as the daily ration of each steer, given in two feeds, morning and evening, with six pounds of long hay at noon. This proportion of flaxseed makes the ration just laxative enough for health, and its oil is also worth all it costs in laying on fat; the corn is very rich in starch, and the pease and oats in albuminoids; and the straw is so softened by the steaming and so permeated with the flavor of the grain as to give it a fine relish for the steers. In fact, this cooked ration with straw is eaten as eagerly as if mixed with hay. About 2 ounces of salt is added for each steer before steaming. At the commencement of the third week the grain-ration was increased to 11 pounds. These steers seemed as contented in their new quarters as if they had been raised in them. This demonstrated the advantage of buying those animals for feeding that have been accustomed to the comforts of a good stable. At the end of the first thirty days these ten steers had gained an average of 75 pounds each, or 2½ pounds per day. Two steers that appeared more perfectly formed than any of the rest were weighed when first put up, and turned the scale on 2,500 pounds, and on being weighed now were found to have gained together 180 pounds, or 3 pounds each per day. The ration was increased 2 pounds for the next thirty days. Care was taken to feed only so much as was eaten with a relish, and 13 pounds of grain of this combination was found to be all that would be eaten clean by these steers of over 1,300 pounds' weight. At the end of the second thirty days the average gain was found to be 100 pounds, or 3⅓ pounds per day. The ration for the next and last period of thirty days was increased to 15 pounds of grain, and the gain for this period was also an average of 100 pounds per head. These steers were then sold at 6¼ cents per pound, and the account stood thus:

10 steers, 12,100 pounds, at 4½ cents	$544 50
11,560 pounds of grain, at $1.10	127 16
5,400 pounds of hay, at 60 cents	32 40
13,500 pounds of straw, at 40 cents	54 00
	758 06
CR.	
By 10 steers, 14,850 pounds, at 6¼ cents	929 12
Balance to pay labor and profit	169 06

This is an unusually favorable case of feeding steers raised by others, but such a rate of gain can often be reached with steers of your own raising. In this ration, double the amount of oil-meal may be substituted for the flaxseed and wheat-middlings, or bran for the oats and pease, with the quantity slightly increased; but oats, pease, and corn, with flaxseed or oil-meal, is a combination of food easily obtained in many parts of our country, and is a great improvement over that of corn alone. So good a result could not be expected with that amount of food without cooking the ration and feeding in a warm stable.

TRUE SYSTEM OF MEAT-PRODUCTION FOR NEW YORK.

We have thus far discussed cattle-feeding in New York as it has been heretofore and is now principally conducted. The early system was based upon the fact that many parts of the State were adapted to grazing and not to grain-raising; and these early farmers were in the habit of raising a few animals each year and feeding them very sparely through the winter, but giving them a good range of pasture in summer, and at three and a half years old they sold them to other farmers to be finished upon grain-feeding. But, as we have seen, these very slow-growing animals did not feed profitably upon grain, it requiring so long a time to get them into a fattening condition. This system is so extremely unprofitable to both sides that it has been largely abandoned; and now the question arises whether New York must abandon meat-production, or whether she may not adopt a better system and produce meat with a profit, besides bringing the more important result of keeping her soil in perpetual fertility. The solution of this problem is found in the system of

FULL FEEDING AND EARLY MATURITY.

In feeding animals, as in other things, time is a most essential element of success. Nature has most clearly pointed out to us the road to success in cattle-feeding. It is found in this law that the young animal takes the least amount of food to produce a pound of growth, and that, all other things being equal, each succeeding pound of growth or live weight up to maturity of the animal costs more than the preceding pound. This has been established by so many facts that it may be laid down as a law.

Two interesting experiments were conducted by Professor Miles at the Michigan Agricultural College farm in 1866 and 1868. In the former year three, and in the latter six, pigs were fed upon milk. These pigs were from four to six weeks old at the beginning of the experiment.

It took an average amount of milk to produce a pound live weight as follows: first week, 6.76 pounds; second week, 7.75 pounds; third week, 12.28 pounds; fourth week, 10.42 pounds. The professor attributes the cause of its taking a greater amount of food the third week than the fourth to a "derangement of the digestive organs during this week, as shown in a tendency to constipation," and he remarks that "the milk to produce a pound live weight constantly increases."

The experiment of 1868 was continued afterward for twenty weeks upon corn-meal. The time was divided into five periods of four weeks each. It required of corn-meal to make a pound live weight: first period, 3.81 pounds; second period, 4.05 pounds; third period, 4.22 pounds; fourth period, 5.24 pounds; fifth period, 5.98 pounds.

Another experiment with a larger number of pigs had a similar result. It will be perceived that in the fifth period, when the pigs were twenty-eight weeks old, it took about 75 per cent. more food to make a pound live weight than in the first period when they were eight to twelve weeks old.

The writer tried a similar experiment in 1874 with a miscellaneous lot of ten calves fed wholly upon skim-milk. The milk was all weighed daily and the calves each week. It required of milk for one pound gain: first week, 11.02 pounds; second week, 12.18 pounds; third week, 13.17 pounds; fourth week, 13.40 pounds; fifth week, 14.60 pounds; sixth week, 15.05 pounds; seventh week, 16.71 pounds; eighth week, 16.80 pounds; ninth week, 17.01 pounds; tenth week, 16.08 pounds; eleventh week, 16 pounds; twelfth week, 15.90 pounds. The decrease of milk to make one pound live weight, beginning the tenth week, was caused by the calves learning to eat grass. These calves were each weighed separately, as was the milk fed to each, and the gain was very unequal in different calves, as they were not a uniform lot; but the result stated is the average of the ten. We regarded this experiment with great interest, not only as showing the gradual increase of cost to put on live weight as the animal grows larger and older, but as showing the value of skim-milk in growing calves. It has a value, when properly fed, much above that usually attached to it. We should also mention the experiments of Mr. J. B. Lawes, of Rothamstead, England, which proved the precise point under consideration, that the cost of putting on live weight is in proportion to the age and size of the animal.

Mr. C. S. Marvin, of Oxford Depot, Orange County, New York, raised the steer called "Uncle Abe," and Hon. George Geddes states the following facts concerning his growth: At birth, October 19, 1864, weighed 134 pounds; at ninety days, 385 pounds, having gained 251 pounds, or 2.79 pounds per day. During this time he had the milk of his mother, and after ten days old a quart of meal and oats per day, the mother having all the meal she would eat. At six months old he weighed 670 pounds, having gained 285 pounds during the second period, or 3.16 pounds per day, its food having been gradually increased to two quarts of meal per day. At one year old weighed 1,036 pounds, having gained the second six months 360 pounds, or 2.03 pounds per day. At eighteen months weighed 1,354 pounds; gaining the third six months 318 pounds, or 1.76 pounds per day. At two years old weighed 1,616 pounds, having gained the fourth six months 262 pounds, or 1.45 pounds per day. At two and a half years old weighed 1,830 pounds, gaining 214 pounds, or 1.18 pounds per day. At three years old weighed 2,070 pounds, gaining 240 pounds, or 1.33 pounds per day. At three and a half years old weighed 2,270 pounds, gaining 200 pounds, or 1.11 pounds per day. At four years old weighed 2,360 pounds, and at the end of four years and four months weighed 2,530 pounds; having gained in the last ten months 260 pounds, a trifle more than in the first ninety days, the rate of increase falling to $\frac{86}{100}$ of a pound per day. As the age increased the food was increased to meet the wants of the animal, and at two and a half years eight quarts of meal, with good roots, hay, or grass, was given. It is easy for the reader to see that this steer might have been sold at a profit at any time up to two years old. At this latter period he would have brought in market as good beef $100, which would have given a profit, but would have brought a better profit at one year old, as he would then have sold for about $70. It will be noted also that it took two years, or till he was three years old, to double his weight at the end of the first year; or, in other words, it costs less than one-half as much to produce a given weight the first year as during the second and third years. This is the earliest complete case of actual weights given at periods of six months that we have seen; but since that several cases of actual weighings at short periods have been reported, among which the following is the most complete and instructive. It was first published in the Live-Stock Journal for May, 1873. It is the history of a pair of grade short-horn twins raised by Mr. William Wallace, of Grant Park, Kankakee County, Illinois:

"ELLSWORTH TWINS."

They were dropped April 2, 1870, and called the "Ellsworth Twins." Their food the first summer was sour milk, oil-meal, and grass. This produced as fine a growth as whole milk. They weighed on the 2d of October, at six months, 1,340 pounds. Their growth is shown in the following weighings:

	Pounds.
January 3, 1871, they weighed, together	1,550
February 30, 1871, each weighed 865 pounds; together	1,730
April 2, 1871, one year old, together	1,960
July 2, 1871, weighed, together	2,330
August 24, 1871, each weighed 1,250 pounds; together	2,500
October 14, 1871, weighed, together	2,692
November 25, 1871, weighed, together	2,880
January 2, 1872, weighed, together	2,950
January 31, 1872, weighed, together	3,062
February 15, 1872, weighed, together	3,125
February 28, 1872, each weighed 1,599 pounds; together	3,180
March 16, 1872, weighed, together	3,265
April 2, 1872, two years old, together	3,305
April 28, 1872, weighed, together	3,400
July 1, 1872, weighed, together	3,575
August 31, 1872, weighed, together	3,650
October 26, 1872, each weighed 1,950 pounds; together	3,900
December 6, 1872, weighed, together	4,145
February 5, 1873, each weighed 2,150 pounds; together	4,300
April 1, 1873, three years old, together	4,500

These steers were fed upon grass, hay, and corn, in the open air, and never stabled. It will be observed that these twins reached a greater weight at two years and three years, with only sour milk and oil-meal the first six months, than the steer Uncle Abe, that had full rations of whole milk. This is a valuable example, showing that butter-dairymen may raise excellent calves and get all the profit from the cream. In this case we also see a very steady and comparatively uniform growth, yet a gradual decline in the ratio of gain per day from the beginning.

The error of exposure to the weather the first winter is very obvious. They gained the first six months (if we suppose them to have weighed 180 pounds when dropped) 1,160 pounds, while the second six months (winter) they gained only 620 pounds. Had they been kept warm, they would, undoubtedly, have gained 200 pounds more. Their gain the first year was 1,780 pounds; second year, 1,345 pounds; third year, 1,195 pounds, a constant decrease the older they grew. But the reader will note the omission of one most important fact in this case, and that is, the amount of feed given in all the different periods; this would have added greatly to its interest.

ANOTHER EXAMPLE.

As teaching by example is more effectual than by precept, another case of rapid growth, occurring the past year, is given. It relates to a grade short-horn calf and its mate, fed wholly upon skim-milk. The calf was dropped March 1, 1876. At four weeks old this calf weighed 160 pounds, and was purchased by C. H. Farnum, of Concord, N. H., for a mate to another one that weighed, at the same age, 205 pounds. His purpose was to raise these for oxen if they should grow alike in form and size. Their feed was exclusively skim-milk, but it soon became apparent that the 160-pound calf was outweighing the other, and he abandoned the project of rearing them for oxen. At 8½ months old the one originally the largest, but now the smallest, was slaughtered. His girth was 5 feet 2 inches, and his dressed weight 522 pounds. This was a remarkable dressed weight, as its live weight must have been 800 pounds; but the other calf was so much better that it was determined to feed it, on experiment, till one year old. The last three months its feed was principally skim-milk and shorts, and his girth, at the end of the year, was 6 feet and 5 inches, and he so fat that his hips were hardly discernible. He was purchased by a butcher at 10 cents per pound for his dressed weight, and slaughtered on the 1st day of March, 1877, at just one year old. His live weight was 1,200 pounds and dressed weight 902 pounds. Meat, 748 pounds; hide and tallow, 154 pounds. Price paid, $90.20.

These cases clearly show that new milk is not indispensable in growing the best calves, and, further, that the system of giving up the whole milk of the dam to suckle the calf is wasteful and unnecessary.

THE PROFIT OF EARLY MATURITY.

Many more cases might be cited to show the practical effect of high feeding at an early age. It may be stated as an established fact that calves, according to breed, may, as an average, be grown to the weight of 800 to 1,000 pounds at one year, and from 1,200 to 1,500 pounds the second year. And it may be further added that the animal shall also have arrived at the same stage of maturity as is usual at three and a half to four years of age under the old system.

M. Renault, at a cattle fair in France, in 1846, found a bull, only two years old, that had all his permanent teeth, and all the points of development and maturity in perfection, and, on investigation, came to the conclusion that high breeding and feeding had produced this result as a natural consequence; that, the growth being accelerated by the improved alimentation, the ripening and maturing of all parts of the system had made equal progress. It is therefore an error to suppose that the animal is as immature as its age would indicate, judged by the old system.

It may be a mystery to some that an increased amount of food should be required the second year to produce a given gain in weight. But the reason may be regarded as twofold: first, that while the young animal is in its most active stage of growth the waste of its system is much less, in proportion to weight, than when mature; and, second, its accumulated weight the second year, on which waste accrues, is more than double that of the first year. Take the case of the steer Uncle Abe. Its weight at birth was 134 pounds, and at the end of the first year 1,036 pounds; it gained, therefore, 902 pounds; half of this gain is 451 pounds, which, added to its birth-weight, gives 585 pounds as his average weight the first year. He gained 580 pounds the second year; half of this, 290 pounds, added to 1,036 pounds, his weight at the beginning of the second year, makes his average weight for that year 1,326 pounds; and in the same way his average weight for the third year is 1,843 pounds.

Now, it is evident that it must take more than double the food the second year to supply the waste of the system that was required the first year, and the third year 50 per cent. more than the second year. This, then, explains the reason of the increased cost of putting on live weight as the animal grows older and heavier. And if this be a law of nature, it certainly behooves the cattle-feeder to take note of it, and regulate his system in harmony with it. If, then, the cost of growing beef constantly increases with the age and weight of the animal, it must follow that economy requires that the animal should be sold at the earliest period of maturity suited to the requirements of the market. This period is indicated at two years; and well-grown animals intended for beef should not be kept beyond this period, except when an unfavorable market requires it.

COST OF A TWO-YEAR-OLD STEER.

Having been driven by carefully-tried experiments to the conclusion that profit can only be expected from full feeding under the system of early maturity, and that to carry out this system to the best advantage the animals should be raised and finished for the butcher upon the same farm, I propose, in conclusion, to examine the real margin for profit under this best system.

Let us take the average gain of good thrifty calves fed upon 20 pounds per day of skim-milk for the first ninety days, with an average of one half pound of flaxseed and one pound of wheat-middlings or oat-meal after the first ten days, giving much less at first, but increasing it to that amount; and the second three months, 10 pounds of milk, 1 pound of oil-meal, and 2 pounds of middlings per day, with pasture. The cost, then, of the first six months will be, for milk, 2,700 pounds, at ¼ cent, \$6.75; 30 pounds flaxseed, 90 cents; 91 pounds oil-meal, \$1.82; 272 pounds middlings, \$2.04; 100 pounds hay during first ninety days, 50 cents; pasture three months, at 15 cents per week, \$1.87; in all, \$13.88. With this feed the calves should average 500 pounds' weight at six months.

The second six months it will require 10 pounds of hay per day, or 1,820 pounds, \$9.10; 182 pounds of oil-meal, \$3.64; three pounds per day of middlings, 546 pounds, at \$15 per ton, \$4.10, amounting to \$16.84; and the gain should to be 2½ pounds per day, or 410 pounds, averaging at one-year old 910 pounds, costing \$30.72.

The second summer, pasture at 30 cents per week will cost \$7.80; three pounds per day of middlings, or oats, \$4.10; total, \$11.90. The second winter he will require 15 pounds of hay per day, or 2,730 pounds, \$13.65; 6 pounds of corn-meal, \$10.42; 4 pounds bran per day, \$5.46—\$16.38; total cost of second year \$41.93. The steer will gain an average of 1½ pounds per day, or 547 pounds, weighing at two years old 1,457 pounds. This steer will cost at our figures, at two years old, \$72.65, and such rapidly-matured steers will always bring, in this State at least, 6½ cents, or \$94.70. This would leave a profit of \$22.05. But it must be remembered that we have estimated for the most expensive food and for feeding wholly on hay as fodder. It must also be remembered that although \$72.65 may be considered a great price for a two-year-old steer to cost, yet it is made up of the products of the farm all estimated, and that the steer will pay a handsome profit upon that, while the ordinary steer will cost two-thirds as much and not bring in market more than one-third the price. I have raised calves upon the food here estimated, and at a cost of only \$25 for the first year, weighing 900 pounds, substituting straw for half of the hay.

Another formula for raising good calves and steers is as follows: The same amount of milk as before, giving, after first twenty days, one-half pound of oat-meal and one pound of bran per day till three months old, then during next three months one pound oats unground and two pounds of bran per day, with pasture. This would make cost of first six months: milk, $6.75; oats, $1.27; bran, $2.28; pasture, $1.80; total, $12.10. The second six months' feed, 8 pounds of hay, with straw *ad libitum*, $7.28; one pound of oats and two pounds of bran per day, $6.37; total, $13.65; cost for the year, $25.75. The second year the cost would be: pasture, $7.80; 4 pounds bran per day, with pasture, $5.40; cost of six months: summer, $13.20. Winter feeding: 8 pounds hay, $7.28; 6 pounds corn-meal, $10.92; 4 pounds bran, $5.40; six winter months, $22.60; cost second year, $35.80. Total cost, two years, $61.55.

This formula has produced an average live weight, with us, of 825 pounds the first year and 1,350 the second year. This steer will bring 6 cents, or $81, and leave a profit of $19.45. I do not feed corn or corn-meal the first year, because the object should be to produce a large growth of frame and muscle, and not to lay on fat excessively. Besides, corn-meal is very apt to derange the digestive functions, producing a feverish state of system. It is, however, allowable to grind one bushel of corn with two bushels of oats, or one bushel of corn with one of pease; but if pea-meal is used for calves, it should be cooked, when it will be found an excellent food to grow a rangy calf. A variety of food will be found preferable to any single kind, and we have found oats, bran, and corn a combination promotive of both health and growth. I should advise, when obtainable, the use of a small quantity of oil-meal or flax-seed; even a half-pound daily will have an excellent influence in winter-feeding to keep the bowels in the proper condition where roots are not fed.

These estimates, it will be understood, are made to suit prices in New York and most of the Eastern States, and of course are much too high for the West, and higher than the prices of cattle-food often are in New York; but they are intended to show that with all these points against the Eastern States cattle may be raised at a profit. We have not estimated the money-value of the manure, which would increase the profit side of the account into fine proportions. The best English feeders think themselves well paid if they can be re-imbursed for the cost of the food in the value of the animal, charging all the labor and profit to the manure.

Let those farmers, who think these estimates produce steers of greater cost than they can afford, take the trouble to estimate in the same way, and as fairly as we have done, the cost of those common, thin, scrimped animals which they do raise, and compare the cost with their value in market, and they will then see forcibly the point we have tried to illustrate. If they will figure the cost of these common steers at two years old, charging fair prices for what they actually eat, it cannot be brought under $35, and they will seldom bring in market over $25. This system of full feeding and early maturity offers the only feasible plan by which the lands of the Middle and Eastern States may be brought into a high state of fertility. With this system, like the lands of England, they may be caused to double their production in a quarter of a century.

It offers a plan by which all the crops of the farm may be fed to animals, and so go back to enrich the soil, receiving a full compensation for the value of the crops in the sale of beef. And as a good augury for the future, it is only the best animals that can be sold to supply this great opening market for our meats in England; and we trust this may be an effectual stimulus to the farmers of New York to strive and grow two animals where one has grown before, and that each animal may outweigh two of its predecessors.

FRESH-MEAT SHIPMENT TO EUROPE.

For many years there has been a search for new outlets to American meat-products. Numbers in proportion to population have not been maintained, but size and quality have both been improved, especially in beeves, since the advent of the short-horn. Shipments of cured and pickled beef, as well as of hams, pork, and lard, have largely augmented in bulk and value; but growers and shippers have not been satisfied, craving the higher prices of prime fresh beef, or the saving of heavy transportation bills by the processes of concentration. Numerous patents have been granted for extract of beef or other cooked and canned products convenient for safe and cheap shipment. The results have not been altogether satisfactory, as the profits only warranted the use of cheap beeves in Texas. Enterprising shippers believed it possible to send abroad our best corn-fed beef, by the use of refrigerating processes, in our fastest steamships, and present it in the principal markets of Great Britain in perfect soundness of condition, in competition on its own merits with English beef of famous repute.

Little more than a year ago a pioneer experiment was made in New York with such success as to command a constant extension of the business, until the weekly shipments have reached an average of fifteen hundred beeves, and Philadelphia and other cities have inaugurated similar enterprises.

The success of the experiment has caused a sensation in England among producers and consumers. The Liverpool Daily News says that the quality of American beef is in no way inferior to that of British production, and can be sold at 2*d.* to 3*d.* per pound lower retail rates. About 600 tons weekly are now shipped, mostly going to London, and taken by west-end clubs and other institutions. A portion is sent to Birmingham, where it has reduced the price of English beef 2*d.* per pound, and to other towns. In Manchester and Liverpool a combination of butchers has prevented its extensive consumption. The Queen, the Prince of Wales, the lord mayor, the governor of the Bank of England, and other persons of influence have indorsed the quality of this meat, and the butchers themselves acknowledge it to be "good, sound meat." Its price is a further commendation, being 6*d.* per pound.

The Agricultural Gazette of London, of January 29, 1877, has the following items of wholesale and retail prices:

On Wednesday last the City of Richmond arrived at Liverpool with 808 quarters of American beef, consigned to Messrs. Archer & Malthouse, of the Central Meat-Market, London; 650 quarters were sold in the large towns in the north of England, and 158 quarters in the London market. The prices realized for the whole, by the carcass, was 6½*d.* per pound.

The sale of American beef in Dublin on Saturday was very considerable. The butchers' shops in which it was sold in different parts of the city were regularly besieged by purchasers. The beef was sold at 8*d.* @ 10*d.* per pound. Next week several shops for the sale of beef will open in the city. A panic has almost been caused by the sale of the beef, which is pronounced better than home produce.

An English member of Parliament, Mr. Barclay, has been discussing before his constituents the probability of disastrous results of competition of American with British meat-production. He admits that it is of good quality, tells where it is produced, and recites the advantages possessed in the great plains and mountains, from Canada to the Gulf of Mexico, for growing young cattle in preparation for feeding in more eastern localities. He deems the situation somewhat grave, but concludes that the ability, perseverance, and frugality of British farmers may overcome an advantage of a penny a pound in price. He says:

I adhere to the opinion I expressed at Forfar, that if they were allowed full scope and liberty in dealing with the land and crops on it in such a manner as they should find most profitable, and if they, in addition, were fully secured for that capital which it is absolutely necessary must be invested in land to produce the best results, I have no doubt they would meet the competition from any quarter of the world.

Relative to the difference in price of British and American beef, he is thus reported:

Before proceeding further he wished to correct what seemed to be a misapprehension in regard to the price which farmers in this country were getting for beef. As they were all aware, the farmer sold his animal alive at a price per cwt. of the carcass dead, and although he appeared to get a high price per pound for the beef, there had to be deducted from it, in comparing it with the price of American, the value of the hide, tallow, offal, &c. On looking to the price of meat in the London dead-meat market, he found that for the best beef it varied from 4*s.* 6*d.* to 5*s.* 2*d.* per stone of 8 pounds, the average being about 4*s.* 10*d.* per stone, or 7½*d.* per pound; but from that a half penny fell to be deducted for carriage to London, so that the price which a farmer actually got for his beef was little, if anything, over 6½*d.* per pound, or 1*d.* more per pound than the wholesale price of American. Of course a difference of 1*d.* per pound is a very serious one. He would, therefore, recur to the point from which he started, Was the importer able to bring the beef to this country and sell it at that price with profit? And, if so, did it pay the producer, and would the supply be likely to continue or increase?

He found from figures that the cost of bringing across the beef, including freight and other charges, was from £7 10*s.* to £8 per ton, so that, added to the price at New York, would bring the cost of the beef to 52*s.* 6*d.* or 53*s.* per cwt., which would leave the whole of the tallow, offal, &c., as a profit to the shipper; and he believed that would be considered a very handsome profit indeed, and sufficient to meet certain contingencies which of course had to be encountered in every trade. Apart from the figures he had given, the continuous increase of the trade, and the fact that one line of steamers after another was making accommodation for carrying on the trade, showed that they had confidence that it could be conducted at a profit and was likely to continue.

The next important question was, Could the farmers in America produce beef so as to be able to sell it at the price he had indicated in Chicago? Before directly going into that matter, he would point out the new state of things which within the past few years had begun to obtain in America. For many years in Texas and other States in America there had been an unlimited number of cattle, but the quality of them, with a few exceptions, was poor, and would not suit the English market, although it suited, to a very large extent, the American public. In fact, there was not in that country a very large demand for the first quality of beef so long as the secondary kind could be obtained at almost nominal prices. But now this new state of matters obtained, that the farmer in the United States and in Canada could get what he considered a very good price for the higher quality of beef; and the difficulty which had arisen now was, where was he to find his supply of young cattle for fattening? He could get any quantity of Texan cattle, but they were not very fat. After remarking that the original settlers in America were generally men of limited capital, and that they naturally, therefore, turned to the cultivation of the cereals as the easiest way to get money out of the land, and that it would take time to develop the breeding of cattle, Mr. Barclay went on to say that in many of the older States the raising of stock had been developed to a certain extent, and that in Kentucky and Pennsylvania there were farms as well farmed and fenced as any in this country, and that in the former States there were some of the finest herds of short-horns.

The London Live-Stock Journal admits that importation of meat from America is "the chief topic of conversation at the farmstead, at the markets ordinary, and in all places where agriculturists do congregate, and is the new element introduced into the stock-breeders' calculations;" also that the new year opens with "an appreciable disturbance of the meat-market, and already the gloomy prophets of evil are predicting a time of increased pressure when the English farmer's last resource shall be taken from him."

This trade is a very promising feature in the meat-distribution of this country. It may grow into a business of vast importance to our farmers. Its extension must depend upon the continuance of a difference between American and English prices sufficient to constitute a satisfactory margin for expenses and profits. One condition needing amendment is evidently the weight of our beeves. Were there a larger proportion of heavy, fully-fattened animals, the price realized would be increased above the advance in cost. Feeders have their share in this work, and must co-operate with shippers if they would develope a permanent and profitable industry. The competition will tend to advance home-prices in proportion to the comparative magnitude of the shipments. Such advance would tend to limit the growth of the trade, even to the destruction of the business, if the margin should be reduced below expense of shipment. A more scientific course of feeding, the exercise of skill and the practice of economy in all the methods of management and feeding, become, therefore, essential elements of growth and success in transatlantic shipment of American beef.

The history of the beginning of this new enterprise which is here presented is the result of the investigation of Col. F. D. Curtis, of New York, an intelligent breeder of several varieties of farm-stock and an enthusiastic promoter of true progress in American agriculture:

In October, 1875, Mr. Timothy C. Eastman began his first shipments of fresh beef from America to England. Mr. Eastman is the pioneer in this enterprise, which has now assumed such extensive proportions. His first shipment consisted of forty-five cattle and fifty sheep. In December following he continued the export, increasing the number of cattle to a hundred, and from that time to the present he has made weekly consignments of from one hundred to several hundreds, gradually increasing the trade until during the close of 1876 and the beginning of 1877 his shipments were from six hundred to one thousand per week. The first week in February, 1877, he shipped ten hundred and twenty-two cattle and seven hundred sheep. Mr. Eastman ships by the Williams and Guion, the White Star, and Anchor lines of steamships. He has shipped about thirty thousand in all, and has opened a market in London, Liverpool, Manchester, Sheffield, Birmingham, Leeds, Newcastle, Glasgow, Edinburgh, Dundee, and other towns in England and Scotland. The meat is kept fresh by a process on which a patent was obtained by Mr. Bate, of which Mr. Eastman is the sole owner. The patent is for preserving meat fresh by inclosing it in an air-tight chamber and forcing among it a current of cold dry air. Refrigerators, or air-tight chambers, are constructed between decks, according to the capacity of the steamers or the demands of trade, the largest one being on the Wisconsin, (Williams and Guion line,) which is 40 feet wide, 100 feet long, and 7 feet high. These immense air-tight chambers are surrounded on all sides by three air-tight walls made of matched lumber covered with air-tight paper, which is made so by being saturated with rosin. Between these surrounding walls there is an open space of an inch and a half, making the walls as perfect non-conductors as possible.

An ice-house is constructed on one side or end of the refrigerator, as is most convenient, and is filled with ice. The ice-compartment is in proportion to the size of the refrigerator, and is lined with galvanized sheet-iron. Fifty tons of ice are required by the Bate process for saving 60 tons of meat. A cast-iron fan or blower is placed inside of the meat-chamber, connected by a belt to a small steam-engine on the deck above. The fans vary in size, according to workrequired The belt is inclosed in an air-tight box. Flues, or air-passages, 10 inches high and 16 inches wide, made of matched boards, extend from the fan along the bottom of the floor to the sides of the refrigerator, where they connect with upright tubes or pipes, of half the size, which stand against the outer wall, into which the air of the refrigerator is drawn by the suction of the fan, and driven into the middle of the ice-chamber through a large flue made of matched boards, where it circulates through the ice and is drawn down and passed back into the refrigerator through an open space about three inches wide left at the bottom of the ice. The fan makes about eight hundred revolutions per minute, and is kept going constantly. These fans are large or small, according to the capacity of the meat-chambers. In this way a constant circulation of cold air is kept up during the entire voyage. A thermometer, suspended in a tin pipe which reaches from the upper deck down into the refrigerator, indicates the temperature, which is kept as near 38° as possible. A cap is kept over the top of the pipe to prevent the escape of the cold air from the meat-chamber. A more rapid circulation of air, which can be made by increasing the speed of the fan, will lower the temperature. The steam to run the fan-engine is supplied from the steamer's boiler.

As soon as the meat is received and put into the refrigerator it is closed, not to be opened until the steamer is ready to discharge her cargo on the other side of the Atlantic. The quarters of beef are suspended on hooks and also laid on the floor. When hogs are shipped they also lie on the floor, and the meat, being packed closely, does not move about when the steamer rolls at sea. If the supply of ice should run too low, it can be added to from the stock kept on all steamers. Usually, however, more or less ice remains in the ice-chamber, and is sold at the port of destination. The meat is generally loaded at night, on account of the cooler temperature and the less liability of delays in getting the trucks onto the docks and alongside of the steamers.

Only the best and heaviest beeves are selected to be sent to Europe. To be the most profitable, they should weigh when dressed not less than 800 pounds, although lighter ones are sent on account of the scarcity of first-class animals.

Mr. Eastman prepares his meat for shipment at the slaughter-houses at West Fifty-ninth street, New York, and at the stock-yards of the New York Central and Hudson River Railroad, where large refrigerators have been constructed by him on the same principle as those on the steamers. The refrigerators, called at the slaughter-houses "chilling-rooms," are situated just in the rear of the platforms where the cattle are killed and dressed, and are so constructed that the sides of beef can be run into them on cars attached to the timbers overhead. The sides of beef are suspended to the cars, hanging by the gambrel-joint, and as soon as dressed are conveyed into the chilling rooms and transferred to the hooks overhead. These rooms are kept shut except when opened to let in the meat, and then they are closed as soon as possible. In this way handling the meat is avoided, and the animal heat is expelled as soon as possible, which is considered very important in preparing meat for long shipments. The meat soon becomes hard and firm. Each quarter is inclosed in coarse canvas, before being removed from the chilling-rooms, to keep it clean and prevent wearing or rubbing in handling and while being transported. In no case is the meat allowed to freeze, but the aim is to keep it as near the same degree of temperature as possible.

The meat remains in the chilling-rooms until the steamer is ready to receive it, and then it is carefully conveyed on trucks with springs, so as to avoid mussing. Mr. Eastman has never lost a single quarter by spoiling, and says that his beef is in better order to ship to the interior markets after it lands and keeps better than beef fresh-killed on the spot. He says that he shipped several hundred quarters last summer when the thermometer stood at 100°, and not a pound was tainted or spoiled. It was taken from the chilling-room at night and rapidly transferred into the refrigerators on the steamers, and on the other side of the Atlantic was sent forward under a very trying temperature. He thinks that the cold atmosphere effectually closes the pores or sears the surface of the meat, so that it is not as susceptible to the effects of heat and taint as freshly-killed meat, while at the same time it looks as fresh and bright as the newly killed, and does not lose anything in flavor. This beef sells in the foreign markets at 7 to 8 pence per pound, and is pronounced just as good as the home fed, which sells at 10 to 12 pence per pound. The American beef is lighter, and this is really the greatest and possibly the only difference. If the American farmer will feed his cattle more, thereby bringing them to a higher condition, and making the beef better and more weighty, he may reasonably expect nearly, if not quite, the same price for his beef in the English market which the home-produced brings. But the light and thin beeves, which make up a large proportion of the supply sent to the seaboard, will not compete with the stall-fed short-horns and other improved breeds of the English and Scotch graziers.

The cost to Mr. Eastman is about $26 per head, in gold, for preparing, freight, and cost in transit, including commissions on the other side. The averaged price realized is about $90, gold. Mr. Eastman is now engaged in constructing three additional large refrigerators or chilling-rooms at West Fifty-ninth street, and will enlarge his operation accordingly. At the present time, on an average, fifteen hundred cattle per week are shipped from New York.

While Mr. Eastman may be properly considered the pioneer in this enterprise, being the first to establish a paying trade in fresh-meat exportation, the fact should be recorded that Mr. John J. Bate, of New York, made several experiments in this direction. He tells the story of this experimental operation as follows:

On the 11th February, 1875, I shipped by the steamer Baltic, in refrigerator, twelve quarters of beef, twelve sheep, and six hogs. The managers of the White Star line thought so little of the enterprise that they refused me the use of steam to run the fan-blower. The meat reached Liverpool in good condition by the use of hand-power to operate the fan. On the 6th of June following I shipped on the steamer Wisconsin ten carcasses of beef, thirty sheep, and twelve hogs, the meat reaching Liverpool in good condition. On the 10th of August following I shipped on the steamer Britannic twenty carcasses beef and one hundred and forty sheep in refrigerator. The meat arrived in Liverpool in good condition. Used steam. In October following Mr. T. C. Eastman made the next and all succeeding shipments.

Gillett and Sherman, another large shipping firm in New York, slaughter and prepare their beef at the New Jersey stock-yards, located at Harsimus Cove, in connection with the Pennsylvania Central and Erie Railroads. They are sending from one hundred to three hundred cattle per week, and ship on three steamers of the Inman line, two of the Cunard line, with one steamer on the National. This firm began in August, 1875, with a shipment of seventy-one cattle. They have sent about three thousand five hundred altogether, and estimate the cost of shipment and sale to be $23, gold, and the average sale per head to be $90, gold. Their largest refrigerator is in the City of Chester, (Inman line,) and will hold three hundred cattle. They send the best cattle they can buy, none less than seven hundred and fifty pounds' weight, if possible to get them. Their last shipment, February 1, averaged 850 pounds dressed weight. Their principal market is London.

Messrs. Gillett and Sherman ship under the patent of Dr. J. J. Cravens, which is a process for radiating cold air and preserving fresh meat. A refrigerator-chamber is constructed between decks by making double walls of planks and lining the inside of both of the plank walls with patent roofing-paper, and so placing the plank that where they join the cracks will not be opposite each other. The doors are made in the same way, and the whole room, fitted in this manner, is made as air-tight as possible. Galvanized-iron pipes, $2\frac{1}{4}$ inches in diameter, connected together, are placed one above the other, reaching from the ceiling to the floor, 13 in all, and extend around the walls and through the middle of the room, through which brine is forced by a Knowles bilge-pump located outside of the apartment. The pump runs on an average of eighty strokes a minute. The brine is pumped into the top pipe and runs by its own gravity and the pressure of the pump down through all of the pipes, and is returned into the reservoir from whence it came. The reservoir is a water-tight compartment situated alongside of the refrigerator, and is filled with ice and salt, at the rate of twenty sacks, four bushels to a sack, of Liverpool salt and forty tons of ice. This amount of ice and salt is sufficient for preserving the carcasses of one hundred cattle for 13 days, which is longer than the time usually required for transportation from America to England. It is calculated that the pipes will radiate a cold temperature for 18 feet, sufficient to keep the meat, and for any space beyond 18 feet another set or tier of pipes must be had. A waste-pipe at the top of the reservoir allows any excess of brine to escape. The brine is pumped from the bottom of the reservoir and returned to it from the refrigerator at the top, so that a constant circulation is going on and the extremes of cold are brought into use. The ice and salt are put into the reservoir a couple of days before the steamer sails, and before the meat is placed into the refrigerator the pump is set going to cool the room and have it ready for the meat. Water is put into the reservoir to create a brine, if it is necessary to do so before the ice may melt sufficiently to cool the pipes. When the meat is put in and hung up on the hooks overhead—as, under this system, it is never laid on the floor—the refrigeratar is closed tight, and the pump kept going constantly during the voyage. The shipper is obliged to have a man in attendance to regulate the pump and watch the temperature, which is kept between 35° and 40°—as near 36° as possible. Greater cold is produced by a more rapid pumping of the brine through the pipes. The steam is supplied by the steamer. A screen is placed over the mouth of the feed-pipe to prevent the pump getting choked. A thermometer is placed near the pipes, and one at some distance off, to note the degree of temperature. These are seen through a glass plate placed in the wall. After the refrigerators have been shut a few hours a rapid condensation takes place, and the pipes are covered over by coating of ice, and the atmosphere is thereby rendered dry. If the temperature runs up to 40°, it must be reduced rapidly, or the meat will spoil. It costs $2,000 to fit up a refrigerator under the Cravens patent large enough to hold one hundred and fifty cattle. Under the other patents the expense is not so great.

Messrs. Gillett & Sherman have an extensive cooling-room at the slaughter-house connected with the New Jersey stock-yards, which is fitted up with an ice-reservoir and pipes the same as on board of the steamer. This room is used for storing the meat before shipment, but these gentlemen do not think that any artificial cooling is necessary in winter, neither do the other shippers who prepare their meat at these yards. All of the quarters are bagged; that is, sewed up in canvas. Messrs. Gillett & Sherman send from forty to sixty sheep with each shipment of beef, but no hogs, as they are so unsalable in the English market, Englishmen not having learned to eat fresh pork sufficiently to create a demand beyond the home-production. Forty cubic feet of space are estimated to hold a ton, according to ship-measurement, and the shippers of fresh meat are charged, according to this rating, 30 shillings, English money, per ton. Shippers in all cases have to be at the expense of fitting up the refrigerators, and have to furnish the engine, pumps, and fans, as well as the ice required.

Under the Bate system no extra man is required to go with the shipments. Shippers are required to pay for the space occupied by the refrigerators and ice-chambers on the outward passage, whether used by them or not. On the return voyage they are usually filled with fine goods, being a secure place for such freight.

Though Gillett and Sherman are intending to increase the numbers of refrigerators, and are now negotiating with the National line for this purpose, Mr. Gillett is of the opinion that the future does not look as promising for success as he wishes it might. The English market is exceedingly sensitive and changeable, and in London the prices of beef have been known to vary a penny in one hour, and two pence in twenty-four hours. They have been obliged to sell as low as four pence per pound, but their average sales have been about six pence, at which price it would pay to ship.

In mutton we can successfully compete with the English and Scotch graziers, as the quality is equal to theirs, although not so fat usually or so thick on the rib; and if our beef was as carefully fattened we could challenge competition, and there would be no doubt of the future success of the trade.

Samuels and Company ship from New York on two steamers, on the National line, directly to London, whenever their steamers go out. Each one is fitted up with a meat-chamber large enough to hold one hundred cattle. They use the Smith process, which is similar to that of Bate.

Daniel Toffey and Company also ship on three other steamers of the National line, whenever these vessels sail from America. The refrigerators on these three ships are each calculated for one hundred cattle, and this is the number they send forward. They use the Banta process, which is also similar to that of Bate. They send lighter beef than the others, the carcasses not averaging more than 600 pounds. They do not contemplate, with the present outlook, any increase in their trade.

Martin, Fuller and Company and Messrs. Morris and Allerton ship from Philadelphia, using the Cravens patent. These two firms together ship five hundred cattle per week. They have all the necessary outfit of chilling-rooms and other appliances under these patents which are required to make their business a success. Live cattle are sent from Philadelphia, but not in any considerable numbers. They have also been shipped from New York in small quantities, but the space required is too great for any extensive trade. From Portland, Maine, about six hundred cattle are shipped weekly by Wells and Company.

When greenbacks get to be at par with gold the margin of profit will be so reduced that, in the opinion of shippers, it can only be maintained by a reduction in home cost and a better quality of meat, so as to compete more successfully with the foreign beef. It is not probable that the cost of transportation of cattle from the West to the seaboard, and also across the Atlantic, can be much reduced. A more systematic and thorough manner of feeding must be inaugurated to cheapen the production. An increase of production will not meet the requirements of the case unless such increase is improved in quality much beyond the average rate now sent to market. Stall-feeding must take the place of the wasteful and careless fattening in the pastures and corn-fields as is now generally practiced. Let the vast areas of pasture in the border States and Territories be employed for breeding and feeding the cattle until they are two years old, and then let them be sent forward to the older sections to be fed a year on corn and rounded up to the proportions of the foreign demand.

The following extract from the London Mark Lane Express of January 15 will be of interest here:

> The excitement upon the subject of the importation of meat from America increases as the news of large freights received circulates through the country, losing nothing, we may depend, in its course. There is no doubt that the large supplies recently sent to London and Liverpool have had a considerable effect upon the trade of those important meat-markets, although up to the present, prices in the country have not been appreciably affected. The present supplies of American meat, if spread anything evenly over the country, would be absorbed without producing any noticeable effect upon the demand of home-produced meat. But the supplies are not, nor are they ever likely to be, evenly spread over the country. Indeed, in hot weather, unless the cold-air process is kept up after disembarkation and during transit by rail, the foreign meat cannot be sent far into the inland districts. What, however, will amount to the same thing will be this, that the price of meat being lower in London and other large ports than in the country markets, less home-grown meat will be sent to the former, and the supply, and therefore the prices, will be again equalized. Then, as we have remarked, if the American supply is not larger than it is now, its effect upon the price of meat will be infinitesimal. But there are those who tell us that the trade is only in its infancy, and as we know but little of the resources of America for meat-producing, we cannot disprove the prediction. Only last week one large importer stated that he had a thousand carcasses of beef, and as many of both mutton and pork as well, on the sea between New York and Liverpool. Such little recitals as that are calculated to cause alarm; but until we know more about American resources it will be foolish to gladden the hearts of consumers and cause producers to tremble with visions of cheap meat. It has not yet been proved that America can keep up her present shipments of meat of fine quality, and it would not pay to send any other; still less that she can increase the supply. Nor has it yet been shown that American farmers can rear and fatten bullocks to send to England and sell with a profit at six pence a pound. We could not do it here with land rent free.

A new impulse has been given to the business by the increased facilities for handling meat on its arrival in England. An immense refrigerator, covering an area of nearly an acre, with numerous apartments, each of which contains a cooling apparatus like that in use on the steamers, has been built and is used for storing the meat and obviating the necessity of immediate distribution and compulsory sale at any price that could be obtained at the moment.

The following official figures show the increase of this trade in eighteen months:

Statement of the quantity and value of fresh beef exported from the United States to Great Britain during the eighteen months ended March 31, 1877, furnished by Dr. Young, Chief of the Treasury Bureau of Statistics.

[Prepared by the Bureau of Statistics.]

Year.	Month.	From New York.		From Philadelphia.	
		Pounds.	Dollars.	Pounds.	Dollars.
1875	October	36,000	2,800	....	....
1875	November	36,000	2,800	....	....
1875	December	134,000	10,700	....	....
1876	January	162,000	12,700	....	....
1876	February	292,000	24,000	....	....
1876	March	302,000	24,300	....	....
1876	April	1,256,000	106,400	....	....
1876	May	1,012,000	77,400	....	....
1876	June	1,140,000	88,000	....	....
1876	July	1,170,200	101,230	....	....
1876	August	1,365,000	134,811	....	....
1876	September	2,451,550	218,005	....	....
1876	October	2,569,075	224,730	150,610	14,308
1876	November	2,974,480	275,550	1,219,500	115,852
1876	December	3,036,980	257,843	737,500	68,062
1877	January	1,796,000	185,550	776,450	69,880
1877	February	3,605,610	293,838	1,348,000	127,619
1877	March	6,262,355	547,762	445,500	42,323
	Total	29,601,250	2,588,439	4,677,560	438,044

Year.	Month.	To England.		To Scotland.		Total exports.	
		Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
1875	October	36,000	2,800	....	....	36,000	2,800
1875	November	36,000	2,800	....	....	36,000	2,800
1875	December	134,000	10,700	....	....	134,000	10,700
1876	January	162,000	12,700	....	....	162,000	12,700
1876	February	292,000	24,000	....	....	292,000	24,000
1876	March	302,000	24,300	....	....	302,000	24,300
1876	April	1,256,000	106,400	....	....	1,256,000	106,400
1876	May	912,000	69,400	100,000	8,000	1,012,000	77,400
1876	June	940,000	72,000	200,000	16,000	1,140,000	88,000
1876	July	645,200	44,500	525,000	56,750	1,170,200	101,250
1876	August	1,037,000	101,811	328,000	33,000	1,365,000	134,811
1876	September	1,838,550	154,275	613,000	63,730	2,451,550	218,005
1876	October	2,202,685	185,088	517,000	53,950	2,719,685	239,038
1876	November	3,598,980	331,402	595,000	60,000	4,193,980	391,402
1876	December	3,364,480	286,055	410,000	39,850	3,774,480	325,905
1877	January	2,312,450	226,430	260,000	29,000	2,572,450	255,430
1877	February	4,410,610	371,557	543,000	49,900	4,953,610	421,457
1877	March	5,099,055	435,585	1,608,800	154,500	6,707,855	590,085
	Total	28,579,010	2,461,803	5,699,800	564,680	34,278,810	3,026,483

RINDERPEST.

[The Secretary of the Treasury having submitted to the Department of Agriculture the question, Whether the disease of rinderpest could be transmitted to this country through the medium of dry or salted hides? the response was the following opinion by Prof. James Law, of Cornell University.]

In answer to the question submitted to me, I would reply that while perfectly fresh hides, like all other products of the victims of the rinderpest, are capable of communicating the disease, no authentic instance can be adduced of its conveyance by dried (hard) or salted hides. On the contrary, a number of experiments, instituted with the object of trying this question, has established that dry or salted rinderpest hides are harmless. These experiments have been conducted in both east and west of Europe with similar negative results. Dr. Rawitsch made "many experiments with dried hides, and with skins which had been hung up in the open air and exposed during twenty-four hours. These skins never infected a single animal. On the same cattle were afterward laid fresh hides, or they were inoculated with fresh virus, and they died. Professor Brauell also experimented largely by inoculating cattle with dried skins and dried hair, but when these articles were inoculated more than forty-eight hours after their removal from the animal furnishing them no case of infection resulted. These experiments were conducted in the Russian steppes. In the north of Europe, Weith, Lorinzer, and Spinola have found the hides infecting on the eighth day after removal from the body. No doubt the cold, perhaps even the freezing, of the elements prevented their decomposition. But the disease has nowhere been even plausibly traced to dry or salted hides.

Contrary to what is true of most animal poisons, that of rinderpest is very easily destroyed, and it seems probable that the chemical changes occurring in skins rolled up in balls or hung up so as to be freely exposed to the air are quite sufficient to destroy the contagion. As an instance of its rapid extinction I may note that at the experimental stables at Albert Veterinary College, London, in 1866, sick and healthy animals were kept in adjacent stables, under one roof, and looked after by the same attendant, who thrice a day supplied the wants of the healthy and those of the diseased. On no occasion did he return to the healthy for several hours after visiting the sick, and in this interval the virus about his clothes must have been decomposed, as this state of things lasted several weeks without any harm coming to the sound cattle. Finally Professor Gerlach, of Hanover, visited the sick animals, and went straight from them into the stable of sound stock, with the result that two days thereafter two of those showed signs of rinderpest, and the stable was permanently infected.

In view of such facts as the above, most European nations permit the free traffic in dry and salted hides, and we may do so with equal safety. Even if they came more in contact with cattle than they do after the importation, the facts would not warrant us in stopping the trade. Only it must be carefully guarded against abuse, as frozen hides, or those that have been stripped from the victims on board ship and hurriedly salted to qualify for admission, may introduce the disease, and the acclimatization of such a poison in the continent is far more to be dreaded than any temporary loss, however great. Fresh and frozen hides must be rigidly excluded.

The distinction made by Mr. Thompson between the hides of calves and grown cattle cannot be supported, as rinderpest, like other contagious diseases, proves congenital; but calves' hides, like others, may be admitted when thoroughly dried or salted.

It must not be inferred that the contagion of rinderpest is always destroyed by drying. On the contrary, it has often been conveyed long distances in dried fibrous material—notably in hay and straw—in which case the exclusion of the air is probably the cause of its preservation. An importation of the malady into the north of Scotland, in the middle of the last century, was made through the medium of Dutch hay.

Hon. D. Christie is in error in saying that *pigs* are susceptible of this disease. In one instance only, at the Jardin des Plantes, was an animal at all related to the pig (the peccary) affected; while, on the other hand, in all the countries of Europe pigs have mingled continually with the diseased cattle during each epizootic of rinderpest without a single case of infection of the species.

While the restriction placed upon cattle should be extended to all ruminants, horses and pigs ought to be admitted without quarantine, but with the simple precaution of sponging the one with a weak solution of chloride of lime or carbolic acid. Any fodder or litter accompanying them from infected countries should be burned, and all clothing packed in trunks or boxes should be fumigated with sulphur smoke or heated to a temperature of 140° Fahr.

I feel called upon to add that, in my opinion, the clause providing for the admission of blooded stock on a consular certificate must render the whole order a dead-letter. What but blooded stock is imported into the United States from Europe? And how is a consular certificate to protect us against a disease that may be contracted on the infected quays at the time of shipping? We have already imported apthous fever, in 1870, exactly in this way: Two fine short-horn cows, taken from a sound herd and in every way worthy a certificate of health when they started, contracted the seeds of the disease at the shipping-port of Liverpool, passed through it on the Atlantic, were landed at Quebec, and conveyed the infection to the herd of their owner, whence it spread throughout Canada and over the Northern States. Now, this affection has a shorter period of latency than rinderpest, and was, therefore, less likely to escape detection. Having, then, already imported apthous fever with *blooded stock* taken from healthy herds in England, what guarantee have we that we shall be saved from a similar introduction of rinderpest?

To sum up, I would advise the following:

1. That all ruminating animals, of whatever breed, be subjected to examination by an expert, to a quarantine of four days, and to a disinfection of their surfaces with a weak solution of chloride of lime or carbolic acid.

2. That horses and swine be admitted, without quarantine, after their skins have been disinfected as above; and

3. That all thoroughly-dried hides, and such as have been salted in Europe before shiping, be admitted without any restriction.

RECENT INVENTIONS FOR INSECT DESTRUCTION.

By Daniel Breed, Washington, D. C.

There are few crops cultivated in any part of the country that are not at some period of their growth liable to injury from some form of insect life. Some of our agricultural districts have, within a few years past, been signally visited, and in some sections extensive crops have been wholly destroyed. Kansas, Colorado, and adjoining States have suffered severely, even to such an extent as to call for legislative action both from the State and General Governments.

Many of the older States have, in view of the gradual encroachment of predatory insects, by legislative enactments endeavored to check the evil by making it a penal offense to destroy insectiverous birds, and there is little doubt that such laws have resulted in much benefit, especially to cultivators of fruit.

Some crops appear to be more exposed to the depredations of insects than others, the protection of which has called into action the inventive genius of man, and patent rights have been sought for the construction and use of machines and instrumentalities designed for that purpose.

Among the most exposed may be named the cotton, potato, wheat, and other small grain and grass crops. A machine or device that will afford protection to one class of plants may not to another. For example, the cotton-plant is preyed upon by the army-worm, larva of a night-flying moth, (*Leucania unipuncta*,) and the cotton-worm, larva of an olive-brown moth called *Aletia argyllacea*. From the well-known nocturnal habits of these moths, and the certainty of their being destroyed by a light, a cheap and effective mode of destroying them, shown in the annexed figure, has been adopted. It consists of a pan of viscid matter placed upon a stake, which is set in the field of cotton at suitable distances. A block of wood is placed in the center of the pan, upon which is placed a lighted glass lantern. The moths, being attracted by the light, dash against it and fall into the pan, and are thus destroyed before depositing their eggs upon the tender leaves of the growing plant.

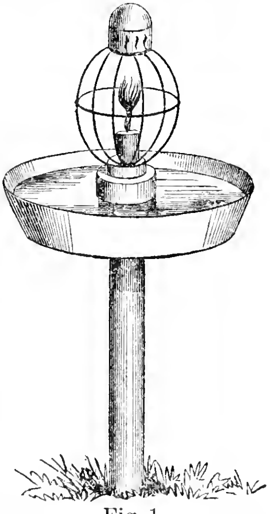
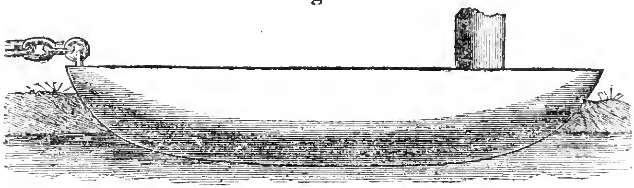


Fig. 1.

The army-worm is arrested in its migrations by plowing a deep furrow around the field, and making it smooth by drawing a smooth log of wood along the furrow. The worms fall into this, and are unable to ascend the steep sides. A safe and novel method for killing the worms has recently been invented. It is shown in Figure 2. It consists of a sheet-iron furnace, having the form of a half cylinder, tapered at the ends, in which a fire is built, and this heated furnace, being drawn along the furrow, destroys the worms. Previous to this invention it was customary to strew dry staw along the furrow and set fire to it, but this was often attended with danger. This heated iron boat can be used without danger, and at the same time it serves to keep the inside of the furrow in a smooth and firm condition.

Fig. 2.



The potato-plant has for many years been exposed to the depredations of an insect commonly known as the potato-fly, (*Cantharis vittata*,) now generally known under the name of *Lytta vittata*. Various modes of treatment have been adopted for its extermination. Latterly a new enemy has appeared, known as the Colorado beetle, (*Doryphora decemlineata*,) which is more destructive than the former.

The unusual ravages of these, especially the latter, have awakened a spirit of inquiry as to an appropriate remedy, and a number of valuable inventions have resulted from such investigation. Among these, we find one for sifting Paris green (arsenite of copper) upon the growing plants, a view of which is shown in figure 3. But it has been seriously questioned whether the use of a deadly poison upon food-producing plants is a justifiable proceeding. Is it not possible that the pores of plants thus treated will absorb some of the poisonous elements, thus rendering the product unfit for the human stomach? It is, on the one hand, claimed that in those sections of the country where Paris green has been used no evil has resulted from its use. On the other hand, some well-informed physicians claim that gastric diseases are more prevalent where it is freely used than in adjoining sections where it is not used. It is undoubtedly true that destruction by mechanical means is a safer method.

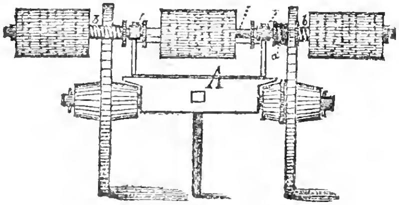


Fig. 3.

Among the mechanical devices there are two that seem to be quite feasible. The one shown in figure 4 may be described as follows: The rear end of the machine is mounted upon two wheels. A trough, with a runner-like bow, containing some adhesive matter, is suspended upon each side of the row. A vibrating arm or beam, carrying whisps or brushes, is adjustably suspended from the frame, and as the machine is pushed along astride the row of plants the insects are shaken into the troughs, from which they are unable to escape.

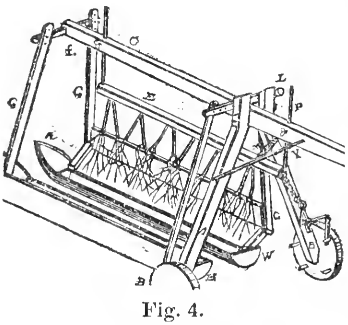


Fig. 4.

Another machine, constructed upon the same general principle, instead of having a trough, with adhesive matter, to entrap the insects, is provided with a pair of crushing-rollers, as shown in figure 5, between which the insects are crushed. The machine is supported upon two wheels, one in the rear of the other. The body is hopper-shaped, with a pair of crushing-rollers at the bottom. On each side there are revolving-wings, which sweep the insects into the hopper, and in addition to these there are two gathering-fingers, which support the vines during the passage of the machine.

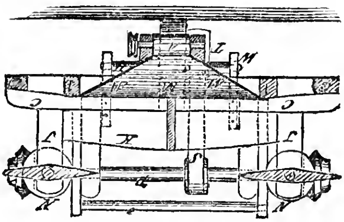


Fig. 5.

"The destructive insects, popularly known in this country by the name of grasshoppers, but which in our version of the Bible and other works in the English language are called locusts, have, from a period of very high antiquity, attracted the attention of mankind by their lamentable ravages. It should be here remarked that in America the name of locust is very improperly given to the *Cicada* of the ancients, or the harvest-fly of English writers."—*Harris*. In what may be here presented, the terms "locust" and "grasshopper" may be taken to mean one and the same insect, of which there are a number of species, all of which belong to the order *Orthoptera*. From accounts we have in the Bible, and the relation of modern travelers in the East, we learn that this insect has again and again proved a terrible scourge to the inhabitants of that quarter. Although the ravages of locusts in America have not been so destructive as in the eastern continent, yet they have been sufficiently formidable to attract attention, and not unfrequently have laid waste considerable tracts of country, and thus have occasioned no little loss to the cultivators of the soil. More than a hundred years ago different parts of New England suffered severely from the ravages of locusts. It is stated in Williamson's History of Maine that in 1743 and 1756 they covered the whole country and threatened to devour every green thing. Indeed, so great was the alarm they occasioned among the people, that days of fasting and prayer were appointed on account of the threatened calamity.

Colorado, Kansas, Minnesota, and other Northwestern States and Territories have, of late years, suffered severely from this locust-scourge. A convention of governors has been held to devise ways and means to stay their destructive ravages, and a commission has been created by Congress to investigate the subject, and, if possible, to devise means of relief.

PROGRESS OF INDUSTRIAL EDUCATION.

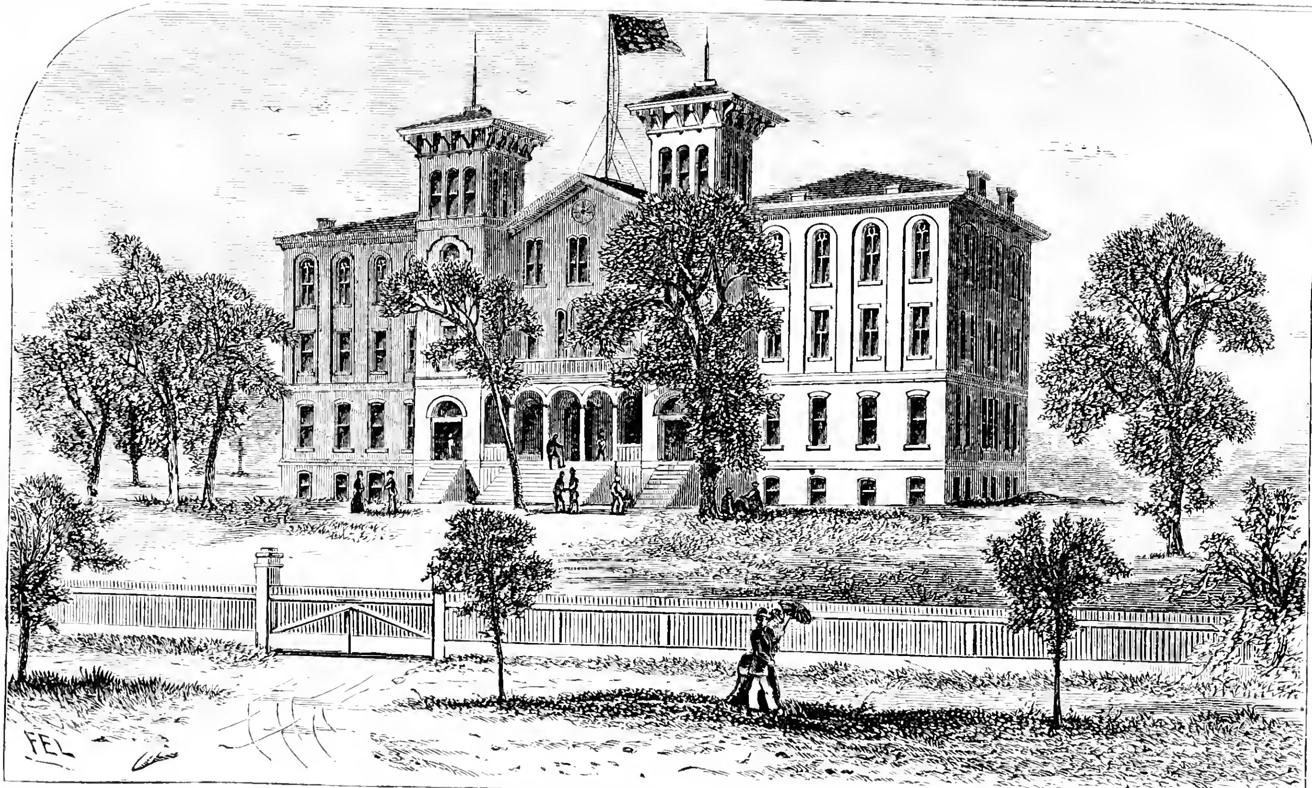
In thirty-six States there are now thirty-nine colleges which have received the congressional land-grant of July 2, 1862. There are also branch institutions in Georgia and Missouri. The Agricultural and Mechanical College of Texas has been opened during the year. All the colleges are now in operation, except that of Florida, which is expected to be opened early in 1877. The professors and assistants in these colleges during the year numbered 473, and the students, 4,211. There are eleven States which have not sold all the scrip or land granted by Congress; Illinois, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Nevada, New York, Oregon, and Wisconsin. They have sold during the year 51,405 acres, at an average price of $4.41 per acre, and 1,463,505 remain unsold. The largest average price obtained per acre by any State was $8.38, by Michigan, and the smallest, $2.20, by Iowa. The annual interest received by the agricultural and mechanical colleges of the several States from the proceeds of all the lands thus far sold amounts this year to $525,745. Thirty-four of the colleges have farms, which contain, in the aggregate, 15,418 acres, and their estimated value is $1,321,092. Statistics more in detail may be found in the tables at the close of this article.

It will be seen that in some of the colleges of which a report is made in the folowing pages, the number of students pursuing agricultural or mechanical studies is much smaller in proportion to the number in attendance than in others. This may be owing to several causes. In some cases the colleges have been recently established, and have not yet been brought into practical working order; in others the students were poorly prepared when they entered, in consequence of the low standard of education in the surrounding country, and in others inducements were greater to enter upon other courses of study which seemed to promise more immediate profit; but these embarrassments are gradually becoming less, and when agriculture and the mechanic arts require higher qualifications for their practice and become more remunerative, they will, no doubt, entirely disappear. Some of the colleges have already attained a high standard of excellence, considering the time they have been in operation and the fact that they have largely to educate their own educators. A large number of students graduate at these colleges every year, and enter upon practical farming and the mechanic arts, or become professors in industrial institutions of our own or other countries.

ALABAMA.

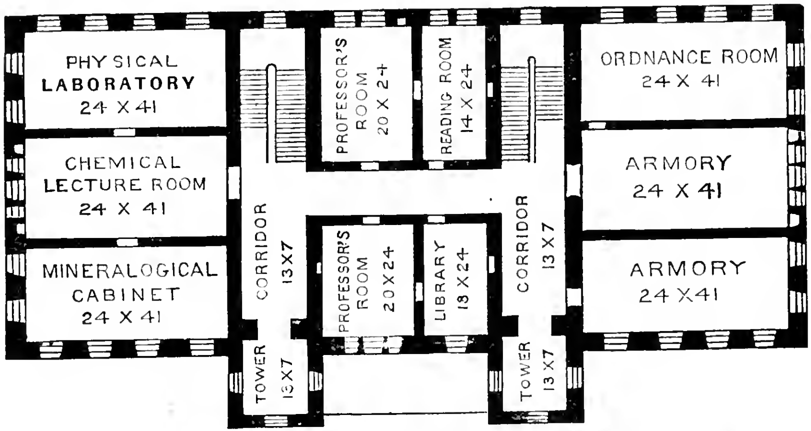
Agricultural and Mechanical College of Alabama, at Auburn; Rev. I. T. Tichenor, D. D., president.—"Our college," says the president, "is steadily increasing in popularity. The people of the State are beginning to understand our aims and to appreciate our efforts." During the year French and German books, plates, and models, and various kinds of apparatus have been imported for reference and illustration of the different branches taught.

PLATE X.



AGRICULTURAL AND MECHANICAL COLLEGE OF ALABAMA.

PLATE XI.



AGRICULTURAL AND MECHANICAL COLLEGE OF ALABAMA

PLAN OF SECOND STORY FLOOR.

The college-farm contains 100 acres, and is valued at $2.000. The soil is naturally poor, but by skillful cultivation and manuring it has been greatly improved. Crops of corn, wheat, oats, cotton, grasses, and a great variety of vegetables have been cultivated during the year. Notwithstanding the season was very unfavorable, in consequence of severe drought, corn yielded 50 bushels, wheat 18½ bushels, and cotton 400 pounds per acre. The great success attending the efforts to improve the fertility of the college-farm has excited much interest among the neighboring farmers, and led to a general improvement of the agriculture of the surrounding country. Similar success has attended the labors of the superintendent of the experimental farm, called the Experimental Station, near Courtland, in the valley of the Tennessee River, referred to in our report for 1875. The superintendent says: "The grasses are splendid, far exceeding my most sanguine hopes, and came out of the drought unscathed, except timothy, which is not so promising. They are the admiration of all who see them, and demonstrate that ours is a grass-growing country.

The college building, represented in the accompanying engraving, is a fine brick edifice, 70 feet long, 60 wide, and three stories high above the basement, and is said to be the best-constructed building in the State. In the basement there are seven rooms, and twenty-six in the stories above. They consist of lecture, recitation, professors' laboratory, cabinet, library, drawing, reading, assembly, and ordnance rooms, and a gymnasium. They are well finished and airy, those of the basement being 10 feet high, of the first and second stories 17, and of the third 13, and each of the towers is 85. The sum of $1,400 has been expended during the year for improvements of various kinds and repairs on the buildings. The annual interest derived from the proceeds of the congressional land-scrip is nominally $20,280, but in consequence of the depreciated State certificates in which it is paid the college actually receives, on an average, only about $16,224.

Professors during the collegiate year, 5; assistants, 2; students, 104; pursuing agricultural or mechanical studies, 80.

ARKANSAS.

Arkansas Industrial University, at Fayetteville; N. P. Gates, A. M., president.—The annual interest derived from the proceeds of the congressional land-grant now amounts to $10,400. The experimental farm contains 160 acres, and is valued at $12,000. Experiments have been made in testing the qualities and adaptability of Tappahannock wheat, Surprise oats, and clover. Ten acres seeded to clover, which has been considered a very doubtful crop in Arkansas, have yielded very largely, and indications are that it will succeed well in that climate on soil properly prepared. All the labor on the farm has been performed by the students at prices varying from 5 to 10 cents per hour, according to their efficiency or skill.

Professors in the university, 9; assistants, 3; students, 270; students in the agricultural course, 25; in the mechanical, 20. The professors give instruction in common in the university and the agricultural and mechanical department.

CALIFORNIA.

University of California — Colleges of Agriculture and Mechanics, at Berkeley; John Le Conte, M. D., president.—The course of study in the college of agriculture has been so changed during the year as to include three instead of two years in the undergraduate course, general and economic botany being taught in the sophomore instead of the junior year. Students are not only enrolled in separate colleges, but in each college they may enter on regular or special courses. The special courses are adapted to those who desire to acquire proficiency in a single branch, or who are unable to remain long enough to pursue a full course. Specialists are also received into post-graduate courses in chemistry and engineering, and such other specialties as may be provided by the heads of the different departments. An opportunity is thus offered to any student who may feel himself deficient in a branch of study which he has pursued in the regular course to acquire such additional information as he may desire.

The annual interest derived from the proceeds of the congressional land-grant, is now $45,000. The college-farm contains 200 acres, and valued at $200,000. This includes the whole domain at Berkeley, 40 acres of which have been under cultivation with experimental crops. It is the design of the university to develop this domain for the purpose of illustrating the capabilities of the State for special cultures, as forests, fruits, field-crops, &c. It will, therefore, be the station where new plants and processes will be tested and the results made known to the public. Experiments have been made on the effects of different depths of plowing and on five kinds of fertilizers in the production of wheat and oats. In the laboratory, investigations have been conducted in the analyses of soils, subsoils, fertilizers, waters and their purification, grape sirups, seeds of the *Rhamnus Californicus*, proposed as a substitute for coffee, and of commercial products for economic use. The garden of economic botany has also been improved by grading and underdraining.

Professors in the colleges, 10; assistants, 9; students, 50; professors in all the departments, 12; assistants, 23; students, 307.

CONNECTICUT.

Yale College—Sheffield Scientific School at New Haven; Rev. Noah Porter, D. D., LL. D., president.—The Peabody Museum of Natural History, referred to in our last report is now completed, at a cost of $140,000; including cases, $175,000. The money was given for this purpose by George Peabody, of London. The plan of the building is so arranged that it can be enlarged at any time when more room is needed without injuring its symmetry or beauty. The basement is devoted to the sandstone collections of fossil foot-prints from the Connecticut Valley and to work and store rooms; the first story, to the mineral-cabinet and recitation and lecture rooms; the second, to geology; the third, to zoology; the fourth, to archæology and ethnology. A part of the collections have already been deposited in their appropriate rooms and systematically arranged. The museum is now open to students daily. Instruction in mineralogy, zoology, and comparative anatomy will be given in this building, and the laboratory of determinative mineralogy has already been moved into it. During the past two years two professors have been added to the faculty of the school, William G. Mixter, Ph. B., professor of chemistry, and Sidney I. Smith, Ph. B., professor of comparative anatomy. These professorships are both new, and the gentlemen selected to fill them have prepared themselves by study in this country and in Germany with special reference to the particular branches they are required to teach.

Large additions have been made to the zoological collections, consisting of fishes, insects, and a vast number of the lower orders of invertebrates. The geological cabinet has also been increased by several thousand species of interesting vertebrate fossils, collected in different parts of our country. Among the especially interesting additions may be mentioned the skeleton of the celebrated mare Esnea, imported from Arabia, and a series of fifty casts of human and other mammalian brains, obtained from the Royal College of Surgeons, London. In geology, excursions are made for the purpose of examining geological phenomena and making special collections of rocks and minerals. The governing board in their report say that the school has always had students pursuing agricultural sudies, although the number taking the regular agricultural course has been small; that its teachers in agriculture from the foundation of the school have wielded a powerful influence, not only in this State, but also throughout the whole country, in matters appertaining to both practical and scientific agriculture, and that the trustees have constantly endeavored to carry out the intent of the congressional act of 1862 in every particular. The annual interest derived from the proceeds of the congressional land-grant is $8,100. A donation of $1,000 has been made for painting Sheffield Hall, and the work was completed during the summer vacation.

Professors in the scientific school, 16; assistants, 15; students, 230; professors in all the departments, 48; assistants, 41; students, 1,021.

DELAWARE.

Delaware College, at Newark; William H. Purnell, LL.D., president.—No changes have been made in the general management of the college. The annual interest derived from the proceeds of the congressional land-scrip grant is now $4,980. The professor of agriculture has a farm of 80 acres. The students cultivate portions of it for instruction in practical agriculture, while those who perform labor not educational receive a liberal compensation, by which they are enabled to pay a part of their college expenses. It is the design of the college to give the students such a course of thorough instruction in agriculture as will enable them to conduct the operations of the farm intelligently and profitably, and, at the same time, secure thorough mental discipline by the introduction of such other studies as constitute a substantial education. The usual crops have been cultivated on the farm, among which the sugar-beet has received special attention by the professor of agriculture, who promises a full account of his experiments and their results in a report soon to be published.

Professors, 5; assistants, 3; students, 43, 16 of whom were pursuing agricultural or mechanical studies.

FLORIDA.

Florida State Agricultural College, at Eau Gallie; Mr. William Watkin Hicks president of the trustees.—The college building, referred to in our report of last year, has been completed. It is fire-proof, having stone partitions between the rooms and a tin roof, and is designed principally for lecture-rooms. A dormitory, tool-house, and other outbuildings have also been built during the year. The trustees intend to erect the main college edifice and several cottages as soon as the means can be furnished. The college has not yet been opened, but it is expected that the work of instruction will commence early in the spring of 1877. Professor A. G. Hill has been employed by the trustees to take charge of the buildings, the improvement of the college-grounds, and the experimental farm. A fine pair of mules and the necessary tools for farm-work have been provided, and a beginning has been made in clearing up the farm for planting an orange-grove and other tropical fruits.

The annual interest derived from the proceeds of the congressional land-grant now amounts to $6,068, and is paid regularly in gold. The college owns 4,000 acres of good land, mostly wild, which is valued at $5,000, and the improvements already made at $2,500. Of this land, 2,320 acres, besides several village lots, were given by W. H. Gleason, and 1,000 by W. R. Arno.

An avenue nearly two miles long and various cross-streets about the buildings have been opened and are in good condition for travel. An avenue has also been opened from Indian River to Lake Washington, a distance of six miles. It passes through the college lands and greatly increases their value. About one hundred lots in the village-plat have been surveyed and will soon be put into the market for sale. All the land, except what is reserved for the college grounds, park, and experimental farm, will ultimately be sold for the benefit of the college. College Place is opposite to College Park, and is designed for the site of the main college edifice. The location is high, salubrious, and picturesque.

GEORGIA.

University of Georgia—Georgia State College of Agriculture and the Mechanic Arts, at Athens; Rev. Henry H. Tucker, D. D., LL. D., chancellor of the university; L. H. Charbonnier, A. M., president of the college.—No important changes have been made during the year. A considerable amount of apparatus has been purchased for illustration in natural history and chemistry. The interest derived from the proceeds of the congressional land-grant is now $17,010, of which $3,000 are paid to the North Georgia Agricultural College, at Dahlonega. The college farm contains 60 acres, and is valued at $1,500, not including the stone house on it, which originally cost $24,000. Experiments have been made on the farm in the culture of cotton, corn, wheat, oats, and potatoes. The prominent agricultural studies with which the students are required to become familiar are agricultural chemistry, physics, mechanics, botany, zoology, economics, geology, and jurisprudence

It is proposed by the trustees to put in operation, as soon as means will permit, a physical laboratory, in which students will have an opportunity of experimentally verifying the laws of mechanics and physics illustrated in the lecture-room; such as the laws of the mechanical powers, friction, specific gravity, hydronomics, heat, electricity, and magnetism. A large hall, 34 by 50 feet, is used by the students in drawing. They are employed in this exercise during a part of the course from one to two hours each day. The full course includes orthographic and isometrical projections, development of surfaces, practical perspective, linear, free-hand, and object drawing, building and architectural drawing, masonry drawing, drafting for carpenters, mechanical drawing, drawing and shading from solid objects, drawing copies, as teeth of wheels, details of the steam-engine, lathes, drilling-machines, pumping-machines, and hydraulic-presses. The students are exercised in military tactics three times a week during the year. The State legislature, at its last session, granted to the university two hundred stands of arms, to be used by the students of the State college and the academic departments. One hundred stands have already been received. All the students of these departments are required to take part in the regular military drills unless excused for satisfactory reasons.

Professors in the college, 8; students, 93; professors in all the departments, 28; assistants, 5; students, 512.

North Georgia Agricultural College, (a department of the university,) at Dahlonega; David W. Lewis, A.M., president.—The part of the annual interest received by this college on the proceeds of the congressional land-grant is $3,000. The college-farm contains 25 acres, and is valued at $1,000. In consequence of its limited means, and for other reasons, the college has not been able to enter upon experiments in practical agriculture on the farm. Most of the young men in the college are the sons of farmers, who have more knowledge of farming than of books. As soon as they are sufficiently advanced in the rudimentary branches, they will enter upon a regular course of instruction in agriculture. Education in that part of the State is in a backward condition, and the board of trustees have been making strenuous efforts to raise the standard by establishing common schools in all parts of the surrounding country, and educating competent teachers to instruct them. For this purpose a normal department has, for some time, been established in connection with the college, and no fewer than fifty young men and women who received their education in this school were engaged as teachers during a portion of this year.

The trustees are now fitting up rooms, which will be free of rent, expressly for young men who obligate themselves to teach in the fall months. By these facilities, and free tuition, the expenses of living have been much diminished, and students, by clubbing together, have, in some instances, reduced them to about $6 per month. As soon as the students and people are prepared for it, and means can be provided, it is proposed by the trustees to establish a school of mines as a department of the college. Dahlonega is located in the midst of the gold-belt of Georgia. Gold-mines exist in the immediate vicinity of the college, and nearly all the precious metals may be found within a short distance from it. In the opinion of Professor Raymond and other geologists, no better location for such a school can be found in the United States. Many of the young men now in the college have some practical knowledge of mines and mining. The college has been in operation four years, and has already had under its instruction nearly one thousand students. The average attendance has been very high, not being surpassed by any other institution in the State.

Professors, 5; students, 245, 30 of whom pursued agricultural or mechanical studies.

ILLINOIS.

Illinois Industrial University, at Urbana; John M. Gregory, LL. D., regent.—The annual interest derived from the proceeds of the congressional land-grant is now $28,200. None of the land has been sold during the year. Experiments were made on the experimental farm with chemical and other fertilizers to ascertain their relative value as compared with stable-manures in the different modes of applying the latter, and in feeding cattle to test the effect of the quantity of food consumed. Investigations have also been made upon the temperature of the soil in different situations and under different treatment, upon the depth of roots of ordinary field-crops, and upon microscopic and injurious fungi. The experimental farm contains 160 acres, and is valued at $16,000. It is used for experiments in testing the different varieties and modes of culture in field-crops and in the treatment of soils, about 60 acres being devoted to this purpose. It is also used for experiments in horticulture and feeding animals of different ages and development on various kinds of food. There is another farm called the stock-farm. It contains 410 acres, and is valued at $40,000. A large stock-barn has been provided for it, with fronts north and west, each 80 feet long, and each limb or L is 40 feet wide, being fitted up with stables, pens, yards, cooking-rooms, steam-boiler for steaming food, and engine for grinding, thrashing, and cutting. This farm is designed more especially for breeding and rearing all kinds of valuable stock, but is also used to illustrate practical agriculture and to exhibit to farmers a model farm. The barn on the experimental farm is of less size, but is fitted up with great convenience, and supplied with a mill for grinding feed, which is run by a large windmill. These farms have been very sucessfully conducted during the year under the direction of the head farmer, Mr. Edwin L. Lawrence, both in experiments and profit, showing a balance of about $3,500 in their favor.

The university claims to have made a larger exhibit at the Centennial than any other institution of learning, for which it received a medal. Medals were also awarded to it for a cabinet of the woods and minerals of Illinois, which it collected. It also exhibited a collection of climatic varieties of maize, obtained from the whole extent of the corn-growing region of the North American Continent. The practical departments are gaining in popularity and efficiency, and the number of students is increasing. In the machine-shop the odontograph, referred to last year, is now made in quantities for sale to the trade. Three other inventions have been patented. A number of compound microscopes, excellent working instruments of new patterns, are now being finished.

Professors in the university, 13; assistants, 14; students, 386; of whom 303 were gentlemen and 83 ladies; professors and assistants engaged in giving instruction in agricultural and mechanical studies, 15; students in agriculture and horticulture, 49; in mechanical studies, 138.

INDIANA.

Purdue University—Indiana Agricultural College, at La Fayette; Emerson E. White, LL. D., president.—Judge John Purdue, who donated $150,000 to the university, died on the 12th of September, 1876, in the seventy-fourth year of his age. The money was to be paid in ten equal installments of $15,000 each. At the time of his death six installments, $90,000, had been paid, and the remainder, $60,000, was voluntarily secured by him on a valuable tract of real estate situated in Warren County. The university has been reorganized during the year, and now embraces three departments: 1 the university academy; 2 the college of general science; 3 special schools of science and technology. The agricultural and mechanical college is included in the last department, which embraces the schools of agriculture and horticulture, civil engineering, industrial design, physics and mechanics, chemistry and metallurgy, and natural history.

The buildings of the university now completed and in use are the boarding-house, dormitory, laboratory, boiler and gas house, military hall, gymnasium, farm-house, and barn. The barn has been built during the year, at a cost of $4,000. It is 42 by 60 feet, with stone basement, and all the improvements of modern construction. The rooms of the dormitory are now used for recitation-rooms, cabinet, and library. A large college building, with suitable rooms for recitation, chapel, library, cabinet, and societies is now in course of construction. The foundation-walls and basement-story are finished, and it is expected that the building will be completed during 1877. Other improvements have been made on grounds, farm, &c., to the amount of $4,239. Also, $3,442 were paid for apparatus and machinery, and $1,051 for books and periodicals. The college is well supplied with apparatus for imparting instruction in agriculture and the mechanic arts. The farm is large, in good condition, and well stocked; and students in the mechanic arts have an opportunity of working a part of each day at the bench, vise, lathe, drill, or planer. In the laboratory analyses have been made in various soils, indigenous woods, and milk from the farm-cows. A large number of forest and ornamented trees have been set out, two acres planted with grapes, and four acres with orchard-trees of various kinds.

The annual interest derived from the proceeds of the congressional land-grant is now $20,314. The college farm contains 159 acres, and is valued at $47,700. Experiments have been made in the culture of various crops. One hundred and sixty bushels of Fultz wheat were raised on five and one-third acres, 120 bushels of Alabama wheat on five and two-thirds acres, 360 bushels of oats on ten acres, 1,950 bushels of corn on thirty acres, 75 tons of hay on forty-five acres, and a large supply of garden vegetables for the boarding-house during the season and for winter use. Five thorough-bred Jersey cattle and several Berkshire, Essex, and Poland-China swine have been added to the live stock kept on the farm. The herd of cattle now consists of five short-horns and five Jerseys. The five short-horns cost $3,000.

Professors in the university, 6; assistants, 2; students, 120; 16 of whom are in the regular university classes, and the remainder, 104, are in the preparatory department. Only one student has been pursuing a course of agricultural studies, but it is probable that several now in the preparatory department will enter upon this course when they are properly prepared to do so.

IOWA.

Iowa State Agricultural College, at Ames; A. S. Welch, LL. D., president.—It has been a prominent object of the trustees to make this college really an agricultural and mechanical institution. Seven-eighths of the branches taught have an immediate relation to agriculture and the mechanic arts. During the year special courses have been prepared in chemistry, botany, veterinary science, geology, physics, and general agriculture; so that any student who desires to do so may become a proficient in any one of them. A boiler-house has been erected and a new heating apparatus put into the main college building, by which it is heated throughout by steam. The building has also been thoroughly repaired, at an expense of $15,000. The heating apparatus cost $11,000. Seven pure blood short-horns have been purchased for the farm.

The annual interest derived from the proceeds of the congressional land-grant now amounts to $34,822. The number of acres of the grant sold during the fiscal year is 5,956, at $2.20 per acre, and the number remaining unsold is 175,244. The experimental farm contains 850 acres, and is valued at $51,000. Experiments have been made with different varieties of grain and corn, and with grasses; also, chemical analyses of several of the cereals, as corn, oats, rye, and barley, have been made by the chemist. Nearly all the heavy work on the farm has been performed by students, largely from the freshman class, who have been paid for their labor from 3 to 9 cents per hour. A few seniors, who have special capacity for the business, are employed as foremen under the several superintendents. At the spring of the year the young men are detailed for manual labor, in convenient numbers, to the farm, garden, and workshop; and the young women are appointed to the different departments of the dining-room and kitchen. No difference is made in the pay of young men and young women for their labor.

Sixty-nine of the ninety-nine counties of the State sent students to the college. The largest number was from Story County, in which the college is located, being fifty-six. Several hundred volumes have been added to the library, which now contains 5,000 volumes, among which may be mentioned the Encyclopædia Britannica, Chambers's Encyclopædia, and the American Cyclopædia, Audubon's Birds of America, and the prominent works on agriculture, horticulture, and applied science.

Professors, 7; assistants, 8; students, 300; 62 of whom were in the agricultural course and 13 in the mechanical.

KANSAS.

Kansas State Agricultural College, at Manhattan; Rev. John A. Anderson, president.—During the year a laboratory building, having the form of a cross, has been built of stone, at a cost of $8,000. It is one story, containing a large office, lecture-room, balance-room, and four spacious rooms for laboratory work. The professor of chemistry, William K. Kedzie, says that the building has more than realized the expectations which had been entertained of it. The water-system proves perfect. The sky-light ventilators maintain the air of the working-laboratory as fresh as a home parlor. The system of sky-light ventilators in the large physical laboratory gives not only admirable perpendicular light for handling apparatus, but, when partitioned off by white screens, furnishes an apartment for photograph purposes which is equaled by few galleries in the State. Also a stone horticultural building has been erected, one story high, with basement, and containing two large lecture-rooms, recitation-rooms, workshop, and cellars. Besides these, a small blacksmith-shop, with two forges, has been built. The college buildings now completed are as follows: The old college building, three stories, 40 by 60; college building, two stories, 42 by 100; laboratory building, one story, 109 by 109; horticultural building, one story, 31 by 80; mechanical building, two stories, 38 by 102; and blacksmith-shop, 20 by 40; all of stone except the latter, which is of wood.

The college-farm contains 255 acres, and is valued at $25,000. Experiments have been made with corn, wheat, rye, oats, potatoes, and grasses. In the experiment of potatoes, 250 varieties were employed, including nearly all those cultivated in the Eastern States. Those which succeeded best were the Kansas, Cheuery, Red Jacket, Carpenter's Seedling, Extra Early White, Great Britain, and Ohio Beauty. Among the forage-plants and grasses, alfalfa, timothy, and orchard-grass proved the most satisfactory. The result of the experiment with corn, by planting in hills and drills, was 62½ bushels per acre by the former mode and 71 by the latter. An experiment in labor on the farm is being tried by giving to each student who desires it the use of a plat of land, teams, &c., and allowing him to cultivate it as he pleases, under the direction of the superintendent, and to have the profit of the crop. This is extra labor, as all the students are required by the regulations of the college to devote daily one hour each to educational labor without compensation.

The annual interest from the proceeds of the congressional land-grant is $20,491. During the fiscal year 5,604 acres have been sold, at $5.83 per acre, and 31,461 acres remain unsold. A paper, called the Industrial, is published weekly by the printing department of the college, on a neat quarto sheet, at 75 cents per year, postage prepaid. It is devoted principally to science and college matters.

Professors, 6; assistants, 8; lecturers, 2; students, 303, 186 males and 117 females, all pursuing agricultural or mechanical studies. In addition to the regular six years' course of study, females receive practical instruction in dress-making, printing, telegraphy, scroll-sawing, carving, engraving, photography, and instrumental music.

KENTUCKY.

Kentucky University—Agricultural and Mechanical College, at Lexington; John B. Bowman, LL. D., regent.—No changes have been made in the course of study, except that the military school has been placed on the same basis as the other schools and made optional. The patronage of the college has been considerably reduced for the last two or three years by the necessity of discouraging the attendance of poor young men, not State students, who wished to secure their education by their labor, for the compensation of which no means were available.

The farm contains 433 acres, and is valued at $130,000. Experiments have been made with new varieties of wheat, rye, oats, and hemp. The Clawson wheat, furnished by the Department of Agriculture, proved to be a successful variety. Valuable collections of plants have been received from the Commissioner of Agriculture and the superintendent of the congressional greenhouses at Washington. The annual interest derived from the proceeds of the congressional land-grant is $9,900.

Professors in the college, 7; assistant, 1; students, 94, all pursuing agricultural or mechanical studies; professors in the university, 24; assistants, 3; students, 273.

LOUISIANA.

Louisiana State Agricultural and Mechanical College, at New Orleans; Mr. J. L. Cross, president.—The "board of control" say that the college has made very satisfactory progress during the past year, and that, considering the short time it has been in operation and the limited means at its command, they may justly feel a pride in its present flourishing condition. At the close of the summer session six gold medals were bestowed on the most deserving students, according to general merit, as indicated by the result of daily markings for scholarship and deportment. The night-school has been continued for the convenience of mechanics and other students, who, in consequence of daily labor at their trades, cannot attend during the day; and such has been its popularity and success, that there are now fifty students in constant attendance on its exercises. The chemical and philosophical apparatus is quite deficient at present, but additions will be made as soon as an appropriation from the State can be obtained.

The annual interest derived from the proceeds of the land-scrip grant now amounts to $13,734. The part of the fund, amounting to $130,800, pledged by the State to make good the loss occasioned when the proceeds of the national endowment were consolidated into new State bonds, has not yet been paid, and no interest is at present derived from this source. A bill has been prepared and presented to the legislature of the State, which provides for its payment by a special State tax of three-fourths of a mill on a dollar. It is expected that the fund will be restored to its original value. The land owned by the college comprises 600 acres, a part of which will be used as an experimental farm, when the college buildings are erected upon it. The land is valued at $40,000.

Professors, 6; students, 209, of whom 115 were pursuing agricultural or mechanical studies.

MAINE.

Maine State College of Agriculture and the Mechanic Arts, at Orono; Charles F. Allen, D. D., president.—The terms of the college-year have been changed from three to two and the courses of study revised. The course for students not intending to pursue agriculture is called "the course in science and literature." A building, called Society Hall, has been erected by the students for society meetings. A vertical circle, made by Messrs. Repsold and Sons, of Hamburg, Germany, has been added to the astronomical apparatus, and 271 volumes and 167 pamphlets given to the library.

In the laboratory, determinations of the percentage of sugar in various kinds of sugar-beets raised on the farm have been made, and also numerous analyses of common grasses, clover, and cereals at different stages of their growth, including both roots and foliage.

Experiments have been conducted on the farm in testing the efficacy of Professor Stockbridge's fertilizers, the value of different manures in top-dressing grass-land, the effect of subsoiling on the wheat-crop, the different methods of sowing wheat and planting potatoes, the comparative merits of different breeds of cows for the production of milk and butter, and the value of cooked and raw meal and skimmed milk in feeding swine. The farm contains 370 acres, and is valued at $10,000. The annual interest from the proceeds of the congressional land-scrip is $7,864.

Professors, 6; assistants, 2; students, 115. All the students pursue agricultural or mechanical studies.

MARYLAND.

Maryland Agricultural College, at College Station; William H. Parker, president.—The financial condition of the college has been greatly improved during the last two years. The total amount received from the State since September, 1875, is $15,709.50. During the same period there have been paid on the old college debt $10,561.46; for necessary repairs, $3,916.89; and on the farm, $1,138.25. The amount remaining unpaid on the debt is $2,215.42; due for tuition, $1,436.86; leaving the present indebtedness of the college only $778.56.

Experiments have been made on the farm with wheat, rye, barley, garden-seeds, fertilizers, Cotswold sheep, and Berkshire and Chester hogs. Twenty-one acres have been sown with wheat and grass, and fertilized with Missouri bone, British mixture, and Taylor superphosphate, at the rate of 200 pounds per acre. The boundaries of each kind of fertilizer used were marked, so that its effects could be easily ascertained. There have been raised on the farm 800 bushels of shelled corn, 200 of oats, 600 of turnips, large quantities of both summer and winter vegetables, and 30 tons of hay. Five Cotswold sheep sheared 55 pounds of wool, 8 calves were sold, and 2,000 pounds of pork will be packed. The farm contains 285 acres, and is valued at $14,250. The annual interest on the proceeds of the congressional land-scrip is $6,900.

Professors, 6; students, 77, 40 of whom pursued agricultural or mechanical studies.

MASSACHUSETTS.

Massachusetts Agricultural College, at Amherst; William S. Clark, Ph. D., LL. D., president.—In consequence of an invitation from the government of Japan, President Clark obtained a leave of absence and sailed for that country on the 1st of June, 1876, for the purpose of establishing there an agricultural college like that of Massachusetts. Three graduates of the college went with him, expecting to remain as professors. The professor of veterinary science and practice has been dismissed, in consequence of inadequacy of means to pay his salary, and the superintendent of the farm has been superseded by a graduate of the college. The farm contains 383 acres, and is valued at $37,000. Great improvements have been made on it during the year by underdraining, grading, and filling depressions; and a change has also been made in its general objects and management. Experiments have been conducted in growing crops with chemical fertilizers, and in feeding fruit-bearing plants with different substances to ascertain their effect on the quality and quantity of the fruit produced. Professor Stockbridge says that "this is the eighth year that crops have been grown on the same land with chemicals, and, as a result, it may be said that it is conclusively proved that chemicals may be substituted for barn-yard manure, if they are properly compounded and used. In fact, in some circumstances these are altogether preferable. In answer to the inquiry whether these fertilizers do not leave the land in an exhausted condition, he says that his experiments thus far show that it is left in a better condition than before the crops were taken from it; and as to the cost of fertilizers, it is not so great that the crop does not pay a large profit over the cost of production. By this method of culture he has raised 104 bushels of shelled corn per acre. Both the prepared fertilizers and the materials for compounding them can be obtained in Boston. In the laboratory, analyses of plants, milk, and fertilizers have been made on a large scale, and also of animal excretions, to ascertain how they are affected, as to their quality for fertilizers, by the food the animal consumes.

The annual interest derived from the part (two-thirds) of the congressional land-grant received by this college amounts to $8,022. The national endowment fund has, at different times, received large additions by the State, so that the permanent interest-bearing fund of the college is $360,067. A post-graduate course has been provided, by which graduates of colleges and scientific schools may pursue their studies under the direction of President Clark in botany, Professor Goessmann in chemistry, or other members of the faculty in their respective departments. A model dairy-house has been built, with all the modern appliances; also a steam boiler and engine have been placed in the barn to cut and steam fodder and roots, and for all purposes for which power is needed. The barns, sheds, and farm-house have been painted and otherwise improved.

Professors, 5; assistants, 3; students, 111.

Massachusetts Institute of Technology, at Boston; John D. Runkle, Ph. D., LL. D., president.—A new department, called "Practical mechanism," has been opened, designed especially for the benefit of those who wish to become master-mechanics, rather than engineers, and for affording a course of thorough preparation for all the higher courses in the institute. There is no other school for metal working, so far as is known, conducted on the same plan, except in Russia. For admission the applicant must be fifteen years of age, and pass a satisfactory examination in arithmetic, geography, spelling, punctuation, English composition, English and American history, and algebra through simple equations. The course, occupying two years, includes shop instruction, algebra, plane and solid geometry, rhetoric and composition, mechanical and free-hand drawing, English literature, and the French language.

Tuition in this course of two years is $125 a year. For a more detailed account of this system the reader is referred to the report of Dr. John D. Runkle, president of the institute, on the "Russian system of shop-work instruction for engineers and machinists."

By the co-operation of the Woman's Education Association of Boston new laboratories have been provided for the special instruction of women. The design is to furnish every facility for the study of chemical analysis, industrial chemistry, mineralogy, and chemistry, as related to vegetable and animal physiology. These courses are intended for such persons as may be able to devote their whole time to the work, as well as for those who can spend only a few hours a week in the exercises. The laboratories are open from half past eight in the morning till half past five in the afternoon. Students in these laboratories pay the same tuition as other students in the institute. The institute, however, provides several courses unconnected with this without charge for tuition, the expense being paid by the trustee of the Lowell Institute. The annual interest derived from the part (one-third) of the proceeds of the congressional land-grant received by this institute, is now $4,011.

Professors, 21; assistants, 15; students, 293. Of this number, 54 were ladies, 38 of whom were special students in design; 14 special students in chemistry, and 2 students in the first year not candidates for a degree.

MICHIGAN.

Michigan State Agricultural College at Lansing; Theophilus C. Abbott, LL. D., president.—The college-year has been divided into three terms instead of two, but its length has not been altered. It appears to be a primary object of the directors to make it in the highest degree agricultural, and a considerable portion of time is devoted yearly to original investigation. Special attention is given to the study of botany. The freshman class devote one-third to one-half of their time to it daily for eighteen weeks, and are required to make rigid analyses and microscopic dissections of a great number of plants, both phenogamic and cryptogamic, with the most approved instruments.

Experiments have been made in the garden by the botanist with two hundred and forty-four varieties of potatoes, and the yield of each is given. He has also conducted some interesting experiments in the production of new varieties. The seeds of fifty varieties were sown in boxes, hot-beds, and in the greenhouse, at the time of sowing seeds for early tomatoes. When of sufficient size, a selection was made of the plants, and they were set two inches apart each way, and after danger from frost was passed were reset, two feet apart, in rows in the garden. About six hundred of them produced potatoes. The yield was surprising. Instead of a few little tubers the size of bullets, many of them were four to five inches long and of good size. In one instance a single plant produced eight pounds of potatoes, many of them being of good size. The yield in many cases was better than from old potatoes planted in the usual way. A test of their qualities will be made next year. From the many experiments which he has made with potatoes, he has come to the conclusion that new varieties must be originated every few years, as old ones degenerate in size and quality in most cases, and that farmers will soon make it a common practice to raise them themselves. In his experiments with apple-trees he has found that applying manure close about tho foot of the trees, or removing the grass and cultivating small circles about them, has very little beneficial effect. It is only by cultivating very large circles, equal to the extent of the branches, or the whole ground, that beneficial results can be obtained.

The college-farm contains 676 acres, and is valued at $47,320. About 300 acres are cultivated with crops in a regular system of rotation. Experiments have been made with White Schönen and Excelsior oats; Clawson, Asiatic, Gold-medal, and Diehl wheat; Yellow-blaze corn; roots, and grasses. The Gold-medal wheat yielded best. The students have been paid for their labor on the farm and elsewhere during the year $4,464, the price paid them being about 10 cents per hour. The farm-crops were valued at $3,154, and the labor required for their production $2,819. The farm live stock is worth $10,888, and the implements $1,685. The annual interest derived from the proceeds of the congressional land-grant, is now $16,880. Of this grant there have been sold during the fiscal year 2,474 acres, at an average price of $8.38 per acre, and 164,799 remain unsold. Three hundred and twenty-eight volumes have been added to the library, and twenty-seven agricultural, scientific, and literary periodicals are received regularly by the college.

Professors, 6; assistants, 7; students, 166, 4 of whom were ladies.

MINNESOTA.

University of Minnesota—Colleges of Agriculture and Mechanic Arts, at Minneapolis; William W. Folwell, M. A., president.—The plant-house has been completed, and the collection and propagation of plants commenced. A belt of trees, designed as a wind-break, has been planted around the barn and another around a portion of the farm.

The annual interest derived from the proceeds of the congressional land-grant is now $13,901. The number of acres of the grant sold during the fiscal year is 3,706, at an average price of $5.44 per acre; the number remaining unsold is 52,187. The college-farm contains 120 acres, and is valued at $12,000. Experiments have been made with 12 varieties of wheat, 20 kinds of fertilizers being used; with 8 varieties of oats, thick and thin seeded; with 5 varieties of corn and 19 varieties of potatoes, both on sandy soil and vegetable loam, 18 kinds of fertilizers being used; and with 225 varieties of garden-vegetables. It has been found by experiment on the farm that corn immersed in tar-water and rolled in gypsum is twenty-four hours longer in germinating, but that there is no difference in yield, and that birds, squirrels, and insects, except the wire-worm, do not touch it; that banking up the earth around the trunks of trees, about the 1st of September, to a height of 15 to 30 inches, according to their size, will cause an early ripening of the wood, and enable the trees to withstand better the sudden changes of temperature to which they are subject; that stripping off the leaves and cutting back the branches appear to produce in a measure the same result; and that want of cultivation is the greatest retarding influence to successful tree-culture.

The professor of agriculture, in giving his views of what an agricultural college should be, says that intelligent agriculture is based upon a knowledge of the natural and physical sciences; therefore the student should be acquainted with these sciences before receiving systematic and connected instructions in the art and practice of agriculture. All practical instruction is not, however, to be deferred until the last year. Verbal instruction and manual practice should be provided in each operation as it occurs in the natural course of events; but the main part, the body, of practical instruction can be fully appreciated only when some knowledge of the sciences has been acquired; therefore let language, mathematics, and natural and physical sciences come in the first years of the course, and practical agriculture later. The library, museum, stock, farm, and gardens are to serve as auxiliaries to this course of instruction.

Professors in the Colleges of Agriculture and the Mechanic Arts, 6; assistants, 2; students, 6; professors in all the departments, 11; assistants, 8; students, 267, 196 of whom were gentlemen and 71 ladies.

MISSISSIPPI.

University of Mississippi—College of Agriculture and the Mechanic Arts, at Oxford; General Alexander P. Stewart, chancellor.—Few changes have been made in this college since our last report. The annual interest derived from one-half of the proceeds of the congressional land-grant is now received by this college, according to the law of 1875, which amounts to $5,678.75. The college-farm contains 100 acres and is valued at $2,000. The trustees have suspended operations on it for the present, but they will probably be resumed when there are students in the college who need instruction in practical agriculture.

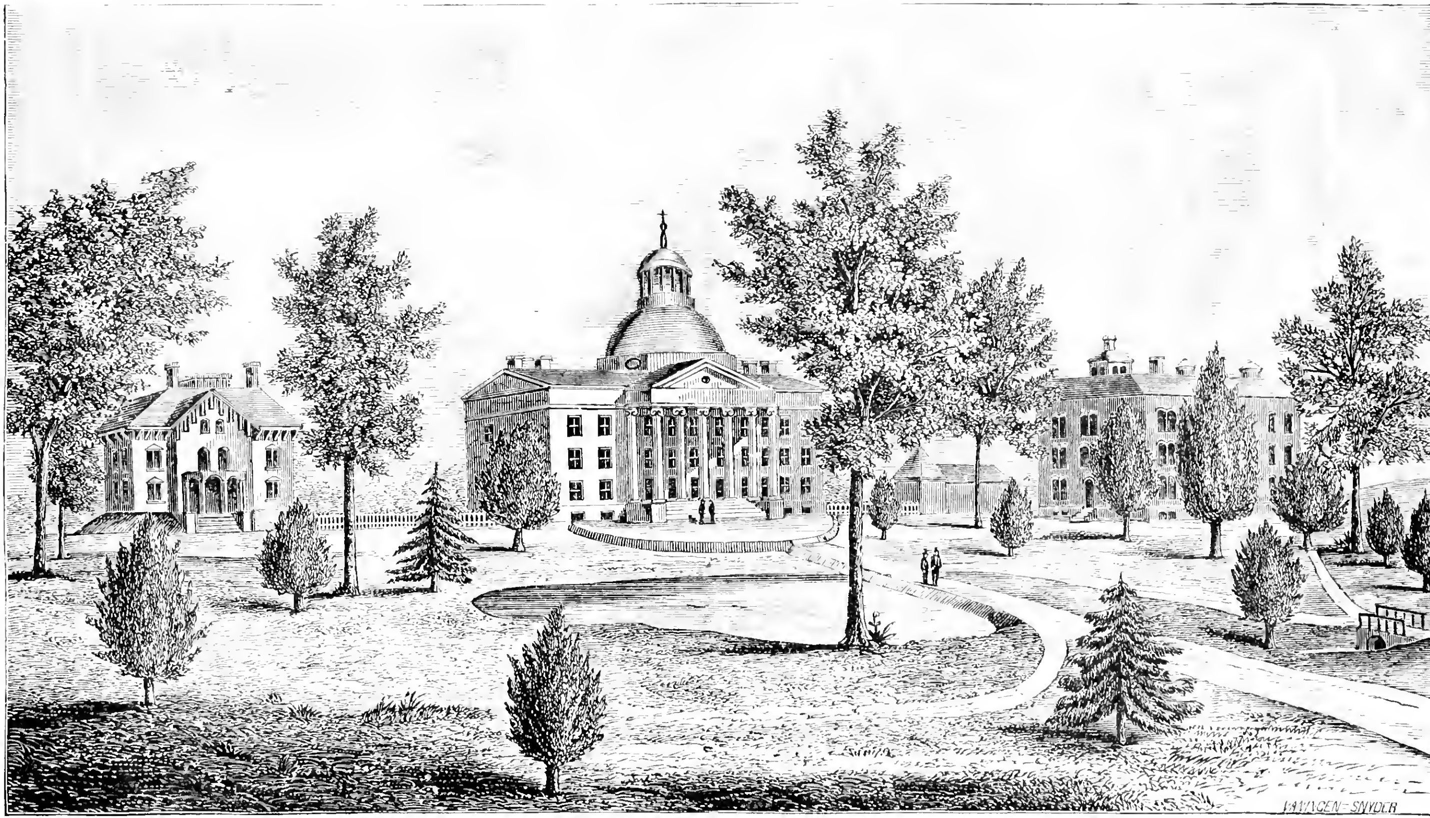
The laboratory for practical work in chemistry is large and well furnished with apparatus. Special attention is given to the chemistry of geology and its economical products bearing on agriculture. A collection of several thousand geological specimens from all the formations of the State has been made, consisting of various kinds of economic rocks, fossils, soils, marls, &c. The collection of soils is of great interest, having been obtained from every county of the State. The analyses which have been made of most of them show all their characteristics, and enable the student to comprehend at once the agricultural resources of every part of the State. The Markoe collection of minerals is claimed to be inferior to none in the world. It includes a large number of rocks, simple minerals, and fossils, sufficient for the fullest illustration of mineralogy and its related subjects. The herbarium contains specimens of all the plants indigenous to Mississippi, and some from the adjoining States.

Professors in the college, 5; assistants, 1; professors in all the departments, 8; assistants, 4; students, 131. There are no students in the college pursuing a regular course in agriculture, but there are 15 in the course of science, which embraces some studies relating to agriculture and the mechanic arts.

Alcorn University—Agricultural and Mechanical College, at Rodney; Rev. Hyram R. Revels, D. D., president.—The university is slowly recovering from the embarrassment occasioned by the abolition of free scholarships by the State legislature and the removal of the board of trustees and the faculty last year. On the 20th of July, 1876, Dr. Revels was reappointed president and a professor was added to the faculty. The prospects of the university are more encouraging than in 1875; but it is believed that at least two years will be required before it can regain its former standing.

The annual interest derived from one-half of the proceeds of the congressional land-grant, the part now received by this university, amounts to $5,678.75. The experimental farm contains 250 acres, and is valued

PLATE XII.



MISSOURI STATE UNIVERSITY.

at $5,000. Experiments have been made in the culture of yellow Maryland corn, Boyd's prolific cotton, and with clover. The results were very satisfactory. Seventy-five acres have been under cultivation. There have been raised 450 bushels of corn, 150 bushels of sweet-potatoes, half a bale of cotton, 2,500 bundles of corn-fodder, and 1½ tons of hay.

Professors, 2; assistants, 2; students, 57. None of the students pursued the agricultural or mechanical course, but 14 were preparing to enter upon it as soon as they were able to do so.

MISSOURI.

University of the State of Missouri—Agricultural and Mechanical College, at Columbia; Samuel S. Laws, LL. D., president; George C. Swallow, LL. D., dean of the college.—No important changes have taken place in the college during the year. Some improvements have been made on the university grounds, which are spacious and very tastefully laid out. An engraving of the university buildings and a portion of the grounds is here presented. The scientific building or agricultural and mechanical college is a large edifice built of brick, 106 feet long, 60 wide, and three stories high, not including the stone basement. It contains twenty-five rooms. Every room is supplied with water and gas, and the chemical laboratory is equipped with the most recent and approved apparatus.

The experimental farm contains 640 acres, and is valued at $60,000. Experiments have been made in fruits, hedges, forest-trees, pear-blight, and several wild plants, with the hope of developing some new principles which may be of benefit to agriculture. It is the determination of the college to enter more extensively upon experimentation with farm-crops than it has previously done. The lectures on agricultural chemistry, delivered to the junior class comprise a scientific exposition of the production of organic matter within the plant, beginning with the structure of the vegetable-cell, and proving the office of chlorophyl to be an apparatus for doing the chemical work in building up the plant. The nitrogenous constituents of the plant are treated in reference to its organs, to the nitrogenous fertilizers, and to the nitrogen of the air, leading to the consideration of the mineral matter or ash, to the growth of plants, and to the soil. The chemical and physical properties of the soil, and the relative values of the different fertilizers now in use, and their employment in cultivation as a paying investment, are fully discussed.

The annual interest derived from the proceeds of the congressional land-grant was $3,040, of which $2,018 were received by the agricultural and mechanical college, and the remainder, $1,022, by the school of mines and metallurgy, at Rolla. None of the land has been sold during the year. Several thousand dollars have been appropriated for apparatus and large purchases made of books for the library.

Professors in the agricultural and mechanical college, 7; assistants, 1; students, 21; professors in all the departments, 17; assistants, 11; students, 391, 70 of whom are in the school of mines and metallurgy.

Missouri School of Mines and Metallurgy, at Rolla, (a department of the University of the State of Missouri;) Charles P. Williams, Ph. D., director.—This school combines theory with practice. In addition to the duties of school-instruction, the director and professors, with the assistance of the students, have done a large amount of work for the State in the chemical analyses of lead, copper, zinc, and iron ores from different mines of the State. The percentage of the several metals and the associated minerals of the ores has been accurately ascertained. Seventeen distinct analyses of lead ores, from different mines, have been made and formulated. The ores employed in these analyses were of great purity, having in no case yielded less than 99 per cent. of lead. The associated minerals were arsenic, antimony, silver, copper, iron, cadmium, zinc, and nickel. It is thought by the director of the school that the results arrived at by these analyses will very much increase the value of the industrial resources of the State.

Maps of surveys of mines and drawings of furnaces and reduction-works have been made by the more advanced students, and display much art and skill in their preparation. The school received, as its share of the annual interest derived from the proceeds of the congressional land-grant, $1,022. None of the land has been sold during the year.

Professors, 5; assistants, 1; students, 70.

NEBRASKA.

University of Nebraska—Agricultural College at Lincoln; Rev. Edmund B. Fairfield, DD., LL. D., chancellor.—The present chancellor was inaugurated on the 22d of June, 1876, and his inaugural address, is given in the register of the university for 1876. He shows what, in his opinion, a university in this country ought to be. Of the agricultural college he says: "You have done well in attaching the agricultural department to the State university. Scientific agriculture belongs of right to every university arrangement, especially in a country of which agriculture is so important and general an interest as it is with us."

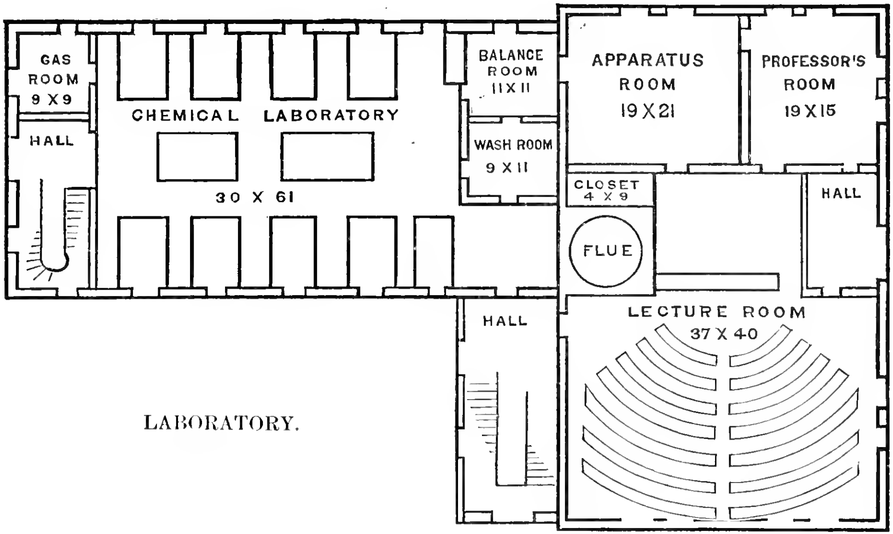
None of the congressional land-grant of July 2, 1862, has been sold, and the expectation is that it will not be disposed of for some time to come. The land is rapidly increasing in value, and by a provision of the new constitution of the State none can be sold for less than $7 per acre. In consequence of this foresight in withholding the land from sale a large endowment-fund will accumulate. The State received another grant of 44,800 acres from Congress for the establishment of the university, and it is estimated by the president of the board of regents, Mr. S. J. Tuttle, that the aggregate endowment-fund of the college and university will amount to at least $1,000,000, and very probably to $1,500,000, when the land is all sold. The university building and grounds were paid for by the proceeds of the sale of lots in Lincoln, and the experimental farm, consisting of 320 acres, by the sale of two sections of land granted by the State for that purpose. The farm is valued at $18,422. Experiments have been made on it during the year to determine the effect of fall and spring plowing on crops; with grasses, to ascertain what kinds are best adapted to the climate of Nebraska; with oats, wheat, and barley, received from the Department of Agriculture; and with mangel-wurzels and sugar-beets, to learn which would be the most profitable for stock-feeding. A slight change has been made in the manual-labor system, by which students, instead of doing any labor that may come to hand, are to have special charge of certain kinds of work, under the oversight of the superintendent, to be responsible for the manner in which it is performed and for the results obtained, and to keep an exact account of the expenses and labor bestowed upon it. Students are paid for their labor ten to fifteen cents per hour, according to the work done.

Professors in the college, 5; students, 13; professors in all the departments, 9; students, 282; 122 of whom are ladies.

NEVADA.

Nothing has been done during the year in relation to the establishment of an agricultural and mechanical college in this State. Applica-

PLATE XIII.



LABORATORY.

MISSOURI STATE UNIVERSITY.

PLAN OF FIRST STORY FLOOR.

tions have been made at the State land-office for portions of the congressional land-grant of July 2, 1862, at $1.25 per acre, but no land has been sold.

NEW HAMPSHIRE.

Dartmouth College—New Hampshire College of Agriculture and the Mechanic Arts, at Hanover; Rev. Asa D. Smith, D. D., LL. D., president.—The exercises of the graduating class are represented by the examining committee to have been of a high order. The subjects were as follows: "Cotton and its manufactures;" "Water and its domestic uses;" "Building materials of New Hampshire; "Irrigation;" "The manufacture of paper;" "Copper and its refining;" "Education of farmers." Of the students who have graduated since the opening of the college, twelve have engaged in agriculture, nine in mechanical occupations, and five in other employments. Thirty students have labored the past season on the farm, and have earned $20 to $90 each, according to the number of hours occupied.

The farm contains 365 acres, and is valued at $21,000. There have been raised on it 150 bushels of corn, 610 of oats, 168 of barley, 100 tons of hay, and a large quantity of garden vegetables. Only a small part is under cultivation; 16 acres being devoted to tilled crops, and the remainder to hay. The uncultivated part is timber and pasture land. The yield of hay was from 2 to 4 tons per acre. The stock kept on the farm consists of 8 cows, worth $440; 1 yoke of oxen, $200; 4 heifers, $200; 11 heifers, $407; 2 horses, $300; 12 shoats, $300; 4 pigs, $16; and 1 full-blood Durham bull-calf, $200; total value, $2,063. The barn has been completed. It is a fine building, 100 by 50 feet, clapboarded and painted. It has a capacity for storing nearly 200 tons of hay; a tool-room 20 by 20 feet; 24 stalls for cattle; 4 calf-pens; and the usual arrangements in the basement. It has a good supply of pure water, brought in pipes from a neighboring spring.

The annual interest derived from the proceeds of the congressional land-grant is now $4,800. The examining committee thus speaks of the success of the college: "In closing this report, we deem it a duty, as well as a pleasure, to bear our testimony to the eminent ability evinced by the president in discharging the difficult duties of his position, and by his able corps of professors, who have labored so long and earnestly to raise this institution to the highly-respectable position it now occupies among the agricultural colleges of our country."

Professors in the College of Agriculture and the Mechanics Arts, 7; assistants, 4; students, 24; professors in all the departments, 22; assistants, 7; students, 439.

NEW JERSEY.

Rutgers College—Scientific School, at New Brunswick; Rev. William H. Campbell, D. D., LL. D., president.—During the year the facilities afforded the students for studying analytical chemistry have been much improved, and a large amount of work has been done in the laboratory in analyzing commercial fertilizers and other substances. The trustees, in their report, say that the progress of the school has been highly gratifying and satisfactory. The laboratory-work of the students in analytical chemistry has received the marked approval and commendation of proficients who have visited the rooms, and will compare favorably with the best results other institutions.

A barn has been built, and the outbuildings re-arranged and improved. The barn is 60 feet long and 40 wide, with posts 22 feet. The main floor has stables for seven horses, feed-room, large thrashing-floor, and spacious bays for hay. There is a cellar under the whole barn on a level with the cattle-yard, which is on the south side. It has in it stanchions for 17 cows, a room for roots, and places for storage of cut-straw, hay, or stalks. Water is supplied for the stables and yards from the city water-works. Lapping on the large barn about 6 feet is another 48 feet long and 26 wide, with posts 18 feet. In the lower part are rooms for a horse, milk-wagon, and for loading cans of milk; pens for bull and calves, and open space unappropriated. The upper part is designed for hay and straw.

The experimental farm contains 100 acres, and is valued at $45,000. When purchased it was almost worthless for farming purposes, but by removing stones, thorough drainage, and skillful cultivation, it has been brought into a high state of fertility. Experiments have been made on it with fertilizers on wheat, oats, corn, potatoes, turnips, and in feeding milch-cows. The long drought in 1876 caused a failure in these experiments, and also in the crops. It was the most severe ever known in New Jersey. The crops began to suffer in the latter part of June, and there was no rain to afford them any material benefit till the 17th of September. Potatoes were entirely destroyed; corn did not grow to half its common height, and the crop was only about one-fifth of its usual amount; pastures dried up; cabbage-plants could not be set out; turnip-seed would not sprout when planted, and carrots and mangolds could make no growth. For want of pasture and green fodder it was found necessary to feed farm-stock on other substances through July and August. The average rain-fall in the months of June, July, and August was only 3.17 inches; for twenty-two years previous to this it averaged for the same months 14.03, and the lowest amount recorded for these months in any previous year is 6.09 inches. The only good crops raised on the farm were wheat and rye, which had made most of their growth before the drought became severe. The yield of wheat on 14 acres of not very good ground was 25 bushels per acre, but on some experimental plots it was 40 to 48 bushels. The variety cultivated was the Fultz. The loss of crops on this farm, occasioned by the drought, is estimated to be at least $1,000. The annual interest derived from the proceeds of the congressional land-grant is now $6,960.

Professors in the scientific school, 9; assistants, 1; students, 42; professors in the college, 11; assistant, 1; students in all the departments, 162.

NEW YORK.

Cornell University—Colleges of Agriculture and the Mechanic Arts, at Ithaca; Andrew D. White, LL. D., president.—No changes have been made during the year in the literary operations of the colleges. The teaching-force of the university has been increased by the addition of six instructors. The college-farm contains 150 acres, and is valued at $22,000. Experiments have been made on twenty-two plots with oats as a soiling crop, cut early and late; to ascertain the effects of sowing in drill and broadcast; of rolling the ground; of gypsum, lime, and salt; of thick and thin sowing; the comparative values of different varieties; to test the effects of Professor Stockbridge's fertilizers: on twelve plots of wheat, to try the Lois Weedon system modified; to show the effect of gypsum and superphosphate; the results of continuous crops with perfect cultivation, but without fertilizers; to ascertain the amount of seed required: on fifty plots of corn, to ascertain the effects of various commercial fertilizers, gypsum, and ashes; to compare results of planting soaked and unsoaked seed; to determine the proper number of stalks in a hill; to compare the productiveness of suckered and unsuckered plants; the values of seeds from the butts, middle, and tops of ears; to ascertain the comparative value of seven varieties of fertilizers; and of pure fertilizers compounded by Professor Caldwell: on twenty-eight plots of grass, to test the effects of various fertilizers as top-dressing: in feeding cattle, to ascertain the effects of various kinds and quantities of food on the quantity and quality of milk: and in breeding cattle, to ascertain the value in the milk-dairy of the progeny of certain pure breeds crossed with the common cow.

The following are some of the conclusions arrived at, viz: that gypsum is of little value to corn and grass in wet seasons, but of great value in dry; that superphosphates are of very unequal values, those of the best reputation proving of little value on the soil of this farm when applied to moderately-fertile and well-cultivated land; that strict laws are needed in the State of New York to control the sale and manufacture of commercial fertilizers; that failures in farming result not so much from poor soil as from poor culture, imperfect preparation of the soil, and stagnant water in the subsoil; that clover and cattle are the cheapest renovators of worn-out fields; that early-sown crops require the least quantity of seed, and promise the best results; that heavy land should not be deeply plowed in the spring; the best results are obtained from land plowed moderately deep in the fall, covered with manure in the winter, and replowed to half the depth in the spring.

The annual interest derived from the proceeds of the congressional land-scrip is $35,000. There have been sold during the fiscal year 17,447 acres of the land, at an average price of $4.65 per acre, and 375,000 acres remain unsold.

Professors in the College of Agriculture, 20; assistants, 12; students, 26; in the College of Mechanic Arts, professors, 11; assistants, 10; students, 58; in all the departments, professors, 31; assistants, 23; students, 526.

NORTH CAROLINA.

University of North Carolina.—College of Agriculture and the Mechanic Arts, at Chapel Hill; Mr. Kemp P. Battle, president.—During the year a chemical laboratory has been thoroughly fitted up for qualitative and quantitative analyses with apparatus and gas, the apparatus costing $2,000; also, a large and commodious hall for lectures on physics, with apparatus worth $2,000. As soon as means will permit, the trustees of the college will make arrangements to give students efficient and practical instruction in matters pertaining to the farm. In addition to the regular course of study in agriculture, instruction will be given largely by lectures, not only by resident professors, but by practical farmers who have devoted time, study, and attention to certain specialties. The college owns some land, which it intends to use for an experimental farm, but it has not yet been surveyed, nor brought into a proper condition for the cultivation of farm-crops. A gold medal, worth $10, is offered to the scholar who, after one year's study, shall pass the most meritorious written examination in chemistry.

The university has an extensive collection of minerals, both native and foreign, to illustrate the courses of study in mineralogy and geology. The Vienna cabinet comprises 2,000 fine specimens of minerals, collected from every quarter of the globe. The large collection of ores, minerals, and fossils, made by Dr. Emmons, and given to the university by the State, has been classified and neatly arranged in a room fitted up especially for the purpose. An instructor in natural history has been employed, and some collections for a museum in this department of study have been made; also, a hall has been provided for an agricultural museum, and a few agricultural implements have been deposited in it. The library contains 5,000 volumes of well-selected books, especially adapted to illustrate the branches taught in the different courses of study. The students of agriculture and the mechanic arts have free access to these works in the same manner as those of the other departments. The annual interest derived from the proceeds of the congressional land-grant is now $7,500, being the interest, at 6 per cent., on the new State bonds, which amount to $125,000. The interest on these bonds is now collected and paid over regularly to the trustees for the support of the college. The college-year is divided into two terms. The expenses of a student for room-rent, washing, board, wood, light, and books are from $93.50 to $123.50 per term; tuition free.

Professors, 7; assistants, 2; students in the college, 61; in all the departments, 106.

OHIO.

Ohio Agricultural and Mechanical College, at Columbus; Edward Orton, Ph. D., president.—This college has been in operation three years, and is now in complete working order. The report of the president shows that a large amount of work has been accomplished in all the departments. Military science and tactics have been introduced as a regular branch of study and drill, and Lieut. Luigi Lomia has been detailed by the Secretary of War to take charge of the instruction in this new department. All male students, not incapacitated by bodily infirmity or exempted on the ground of conscientious scruples, are required to take part in the military drill, but are at liberty to choose for themselves whether they will pursue the course in military science or not. Four drill exercises, of thirty-five minutes each, are required weekly. The War Department has furnished the college with a full supply of arms and ordnance of the most approved patterns.

The college-farm contains 320 acres, and is valued at $200,000. Its value has been recently much increased by its being brought within the city limits. Extensive improvements have been made upon it during the year. A swamp of 60 acres has been reclaimed by underdraining, and the most of it is now dry and in good condition for cultivation. Fences have been built, one small building removed and another erected, and a supply of excellent water furnished for the stock at the barn. The total cost of these improvements was $1,690. Experiments have been made with wheat to determine the comparative value of thick and thin sowing; with oats, to ascertain which varieties were most productive; and with corn, to test the effects of different fertilizers. There were raised on the farm 1,975 bushels of corn, on 46 acres; 363 bushels of wheat, on 32 acres; and 75 tons of hay, on 57 acres; total value of all the crops, $2,122; net profit, $1,342. A part of the work was done by students and a part by hired labor. Nine head of fat cattle were sold from the pasture for $835; 32 hogs, for $733; 14 pigs, for $42. Six of these cattle, having been bought the year before, were kept through the winter, and sold for $90 each. The stock now kept on the farm is valued at $1,812, and the farm-implements at $994.

The annual interest derived from the proceeds of the congressional land-grant is $30,000. The receipts of the college from all sources during the fiscal year were $40,539; the disbursements $38,517, of which $26,970 were paid for salaries. John H. Wright, A. B., assistant professor in the Latin and Greek languages, has resigned his professor-ship to enter upon an extended course of study in Europe. His place has been filled by Josiah R. Smith, A. B., a graduate of Amherst College.

Professors, 10; assistant, 1; student, 140; pursuing agricultural or mechanical studies, 126.

OREGON.

Corvallis College—State Agricultural College, at Corvallis; B. L. Arnold, Ph. D., president.—The president, says that the college is in a healthy condition and well attended. During the past two years about one hundred young men have pursued agricultural studies. They have received instruction in practical agriculture, the physiology and chemistry of plants, analysis and improvement of soils, animal physiology, the economic use and preservation of farm-crops, and other branches of the agricultural course important for farmers to understand. A wing has been added to the college building, and other improvements have been made, the whole costing about $3,000. The building as now improved is of such size as to afford ample room for several years. A greenhouse will be built in a few months. The apparatus has been so much increased by yearly additions that it is now sufficient for illustration of all the fundamental principles of chemistry and physics. A fine collection of minerals has been added to the cabinet, for the special use of the class-room, through the kindness of A. H. Brown, secretary of state.

The experimental farm contains 35 acres, and is valued at $5,000. Experiments have been made with wheat in connection with soda, potash, lime in three forms, ashes, sulphuric acid, marl, chlorine, superphosphate of lime, urine, and ammoniated phosphate. The conclusion was that the fertilizer last named is by far the best; it hastens the crop, and causes a much larger yield than any of the others. Analyses and tests of the "white soil," mentioned in a previous report, have been continued, and the conclusion arrived at is that if it is thoroughly drained, well plowed, and cultivated with green crops for several years, it will produce grain as well as any other. All students are required to perform a small amount of labor on the farm and to practice the military drill daily.

The annual interest from the proceeds of the congressional land-grant has not been reported. The State makes an annual appropriation of $5,000 for current expenses of conducting the college. During the fiscal year 10,000 acres of the land-grant have been sold at an average of $2.50 per acre, and 79,300 remain unsold.

Professors, 4; students in agricultural college, 51; in all the departments, 147.

PENNSYLVANIA.

Pennsylvania State College, Centre County; Rev. James Calder, D. D., president.—This college has undergone some changes in its name, but its purposes as an agricultural and mechanical college remain the same. According to the latest documentary authority it was first incorporated as "The Farmers' High School of Pennsylvania," February 22, 1855; next, as "The Agricultural College of Pennsylvania," May 1, 1862; and lastly as "The Pennsylvania State College," July 26, 1874.

The four farms belonging to the college contain 600 acres, and are valued at $75,000, as follows: The college-farm, 300 acres, at $100 per acre, $30,000; the central experimental, 100 acres, at $100 per acre, $10,000; the eastern experimental, 100 acres, at $200 per acre, $20,000; the western experimental, 100 acres, at $150 per acre, $15,000. The work which has been done on these farms for many successive years in experimentation and with the aim of presenting model farms has been extensive, and results have been arrived at which are of high practical value to the farmers of the State. Experiments have been made during the year in acclimating seeds, testing varieties of seeds and grains, methods of cultivation, the use of manures, various rotations of crops, the culture of wheat and potatoes, soiling cattle, and culture of fruit trees.

From various experiments continued for several years the professor of agriculture has come to the conclusion that it is profitable to feed cattle during the winter for furnishing manure; that stock, when confined to small lots or yards and soiled, do equally as well, if carefully attended, as when allowed the liberty of the fields, and can be fed on the product of one-third lessl and; that purple lucerne (*Medicago sativa*) is a good soiling-plant on strong land, yields heavily, grows rapidly, bears cutting, and is perennial; that the old method of cutting indiscriminately the large and small potatoes for seed, not going to extremes, and of planting the seed and root ends, is practically as good as any other; that in planting apple-orchards it is the most profitable to plant only two or three varieties, and these of the most marketable kinds; that surface-culture, good manuring, scraping, and washing the trees with an alkaline mixture, and a dressing of five or six pounds of muriate of potash per tree, have proved to be a very profitable mode of treatment. The college-farm has been very much improved by clearing off old stone fences, removing worthless hedges, and planting fruit-trees; and the campus, by constructing roads and filling up inequalities.

The annual interest derived from the proceeds of the congressional land-grant is now $24,420. Some small buildings have been erected and others repaired, and arrangements have been made for supplying the college with an abundance of pure spring-water. About $500 have been expended for apparatus for the physical department, and $100 for increasing the library.

Professors 12; assistant, 1; students, 161.

RHODE ISLAND.

Brown University—Agricultural and mechanical department, at Providence; Rev. E. G. Robinson, D. D., LL. D., president.—The course of study in the department of practical science for the degree of bachelor of philosophy has been extended from three years to four, as contemplated by the university last year. There is no prescribed course laid down in the catalogue for students in agriculture, but provision has been made in the department of practical science for selected courses of instruction in such branches of learning as are related to agriculture and the mechanic arts. Students who enter with the intention of pursuing selected studies are subject to the same conditions of admission as for the regular scientific courses; and when they have completed the studies which they have selected, they are entitled to a certificate stating the time of their connection with the university and the amount of their acquisitions. Direct instruction in agriculture appears to have been given by the professor of agricultural zoology and curator of the museum. He says that during the last half of the year a weekly course of lectures on agricultural zoology has been given to the senior class. About one-fourth of the class have also attended to taxidermy as a voluntary exercise throughout the year.

The annual interest from the original fund derived from the proceeds of the congressional land-grant is $3,000; but this fund has been allowed to accumulate by judicious management, so that the annual interest now amounts to $6,624. Very valuable additions have been made to the museum, consisting of about 100 specimens of fishes; 50 of woods native to Massachusetts; a large collection of plants, insects, and native weapons; war-implements, domestic utensils, and fabrics from the interior of Africa; several species of mammals, and numerous miscellaneous specimens.

Professors in the agricultural and mechanical department, 10; assistants, 3; students, 35; professors in all the departments, 13; assistants, 3; students, 251.

SOUTH CAROLINA.

Claflin University—South Carolina Agricultural College and Mechanics' Institute, at Orangeburgh; Rev. Edward Cooke, D. D., president.—The annual interest derived from the proceeds of the congressional land-grant is $11,508, but the whole amount is not always paid to the college by the State. This year it received $10,000, leaving a balance of $1,508 unpaid. Of the sum received, $4,000 were used for expenses in conducting the college and the remainder in payment of the experimental farm. The farm contains 116 acres, and is valued at $10,000. It has been considerably improved during the year, and the facilities for students to engage in manual labor have been much increased. Experiments have been made with different kinds of manures and in plowing to ascertain the kind best adapted to the soil and climate of that part of the State. Crops have been cultivated successfully, and 43 bushels of shelled corn were produced per acre, which is much above the usual yield in the State. A neat and commodious brick building is in course of construction on the site of the one burned about a year ago, and will be completed next spring. It will be occupied jointly by the university and college. It is 80 feet long and 40 wide, three stories high, with mansard roof, making a fourth story, and has a piazza on the front and back sides. It contains two school-rooms, three recitation-rooms, library-room, and thirteen dormitories in the mansard story; also, a chapel which will seat two hundred persons, and a family residence, with parlors, kitchen, and dining-room. Besides this building, there are several others which are used for school purposes. The collegiate year is divided into three terms of eleven weeks each. Tuition is free; care of room per term, $1; board in hall per week, $2.50; room-rent and fuel for self-boarders per term, $3. Students have an opportunity of paying their bills in part by manual labor.

Professors in the college, 3; assistants, 3; students, 40; professors in all the departments, 4; assistants, 3; students, 195.

TENNESSEE.

East Tennessee University—Tennessee Agricultural College, at Knoxville; Rev. Thomas W. Humes, S. T. D., president.—Some changes have been made during the year in the agricultural course of study, by which additional instruction is given in chemistry and botany in the freshman year, and in market-gardening and dairy-farming in the junior. A few additional branches have also been introduced into this course.

The annual interest derived from the proceeds of the congressional land-grant is $23,760, but the college has not always received the full amount, the payment having sometimes been made in State treasury warrants, on which there is a discount in the market.

The college-farm contains 260 acres, and is valued at $24,000. Important improvements have been make on it during the year, and experiments conducted in the cultivation of wheat with different fertilizers, with white rye received from the Department of Agriculture, and with barley. From experiments made with timothy-grass, it has been discovered that it cannot be relied on as a permanent crop in the locality of the college, being incapable of resisting the drought, and after two cuttings dies out. Orchard-grass, on the contrary, flourishes well, and is not permanently injured by dry weather. A new barn has been erected on the farm, and apparatus for instruction in chemistry has been purchased to the amount of $300; seventy-two dollars' worth has also been purchased for the use of the professor of agriculture.

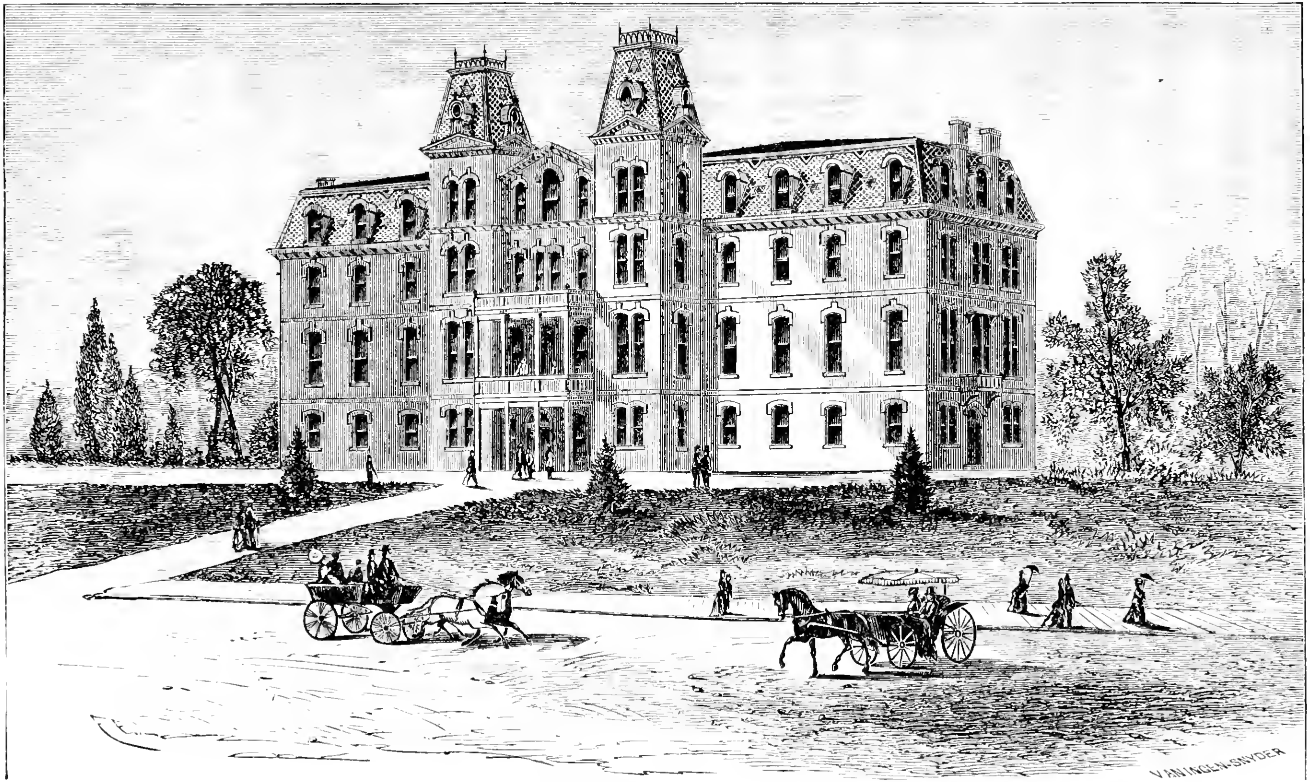
Professors in the agricultural college, 9; assistants, 3; students, 58; professors in all the departments, 9; assistants, 8; students, 300.

TEXAS.

Agricultural and Mechanical College of Texas, at Bryan; Thomas S. Gathright, A. M., president.—The college was inaugurated and opened for the reception of students October 4, 1876. It is beautifully located, in a healthy section, four miles from Bryan, on the Houston and Texas Central Railroad, and is easily accessible from all parts of the State. The college building, of which an engraving is here presented, is claimed to be equal to the best in the country. It is 153 feet long, 60 wide, four stories high, and is built of brick, except the foundation, which is stone. The window and door sills and caps are made of Texas granite. On each floor, except the fourth, it contains three halls, running the entire length of the building. The two set apart for literary societies will each accommodate 400 persons. On the fourth floor are a chapel, 60 feet square, six lecture-rooms, library, president's office, cadets' room, armory, and guard-room. The remaining rooms are for students' dormitories The inside of the building is finished with native cypress in the highest style of architecture, varnished to show the texture of the wood to the best advantage. Besides the college building, there is another called the "students' hall," four stories high, and built of the same materials as the main building, but not so elaborately finished. Also four brick cottages for professors' residences, and a nice barn. The cost of the college building was $100,000; of the students' hall, $32,000; and of the smaller buildings, $20,000. The State appropriated the liberal sum of $187,000 for the erection of these buildings and the purchase of the farm. None of the fund granted by Congress has been used.

There are five courses of study in the college: (1) Preparatory and general; (2) in agriculture; (3) in mechanics and engineering; (4) in languages and literature; (5) in military tactics. The first-named course occupies three years. It is designed to afford the student a good education for the practical duties of life, or to prepare him for entering upon any special course he may choose. Each of the special courses occupies two years. The general course includes rhetorical reading, declamation, English grammar, composition, higher arithmetic, geography, history, drawing, algebra, geometry, trigonometry, physics, chemistry, geology, plain and topographical surveying, zoology, animal and vegetable physiology, elements of agriculture, French, Spanish, German, Latin, Greek, and military tactics. Modern languages may be substituted for Latin and Greek, if desired. The course in agriculture includes analytical geometry, conics, calculus, physics, astronomy,

PLATE XIV.



Agricultural and Mechanical College of Texas.

chemistry, structure and physiology of plants, water, the atmosphere, soils in their relation to vegetable products, improvement of the soil by chemical and mechanical means; history, care, breeding, diseases, food, digestion, respiration, assimilation, and excretions of domestic animals; milk, butter, cheese, flesh, and wool as agricultural products; development and present condition of agriculture as an art, its principles, economic requirements of vegetable growth, soils and theory of manures, plowing, physical manipulations of land, implements and machinery; drainage, construction, and arrangement of farm buildings; care of grass and pasture lands, rotation of crops, use of artificial fertilizers, designs for farm-machinery, meteorology, farm and road surveying, water-courses for irrigation and draining, book-keeping, free-hand drawing and sketching, strength of materials, practical hydraulics and pneumatics, mineralogy, geology, zoology, insects injurious and beneficial to agriculture; care and marketing of crops; orchard and vine culture; Latin, French or German, and military tactics.

It is prescribed, "as a permanent rule of this college, that no applicant for admission as a student shall be received unless of the white race." Provision is made for educating, free of tuition, "State students," as follows: Two to be appointed from the State by the United States senators, one from each congressional district by the member representing it, and three from each State senatorial district. In the latter case, the choice is to be determined by a competitive examination under the direction of the district senator. Tuition for other than State students is $50 per annum. The estimated expenses of a State student for a year of nine months, including matriculation-fee, board, washing, fuel, lights, two suits of clothing, and medical attendance, are $200; of other students, $250.

Special care is taken to give thorough instruction in military tactics, including, besides the general drill, guard duty and outpost-picket service. To aid in teaching this branch in the best manner, the State has provided the students with complete sets of breech-loading cadet-rifles, swords, and accouterments.

In August of the present year an act was passed by the legislature to establish another agricultural and mechanical college for the education of colored youth of the State, and the college will be organized and put in operation at the earliest day practicable.

The annual income from the proceeds of the congressional land-scrip is $10,962 in gold, which, in the present currency, is equal to about $12,000. The land appropriated by the State to the college, and on which the college buildings are located, embraces 2,200 acres, a part of which is used for an experimental farm, and the remainder is unimproved. The entire tract is valued at $20,000. Liberal appropriations have been made for chemical and philosophical apparatus, and it is intended to purchase such as will be equal in quality to the best used in the agricultural colleges of the other States.

Professors, 6; students, 50. Sufficient time has not been given for the organization of classes in the agricultural course of study.

VERMONT.

University of Vermont and State Agricultural College, at Burlington; Matthew H. Buckham, A. M., president.—The college has not yet entered into the work of conducting an experimental farm, although it has land in ample quantity for experimental purposes, and would gladly use it for a farm if the funds could be procured to provide the necessary equip-ments and a professor of agriculture to superintend it. The annual interest derived from the proceeds of the congressional land-grant is $8,130. Professors in the agricultural college, 7; assistant, 1; students, 23; professors in all the departments, 22; assistants, 3; students, 168; 14 of whom were ladies; lady graduates, 5. The following statement has been received from the president:

An attempt to establish a separate institution out of the proceeds of the congressional land-grant having failed for want of sufficient additional endowment, the legislature, in 1865, offered the fund to the State University on the condition that it should accept a new charter conforming it to the requirments of the act of Congress establishing colleges of agriculture and the mechanic arts. The institution thus chartered is the "University of Vermont and State Agricultural College," having one board of trustees, one treasury, one faculty, but several departments. The State has as yet done nothing to increase the resources of the institution. On accepting its new trust, the university raised a subscription of $80,000, mainly among its alumni and old friends, to enable it to meet its new responsibilities. Three new departments were created, that of general and agricultural chemistry, that of civil engineering, and that of modern languages.

Besides these, the department of natural history was modified and enlarged so as to give greater scope to the studies bearing directly on agriculture, such as mineralogy, botany, physiology, and zoology. The institution does not manage a farm, but it has land ample for experimental purposes if funds should be supplied therefor. About 100 students are in attendance, the numbers in the scientific departments being from one-quarter to one-third the total number. By the statistics furnished for the report of the congressional committee in 1874, it appears that of those who have been members of the institution for a longer or shorter time since 1865, a large number have entered into the various industrial pursuits by which the resources of the country are developed, and that thus the college is fulfilling the designs of its founders by sending well-trained men into the great industries of the nation. In addition to the work of the institution in its new ground, it has done considerable missionary work through the State by sending its professors to farmers' meetings, teachers' associations, and other general gatherings. During the past winter Professor Cressy, late of the Massachusetts Agricultural College, was employed by the university to lecture in every county in the State on the diseases of animals, and to give a consecutive course on veterinary medicine and surgery in Burlington. These lectures were provided in the hope that in this way the attention of young farmers might be drawn to the college, and that they might be induced to pursue other branches of study bearing on agriculture. Finding that these lectures through the State awakened a great interest on the subject, the college had the lectures in Burlington reported, and a large edition of the reports in pamphlet form distributed gratuitously among the farmers and stock-raisers of the State.

From the beginning the institution has had to encounter opposition from those whose ideas of an agricultural college is a mere manual-labor school for apprentices to farm-work. The aim of the institution has been to provide, first, for instruction in those sciences—those "branches of learning" which relate to agriculture and the mechanic arts; to equip laboratories, to furnish museums, to secure apparatus, to gather all the appliances for imparting scientific and practical instruction, and to add, as fast as funds could be got, the means of exemplifying such instruction in farm, stock, machinery, &c.

VIRGINIA.

Virginia Agricultural and Mechanical College, at Blacksburgh; Charles L. C. Minor, LL. D., president.—One of the two college buildings, referred to in our report of last year as being in course of construction, is now completed and occupied. It is used for lecture and recitation rooms, laboratories, &c. The other, which is of the same size and finish and designed for similar purposes, will be completed and ready for occupancy early in the spring of 1877. The two dwelling-houses, begun last year and intended for professors' residences, are also completed and occupied. They are neatly finished and of excellent quality. So great has been the increase of students since the opening of the college in 1872, that the number is now doubled, and no more can be received in future until the resources of the college are augmented. The machine-shop, which was completed two years ago, has been enlarged and furnished with additional machinery and tools. A grist-mill has been erected adjoining it, and is driven by the same engine as the machinery of the shop. The addition to the shop, the mill, and a brick kitchen were all built by the students, except the mason-work. They have also set up a line of telegraph, connecting the college with the Western Union Telegraph line, and thus furnished for themselves a practical school for learning the art of telegraphy. They have removed two houses, and remodeled three messing and lodging houses. By employing the messing system they have sometimes reduced the price of board to $6.50 per month. Board with lodging can be had for $10 per month, and never exceeds $15. Many students pay a large part of their expenses by their work, and some who have skill in trades have been able to cancel the whole.

The college-farm contains 250 acres, and is valued at $28,000. Important additions have been made to the stock kept on the farm. Daily instruction is given in practical agriculture to details of students during the crop-season, and in mechanics throughout the collegiate year. The school of drawing, including free-hand drawing, has been attended with great efficiency and success. The course of instruction in the college is confined strictly to what is believed to be best for fitting young men for success as farmers and mechanics. The annual interest derived from the two-thirds ($190,000) of the proceeds of the congressional land-scrip received by this college is $20,638.72, which is nearly 11 per cent. on the $190,000 invested in Virginia State bonds. The bonds were purchased at a little more than 50 cents on a dollar, and interest is paid on their full amount.

Professors, 7; assistants, 3; students, 255, all of whom pursued agricultural or mechanical studies; graduates, 27, 22 being graduates in agriculture, and 5 in both agriculture and mechanic arts.

Hampton Normal and Agricultural Institute, at Hampton; General Samuel C. Armstrong, president.—The receipts of the institute for the fiscal year of 1876 were $67,444.94. Of this sum, $39,235.74 were derived principally from private donations made by benevolent persons in the several States. The disbursements were $67,332.41, leaving a balance of $112.53 in the hands of the treasurer. The indebtedness of the institute is only about $4,000.

During the year a new Hoadley agricultural steam-engine, of nine horse-power, has been purchased for $1,200, and the small three horse-power Baxter engine used last year has been transferred to the printing-office, where it is used with profit. The earnings of the agricultural engine for work done in thrashing for farmers unconnected with the institute have amounted to $200. In addition to this, a steam-digester for steaming bone has been bought for $154, and a buhr-stone mill for grinding corn for stock and steamed bones into flour of bone for manure. Also a Hunneman hand fire-engine, with 700 feet of hose, for $1,200, to be used in protecting the institute buildings. A fire-company has been formed by the students, who have been drilled and are capable of performing efficient duty in case of fire. The grounds have been graded and improved by filling up a malarious marsh in the vicinity of the institute buildings, an ornamental pond being left in the center, which adds much to the beauty of the landscape and serves for a reservoir from which water can be taken in case of fire and thrown upon five adjacent buildings. Hundreds of shade-trees have been set out, taken from the farm-nursery, which was planted five years ago. More than 2,000 small ornamental trees have been added to the nursery-stock, for sale and for use in increasing the beauty and value of the premises. A substantial brick engine-house has been built and a corridor finished off in the upper story of Virginia Hall, making ten dormitories for girls. A cooper-shop has also been put into operation for the manufacture of market barrels. The work has been done by two students, and proved profitable. Two hundred and twenty-four thousand bricks have been manufactured and sold at a profit of $1,246. Three-fourths of the students pay their own board-bills, $10 per month, half in cash and half in labor. About $7,000 are paid annually for students' labor in all the industries pursued. Mr. F. Marquand, of New York City, gave, in June last, $5,000 for the erection of a building for a home for male students. It is now completed, and called Marquand Cottage. It affords comfortable and excellent rooms for thirty-eight young men. The furniture will be made by the students in the normal-school workshop.

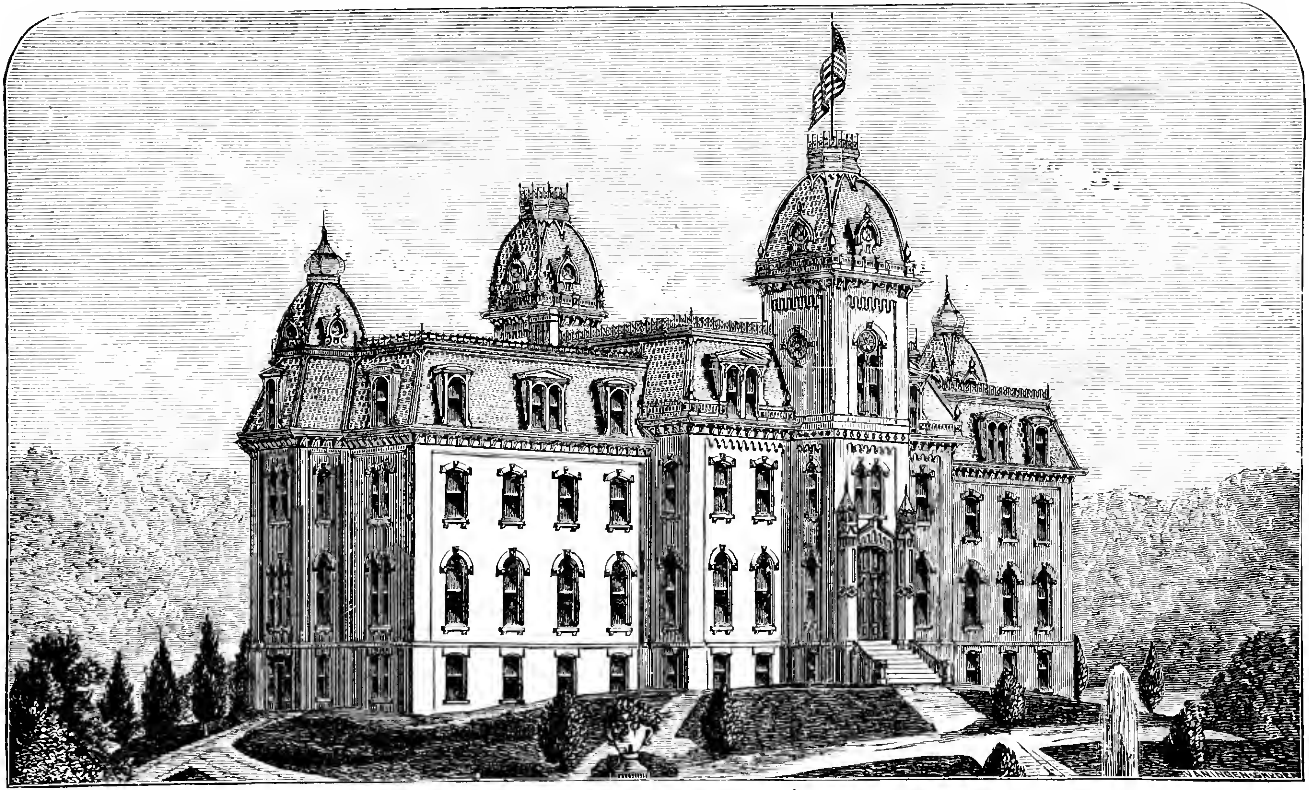
Sixty-nine girls have worked in the industrial room during the year, and about 1,200 pieces of work have been finished, and 200 mended by them each week, besides making dresses and other garments for themselves in time not devoted to required labor. Sewing-machines are used by the more advanced pupils. Those in the middle and senior classes receive weekly instruction in housekeeping, bread-making, and plain cooking, eight being detailed every Saturday to the different housekeepers on the premises, who teach them in these useful arts. Last winter about 4,000 colored children were under the instruction of teachers who have graduated at this institution. A teachers' institute has been held for the benefit of the graduating class and such post-graduates as might desire to attend. Twenty post-graduates and more than forty of the graduating class availed themselves of the advantages of its exercises.

The farm contains 190 acres, and is valued at $33,000. During the year 40 acres of corn have been cultivated, 25 of oats, 1 of rye, 12 of clover, 7 of early potatoes, 8 of sweet-potatoes, 9 of corn-fodder, 3 of sorghum, 3 of pease, 2½ of cabbages, 2 of onions, 4 of asparagus, 2 of roots, 1 of snap-beans, 4½ of vegetables and strawberries, and 4 of broom-corn. The stock on the farm consists of 9 horses and mules, 5 colts, 18 cows, 4 oxen, 16 yearlings and calves, 1 thoroughbred Ayrshire bull, 50 hogs, and 20 sheep. Seventy head of cattle and horses were wintered on the farm the past season. The care of this stock furnished labor for students, and a large amount of manure is made for the farm. Cash received from sales of beef amounted to $3,840. The income of the farm exceeded the expenditures by $833.43, while the knowledge acquired by the students in its cultivation is incalculable.

The annual interest on the one-third ($95,000) of the proceeds of the congressional land-grant received by this institution is $10,319.36, being nearly 11 per cent. on the sum invested. About $200 more are received from a small private endowment-fund. In addition to the income from these sources, $17,000 are required annually to pay the expenses of conducting the institute. The money thus far has been derived from private contributions, principally in the Northern States.

Teachers, 17; assistants, 3; students, 256; pursuing agricultural or mechanical studies, 99.

PLATE XV.



West Virginia Agricultural College.

WEST VIRGINIA.

West Virginia University—Agricultural Department, at Morgantown; Rev. J. W. Scott, D. D., LL. D., acting president.—A permanent president of the university has not yet been elected, but it is expected that one will be soon. The central portion of University Hall, or the Agricultural College, has been completed during the year. It is claimed that there is no better-finished public building in the State. The wings will be erected as soon as means will permit. The following is the plan of the entire building when completed, as seen in the accompanying engraving: Length, including the wings, 150 feet; breadth of the main central section, 104 feet; of each of the wings, 65 feet; height of basement, 11 feet; of first floor, 17½ feet; of second floor, 15½ feet; of mansard story, 20 feet; of the main tower from basement, 101 feet. There are four rooms each on the basement and second and third floors, measuring 23½ by 35 feet each. They are for laboratory and lecture-rooms. In the mansard story is the commencement-hall, 55 by 78 feet. The basement-walls are made of light sandstone, of uniform color and texture; the other walls, of pressed brick, laid in white mortar; window-sills, corbels, and keystones, of light sandstone; finials and belts on pilasters of entrances, &c., cut stone; belt-course on both towers, composed of *fascia* and water-table, of cut stone. The inside is elegantly finished with chestnut. Estimated cost of the entire building when completed, $75,000. A new building, called University Boarding-hall, has been erected by private enterprise in close proximity to the university, designed to supply a want which the regents had been unable to meet. It is heated by furnaces, has a plentiful supply of soft water, and is furnished with modern appliances for thorough ventilation and conveniences for outdoor exercise. Board, including everything except washing and lights, is furnished to students for $3.75 per week.

The annual interest on the proceeds derived from the congressional land-grant is $5,400. The State has made at different times two appropriations of $10,000 each to the university for a permanent fund, the interest of which is shared in common by the different departments. It amounts to $1,200 annually. These incomes and the tuition received from the students are not, however, sufficient to pay the annual expenses of conducting the institution, but the deficiency has been generously supplied by the State, so that there is no incumbrance of debt. An effort has been made to induce students to pursue the agricultural course of study, but not with the success desired. Quite a number, however, pursue studies relating to agriculture and the mechanic arts. It is expected that this embarrassment will be corrected when the college becomes older and the importance of an agricultural education is more highly appreciated. The university has no farm. The campus contains 25 acres, but is not used for agricultural purposes.

Professors in the university, 8; assistants, 5; students, 96; professors in the agricultural department, devoting a part of their time, 5; students, 2.

WISCONSIN.

University of Wisconsin—College of Arts, at Madison; Rev. John Bascom, D. D., LL. D., president.—Science Hall, referred to in our last report as being in course of construction, and then described as far as information would permit, is now completed. It is a magnificent brick building, four stories high, and really constitutes the agricultural and mechanical college of Wisconsin. In it are the machine-shop, carpenter-shop, chemical laboratory, cabinet of natural history and agriculture, and numerous other rooms mentioned in a previous report. It is heated by steam, and has a system of water-works from which the same power that operates the machinery used for instruction in the mechanical shops supplies an abundance of water for its own use and Ladies' Hall, and for the hydrants which are in connection with all the principal buildings. There is also an ample system of sewerage connecting Science Hall and Ladies' Hall with Lake Mendota, by which cleanliness and health are secured.

The department of agriculture is reported as in successful operation, and its scope and benefits as appreciated by the people. The experimental farm contains 196 acres, and is valued at $40,000. The university grounds occupy 40 acres, which are not included in the area of the farm as now given. The professor of agriculture and chemistry, W. W. Daniells, M. S., has conducted experiments on the farm with four varieties of winter-wheat, ten of spring-wheat, one of rye, four of barley, six of oats, five of corn, and thirteen of potatoes. The yield of winter-wheat was about double that of the summer varieties. Experiments have also been made with soils to test the effects of different depths of plowing, which varied from 5 to 20 inches. The largest yield of corn was obtained on land plowed at a medium depth of 12 inches. Extensive meteorological observations have been made several times each day throughout the year on the temperature of the atmosphere, barometrical changes, relative humidity, direction and force of wind, kinds of clouds, and fall of rain and snow. The annual interest derived from the proceeds of the congressional land-grant is $13,490. There have been sold of this grant during the fiscal year 6,218 acres, at an average price of $7.34 per acre; and 51,635 acres remain unsold.

Professors in the agricultural and mechanical college, 10; assistants, 6; sudents, 124; professors in all the departments, 29; assistants, 7; students, 316, 77 of whom were ladies. The board of visitors, in their report, say that "in the present senior class the percentage of young women to be graduated with honor in respect to higher scholarship is, relatively to their whole number, decidedly larger than that of the young men; and this disparity is emphasized by the loss to the latter of the first honor."

The report of the board of regents thus refers to the female department:

The act to re-organize the university, enacted in 1866, requires that "the university shall be open to female as well as male students, under such regulations and restrictions as the board of regents may deem proper." In pursuance of this requirement, the educational privileges of the university are extended to students of both sexes without discrimination, thus far with no reason to regret the obligations imposed by the law. But the regents do not understand that the law, in providing an equality of educational privileges, contemplates any special experiments in the matter of education, or the adoption of any rules or regulations founded upon any novel or theoretical view of the personal and social relations of the sexes. The law assumes that young ladies possess the capacity and the disposition to acquire that degree of knowledge and mental discipline in the study of the arts and sciences which is imparted by a course of collegiate instruction. It assumes no more. It certainly does not assume to approve any method of instruction or discipline contrary to the current and accepted views of the parents who have children to educate. And while the board is responsible to the law for the fulfillment of all the obligations imposed in this respect, it is equally responsible to the public, and especially to the parents and guardians of students confided to their charge, for the enforcement of such prudent rules of discipline as the circumstances render obviously judicious and appropriate. Parents, therefore, should feel assured, and possess positively good reasons for the assurance, that those young ladies who by their presence at the university contribute equally to the honor and reputation of our educational system, while here specifically for educational purposes, are sacredly exempt from every phase of social influence or instruction of an exceptional or obnoxious character, and that such exemption is required and enforced as a matter of good faith on the part of both regents and faculty. The privileges of the university are thus accorded to young ladies under regulations as purely unobjectionable and unexceptionable as those provided for any other school of similar character and purpose, public or private. About one-quarter of the whole number of students now attending the university are young ladies, successfully competing for equal rank with the remaining number in the several departments of instruction. With a due appreciation on the part of the public of the valuable advantages thus conferred upon both classes of students without distinction of sex, and of the views of the authorities upon the subject, there is reason to anticipate a more equal proportion in the number fitting for and attending upon the university classes.

Statistics for 1876 of the industrial institutions of the United States which have

Number of States having industrial institutions.	Location of the institution.	Number of industrial institutions.	Name of the institution.	Name of the president of the agricultural and mechanical college and of the university.
1	Auburn, Ala	1	Agricultural and Mechanical College of Alabama.	Rev. I. T. Tichenor, D. D.
2	Fayetteville, Ark.	2	Arkansas Industrial University	N. P. Gates, A. M.
3	Berkeley, Cal	3	University of California—Colleges of Agriculture and Mechanics.	John Le Conte, M. D
4	New Haven, Conn	4	Yale College—Sheffield Scientific School	Rev. Noah Porter, D. D., LL. D.
5	Newark, Del	5	Delaware College	William H. Purnell, LL. D
6	Eau Gallie, Fla	6	Florida State Agricultural College	Hon. William Watkin Hicks, (president of the trustees.)
7	Athens, Ga Dahlonega, Ga	7	University of Georgia. Georgia State College of Agriculture and the Mechanic Arts. North Georgia Agricultural College.	Rev. Henry H. Tucker, D. D., LL. D., (chancellor.)
8	Urbana, Ill	8	Illinois Industrial University	John M. Gregory, LL. D., (regent.)
9	La Fayette, Ind	9	Purdue University—Indiana Agricultural College.	Emerson E. White, LL. D
10	Ames, Iowa	10	Iowa State Agricultural College	A. S. Welch, LL. D
11	Manhattan, Kans	11	Kansas State Agricultural College	Rev. John A. Anderson
12	Lexington, Ky	12	Kentucky University—Agricultural and Mechanical College.	John B. Bowman, LL. D., (regent.)
13	New Orleans, La	13	Louisiana State Agricultural and Mechanical College.	Maj. J. L. Cross
14	Orono, Me	14	Maine State College of Agriculture and the Mechanic Arts.	Rev. Chas. F. Allen, D. D.
15	College Station, Md	15	Maryland Agricultural College	Capt. William H. Parker
16	Boston, Mass	16	Massachusetts Institute of Technology	John D. Runkle, Ph. D., LL. D.
	Amherst, Mass	17	Massachusetts Agricultural College	William S. Clark, Ph. D., LL. D.
17	Lansing, Mich	18	Michigan State Agricultural College	Theophilus C. Abbot, LL. D.
18	Minneapolis, Minn	19	University of Minnesota. College of Agriculture College of Mechanic Arts	William W. Folwell, M. A
19	Oxford, Miss	20	University of Mississippi—College of Agriculture and the Mechanic Arts.	General Alex. P. Stewart, (chancellor.)
	Rodney, Miss	21	Alcorn University—Agricultural and Mechanical College.	Hiram R. Revels, D. D.
20	Columbia, Mo Rolla, Mo	22	University of Missouri. Agricultural and Mechanical College. Missouri School of Mines and Metallurgy.	Samuel S. Laws, LL. D.
21	Lincoln, Nebr	23	University of Nebraska—College of Agriculture.	Rev. Edmund B. Fairfield, D. D., LL. D., (chancellor.)
	Nevada	...	(No industrial institution established in the State.)	....
22	Hanover, N. H	24	Dartmouth College—New Hampshire College of Agriculture and the Mechanic Arts.	Rev. Asa D. Smith, D. D., LL. D.
23	New Brunswick, N. J.	25	Rutgers College—Scientific School	Rev. William H. Campbell, D. D., LL. D.
24	Ithaca, N. Y	26	Cornell University. College of Agriculture Sibley College of the Mechanic Arts.	Andrew D. White, LL. D.
25	Chapel Hill, N. C	27	University of North Carolina—College of Agriculture and the Mechanic Arts.	Hon. Kemp P. Battle
26	Columbus, Ohio	28	Ohio Agricultural and Mechanical College	Edward Orton, Ph. D
27	Corvallis, Oreg	29	Corvallis College—State Agricultural College.	B. L. Arnold, Ph. D
28	Centre County, Pa	30	Pennsylvania State College	Rev. James Calder, D. D.

a The States having blanks against them in this column have sold all their scrip or land.
b This college has not been opened to students.

received the national endowment of land-scrip under the act of July 2, 1862.

Number of professors and assistants in the agricultural and mechanical college for the collegiate year.	Number of students in the agricultural and mechanical college for the collegiate year.	Number of students in the agricultural and mechanical college pursuing agricultural or mechanical studies.	Number of professors and assistants in the university, including all the departments, for the collegiate year.	Number of students in the university, including all the departments, for the collegiate year.	Number of acres sold during the year of the scrip or land granted by Congress July 2, 1862.	Average price per acre of the scrip or land sold during the year.	Number of acres unsold of the scrip or land granted by Congress July 2, 1862.	Annual interest derived from the scrip or land granted by Congress July 2, 1862.	Number of acres contained in the agricultural and mechanical college farm.	Value of the agricultural and mechanical college farm.	Number of States having industrial institutions.
7	104	80	......	......	(*a*)	......	......	$16,224	160	$2,000	1
12	45	45	12	270	......	......	......	10,400	160	12,000	2
19	50	59	35	307	......	......	......	45,000	200	200,000	3
31	230	230	89	1,021	......	......	......	8,100	No farm..	......	4
8	43	16	......	......	......	......	......	4,980	......	......	5
(*b*)	......	......	......	......	......	......	......	6,068	......	......	6
8	93	93	33	512	......	......	......	14,010	60	*1,500	7
5	245	30						3,000	25	1,000	
15	187	187	27	386	(*c*)	......	25,440	28,200	570	56,000	8
8	1	1	8	120	......	......	......	20,314	159	47,700	9
15	300	75	......	......	5,956	$2 20	175,244	34,822	850	51,000	10
16	303	303	......	......	5,604	5 83	31,461	20,491	255	25,000	11
8	94	94	27	273	......	......	......	9,900	433	130,000	12
6	209	115	......	......	......	......	......	13,731	600	40,000	13
8	115	115	......	......	......	......	......	7,864	370	10,000	14
6	77	40	......	......	......	......	......	6,900	285	14,250	15
36	293	293	......	......	......	......	......	4,011	......	......	16
8	111	111	......	......	......	......	......	8,022	383	37,000	
13	166	166	......	......	2,474	8 38	164,799	16,880	676	47,320	17
8	6	6	19	267	3,706	5 41	52,187	13,901	120	12,000	18
6	15	15	12	131	......	......	......	5,679	100	2,000	19
4	......	......	4	57	......	......	......	5,679	250	5,000	
8	21	21	28	391	(*c*)	......	328,429	2,018	640	60,000	20
6	70	70						1,022	......	......	
5	13	13	9	282	(*d*)	......	90,000	None.....	320	18,422	21
......	......	......	......	......	(*d*)	......	90,000	None....	......	......	
11	24	24	29	439	......	......	......	4,800	365	21,000	22
10	42	42	12	162	......	......	......	6,960	100	45,000	23
32	26	26	54	526	17,447	4 65	375,000	35,000	150	22,000	24
21	58	58									
9	61	61	9	106	......	......	......	7,500	Unknown	......	25
11	140	126	......	......	......	......	......	30,000	320	200,000	26
4	51	51	4	147	10,000	2 50	79,300	Unknown.	35	5,000	27
13	161	161	......	......	......	......	......	21,420	600	75,000	28

* Exclusive of the value of the college building the original cost of which was $24,000.
d This State has sold none of the scrip or land granted by Congress July 2, 1862.
c This State has sold no scrip or land during the present year.

Statistics for 1876 of the industrial institutions of the United States

Number of States having industrial institutions.	Location of the institution.	Number of industrial institutions.	Name of the institution.	Name of the president of the agricultural and mechanical college and of the university.
29	Providence, R. I	31	Brown University—Agricultural and Mechanical Department.	Rev. E. G. Robinson, D. D., LL. D.
30	Orangeburgh, S. C	32	Claflin University—South Carolina Agricultural College and Mechanics' Institute.	Rev. Edward Cooke, D. D.
31	Knoxville, Tenn	33	East Tennessee University—Tennessee Agricultural College.	Rev. Thomas W. Humes, S. T. D.
32	Bryan, Tex	34	Agricultural and Mechanical College of Texas.	Thomas S. Gathright, A. M.
33	Burlington, Vt	35	University of Vermont and State Agricultural College.	Matthew H. Buckham, A. M.
34	Blacksburgh, Va	36	Virginia Agricultural and Mechanical College.	Charles L. C. Minor, LL.D.
	Hampton, Va	37	Hampton Normal and Agricultural Institute.	General Samuel C. Armstrong.
35	Morgantown, W. Va	38	West Virginia University—Agricultural Department.	Rev. J. W. Scott, D. D., LL. D.
36	Madison, Wis	39	University of Wisconsin—College of Arts.	Rev. John Bascom, D. D., LL. D.
	Total			

which have received the national endowment of land-scrip, &c.—Continued.

Number of professors and assistants in the agricultural and mechanical college for the collegiate year.	Number of students in the agricultural and mechanical college for the collegiate year.	Number of students in the agricultural and mechanical college pursuing agricultural or mechanical studies.	Number of professors and assistants in the university, including all the departments, for the collegiate year.	Number of students in the university, including all the departments, for the collegiate year.	Number of acres sold during the year of the scrip or land granted by Congress July 2, 1862.	Average price per acre of the scrip or land sold during the year.	Number of acres unsold of the scrip or land granted by Congress July 2, 1862.	Annual interest derived from the scrip or land granted by Congress July 2, 1862.	Number of acres contained in the agricultural and mechanical college farm.	Value of the agricultural and mechanical college farm.	Number of States having industrial institutions.
13	35	35	16	251	....	......	....	$6, 624	No farm..	....	29
6	40	40	7	195	....	......	....	10, 000	116	$10, 000	30
12	53	53	17	300	....	......	....	23, 760	260	24, 000	31
6	50	....	......	....	....	......	....	12, 600	2, 200	20, 000	32
8	23	23	25	168	....	......	....	8, 130	No farm..	....	33
10	255	255	......	....	....	......	....	20, 639	250	28, 000	34
20	256	99	......	....	....	......	....	10, 319	190	33, 000	
5	2	2	13	96	....	......	....	5, 400	No farm..	....	35
16	124	124	27	316	6, 218	$7 34	51, 635	13, 490	196	40, 000	36
473	4, 197	3, 354	516	6, 723	51, 405	4 41	1, 463, 505	526, 283	11, 338	1, 295, 192	

The foregoing tables show an increase, compared with the previous year's report, of 10 instructors of all grades and 494 students in the agricultural and mechanical colleges of the different States. Agricultural-college scrip was sold in larger quantities than in the previous year. It is noticeable that the price per acre realized shows an increase, having risen from $3.27 to $4.41, or nearly 35 per cent. As the amount of unsold land is thus annually reduced its value per acre will appreciate still more rapidly, and those institutions which have reserved their lands will enjoy a great advantage over those that rushed into the market at an early day. Vast masses of endowment-lands were sold as low as 80 cents per acre.

For the first time since this Department has begun to publish the annual statistics of agricultural education has it been practicable to present even an approximate statement of the proceeds of this endowment-fund available for the support of the faculties. The annual interest of all the institutions, except two or three, is given at $526,283, which, at 6 per cent. per annum, represents an investment of $8,771,383. The Commissioner of the General Land-Office, in his annual report for 1869, states the aggregate claim upon the public domain accruing under the agricultural-college-scrip legislation at 9,510,000 acres, which, at the minimum price, $1.25 per acre, amounts to $11,987,500. But the prudence with which some institutions have husbanded their resources has raised the average much above this minimum. There yet remain 1,463,305 acres to be disposed of, which, at the average price obtained during the last year, will add about six and a half million dollars to the fund. It will doubtless average much higher than this, and will probably raise the aggregate to nineteen or twenty millions of dollars.

DIGEST OF STATE REPORTS.

CONNECTICUT.

With the exception of a brief article on the subject of fruit-culture, the eighth annual report of the Connecticut State Board of Agriculture, for the years 1874–'75, is entirely devoted to a discussion of questions relating to the production and manufacture of milk. The work is of more than average value, as many of the papers and discussions are of an exhaustive character.

The annual meeting was held at New Haven, May 27, 1874. A farmers' convention, under the management of the board, convened at Woodstock, December 16, 1874, and continued for three days. Milk, its production and manufacture, was the only subject discussed. Leading agriculturists and dairymen were in attendance from various sections of the country and took an active part in the discussions.

Mr. T. S. Gold, secretary to the Board, opened the discussion. He stated that there was not only a diminished number of cattle in the country, but also a decreased production per acre of grass and other forage-plants. To remedy this evil, as it relates to, and has a direct bearing upon, dairy products, he advises the rearing and keeping of a better grade of cows—cows that will give more milk on the same amount of feed—thereby increasing the profits of the dairy by decreasing the cost incident to keeping a larger number of cattle. Not only the quantity of the milk may be thus increased, but the quality also may be greatly improved. He says:

Cows differ almost as much in the quality of their milk as they do in their external form and appearance. The amount of the principal constituents, as casein or curd, butter, oil, and sugar, can be easily ascertained and their variations marked, but there are more subtle qualities, giving rise to flavor and to its hygienic properties, which, while more difficult of determination, are of no less importance in a sanitary point of view and in the estimation of the customer. If the product varies so much when the animal is in health, how will it be when disease supervenes to form another important element in the calculation? Cows often continue to give a good flow of milk under local and constitutional disorders. The cow-pox, the fouls, garget, disturbances of the alimentary canal, foot and mouth disease, and pleuro-pneumonia, though interrupting, do not always prevent, the secretion of milk. The cow-pox, even in its mildest form, often causes the teats to crack and bleed, and the exudation may drop into the pail. Harsh handling of the udder in milking, or some slight injury, often causes one-quarter to give bloody milk; and garget, when it does not entirely stop the flow of milk, injures its quality in all degrees of vileness. All the secretions of an unhealthy animal must be tainted, and milk is no exception. * * * Garlic and onions, and in some degree the cabbage family, to which the turnip belongs, give their peculiar odor to the milk. Weedy pastures abound in vegetation of strong odors and taste, liable to be transferred to the milk. Drink as well as food may introduce impurities. Out of one hundred and seventy families supplied with milk from a dairy in Islington, England, seventy suffered from typhoid fever. One hundred and sixty-eight individual cases occurred in ten weeks, and thirty died. An investigation showed that the cows drank water from an old underground tank, built of wood and much decayed. * * * Professor Law, of Cornell University, relates a similar case where the milk had a ropy or slimy character, and a microscopic examination revealed the presence of certain animated germs, which had their rise in the filthy pool from which the cows drank. These entered into the secreted milk, and there multiplied to such a degree as to render it entirely unfit for food. * * * Even impure air breathed by the cow will taint her milk. It is reported on good authority that the milk from a dairy in the State of New

York when brought to the cheese-factory was found tainted, and on examination the cause was discovered to be a putrid carcass lying in the pasture. * * * Milk and cream set in the dairy are very susceptible to odors of every kind. The smoke of the kitchen, of cooking vegetables, are readily absorbed. The proximity of the hog-pen, or of the milking-yard, sometimes taints the milk. Wherever milk is kept, either in the spring-house or dairy, every pains should be taken to secure a pure atmosphere. When the milk is set in a kitchen, dust and smoke will affect it injuriously, and first-quality butter cannot be made from it.

Mr. Nathan Hart presented a paper on feeding for the production of milk. He states that he is engaged in developing an enterprise involving the winter dairy as an important part of dairy husbandry in a territory formerly interested largely in the fattening of cattle. In this new enterprise the question of feeding for the production of milk being one of great importance, he has devoted much time to an investigation of the subject. A series of experiments with different kinds of fodder and ground feed has convinced him that hay is the basis for all winter feeding, and that made from the natural and cultivated grasses grown on upland meadows is the most valuable, if cut early and nicely cured. This may be supplemented with sowed corn and the annual grasses, millet, Hungarian grass, and others. Different varieties of roots are also valuable, and more concentrated food is found in corn, oats, buckwheat, rye, wheat, and brewers' grains. The latter is used extensively in the vicinity of New York, where these experiments were made. Different methods of preparing these materials, and entirely different proportions and varying quantities, are used either from choice or necessity. Mr. Hart says:

After a more or less extended inquiry and trial, guided by the closest observation and a full knowledge of the net results, I have adopted the practice of feeding hay and all kinds of what is generally denominated fodder, uncut, and (including ground feed,) dry, and I apprehend that the varying results may be accounted for more in the external conditions and the quantity and quality than in the preparation. The system of the cow is a laboratory in which chemical and mechanical changes are constantly going on; into this we put the raw material, consisting of the articles named; a part the animal uses to support itself, to run the machinery, to keep up warmth, repair the waste; a part is thrown off as refuse, and a portion is yielded for the support and profit of the farmer. How milk is produced, whether it is a secretion or the result of some other operation of nature, is for the physiologist, and perhaps the chemist, to investigate. What is required of the feeder is to give the cow just such quantity, quality, and relative variety and proportion as shall give the greatest quantity, reference being had to the cost of the material and the value of the product. The question of profit and loss should enter into the calculation. If too large quantities of these substances (all or any of them) are given, digestion will be interfered with and the yield of milk will be diminished. If too little, it will be the same, as the proportion needed to support the cow will leave a smaller surplus for the pail, and right here, it seems to me, lies the field of investigation and experiment. There is a point in quantity and concentration of milk-producing constituents beyond which if we go we do it at a loss. If we feed a pail of new milk to a cow, it will not affect the flow of milk so much as a quart of bran in a pail of lukewarm water with a little salt thrown in, other things being equal. The point aimed at, then, is to feed in quantity, quality, and condition so as to secure perfect digestion and the largest possible product at the least possible expense, having regard to quality and profit and loss.

Is it necessary to cook it to secure perfect digestion? If it is necessary, will or will not the increased capital, skilled and consequently more expensive labor, more than counterbalance the benefits of cooking? May we not secure, very nearly, the same result at much less expense, and at the same time secure a larger margin of profit in consequence? * * * Hay should be cut early and nicely cured, and fed in quantity with other substances just as much and no more than is perfectly digested, and as nearly regulated in time and manner as we observe the habits of the animal indicate when left to help herself when at pasture. My own practice is to give a light feed the first thing in the morning, which will be eaten up clean in ten or fifteen minutes, while the milking is going on, and then the ground feed is given dry with a small quantity of salt. In about an hour the cows are let out to go to water, and I prefer they should go twenty or thirty rods, to drink from warm springs, and get exercise, rather than drink almost frozen water in the yard. While they are absent the stables are cleansed and another feed about the same as the first given, and the cows put up immediately on their return, which will be in about an hour, and they stand or lie down at their choice, in an atmosphere almost a genial as the family sitting-room in respest to temperature. If I am feeding roots, they are fed just before milking at night, and the last feed of the day is given immediately after, which is always the largest, and is dictated by what I observe when the animal is at pleasure, which is that she always takes the largest meal just at night. A healthy cow giving milk in winter has a voracious appetite, and if allowed will eat far more than she can properly digest, and therefore much is wasted unless the quantity is regulated by careful observation and experiment.

Mr. Hart gives the results of his experiments in feeding for the production of milk: First dairy of 12 cows, commencing April, 1870, and ending March, 1871, produced a total of 30,680 quarts, being an average of 2,556 quarts per cow. Second dairy of 21 cows, distributed through the year, about the same; total, 53,445 quarts; per cow, 2,549 quarts. Third dairy of 18 cows, 47,100 quarts; average per cow, 2,617 quarts. Fourth dairy of 12 cows, averaging for three years, 2,416 quarts. The lowest net proceeds were $85 per cow, with milk at 4 cents per quart for six months and 2½ cents per quart for six months.

During a discussion which followed the reading of this paper, Mr. Hart stated that he did not think the feeding of turnips imparted any deleterious taste to the milk, especially if they were properly fed. It would not do, at first, to give the cow a full ration of any kind of roots. If commenced in a moderate way, the quantity may be increased until the cow can take all she will eat without communicating any bad flavor to the milk. As to the profits of feeding turnips for the production of milk, Mr. Hart says:

A few winters since I was feeding common turnips, and when the supply was exhausted I had the curiosity to estimate the value of turnips per bushel for feeding purposes from the returns that I actually received from the milk. We were then getting 6 cents per quart for our milk. The diminished flow of milk resulting from discontinuing this feed of turnips enabled me to calculate that the turnips were worth 25 cents per bushel to feed to cows. I refer to the common flat or field turnip. But as to their saving hay, I do not think they do. I think they act as an alterative, and their use will cause the cow to more perfectly digest her food. It seems to be adapted to the wants of the cow and produces a good digestion. I feed just before milking.

Dr. E. Lewis Sturtevant read a paper on the physiological considerations concerning feeding for butter and cheese. He states that milk derives its whiteness and opacity from the presence of innumerable globules of very minute size, floating in a water-like fluid or serum. These globules are composed of the butter-fats inclosed in a capsule or membranous covering, and vary in size from the 1,500th of an inch to granules of less than the 27,000th of an inch in diameter. The variation in size varies with the breed; it varies with the time from calving, and it varies with the food. After describing the process of the formation of these globules, and indicating their source, he says they are found to be larger in the Jersey cow than in the Ayrshire cow, and the Ayrshire globules are larger than those from the American Holstein. These globules are covered by a membrane of extreme tenuity, which protects their contents, and has to be ruptured through the process of churning before the contents of the different globules can aggregate into butter. This covering is more easily broken in some breeds than in others. The Jersey cream can be churned into butter more quickly than can the Ayrshire cream. These coverings are also differently affected by the acidity developed in the milk. Twenty-four hours' standing will hasten the churning of Jersey milk more than will forty-eight hours affect the churning of Ayrshire milk. The contents of these cells are in varying proportion, and the mixture seems in part physical. Thus, the butter made from the milk of one breed may be more waxy than butter made in a like manner from milk from a cow of a different breed. The butter made from the large globules of a milk appears to be of a superior grain to the butter made from the small globules of the same milk. Globules of a large size are more easily ruptured through the process of churning than those of a small size, and those of extreme minuteness cannot be ruptured at all. Consequently the quantity of butter obtained in practice is not dependent entirely on the amount of fat in the milk by analysis, but rests upon the form in which it occurs. By means of a microscopic study of milk, the experienced worker can judge of the butter-value of a milk, and can quickly separate from a herd those cows which produce an unprofitable milk for the butter-manufacturer. He can also separate those milks which are the least valuable for the cheese-maker from those that are the most valuable. He can also tell to a certain extent what food will make his milk best for his purpose. Of the effect of food upon the yield of butter from milk of different breeds, the writer says:

The question of the effect of food upon the butter is, therefore, principally a question concerning nutrition, of the digestibility of food, and of the ability to cause certain constituents of the food to be taken up in a quantity sufficient for the wants of the animal as determined by structure. When a cow is producing less butter than her structure fits her for secreting, then must an increase of proper food increase her butter product. When her food is unfitted, through its character or condition, to supply the blood with the requisite elements, then must a change of food for the better be beneficially perceived on the butter-yield. We have an individual influence, however, which complicates the action of nutrition, for the superior cow is more a creature of art, the inferior cow more the production of nature, and accordingly the best and poorest cow of a herd being fed with an increased supply of food, in every case the better cow will respond to a greater extent than the poorer.

The influence of the fats of the food in accelerating digestion and other chemical reactions of the food is of importance in a practical view of the effect of the feeding. It is even probable that the nearer the food given approaches the state in which its elements are found in the product, (if the food be digestible in this state,) the better the result. It is even probable that the presence of certain oils or fats in the food may influence to some extent the proportionate quantity of the separate oils in the butter and the fat. It is but as we regard an animal as a whole, and attempt to know her by the study of the history of how she came to be what she is, as well as what she is, that we can form an understanding of the action or product of any particular part. We recognize the formation of butter as allied to the formation of fat, with this essential difference: the fats are formed and stored subject to the order of the animal economy; the butter is formed and thrown off, and thus disconnected with the animal structure is nominally subject but to the order of an external being, the calf or the milker.

The summary of what would be indicated by the theory of the cow and her food is that each cow has a limit to production, governed by structure, and the greatest gain of butter is when her food keeps her to this limit and is not in excess. Second, that the character of the food must influence to a certain extent the character of the butter, but that in the presence of abundant and similar food, heredity exerts a prepotent influence. The third indication is that the proportion of the butter stands in no definite relation with the casein, but that either may be increased within certain limits without a proportionate increase of the other. I call this an indication only, for we have not as yet presented the formation of casein, but will here assume that it arises in the milk through an entirely different process from the butter, and although influenced by structure, yet in a different manner from that in which the butter element is influenced, and there is accordingly no necessarily direct co-relation between the quantity of these two products.

A summary of facts indicating the same propositions as our theory is, first, that common experience has shown that one cow is always better than some other cow in a herd, and that no matter what may be the food the poorer cow can never, on the same kind of food, and both abundantly supplied, equal in product the better cow. Our second proposition is shown by the experiments of Thomas Horsfall, as given in full in the Journal of the Royal Agricultural Society of England, xvii, 260; xviii, 150. Our third, is the fact that the difference between the butter percentage of various breeds is far greater than is the difference between the case in percentage; that series of analyses of same milks at different periods from calving indicate no ratio between the two.

In maintaining that superior cows will always respond to increase of food to a larger extent than inferior ones, Dr. Sturtevant states that in just so far as animals have been removed from the natural state through breeding will they be influenced in their product by a more nutritious and concentrated kind of food; for natural food may not be the best attainable under an artificial environment which not only exists, but has been of long continuance, although the same food may be the best in a state of nature. The art of man consists in intensifying natural conditions in the direction toward his own desires. The natural food of animals, although best for the wild condition, cannot be considered as natural food when the whole condition of life of the animal, and her habits and functions, have been modified to a very large extent from those habits and functions of the undomesticated state; for artificial methods of long continuance, and artificial conditions brought about through artificial environment, tend to so completely change the conditions of being of the wild animal, that what in the wild animal might be an artificial food may be the natural food for the domesticated animal, and *vice versa*. In fact, the establishing of harmony between form and function, food and desired product, is the using of the laws of nature through man's power for man's own good.

The practical fact which is worthy the attention of all those who keep cattle is that an increase of food, gained by the feeding of meals and other concentrated and artificial foods, may perhaps bring profit to the owner of superior animals, while the same course pursued by the owner of indifferent animals would be surely done at a loss. One farmer can feed grain to his better cows and receive a profit on the extra cost, while his neighbor, perhaps, with inferior stock, can increase his product but very little by the same means, and then this increase will not be sufficient to compensate for the extra expense. Improvement in breed, therefore, should go hand in hand with improvement in feed. The dairy-farmer who believes in artificial feeding, which experience shows to be the true course, must also, for the most profitable results, believe in an artificial breed. As the milk-functions are entirely the creation, in their usefulness, of man, and are hence artificial, the superior cow will pay a larger profit on concentrated food than will another animal, her inferior, while the inferior animals, under the feeding requisite to obtain the best results from a herd as a whole, are kept at a loss.

He closes this paper with the following summary of conclusions from the propositions advanced:

First. That the production of butter is largely dependent on breed.

Second. That there is a structural limit to the production of butter to each cow.

Third. That when the cow is fed to this limit increased food cannot increase the product.

Fourth. That the superior cow has this structural limit at a greater distance from ordinary feed, and more ready to respond to stimuli than the inferior cow.

Fifth. That consequently the superior cow is seldom fed to her limit, while the inferior cow may be easily fed beyond her limit; and, as a practical conclusion, increased feed with a superior lot of cows will increase the butter product, but if fed to an inferior lot of cows waste can be but the result.

Sixth. That the character of the food has some influence on the character of the butter, but even here breed influences more than food.

Seventh. That there is no constant relation between the butter product and the cheese product.

Eighth. That the casein retains a constant percentage, and that this percentage does not appear to respond to increase of food.

Ninth. That the casein appears to remain constant, without regard to the season.

Tenth. That increase in the quantity of milk is followed by an increase in the total amount of casein.

Eleventh. That insufficient feed acts directly to check the proportion of butter, and has a tendency to decrease the casein of the milk and substitute albumen.

Twelfth. That the best practice of feeding is to regulate the character of the food by the character of the animals fed; feeding superior cows nearer to the limit of their production than inferior cows; feeding, if for butter, more concentrated and nutritious foods than for cheese; feeding for cheese product succulent material, which will increase the quantity of the milk-yield.

A paper on the results of late European experiments in the feeding of cattle was read by Prof. W. O. Atwater, of Wesleyan University. The experiments alluded to have been prosecuted during the past fifteen years at the principal agricultural stations of Europe. The tables given are valuable and worthy the close study of those engaged in rearing cattle, but are of too great length to receive special mention in this brief review. A few of the conclusions drawn from the result of these experiments may be briefly noticed. Some of the trials made to test the effect of boiling, steaming, and fermenting fodder, with a view to increasing its nutritive qualities, showed that its digestibility did not appear to be increased by these means; still, the food was made more palatable, and, in cold weather, some advantage is derived from warm food. The nutritive effect of food may, therefore, be increased by these means, while its digestibility may be but slightly increased. The statements concerning the proportions of crude foods, as hay, clover, straw, green fodder, &c., that animals digest, apply only to cases where they are fed either alone or with proper admixtures of other foods. Very often, however, the digestible parts of the food are not all digested. It is easy, for instance, to mix potatoes or turnips with hay or clover in such proportions that the animals will digest much less of the hay than they would if the different foods were used in proper amounts. There are likewise some kinds of fodder, as straw, chaff, and corn-stalks, of which many farmers make but little account, and yet which contain a great deal of nutritive matter. In ordinary practice much of this is wasted, when, if mingled with other foods, it might be saved. As to the digestibility of different foods, Professor Atwater says:

Whether all the digestible and nutritious matter of a ration is actually digested or not depends largely upon the relative amounts of nitrogenous materials it contains. In general, when concentrated foods, rich in nitrogen, are added to crude foods, as hay and clover, they do not decrease the digestion of the latter. But the addition of large quantities of easily-digestible materials, containing little albuminoids and much starch, sugar, &c., to crude foods, prevents the digestion of part of the latter, and thus causes waste. The scarcity of hay and clover, and the ever-increasing necessity of using oil-cakes, beans, pease, grains, and other foods, has given great importance to these matters, and a large number of feeding trials have been lately made with oxen, cows, and sheep, &c., to discover the facts pertaining thereto, and their explanation. The general plan of these experiments is as follows: The animal—a cow, for instance—is fed for a certain time with hay or clover alone, and the proportion of the albuminoids and carbo-hydrates which she digests from the hay is determined by weighings and analyses of food and excrement. Then, for some time, an easily-digestible albuminoid substance, as gluten, is added to the ration, and the effect on the digestion of the hay is noted. Or, instead of the albuminoid substance alone, food-materials rich in nitrogen, as oil-cake, bean-meal, or bran, are used and their effect likewise determined. In other experiments, carbo-hydrates, as sugar, or starch, or easily-digested foods containing much of these and little nitrogen, as potatoes, are mixed with the hay or clover, and thus their influence on the digestion is determined.

The general results of these experiments are:

First. As to the effect of albuminoids. The addition of even considerable quantities of easily-digestible substances rich in nitrogen to crude fodder-materials causes no change in the digestion of the latter. As large a percentage of both albuminoids and carbo-hydrates of hay was digested by oxen, cows, and sheep when the hay was mixed with gluten, bran-meal, rape and linseed cake, &c., as when the hay was fed alone.

Second. As to the effects of carbo-hydrates. When non-nitrogenous substances, as starch, or sugar, or easily-digestible foods containing much of these and little nitrogen, are added to crude foods, as hay, straw, and clover, the digestion of the latter is decreased, and, what seems paradoxical, it is not the carbo-hydrates alone, but rather the albuminoids of the hay, whose digestion is prevented by the addition of the carbo-hydrates. An illustration of this is found in a series of experiments performed by Wolff, at Hohenheim, in which sheep were fed with clover hay alone, and 63.7 per cent. of the albuminoids, and 51.2 per cent. of the crude fiber were digested. In succeeding periods mixed rations of clover hay and potatoes were given, the proportion of the potatoes being increased in successive periods. The proportion of albuminoids digested from the hay in these periods was gradually reduced from 63.7 to 45.7 per cent., and that of the crude fiber from 51.2 to 43.3 per cent.

From experiments upon the use of potatoes and turnips with hay and clover, Wolff concludes that when hay and potatoes are so mixed that the dry substance (organic substance + ash) of the potatoes is not over one-eighth of the whole dry substance in the mixture, the hay is digested as when fed alone. But if the dry substance of the potatoes be one-fourth of the whole, the digestion of the hay will be 5 to 10 per cent. less, and if it be one-half of the whole the hay digested will be 10 to 20 per cent. less than before. The decrease of digestion from use of turnips in like proportion would be only half or three-fourths that produced by potatoes. It is probably safe to assume as a general rule that concentrated food, containing not over seven or eight pounds of digestible albuminoids to one of digestible carbo-hydrates, may be fed with hay and clover without detriment to the digestion of the latter. * * *

The writer says that crude foods like straw and chaff suffer much more loss in digestion than hay and clover when mixed with easily-digestible carbo-hydrates. These contain relatively small percentages of albuminoids and large percentages of carbo-hydrates, and when more carbo-hydrates are added the excess is of course made larger, and the digestion of both crude fiber and albuminoids made smaller. There is a difference in the quality of the food contained in the straw and the hay. The quantity of the nutritive material and its value are two different things. In other words, from the meadow-hay the animal digests a little less of carbo-hydrates and more than twice as much of albuminoids as from the oat straw. The meadow-hay is a richer food than straw, richer in albuminoids. Straw is rich in non-nitrogenous, but poor in nitrogenous nutritive material. It is, however, a very valuable fodder when fed so as to secure the utilization of the digestible material which it contains. To make it an appropriate fodder, fit for the ordinary demands of animals, it must be mixed with some other substance rich in nitrogen. In the experiments referred to, straw was mixed with bean-meal, which contains a large proportion of albuminoids; in this way the fullest utilization of both was secured.

The value of straw, corn-stalks, chaff, &c., as fodder for stock, is very much underrated by many farmers. There are two chief causes of this: one is that the crops are often allowed to stand unharvested until they have become very indigestible; the other is that they contain so little nitrogen that the animals do not digest them completely, and the material that is digested has so small a proportion of albuminoids as to be quite unadapted to their wants. It is a great error to allow forage crops, as hay, clover, grain, &c., to become too ripe before harvesting. As the plant grows older it becomes less digestible, and, further, the young and succulent plants are much richer in nitrogen than when they are older. Better a lighter crop of rich young hay, with a nutritious aftermath, than a crop of riper hay, which, though heavier, contains less digestible material, and that poorer in nitrogen. A second error is in either ignoring as fodder or feeding unmixed such foods as straw, chaff, corn-stalks, &c. These should be mixed with materials rich in nitrogen, and thus form staple and valuable food for stock.

In discussing that branch of his subject relating to feeding for the production of milk, Professor Atwater gives a table showing that 30 pounds of fine quality hay, or 120 pounds of young succulent grass, both of which materials are excellent for producing milk, will furnish just about the amounts and proportions which it is calculated a milch-cow would need to give a full yield. One hundred and fifty-four pounds of young clover contain about the same amount of digestible material, but this is richer than it need be in nitrogen. On the other hand, it would require 40 pounds of poor quality hay to furnish as much nutritive matter as the 30 pounds fine quality hay or 120 pounds of young grass, and this would contain only about one-half as much albuminoids as the cow needs for production. In the better hay and young grass there is one pound of albuminoids to about $5\frac{1}{2}$ of carbo-hydrates, in the poorer hay one to $10\frac{1}{2}$, and in the young clover one to $3\frac{3}{4}$. Cows will do well on young grass, and probably very little better on young clover, but they will not do as well on poor hay.

An experiment in *ad libitum* foddering, *i. e.*, giving the animals all they would eat, showed that the cows which consumed a ration of 87 pounds of green clover and 6.7 pounds of barley straw, produced the same quantity of milk as they did when given 123 pounds of green clover alone, while the composition of the milk in both cases was the same. The green clover was over-rich in albuminoids, and when it was fed alone there was a waste of valuable material. In this especial case a part of the waste was due to the fact that the cows were fed *ad libitum* and ate more than they could well utilize. The result shows that the nutritive material of the fodder will be more or less profitably utilized in proportion as the composition of the ration approaches more or less nearly to that most naturally adapted to the special demands of the animal.

The experiments conducted by Professor Haubner in *ad libitum* feeding are alluded to, and his conclusions quoted as follows:

> The *ad libitum* foddering has proved unsatisfactory both with milch-cows and in fattening sheep. The nutritive effect, as expressed in the quantity and quality of the milk and in increase of weight, was proportionate neither to the quantity and cost of the fodder, nor to the nutritive effect obtained from a smaller but properly-measured ration.

In answer to a question asked during a discussion which followed the reading of this paper, Professor Atwater stated that by increasing the ration up to a certain point the yield of milk may be increased, and not only the total yield but also the richness of the milk. The amount of dry substance, fat, casein, sugar, &c., may be thus increased; but at the same time the composition of this dry substance, the relative percentages of fat and casein, remain even, though the proportion of fat or albuminoids in the food may be changed. He further said:

> To feed milch-cows the largest amounts of the richest fodder may be very wasteful. Too meager fodder is still less economical. Here as elsewhere a fair mean will be found best. As regards the effect of different foods on the composition of the milk we may not hope by variation in the fodder to change a "casein" (cheese) cow to a "butter" cow. We must rather depend for the quality of the milk—the relative richness in fat or casein, its special fitness for butter-making or cheese-making—upon the peculiarities of different breeds or different individuals, and for quantity upon the peculiarities of the animals themselves; or, in few words, for quality of milk select proper breeds; for quantity, good milkers. Suit the food to the animals and feed well, but not over-richly.

At the annual meeting of the board, held in May, 1874, Gov. Charles R. Ingersoll was elected president; T. S. Gold, secretary; Profs. S. I. Smith, entomologist; W. H. Brewer, botanist; S. W. Johnson, chemist; and Mr. P. M. Augur, pomologist.

INDIANA.

The twenty-fifth annual report of the State Board for 1875 is a volume of smaller dimensions than its immediate predecessors, owing to the omission of the reports of the State geologist and the State pomological society, which have been published separately. In addition to reports of the Board, of the State association of short-horn breeders, of the State poultry association, of a meeting in the interest of the State exposition at the Centennial, of the third State fair, and of operations at the Purdue University farm, the volume contains essays on subjects of great interest to the farmers of the State.

Among the essays is one by Mr. Thomas Olcott on grain and grass growing. He says:

> The main point is to make every rod of land available in raising something useful. Good crops and increased fertility are the objects. Manuring is the life of farming. The true ideal of farm-life is to raise such variety of grains and grasses, of rich, luscious fruit and beautiful flowers, variegated with the finest selections of stock and domestic animals, as will throw a charm around that spot called home. * * * I abhor the idea of large farms with isolated homes, beyond the reach of church and school-house. The danger of large cities is preferable to the other extreme. Why pay taxes for five times as much land as you can cultivate? It is the rich, closely cultivated spots that are winning. The capability of land is almost unlimited. If 200 bushels of potatoes, or 100 bushels of corn, or 40 bushels of oats, or 25 bushels of wheat, or $2\frac{1}{2}$ tons of hay can be raised from one acre, why go over five acres to get the same amounts? Suppose you own but forty acres, and six acres of this is wood-land; on this small farm you might have nine acres in corn, five in wheat, five in oats, five in grass, two in potatoes, two in buckwheat, one acre in rye, and three acres of orchard, which would be in clover or small grain, leaving one acre for a house, barn, and garden, and one spare acre for pasture lot. Here is a great variety, and if highly cultivated would feed the family and give a surplus for market. This is not ideal, for we have approximated it the present year. But suppose each crop was brought to its highest capabilities, and that each field was enlarged according to the circumstances of your farm, how much could be done with small capital?
>
> There is one section in the State that specially needs development. Along the line of the Ohio and Mississippi Railway, particularly through the counties of Ripley and Jennings, there is a wilderness of uncultivated land, wonderfully adapted to grass-growing, and consequently to stock-raising. This land ranges from \$15 to \$50 per acre. It only waits the skillful hand, and it becomes the finest and healthiest stock-growing region of the State. Inclose these lands with a neat, substantial fence, surround its borders with native forest-trees, such as sweet-gum, maple, and white oak, all neatly trimmed; clean up the thicket; drain the wetter portions, and you have something substantial for the abundant growth of timothy, red-top, clover, or blue-grass. Most of this land will also produce any crop raised in the State. Its nearness to the best markets, its healthfulness for man or beast, resulting from its under stratum of clay and limestone, and its pure water; all these and many other advantages invite the enterprising, intelligent farmer to come and subdue this wilderness and transform it into a picture of beauty as God designed it should be. That this region of Southern Indiana is capable of the highest culture we need only refer to the few cultivated tracts already existing there. Fields of timothy yield readily two tons per acre; corn, with reasonable drainage and culture, 60 to 80 bushels. Its forests are abundantly supplied with fox-grapes as large as the Catawba. The greatest want in this entire region is more model farmers who have faith in the work, and the ability, and brain, and will-power to put it through.

The short-horn breeders' association met in Indianapolis May 26, 1876. Representatives were in attendance from almost every county in the State. Favorable reports were made by a large majority, and the outlook was thought to be very encouraging. There are now but few counties which do not contain from one to three or four herds of thorough-bred and high-grade cattle.

A discussion occurred in regard to the proper treatment of young stock intended for the shambles. Mr. Woodruff thought it most profitable to fatten and sell cattle before they were two and a half years old. He had found by experience that they could be made to weigh from 1,200 to 1,500 pounds the first year, and this ratio diminished as they grew older. Mr. Aikman stated that he had found that a calf, by proper treatment, increased in weight at the rate of about a hundred pounds a month; while a steer three years old, which would eat twice as much as the calf, would increase only at the rate of about 50 pounds a month. Mr. Thrasher (one of the oldest breeders in the State) said he was satisfied that the first thousand pounds of increase of weight cost but half as much as the second, and so on. A great mistake is made by turning cattle out on grass too early in the spring and stopping the feed. That is the very time they ought to be fed. At first they should be fed as regularly and strongly as during the winter months, and the amount of feed gradually decreased as the grass becomes more mature.

Mr. Lowder read a brief paper on the value of short-horn bulls and the characteristics of a good breeding-bull. He said:

A good short-horn bull, descended from pure ancestors, both male and female, that were themselves good, may be depended upon for producing good calves, even from very inferior cows. On an average, it would be safe to say that his calves would at one year old sell to the intelligent grazier for $10 more than those sired by an ordinary low grade; and at two years, for $25 more; and at three years old, to the butcher or shipper for $40 or $50 more. It would be safe to say that calves from such a bull, bred and kept by the well-to-do farmer until three years old, would each net him at least $25 more than those sired by such bulls as usually run the public highways, and to be found on many good farms. A little calculation would illustrate what a short-horn bull would be worth. From the time he is one year old until he is two, he would sire twenty-five calves, and after that until ten years old seventy-five a year. Suppose, then, a farmer having as many cows as one bull can serve, and he should buy a first-class short-horn of only good pedigree one year old, and should keep him three years, he would then have one hundred and fifty calves that would be worth when disposed of the nice little sum of $3,750 as the profit for the service of the bull. The bull earned it. The farmer would not have had it but for the use of the thoroughbred bull.

Stating that the last census showed that there were 393,736 milch-cows in the State, while there were now but 260 short-horn bulls, or about one-twentieth of the number needed for that number of cows, he continues:

While I am free to acknowledge that an ordinary small farmer with only four or five common cows cannot afford to pay for his own use $200 for a bull, I wish to insist that while there is a lack of at least 5,000 thoroughbred bulls in Indiana that should be supplied, and at least 50,000 farmers in our State organized into granges for the purpose of co-operation and mutual assistance in all things that pertain to their interest, no good thoroughbred short-horn bull should sell in the State at public auction for less than $500. Though the assertion may not be believed by some of my hearers, yet I declare he is worth the money, and would earn the amount in one season, if properly used, simply in the production of steers alone. Then, when we consider that there are probably not less than 250,000 cows in Indiana that ought to be replaced with half-bloods or higher grades, or thoroughbreds, and that by the use of thoroughbred bulls only the native and low-grade cows can be replaced by the high-grade or thoroughbred in a few years, the value of their services becomes more apparent. It is their known superior merits in grading up the common stock of the country that brings them into such demand, and the comparative scarcity of good bulls contributes to the high price. The price is regulated by the supply and the demand. The farmer who proposes to wait until good short-horns can be bought at beef-price will never be the purchaser of a good bull.

He gave the points of a good breeding-bull as follows:

It is impossible for any one always to tell how bulls will breed until they are tested, yet the intelligent and careful farmer or herdsman can guess with approximate certainty as to the general character of the get. A good breeding-bull must not only be like a bull, but he must look like a bull; that is, he must not look like a cow; he must be masculine in appearance. And this holds good in the pure short-horn as in the scrub, or any other breed. A good bull is as much entitled to the peculiar eye, head, horn, neck, shoulder, and chest that characterize him as a male as a man is entitled to his beard and the peculiar expression of his countenance. A bull with light jaws, narrow face and forehead, slim horns, thin neck and shoulders, is seldom an impressive sire of good things. He must be masculine in appearance. This does not imply that he must be coarse; on the contrary, he should be fine. Coarseness may be defined as unevenness, while fineness is the result of uniformity. Each part should be such that it fits smoothly and evenly to those adjoining it.

As has been said above, a bull is valuable only as his breeding is valuable. This depends, of course, to some extent upon the cows to which he is used. Great extremes between sire and dam seldom nick well together. The intelligent breeder, in making selection of his breeding-bull, will have regard to the cows with which he is to be coupled. If they are under size, he will select a bull of good size, one that is not too large. Great extremes don't mix well. If his cows are large and inclined to breed too much bone for the amount of flesh, he will select a bull of rather compact form and good fleshy qualities, but one that is not too much under size. The skillful breeder, before selecting his bull, should determine what he wants, and should be able to give an intelligent reason why he wants him; and, after having made his purchase, should know how to use him. The ability to answer intelligently to what, why, and how, is as indispensable to the intelligent breeder of neat-cattle as it is to the man in any other profession.

Mr. S. F. Lockridge read a paper on Indiana as a grazing State, which elicited some discussion. Mr. Thrasher desired to call attention more fully than the writer had to the importance of underdraining pastures. He stated that while it is found almost impossible in many portions of the State to raise corn without underdraining, but little attention is given to underdraining grass-lands. Farmers seem to think that grass will grow any way. In his opinion, it was just as necessary and important to drain grass as grain lands, and the effects will be seen in the grass and upon the cattle as readily as upon grain. In most pastures there are low places not fit for grazing, and these places are shunned by the stock whenever they can do better. It is only when they are compelled by scarcity of grass elsewhere that they will eat the inferior grasses of these low places. Nothing is better for winter forage than blue-grass, and to have this grass in winter a field should be pastured closely until about from the 1st to the 10th of June, when the stock should be taken off, allowing it to grow up and fall over in one dense mass. His reason for pasturing early is, the blue-grass seeds early, and pasturing at this period prevents the seed-stalk from forming, and then, when the stalk is removed, the grass branches out into heavy foliage—nothing but blade upon blade. Such pasture in winter is better than the best of hay. Indeed, cattle can be wintered exclusively upon such pasture and come out in the spring in fine condition, having made some growth all through the winter. As to the value of blue-grass, Dr. Stevenson said:

Blue-grass, I believe, was styled by my friend Lockridge the grass of grasses. I think, probably, he was about right; but the trouble with us is, when we get a good thing we use it sometimes a little too much. Land has become very valuable with us. In many places it is worth a hundred dollars an acre. The question is this with blue-grass: There is no doubt about its making the best winter pasture we have; there is nothing equal to it; it stands the frost and the breezes; keeps green with me until about the middle of February or the 1st of March. Would it be more profitable, taking into consideration the value of the land, worth from fifty to one hundred dollars an acre, to secure hay enough for your stock by cutting your grass and stacking it, and then feeding upon the cured grass rather than upon this winter grass in the fields? Of course you save the expense of cutting it; but it only affords green grazing. Would it not be a matter of economy to use meadows where land is very expensive, because it gives much more upon which to keep your stock? It might be best for those who have cheap land to have more winter pasture, and to the interest of those who have high-priced land to make more hay for the winter feed and to keep their cattle in houses.

As to the profits of grazing, Dr. Stevenson said:

My impression is that grazing is the great interest of the country, for, as I have already said, it does not wear out our lands, and it produces almost everything we need as a matter of subsistence. There is nothing, in my opinion, equal to beef as a meat. I think it is encouraging to short-horn breeders to know that the consumption of beef is rapidly increasing. Every farmer is using it almost exclusively. They can have good beef through the winter and the summer without running the plow at all. You have the flesh to eat, the hides for shoes, the tallow for lamps, the bones for manure, and the hair for plastering. There is nothing about the cow that is not valuable. You can raise your sheep and kill them yourselves; so that your grass produces almost everything that you need.

Mr. Thrasher gave the following description of the points of a model short-horn cow:

Head short; broad between the eyes; eyes full and prominent, yet mild; small in the muzzle, with orange nose, (black nose not allowed, mottled nose objectionable;) slim neck, neat in throat latch, with no surplus skin underneath the neck; brisket prominent and full, with straight bottom line; flank well let down; horns waxy in color, standing level with the back; wide, level hips, and low; ribbed out well behind the shoulder, with full crops; tail small; hide yellow or orange color, soft and elastic to the touch, with good thick coat of hair, with fur next the skin, as a good handler always has; fine in bone; legs tapering nicely from the body to the hoof; straight hind legs. She may be white or red, or a mixture of the two.

Mr. J. T. Williamson read a brief paper on the preparation of short-horns for exhibition. He stated that it was injurious to breeding-cows to fatten them to the extent necessary for public exhibition. Mr. Thrasher objected to this declaration. He did not think an over-fed animal would be quite so surely a good breeder as she would be in lower flesh, yet he was satisfied but few men in the country fed to an extent which would prove injurious to breeding-cattle. He claimed to have had considerable experience in the matter, and stated that he had exhibited at Indianapolis as fat short-horned cows as most other exhibitors, and they were as regular breeders as any he had. As to the popular color of short-horns, he said:

We find that the public mind now is not satisfied with anything but red. Now, I have but one objection to the red animal, if it possesses good qualities. The red color is so much thought of that whenever a red bull-calf comes into the world he is kept, whether he is any account or not. It is certainly a mere fancy. But we, as American people, take up with some hobby and never stop until we run it into the ground. It will be just so with this question of color. It is pretty near in the ground now. It is no evidence at all that a red animal, because it is red, is a perfect short-horn. There are a great many that are white as pure as the reds. The natural color of the short-horn is a mixture of the two. Yet I try to raise the reds, to accommodate the popular demand, because I can sell them better than I can the white ones or the roans. As a rule, the whites or light roans are the best "handlers" decidedly. We mean, when we say good "handling qualities," that an animal is soft and mellow to the touch when you put your hand upon it; such an animal as the butchers say will die right; its meat will be tender and juicy. * * * There are a few good handlers among the reds, but, as a general thing, they are not as good handlers as the others. If we examine the history of short-horns, we will find that the reds have had no predominance until recently; that the whites and the roans predominated until now.

The secretary of the board states that there are now seventy-six county and twenty-one district agricultural societies in existence in the State. Reports from these societies show the most of them to be in good working condition.

Indiana is among the few States which publish annual statistics of crops, farm-animals, and manufactures in each county.

Among the contents which have not been specially referred to are essays on thoroughbred horses and cattle; the era of machinery; agricultural education in college, and road-making.

KANSAS.

One of the most interesting and valuable contributions to the agricultural literature of the year is the fourth annual report of the Kansas State Board, including a State census, for 1875. It is printed on beautifully-tinted paper, and contains about eight hundred pages. It embraces statistical exhibits, with diagrams in colors, of the agricultural, industrial, mercantile, and other interests of the State, together with a colored outline-map, showing congressional and land districts; sectional maps in colors, of each organized county, showing their relative size and location, railroads, railroad and public lands, towns, school-houses, water-powers, &c. These maps, produced at great cost, are likely to prove serviceable, among other things, in inducing immigration.

A brief synopsis of the transactions of the Board in 1875 is followed by reports and papers on subjects of interest to the people of this young and rapidly-growing State. Among these are a sketch of the history of Kansas, including its tribulations and its triumphs; a sketch of its agriculture, abundantly illustrated with diagrams; separate papers on the geology, the rivers, the birds, the fishes, and the railroads of Kansas; the history and present condition of its public-school system; historical sketches of the State institutions for deaf mutes, for the blind, and for the insane, and of the State penitentiary; a condensed history of the name, settlement, population, industries, and products of each settled county; a State census, including very complete and well-digested statistics of population, occupations ,and industries, public institutions, farm-animals and their products, field-crops, agricultural organizations, &c.; State laws to promote timber-culture; also the herd-law and fence-laws. The volume concludes with an extended report of transactions at the eighth annual meeting of the Kansas Academy of Science. This includes brief papers on ozone in Kansas atmosphere; the Nebraska hot bluff; Kansas chalk; analyses of Kansas soils and of Kansas salt; calamites; Kansas mammalia; the habits of certain larvæ; the cottonwood-leaf beetle; the Rocky Mountain locust; larva and chrysalis of the sage-sphinx, and the Lepidoptera of Eastern Kansas.

Prof. W. K. Kedzie, chemist to the board, gives a brief account of his trip to Europe and his investigations into the workings and operations of the agricultural stations he visited.

Mr. Alfred Gray, secretary to the board, gives a detailed history of the damages sustained by the grasshopper invasion and the efforts made for the relief of the sufferers. From his statement it appears that the Kansas central relief committee received and disbursed during the period of its operations the sum (in cash) of $73,863.47; supplies, 265 car-loads, and 11,049 packages. The average value of a car-load was estimated at $400, and of packages $5, which gives $161,245 as the aggregate value of contributed supplies received and distributed by the committee. This added to the cash receipts gives a total as disbursed by the committee of $235,108.47.

Mr. Gray quotes the following from the report for 1875 of Professor Riley, State entomologist of Missouri:

> The life-history of this insect is essentially the same as that of the more common locusts that are with us every year. The female, when about to lay her eggs, forces a hole in the ground by means of the two pairs of horny valves which open and shut at the tip of her abdomen, and which, from their peculiar structure, are admirably fitted for the purpose. With the valves closed she pushes the tips in the ground, and by a series of muscular efforts and the continued opening and shutting of the valves she drills a hole, until, in a few minutes, (the time varying with the nature of the soil,) the whole abdomen is buried, the tips reaching an inch or more below the surface by means of great distension. Now, with hind legs hoisted straight above the back, and the shanks hugging more or less closely the thighs, she commences ovipositing, the eggs being voided in a pale, glistening, and glutinous fluid, which holds them together and binds them into a long, cylindrical pod, covered with particles of earth which adhere to it. When fresh the whole mass is soft and moist, but it soon acquires a firmer consistency. It is often as long as the abdomen, and lies in a curved or slanting position. It is never placed much more than an inch below the surface, except when some vegetable root has been followed down and devoured and the insect leaves her eggs before emerging. In this way the mass is sometimes placed a foot below the surface.
>
> The eggs which composed this mass are laid side by side to the number of from thirty to one hundred, according to size of mass. They are 0.15 to 0.20 inch, one-fourth

as wide, slightly curved, of a pale yellow color, and rather larger at the anterior than the posterior end.

As the hatching period approaches, they become more plump and pale, and the embryo, with its dark eyes, is visible through the shell, which is now somewhat transparent. The opening to this egg-mass is covered up by the mother, but the newly-hatched insect has no difficulty in escaping. When first hatched, the little hopper is quite pale, but soon becomes mottled with gray and brown. In escaping from the egg, it is first covered with a delicate white pellicle, which has to be cast off before there can be freedom of motion, so that the insect may be said to molt as soon as it is born. Except in having a narrower prothorax, sloping roof-fashion to a median ridge, and in lacking wings, the young locust scarcely differs in structure from its parent; and the perfect winged form is gradually assumed through a series of four molts, during the first three of which the wing-pads become larger, and during the last, from the pupa to the perfect state, the thorax becomes flattened, the wings are acquired, and the insect ceases to grow and is ready to procreate. The time required from hatching till the wings are obtained averages about two months. The high and long flights, characteristic of the species after the wings are acquired, are seldom indulged, except when there is a fair wind. * * * The eggs are laid, by preference, in bare, sandy places, especially on high, dry ground which is tolerably compact, and not loose. It is generally stated that they are not laid in meadows and pastures, and that hard road-tracks are preferred; in truth, however, meadows and pastures where the grass is closely grazed are much used for ovipositing by the female, while on well-traveled roads she seldom gets time to fulfill the act without being disturbed. Thus a well-traveled road may present the appearance of being perfectly honey-combed with holes, when an examination will show that most of them are unfinished and contain no eggs, whereas a field covered with grass-stubble may show no signs of such holes and yet abound with eggs.

In comparing the year 1874 with that of 1875, the secretary says:

Eighteen hundred and seventy-four teemed with eventful disasters; 1875 with abundance. The wonderful recuperative powers of the State from an unexampled devastation, and the catalogue of misfortunes incident thereto, are prominently and vividly portrayed in the progress of the year. More than a million acres have been added to the cultivated area; the corn product has leaped from fifteen to eighty-one million bushels; wheat from less than nine to nearly fourteen millions; other crops have increased in like ratio. Such progress, following on the heels of most dreadful disaster, has no parallel in the progress and history of agriculture. Last fall the farmers foresaw that the destrution of corn and many other crops by locusts would not only entail suffering, but render work-animals unfit for farm operations. This stimulated fall plowing, while work-animals were comparatively in good heart. An increase in acreage of winter wheat and rye, and a large breadth turned over for spring grains, was the result.

Hay was light, but exceedingly nutritious. Necessity compelled farmers, for once in the history of Kansas, to go into winter with an abundant supply, it being the chief, and in many cases the only, stock-food on which they could rely. The winter was about an average one in severity of cold, but comparatively dry, and therefore favorable to stock that had no artificial shelter or protection. All kinds of farm-animals, except swine, came out of winter thin in flesh, but in good heart, and free from any prevailing disease. The percentage of mortality was less than during any previous winter; that of sheep could hardly be computed at all.

The settlement and unparalleled growth of Kansas are graphically portrayed in a paper by Mr. Daniel W. Wilder; Kansas agriculture is presented by Mr. J. A. Anderson, president of the State Agricultural College. This paper contains much valuable information in relation to the wonderful productiveness of the soil of Kansas. In an article on the railroads of Kansas, Mr. T. Dwight Thacher names twenty-one lines in or passing through the State, of which the miles in operation within the State aggregate 2,084¼. Of the rivers of the State, Mr. Thacher says:

The Missouri River forms the eastern boundary of the State from the Nebraska line to Wyandotte. It is navigable almost the entire year by the largest steamboats, and is a very important channel of transportation. Elegant and substantial iron bridges for railway and wagon travel span this great river at Wathena, Atchison, Leavenworth, and Kansas City. The Kansas River was navigated in early days by small steamboats as far west as Fort Riley. In 1869 a light-draught boat made several trips between the Missouri and Lawrence, taking out corn. This stream has since been bridged at Wyandotte, Lawrence, Topeka, and Wamengo, and is no longer navigable. The Arkansas, Neosho, Republican, Solomon, Verdigris, Blue, Cottonwood, Spring, Marais du Cygne, Delaware, and Nemaha Rivers are all fine, full-flowing streams, and nearly all of them afford excellent water-powers. The Kansas River is dammed at Lawrence; the Blue, at Manhattan, Blue Rapids, Waterville, and Marysville; the Neosho, at Burlington, Neosho Falls, Le Roy, Humboldt, Oswego, and several other points; and the Delaware, at Valley Falls. The water-powers afforded by the Blue, Neosho, Solomon, Republican, Cottonwood, Delaware, Marais du Cygne, and several other streams, are unexcelled in the West. The rivers and creeks of Kansas, both large and small, are more generally bridged than is common in new States. Many of these bridges are substantial iron structures resting on stone abutments and piers.

In an article on the geology of Kansas, Prof. B. F. Mudge speaks as follows of the area, latitude, and soil:

The State of Kansas is about four hundred miles long, from east to west, and about two hundred miles (three degrees) in width, from north to south. Its average altitude above the level of the ocean, based on the "List of Elevations," by Henry Gannett, one of Hayden's reports connected with the United States geological survey, is not far from 2,375 feet. The lowest point is at the junction of the Kansas and Missouri Rivers, and is 750 feet. The highest is in Cheyenne County, about 4,000 feet. The altitude of Monotony Station of the Kansas Pacific Railway, on the west line of the State, is 3,792 feet. The Atchison, Topeka and Santa Fé Railway station at Syracuse, Arkansas Valley, near the line of Colorado, is 3,425 feet. Though, theoretically, this altitude would give a cooler climate than that of States in the same latitude farther east, on a lower level, yet the records of the temperature kept at the various forts and other points within our State show that the climate does not differ from other places in the same latitude.

By an inspection of a map of the State, it will be seen that the rivers drain the country in a southerly and easterly direction. As there is not a fall on any of these streams 7 feet in height, the descent is very gradual, averaging 7½ feet to the mile. The surface for the most part is a gentle rolling prairie, with few steep hills or bluffs. Even where the rivers have rapids, a mill-dam can seldom give a fall of more than 10 feet.

The soil of both valley and high prairie is the same fine, black, rich loam, so common in the Western States. On the high prairie it is from 1 to 3 feet deep, but in the bottoms it is sometimes 20 feet. A few exceptions to this general rule of fertility exist in the extreme western and southwestern counties, but they constitute but a small proportion of the whole. The State is so well drained that there are very few valleys with stagnant pools, and there is not a peat-swamp of 50 acres within its boundaries.

The following facts relating to the economical geology of the State are gleaned from the same article: Limestone is the most abundant and best building-material in the State. It is found in all the formations, except the Pliocene and the lower part of the Dakota. The limestones of all the Carboniferous divisions furnish a great variety of good building-material of all degrees of hardness and shades of color. That known as junction-stone has been used extensively. It is soft, and can be sawed with a common saw and smoothed with a carpenter's plane, and is yet firm enough to be durable. The limestones from Manhattan, Atchison, Leavenworth, Lawrence, Fort Scott, Florence, &c., are also noted as affording excellent building-material. Some of the limestones take a good polish, and are used as marbles. The sandstone of the Dakota group is usually some shade of brown. It is of all degrees of hardness, from that which crumbles between the fingers to that which turns the edge of the best cold-chisel.

Hydraulic limestone, suitable for the manufacture of water-cement, is found near Fort Scott, Leavenworth, and Lawrence, and probably exists at many other places. Gypsum (sulphate of lime) is found in many places. While Kansas is relying for its supply of salt on New York, Michigan, and other States, there is an abundance of that article within its limits, sufficient, if well developed, to meet the demands of the whole valley of the Mississippi. Small deposits occur in various places, and brines have sometimes been struck in wells dug for fresh water, also in boring for coal. Several of these have been made useful in manufacturing salt for the local demand. A very large deposit of crystallized salt exists south of the great bend of the Arkansas River.

Lead and zinc have been found at various points, and in some localities mining has been prosecuted with energy. Bituminous coal of good quality has been found, and mines are worked to some extent. The production at Osage City, Scranton, Burlingame, and Carbondale in 1875 was estimated at 123,400 tons.

The secretary gives the production of cotton in the State in 1874 at 89,729 pounds, and in 1875 at 325,825 pounds, an increase during the year of 236,096 pounds, or 263 per cent. The crop of flax-seed in 1874 was 174,698 bushels; in 1875, 273,166 bushels, or an increase of 156 per cent. The cheese product in 1870 was 226,607 pounds; in 1875, 1,240,610 pounds, an increase of 447 per cent. Butter, in 1870, 5,022,758 pounds; in 1875, 8,827,810 pounds, an increase of 75 per cent. The increase in the number of milch-cows during the same years has been nearly 100 per cent.

Prof. George E. Patrick, in a paper on the chalk-beds of Kansas, which are of great extent, says:

Among the possible uses to which this material may be applied, I would mention, as giving the greatest promise of profit, the manufacture of whiting of the various grades for putty, for calcimining, &c., and the manufacture of Portland cement. The latter is a branch of industry not yet established in the United States, and this simply for the reason that in the older States, where such a manufacture would otherwise have arisen, chalk—an essential in the economical manufacture of this cement—was not to be found. One other essential, and the only other, is clay. Only where these two materials are found in quantity can the manufacture be most profitably carried on; and these conditions are fulfilled in this country, as far as our present knowledge extends, only in this State.

Portland, on account of its vast superiority over our American cements, has in our growing cities a large sale, which, however, is checked by its high price, consequent upon importation. Its price is from two to five times that of the various American cements.

MAINE.

The nineteenth annual report of the State Board of Agriculture, for the year 1874, is a valuable contribution to the agricultural literature of the country. In addition to the transactions of the State Board, the volume contains the transactions of the State Pomological Society and returns from a number of district and county associations, the first annual report of the Maine Dairymen's Association, and copious statistics relating to the dairy interests of the State. The volume is well bound, and contains over six hundred pages.

The annual meeting of the board was held at Wiscasset, on the 10th, 11th, and 12th of February, 1874. The papers and lectures given contain a fund of scientific and practical information on leading subjects in agriculture, which must do much toward guiding the work of the farm to better and more satisfactory results. Aside from the many valuable and suggestive papers presented by members of the board, which cover a variety of subjects and embrace the results of much thought and practical experience, the lectures given by men who hold high rank in agricultural science from other States, and who were present, will be found full of important information on the subjects treated.

During the current year the State and local agricultural societies and farmers' clubs held successful exhibitions, and great unanimity was manifested on the part of all interested in carrying forward the work in which they were engaged.

Of the thirty-four cheese-factory companies incorporated during the winter, less than one-half went into operation, making, with the twenty-four in operation in 1873, a total of thirty-six doing business during the season.

In his preliminary report, Secretary Samuel L. Boardman thus alludes to an investigation made by him of the menhaden and herring fisheries of the coast of Maine:

In August last, in accordance with a recommendation of the board, I spent two weeks in visiting and inspecting the establishments along our coast where the fish known as menhaden (*Brevoortia menhaden*) are manufactured into oil. Commencing my investigations at Booth Bay and Bristol, they were extended eastward to Lubec and Eastport, where the herring is the fish most used for oil, the residue of which is used to some extent as a feed for sheep and poultry. In a discussion on the value of the scrap or residue from the oil-factories as a fertilizer, at the meeting of the board at Wiscasset, it was suggested that this might be prepared in such a way as to be transported to the farms in the interior of the State; and one of the main points in my inquiries was in reference to this particular. In Booth Bay there are five companies or firms engaged in this business, and in Bristol and Bremen seven companies, while in the towns of Sedgwick, Blue Hill, Surry, &c., are a number of companies doing a smaller amount of business. During the past season the Bristol companies made 381,000 barrels of oil, and the Booth Bay companies 174,000, a total of 555,000 barrels. From this 18,500 tons of scrap were made, for which $11 per ton is obtained at the works, giving a revenue of $203,500; the total product from both items being $631,475 for the year 1874.

Almost the entire amount of scrap produced is used in the manufacture of superphosphate in this and other States, and a large portion of it finds a market in the Southern States. During my investigations of this subject I obtained a large mass of facts in regard to the natural history and economy of the menhaden and herring, together with many statements from farmers who have used the scrap as a fertilizer, either in a direct manner or as a compost, and also as a provender for sheep. I also obtained some of the chum, the use of which, as a feed for sheep, has been so highly commended, and have forwarded the same to Professor Farrington, superintendent of the State college farm, who is now carrying on an experiment in feeding it in connection with Indian corn, and the fish-scrap is being experimented with under my direction as a fertilizer.

In a discussion on the subject of porgy chum as a feed and fertilizer, Mr. Wasson gave the results of some five years' experiments with it as a feed for sheep and poultry. Chum is the refuse of menhaden, which are caught along the entire coast of Maine. The oil is expressed and the residue used in a green state as a fertilizer. When used as food it is prepared by drying in the sun on elevated racks for two days, by which process the water is expelled, after which it will keep for an indefinite period. One barrel of it, costing $2, is sufficient for 3 sheep during the entire winter. Mr. Wasson's sheep gave an average increase of 1¼ pounds of wool per head from the use of this chum. The sheep kept in good order and brought heavy lambs. Hens eat it with avidity. Mr. Percival stated that he had experimented with it as a fertilizer and had found it a valuable manure.

Mr. George B. Sawyer thus speaks of the original boundary and extent of territory within the county of Lincoln:

The county of Lincoln, at the time of its organization in 1760, embraced about seven-eighths of the whole State, being all except the counties of York and Cumberland, which then included Oxford and a part of Franklin and Androscoggin. Its western boundary, started at Small Point, the eastern point of Casco Bay; thence running northwesterly on said bay to New Meadows Creek or River; up said river and across Stevens's carrying place to Merrymeeting Bay; thence up the Androscoggin River 30 miles; and thence by a straight line north two degrees west, to the utmost northern limits of the province, which limit formed its northern boundary, its eastern the province of Nova Scotia, its front resting on the ocean. It was, indeed, a magnificent domain; an empire in itself, larger than all the rest of New England. Its shire-town was Pownalborough, which was incorporated in the same year, and included the present towns of Wiscasset, Dresden, Alna, and Perkins, the last named being Swan Island, in the Kennebec River, and now a part of the county of Sagadahoc. * * *

During her corporate existence of more than a century, the county of Lincoln has witnessed a stupendous development within her original domain. She has seen a dozen counties spring up within her original territory, many of them outstripping her in population and material prosperity. Among the smallest of the counties in territorial extent and population, she stands, by the returns of the last census, as the tenth in the cash value of farms, the eleventh in the value of farming implements and machinery, as well as of total agricultural productions, and in the various classes of live stock holds about the same relative position.

Mr. Horace Colman, in an essay on the subject of butter and cheese making, maintained that butter-making is the most profitable. He stated that a cow that will make one pound of butter per day will make two of cheese. As a good article of butter will always bring 40 cents per pound, with cheese at 15 cents per pound, (the usual price,) this would give 10 cents per day in favor of butter-making. He thinks it less trouble to make butter than to manufacture cheese, but if equally as much labor is required, the skim and butter milk will be clear gain, whereas the whey in cheese making is regarded as nearly worthless. In associated dairying a great many things may come up that will not prove very pleasant. In the first place, the difference in cows in regard to the quality of their milk, charges of adulteration of milk, tainted milk, &c., are subjects that are continually arising. Butter being made at home, these controversies are of course avoided. He gives his own experience in butter-making as follows:

I kept eight cows during the year 1862. I thought I should like to know if dairying paid. At a certain time in the spring I commenced to set down the amount of butter of each churning, and kept a strict account through the year; I had scales sitting handy, so it was not much trouble to weigh it after it was ready for market. I had hogs enough to eat the skim-milk and more, but kept a strict account of all I fed to them besides the skim-milk. At the year's end I made up my account of sale of butter and pork, pigs and calves, and a family of twelve had all the milk they needed. The proceeds were almost thirteen hundred dollars, over $150 per cow. But we are to take into account that butter sold for 50 cents per pound, pork for 19 cents per pound, pigs at $5, and calves at $10. The season at my place was good for grass; fed second crop. October and November fed refuse potatoes and pumpkins, and through the winter months fed freely on good hay, with provender. Cheese at that time was from 20 to 22 cents per pound, so it left from 8 to 10 cents in favor of butter; that is, if the same amount of milk that will make a pound of butter will make two pounds of cheese.

In replying to the statements and declarations of Mr. Colman, Mr. Z. A. Gilbert said:

In considering this subject, it is safe to deal with averages only; the extremes will not do; and the average of milk-production for the making of butter is, that it requires 24 pounds of milk to make 1 of butter. There have, it is true, been instances where more was required, and in a few cases a less quantity has made it. Now, the returns from all the cheese-factories in the country show that on an average one pound of cheese is made from 9.76 pounds of milk; our own State, it is true, does a little better than this, a matter which renders Maine well adapted for cheese-making. In my own dairy it has taken from 8½ to 9 pounds of milk to make 1 of cheese. From these averages it is clear that 2⅗ pounds of cheese will be produced from the milk required for 1 of butter; but to be generous, and leave a wide margin for contingencies, it may be set down with safety at 2½ pounds. Now, as to the prices of the two products: It is pretty hard averaging the price of butter, it is so variable in quality; but it may be called 30 cents, though this is too high. Good cheese the country over is sold at 14 cents. Of that manufactured in this State, none has sold less than 15 cents, while some has sold at 16 cents at the factory, and at the stores it retails at 20 cents. Thus the milk required for a pound of butter, selling at 30 cents, made into cheese, will actually sell for 40 cents on an average; the lowest estimate giving 37½ cents. This difference may be offset with the value of skimmed milk over whey.

Mr. D. M. Dunham read a paper on irrigation in Maine. He stated that at a meeting of a farmers' club he had recently attended, in discussing the best way to renovate worn-out grass-lands, a remark was made that irrigation might be a help, and it was made a matter of ridicule. Maine was thought to be too cold a country for cold-water farming, as it was expressed. But this declaration was disputed by another member of the club, who stated that he had turned the water from a spring on to a field that cut but half a ton to the acre, and thereby increased the yield to 1½ tons. He believed that at no distant day irrigation would be largely practiced by the farmers of the State.

In the course of his remarks, Mr. Dunham said that some degree of knowledge of what constitutes the food of plants seems indispensable to any well-conducted system of producing them in the greatest perfection; and such knowledge seems most likely to be obtained by minutely examining their structure and carefully observing the manner of their growth. The indispensable agency of water in the growth of plants has been universally acknowledged, and could not be overlooked by the most careless observer. But while this universal agency has been acknowledged, it is believed that a very inferior office has been assigned to it from that which it really performs. It has been considered as the mere vehicle which carried the nutritious particles of other substances, while it in reality was contributing much the largest portion of the actual nourishment to the plants which annually clothe the earth in living green.

After stating the results of certain experiments to prove that water constitutes a large portion of the food of plants, he says:

> With so favorable a history of irrigation for so many centuries and from so many countries, it seems wonderfully strange that, situated as favorably as we are for trying the experiment upon our own soil, and suffering as we do from drought, so little is actually known, and that so few experiments have been tried. It may be that from some condition of our soil or climate irrigation may not be as successful here as in some other countries, but from what few facts I can gather, the success is such as to warrant a very general experiment in every part of our State.

Prof. W. O. Atwater, in a brief address, explained the advantages derived from the various systems of irrigation, as practiced in European countries.

Mr. George E. Brackett read a paper on associated dairying in Maine. Referring to Waldo County, he said that two years previous—that is, in February, 1872—the farmers had heard a rumor that a cheese-factory was in operation somewhere in the State, but how or where was a question of doubt; but in the summer of 1873 four factories had been in successful operation in the county, seven more were organized for work the coming season, and others were in the process of incubation. Of the advantages accruing to the farmer from this system of associated dairying, he says:

> Let us consider briefly the subject of associated dairying in some of its most important bearings. It is a fact and a crying evil, that a majority of the farms in Maine are deteriorating—growing poorer and less valuable year by year. And why? Because the original richness and fertility of our soils have been wholly or partly exhausted by our farming system, which has taken from them, year by year, more than has been returned. We extract and sell off raw material—hay, potatoes, and grain—neglecting to make corresponding returns; hence we are constantly impoverishing the soil. Associated dairying put in practice would be a step toward stopping this drain from the farm. Cheese-factories require milk; more milk means more cows; the keeping of more cows requires the consumption of the hay and grain, or the farm-products, upon the farm; all of which means more manure, which must be returned to the soil, so that every season a cheese-factory operates in a neighborhood the farms supplying milk are growing just so much richer and more valuable. This, in my opinion, is the strongest argument yet adduced in favor of cheese-factories; this gradual and sure, though small, increase in the fertility of our farms.
>
> Then it is no doubt a fact that the more condensed the form in which we can market our farm-products the better it pays. * * * Take my section of the State as an example. The cost of hauling or transporting a ton of farm products to market at Belfast, from most of the towns in Waldo County, where cheese-factories are organized, is about $2. Thus it costs $2 to market a ton of pressed hay, which is one of our principal farm products, and $2 to market a ton of cheese. In one case the value of the product is $16; in the other, $320. In other words, it costs $40 to market $320 worth of hay, and only $2 to market $320 worth of cheese.

Prof. W. O. Atwater read an elaborate lecture on the "Science of cattle-feeding," which was followed by a brief discussion. Mr. Hall C. Burleigh, an extensive breeder of Herefords, said he believed in practice with theory in this matter of feeding stock, and in all other subjects pertaining to farming. His own interest in it had led him to examine carefully into more than one hundred published experiments of feeding, but few of which he regarded as of any value. He believed in plenty of good hay for feeding, in science as well as practice in farming, in brains as well as muscle. From his own trials he was satisfied 18½ bushels of corn or oat meal were equal to one ton of first-quality hay for feeding to farm-stock. A pair of two-year old steers he once owned gained 14½ inches in girth in six months by feeding them with good early-cut hay, and two quarts per day of corn, barley, and bean meal mixed in equal parts.

Mr. Harris Lewis said the experiments reported by Professor Atwater were very elaborate, and he feared he should underrate them, and yet they were not of the slightest value to our farmers. It is true that science is founded on experiments, but these German experiments are worthless to us because their crops, soil, and climate are so different from our own. We never know at what stage in the growth of the straw or grass the experiment is made, and straw as they have it in Germany is so valuable as to even produce fat on animals to which it is fed. But fast as we are, our straw and grass both get overripe before they are cut, and our straw, as compared with that used to feed domestic animals in Germany, is of very little value. To feed straw to a profit we should cut it green and leave the grain on. There is nothing better than grass to feed an animal. Nothing that can be given can add to the quality of this food, for grass is the perfection of cattle-food, and he was satisfied if farmers fed anything less than grass they are feeding at a loss. Early-cut hay, that cut in the blossom, makes the very best winter food for cattle.

In a valuable paper on the various taints, odors, and adulterations of milk, Mr. Harris Lewis, president of the New York State Agricultural Society, makes the following statements:

Milk, when drawn from the cow, often contains taints and odors introduced by the cow, from an impure atmosphere she has been compelled to breathe, from impure or filthy water she has drunk, and from improper food she has eaten. These taints and odors may be called natural taints and odors; the three last may always be avoided by proper care in furnishing the cow pure air to breatne, pure water to drink, and suitable food to eat; but the first (the animal odor) is always present whenever the milk is drawn from the cow, but always varied in intensity or degree of offensiveness by the condition of the atmosphere, the temperature of the atmosphere, the condition of the cow in regard to sickness or health, the food she eats, the water she drinks, the air she breathes, and last, but not least, by the treatment she receives. Nearly, if not all, these natural taints and odors may be expelled from the milk by heating it to 140° as soon as it is drawn from the cow, and then aerating it while warm.

While we have no convenient contrivance for heating milk, (which is to be regretted,) we have an admirable one for aerating it, invented by A. P. Bussey, of New York. This aerator is cheap, easy to keep clean, convenient to use, and should be used during hot weather by every butter and cheese factory patron. The aerator consists of a simple tin pail, with one or two rows of holes around near the outside of the bottom, suspended over and above the top of the can, with a cloth strainer over the top, held in place by the arm in which the pail is placed. The arm in which the strainer is held is passed into a wooden standard, which is attached to the can, and held in an upright position by passing it down through a loop on the can to the handle at the outside of the milk-can. The milk is turned into the strainer, through which it passes to the bottom of the pail, and then through the small holes in the bottom in fine streams, but separates into drops by falling a distance of 12 or 15 inches, exposing it all, drop by drop, to the purifying influences of the atmosphere. This aeration alone will rid the milk of its cowy odor, and most of the others before mentioned, and if done in a pure atmosphere will keep sweet more than twice as long as that not aerated, but alike in other respects. But using this aerator in a foul stable, or foul atmosphere, would be likely to add taint to taint and odor to odor, as it would be an attempt to banish filthiness by an addition of more nastiness.

There is one other natural taint of milk to which I will call your attention. It is the milk from sick or unhealthy cows. I do not believe that a sick cow can produce pure or untainted milk. There is abundant evidence, furnished by the medical profession, showing that the milk of sick cows is often tainted with the disease from which the cow is suffering, to a dangerous and sometimes fatal degree. Hence, selling the milk of a sick cow to customers as food, or delivering it at the cheese or butter factory, is, in my opinion, a crime. It is not safe food for hogs, and should be thrown on the manure or compost heap.

In a discussion which followed the reading of a paper on farming as a profession, by Mr. J. W. Lang, Mr. Isaac T. Hobson made some statements in regard to farming in Maine. He said that the yield of corn exceeds the average production per acre of the New England States, and the average value per acre of the six largest corn-producing States outside of New England; that in the yield of wheat Maine exceeds the average yield of the six largest wheat-growing States by more than two bushels per acre, and the average value by more than $14 per acre; that in potatoes Maine exceeds the average yield and value not only of New England, but of the six largest potato-growing States outside of New England; that in the matter of hay Maine takes high rank, and in oats it exceeds the value per acre of the six largest oat-producing States outside of New England.

In some notes on Maine cattle, it is stated that as early as 1791 cattle were imported from England by the farmers of this State, and as late as 1836 Maine farmers sent breeding-animals of thoroughbred stock to Vermont, Massachusetts, New York, and even as far west as Ohio. It was one of the earliest sections of the country to attempt an improvement of its breeds of cattle by the introduction of thoroughbred animals from other countries.

The semi-annual meeting of the board was held in October, at Orono, the seat of the State College of Agriculture and the Mechanic Arts. The first day was spent at the State college in attending the various recitations and in examining the departments, outbuildings, implements, stock, and farm-work. The opening address was by President Z. A. Gilbert, and the address of welcome by Mr. Charles Buffum, of Orono. Mr. Samuel Wasson read a paper on the importance and profits of cattle breeding and rearing. Believing the only true system of farming to be that which consumes the crops on the farm, he regards the following propositions as incontrovertible:

First. Cattle afford the most direct, the cheapest, and, as at present advised, the only agency to stay sterility of the soil and keep it productive.

Second. A combination of causes has given the pre-eminence to cows, not because their droppings are of superior value, for that of cows in milk is inferior in quality, but because they can be made to pay a larger dividend for their keeping than any other kind of stock, and the labor which their keeping induces is more remunerative than that of any other branch of cattle-husbandry.

Third. They excel as machines or instruments of transformation. Not that a cow *per se* is gifted to excel in the process of transformation, but that the product which she turns out is at less cost and of superior value. A large portion of farmers are too far from market to transport bulky and weighty products, like hay and hoed crops, and hence the value of cattle to reduce the bulk, and of cows to increase the value of the concentrated product, that there be no loss of value to the article in bulk and compensation for the transformation; in other words, that the value of the milk, cheese, or butter shall equal the value of the hay, together with the cost and labor of dairying. There is another phase of the case which strikes deep-rooted in this matter. In a soil like that of Maine, which must be fed to keep it fruitful, it is soil-murder in the first degree to market raw material, working as sure and certain ruin as it would to cart off the enriched surface soil and dump it into the ocean; but by converting it into some animal product the same material may be marketed and the fruitfulness of the soil preserved and increased.

Fourth. The amount of cheese and butter which a cow can be made to produce in a given time, or rather which they have produced, almost surpasses belief. The noted Oakes cow, a native animal, in Massachusetts, yielded in one season an average of 18 ounces of butter per day for 215 days, or 467½ pounds, which, at 35 cents, is $162.62, or $134.57 more than the average of our cows. Numerous instances are on record of a per annum yield of 1,000 gallons of milk, or 780 pounds of cheese. These are some of the possibilities, and while such may be rare and extreme cases, they show a defect somewhere when the average falls to 80 or 90 pounds.

Mr. A. L. Bradbury addressed the board on the advantages to dairymen from raising their own cows. He closed his remarks with the following directions for the treatment of calves:

Admitting that it is better to raise our own cows, how shall we raise our calves so as to retain the use of the cow in the dairy? * * * How soon can we begin to substitute other food than milk for our calves? Not the first week, for the calf should have the milk of its dam for one week at least. Now, if we wish to commence to substitute something instead of milk, he must be taken from the cow and taught to drink and feed the same elements of nutrition the milk contains. One quart of milk contains about 1½ ounces of butter, 1 ounce of sugar, 1½ ounces of casein, and 70 grains of bone matter. Experiments have shown that one pound of oil or fat is equal to 2½ pounds of starch or sugar; thus one quart of milk contains of flesh-forming material 1½ ounces, of fat or heat-giving material 4⅓ ounces, or a total of 5⅝ ounces of nutritive elements. Now, if we take out one ounce of butter to a quart of milk, we shall have removed one-half of its value for the calf, which we must make up in quantity by doubling up, or substituting starch in the form of buckwheat flour, at the rate of 2½ ounces for every ounce of butter taken away. The better plan is to gradually substitute skimmed milk for the new by adding new milk with warm skimmed milk for its morning and evening meals, and giving it skimmed milk at noon, for it should be fed three times per day at least. When the calf is four weeks old it will do well enough on skimmed milk alone, provided it can have enough, with always keeping good sweet hay by it. Reared in this way, we have our milk for use in the dairy, and get much better calves than in the ordinary way of letting them draw the milk themselves until they are ten or twelve weeks old, then taking them away at once. A calf should not be weaned until it is four or five months old. In a cheese-dairy whey and oatmeal can be substituted for skimmed milk, after the calf is two months old, with good success.

Mr. Colburn said that farmers and dairymen made a great mistake by selling their March calves, as they made much better milkers than those dropped in June. While it costs a little more to raise these early spring calves, on account of the high price of milk and butter at that season of the year, he thought that the additional expense was more than overbalanced by the extra milking qualities of the cow. His method of treatment in the rearing of calves was given as follows:

For the first week I let them have half of the milk; then I take them off and teach them to drink. I let the milk stand from twenty-four to thirty-six hours, skim it, warm it milk-warm, and give it to them, six quarts to a feed, twice a day for the first week or fortnight; then I increase the quantity so as to give them all that the cow will give. When they are about four weeks old, I put a little shorts, oatmeal, or oats, cooked potatoes, or crusts of bread in a trough where they can get at it. After they get so as to eat too much, I allowance them to about a pint and a half of oats a day, or something equivalent; and so right on until they are six or eight months old, increasing the feed. I give them milk until they are four months old. If you want to carry the calves up to great growth early, keep them up for eight months; but I usually turn them out to grass when four months old. The first winter I feed some roots with good dry grass, not hay. I have by this system of feeding matured my Jersey calves at seventeen months old.

In the course of discussion on the subject of farm experiments, Mr. Stewart, of Newport, gave a detailed statement of his system of treating grass-lands. After stating that he had commenced farming on an old run-down farm, he said:

My only object has been to raise grass, consequently my experiments have been in that direction. The first year I succeeded very well in getting along with the drought, and the grasshoppers passed by me with but little injury. But the second year they came down about the middle of July, and seemed to drop down on my land more than upon any other farm in that locality. They killed almost every blade of grass I had; my fields looked as if the fire had gone over them. I was compelled to sell off a large portion of my stock, because I had not sufficient fodder to keep them through the fall and winter. I did not care so much for the loss of my stock and cereal crops as I did for my acres of grass. My object was then to get my fields back again, and I had the greatest success in this way. I commenced sowing grass-seed in the fall; sowed some in September. This started well and grew well. We had an average winter, but still it killed out in the spring. I found before this that the greatest trouble was in getting a catch—seeding my land down to grass. My idea was to experiment until I could find some way by which I would be sure of success every time. The result has been in favor of either harrowing my ground, if it is very mellow, in the fall, pulverizing it very nicely, or plowing it and then harrowing it well, then putting on the roller, letting it remain until very early in the spring—if the snow is on the ground, I do not know as it makes any difference—and then sowing my grass-seed. In this way I have always succeeded in getting, I might say, more than a catch. At first I got too much, and I found it best not to sow more than two-thirds the amount of seed usually sown with the grain in the spring. * * * Until within a few years I have plowed or harrowed in my dressing, but now I use top-dressing. I had a piece of land, perhaps an acre and a half, that seemed to be drowned out badly. I plowed up about two-thirds of it, planted it with beans and corn the first year; should judge I put on fifteen loads of manure to the acre; I then seeded it down with herds-grass, clover, and red top. The other third of the piece I concluded I would not plow, and I do not think I cut over fifteen hundred-weight of hay to the acre on it; but late in the fall I hauled on not more than six or eight loads of manure to the acre, left it in small heaps, and spread it very early in the spring. It was very fine after being frozen through the winter, and I spread it very evenly. The first year I had about a ton to the acre; but for the last four years I am satisfied that I have cut two tons and a half to the acre on that piece, while upon the other part that I dressed with more than twice the labor and with the expense of seeding it anew, I have not received over two-thirds, if I have one-half, that amount of hay. I am experimenting with other pieces with about the same success. My land is principally flat and gravelly, with not much clay, but considerable muck. I have top-dressed in the fall, and I cannot see any benefit from it. I have come to the conclusion that spreading manure immediately after haying, and allowing it to dry up in the hot sun, is a useless waste of labor.

In his report of "the transactions of the State Pomological Society during the second year of its existence," the secretary says:

The work of the first year, including the winter meeting of January, 1874, was of a preliminary character and devoted chiefly to organization, laying out of work for the future, and devising means for the accomplishment of specific objects and for running the machinery of the society with the least possible expense and friction. Among the objects which the society has prominently in view are the following: To develop and systematize the pomology of the State; to fix reliable and standard lists of varieties of fruits adapted to the different sections, by the aid of which the beginner may avoid the loss of his time and money in planting unsuitable varieties upon the recommendation of itinerant vendors; to ascertain and disseminate the knowledge of the principles and processes essential to successful cultivation; to develop the capacities of the State to raise not only its own fruit, but its fruit-trees also, affording a surplus of both for exportation, instead of importing vast quantities of each, as at present; to obtain and publish accurate annual statistics, showing the condition and progress of this important interest. * * * The efforts of the society have already awakened a new and deeper interest in fruit-growing both in the orchard and nursery. Improved varieties of fruits and better methods of culture are being eagerly sought for; worthless or unprofitable varieties and methods of doubtful utility have in many instances been discarded; more numerous and better exhibitions of fruit have been held than in any previous year, and the discussion of the various questions connected with fruit-culture, both in the farmers' meetings and in the newspapers, has been more general, more intelligent, and more practical than ever before.

The Maine Dairymen's Association was organized at Augusta in April, 1874. The following officers were elected: President, Seward Dill; vice-presidents, T. P. Batchelder, William D. Hayden, Frank Buck; secretary, J. W. Lang; treasurer, Dr. J. W. North, jr. The secretary states that the season of 1874 was one of only average returns to the dairymen. A wet spring gave an abundant supply of grass, but it lacked those rich, nutritious qualities of the highest excellence. A great flow of milk was had through June and July, but the milk yielded less butter and cheese than usual. In August a short, sharp drought cut off the exuberance of the forage, and a sudden shrinkage was experienced. Many cheese-factories stopped operations the last of August, and nearly all by the middle of September.

Report for 1875.—This volume is also one of more than average interest, although it contains neither so many pages nor so great a variety of papers as that for 1874. The annual meeting was held at Waterville, in connection with the Maine Dairymen's Association, in February, 1875. Z. A. Gilbert was elected president of the board; J. E. Shaw, treasurer, and Samuel L. Boardman, secretary. Mr. Lyman Lee read the opening paper, on raising horses for Maine. It was discussed with considerable spirit by the farmers present. He took the position that the farmers and horse-breeders of the State have generally been producing a class of horses altogether too light for general road purposes. While oxen have been going out of use, and horses have been gradually taking their places, horses of the right kind for farm and heavy road work have not been raised in sufficient numbers to supply the demand. The result has been that the people of the State have been compelled to import them from the West and from the provinces of Canada. He said:

The fatal fascination of raising fast horses has seized upon too many farmers, and attention to the breeding of this class of horses has driven out all attempts in the direction above indicated. A showy little stallion of eight or nine hundred pounds is too often patronized in the vain hope of securing a speedy colt, when the services of a well-made-up horse of from eleven to fourteen hundred pounds, which should be secured, are not used. Farmers seek for speed in raising horses, and obtain it only in very rare instances. Now, if these animals chance to become a little lame, or slightly blemished, they are of little or no value, while heavy horses, although they may not be perfect, are still useful and command good prices. The breeding of fast horses should be left to the professional horsemen and trainers, as farmers seldom make it profitable. One trouble must be encountered at first, and that is, many of our mares are not large enough to breed from. This, however, may in a measure be overcome by selecting the largest and best mares for stock-raising, and even by importation at first, if need be. But in case of the stock-horse from which to breed, there will be no difficulty, for as soon as the owners and keepers of such horses learn that a large, firm, and compact breed of horses is desired, they will find it for their interest to patronize the same. Then, again, would it not be better to arouse the ambition of our young men, and some of the older ones too, to raise and keep a team of splendid, sturdy horses for valuable use, instead of engaging in racing and pool-selling, with their attendant influences, which in fact more or less affect the whole community? Of course no word is to be said against breeding lighter horses for light-carriage use and for driving; but experience will show that there will always be a sufficient supply of small horses.

In the discussion which followed, the general conclusion reached was that the raising of light, speedy horses should not lead the farmers to lose sight of the importance of other lines of breeding and other branches of farming; for while there could be no question as to the high value of the road-horses of the State, yet sheep, young cattle, and dairy-stock certainly needed encouragement, and beef-growing, dairying, orcharding, market-gardening, and other important branches of farming, for which certain sections of the State were especially adapted, should not be overlooked. Speed is a valuable quality, but there are other valuable qualities possessed by the horse which are equally as necessary to develop as that of speed, and it is a question if the best horse is not that one possessing the most complete development of all these qualities, such as would best fit him for all useful and desirable purposes.

Mr. A. L. Bradbury read a paper giving the results of his experiments as to the value of whey and skimmed milk for feeding to calves and pigs. He stated that some years ago he took two calves from the cows at two weeks old, and put them on skimmed milk and potatoes, and fed two others on the cows until thirteen weeks old. The result was, that the hand-fed calves so far outgrew the others that he had hard work to keep them from the butcher, while the others he did not want. The hand-fed ones kept constantly ahead of the others, and at two years old the smallest one came in as a cow, and measured more than 6 feet, while the best one fed on the cow was only 5 feet, both having had the same treatment after weaning. Like results followed other experiments of a similar character, and proved beyond question the value of whey and skimmed milk as feed for calves. Whey alone fed to pigs had proved that it was worth saving for this purpose.

The lectures by Professor Arnold on "Needs of the Dairy" and on "Cheese-Making," form valuable contributions to a correct understanding of an interest which seems to be making more progress than any other productive industry in the State. A careful study of these papers must prove of great practical benefit to dairy-farmers, whether in Maine or elsewhere.

The points in a paper by Mr. S. G. Foster on the management of a private butter-dairy are reported as follows:

Mr. Foster stated that there was no royal road to success in the matter of butter-making. While first-class butter sells for 45 cents per pound, and a fancy article at from 50 cents to $1.25 per pound, the great mass manufactured sells for an average of only about 20 cents per pound. If a choice article of butter is desired, care must be exercised from the time the milk is drawn till it is ready in the finished article for market. The causes of poor butter are numerous. There are many points upon which more light is needed, and this can be eliminated only by careful experiments conducted with nice and accurate instruments. Nothing should be done without careful weights and measures, and careful thought. Good butter is not produced in ignorance; it is the result of skill and common sense. The quantity of milk given is made the test of the value of the cow by too many, rather than the quality of the milk. There is no breed but produces good cows; no breed but produces some poor ones. He next spoke of the necessity of cleanliness in everything pertaining to the stable, the milking, and the care and keeping of the milk. The manipulating, the packing, and the storing of the butter all require good common sense, skill, and cleanliness. In a discussion which followed, Professor Arnold said the experience all over the country was that the best cows for producing milk were one-half, three-fourths, and seven-eighths grades, and, so far as his own experience and observation went, it was not true that extraordinary milkers reproduced their own qualities in their offspring.

Among the contents which have not been noticed are interesting articles on "The Influence of Education upon Labor;" "Labor upon Capital;" "Agricultural Education;" "Aims and Methods of the State College with respect to Practical Education;" "Specialties in Farming;" "Success in Farming;" "A State Industrial Exposition;" "Fish and Crops and Fish Guano;" "Management of Grass-Lands and Pastures;" "Planting an Orchard;" "Sheep-Husbandry and Legislation for its Protection;" "Raising Neat-Stock;" "Associated Dairying in Maine;" "What the Dairy Cow is, and whence she came;" and other papers of minor importance.

The semi-annual meeting was held at Calais, Washington County, in November. Much of the time of the first day was taken up in the reading of county reports. At the request of the farmers of the county, fruit-growing, dairy-farming, and sheep-husbandry formed the leading topics of the papers read and the discussions which followed.

During the progress of the meeting Mr. F. W. Shepherd, who had used menhaden as a fertilizer for many years with varying results, gave an account of a recent experiment with which he was highly gratified. He had secured the best results by making them into a compost in connection with yard-manure, loam, ashes, and plaster in the proportion of one cord each of loam and manure, ten barrels of menhaden scrap, (eleven barrels to the ton,) one bushel of plaster, and from eight to twelve bushels of ashes. This is put up in layers, sods being placed on the outside to hold the mass. In a few days it will heat, when it is worked over, and in a few weeks the entire mass will be about the consistency of leached ashes. This is applied to land for grain and grass. Put on to grass-land in October, it had given two loads of hay that year on land that the previous year gave but one; and on a field that had not been plowed for ten years, and had yielded but two or three loads, applied as above, it had this season given seven loads. The heap will compost more readily if built up high than if spread out broad, and will take about ten days or two weeks to become fit for use. The scrap costs at the factory $10 per ton from the press, or $12 per ton if packed in barrels. In this connection it should be mentioned that an article by Secretary Boardman, on the menhaden and herring fisheries of Maine in connection with agriculture, appears in this volume. The paper is a very elaborate one, occupying 64 pages.

Reports from the various counties of the State show that upward of forty associated dairy companies were in operation during the year. The secretary closes his condensed report as follows:

> The year has been one of fully average returns, and the farmer may well be satisfied with the results of his labors. Our flocks and herds have been free from plague and disease, our staple crops generally spared from blight and the ravages of insects, and on the whole contentment and comfort have waited on industry, crowning it with satisfaction and plenty. No one has lost faith in farming, but, on the contrary, faith in intelligent, systematic, and well-directed farming has steadily gained ground every day during the year, and more men are in love with it, believe in it, and are following it now than formerly. Many farms, it is true, have been deserted; but all over our State men are returning from the city to the farm, and, putting into operation business principles and intelligent direction, are working out good results and stimulating improved farming throughout large sections.

The transactions for 1875 of the Maine State Pomological Society fill 172 pages, and the second annual report of the Maine Dairymen's Association 42 pages, with interesting matter.

MASSACHUSETTS.

The twenty-third annual report of the State Board for the year 1875 is one of more than average interest. It contains elaborate papers on a variety of important subjects and exhaustive discussions participated in by many of the most prominent agriculturists of New England.

The secretary, in his preliminary report to the legislature, states that the year has been prosperous and favorable for most branches of farming industry. The presence of heat and moisture, distributed with some degree of uniformity throughout the season of most active vegetation, furnishes the conditions favorable for a productive year on the farm. In this respect the season was more than usually propitious, no drought of any severity having occurred to injure the crops or cut short the period of vegetable growth.

Among the enterprises of an agricultural character that are especially worthy of mention is that of diking in and reclaiming extensive tracts of salt-marshes along the sea-shore. Green Harbor Marsh, situated in the town of Marshfield, has been shut off from the tides of the ocean at an expense exceeding $30,000, and over 1,400 acres have been thus put into a condition to add materially to the productive wealth of the State. Extensive and careful scientific investigations have been instituted, under the direction of the State board, to ascertain the changes which take place in the soils of reclaimed marshes, with the hope of rendering efficient aid to those who have undertaken this great public work.

The usual country meeting of the board was held at Haverhill, Essex County, in November. In his opening address, Mr. George B. Loring thus alludes to the place of meeting:

The town in which we are assembled has long been distinguished for the care and system with which the land has been cultivated and the business of manufacturing has been conducted. Settled, as it was, two hundred and thirty-five years ago, in precisely the same manner in which so many New England towns were settled, by an honest, faithful, and earnest clergyman leading his little flock into the wilderness for the purpose of enjoying what our fathers demanded and insisted on here, "freedom to worship God," it became at last one of those towns in the county which were distinguished for the skill and prosperity of the agricultural community which was settled here. It was finely located on the banks of this swift-running river, which came flashing along from the mountains of New Hampshire and the lakes above, with no alluvial soil, but with those rich and fertile and heavy clay banks which are so superior, under the long-continued toil of the farmer, for the purposes of the various crops. Here the fathers established a prosperous agricultural community, and year after year, for more than two centuries. Haverhill performed her part as one of the leading towns in this commonwealth. When the business of agriculture began to decline and the attention of our people was turned to other branches of business, how she sprang forth to accept the work which was then laid before us, advancing in a few years from a little town of 3,500 people, prosperous in their agricultural pursuits, to a city of almost 15,000 people, with more than 150 firms engaged in the manufacture of leather and its products, and with an annual production of $10,000,000 from her industry alone.

Mr. Loring gives the following instances in illustration of the fertility of the soil of Essex County in former years:

I remember one of the records kept in this county less than a century ago, in which it was stated that under the ordinary cultivation of the soil 750 bushels of potatoes had been raised upon one acre of land, and 650 bushels of carrots, 850 bushels of ruta-bagas, (Swedish turnips,) and 1,050 bushels of mangold-wurzels; and upon ten acres of land for thirty years there had been produced an average of three tons of hay to the acre—land that had not been broken by the plow in all that time, but had received at the hand of the cultivator a fair and proper top-dressing from year to year.

Prof. Levi Stockbridge read a paper on plant-food, in which he gives the results of a series of experiments in feeding plants, conducted on the agricultural-college farm. He asks: "What have the ordinary variations of our seasons to do with the nutrition of plants, or with the development of plant-food in the soil?" Answering, "Much, every way," he proceeds to explain by saying:

If we have a wet season, an extra quantity of water-fall, this fills the interspaces of the soil so that the air is excluded, so that the warmth is excluded; the soil does not become heated. The coarse, raw, undecomposed, unfermented mass of barn-yard manure, compost, muck, straw, clover, or grain crops plowed in, remain dormant and dead, no nutriment is formed, and your plant is starved for want of food. If, on the other hand, your season is one of excessive drought, little rain-fall, and the soil becomes dry, so that decomposition stops, then your raw, crude material, your barn-yard manure, and your muck remain unchanged; no food is formed, and your plant starves for want of nutrition. Now, then, the seasons have to do with plant-nutrition in just this way, and the farmer should have known that if he would feed his plants, and do it thoroughly, with the variations of the seasons, he could not afford to trust them to make plant-food out of raw or crude materials; but that it was a part of his duty to prepare the food for his plants ere he committed it to the soil, and then the action of the season of which he complains would have been entirely obviated, and he could have produced crops yearly without regard to these variations of the seasons which make maximum or minimum crops.

After stating that the primary aim of a series of experiments begun at the agricultural college in 1869 was "to prove just this thing, whether certain elements of plant-food, prepared in the condition of plant-food ready to nourish the plant, would not nourish and produce almost in any quantity desired, without regard to the ordinary variations of the season," he continues:

The first point to be ascertained was, whether certain elements of plant-nutrition—prepared in a certain way and given to the plants—would produce plants. Those experiments were tried four years, and it was found by using the ordinary materials known to everybody—nitrogen, potash, phosphoric acid, soda, magnesia, &c., in certain forms, on soils that were absolutely sterile—plants could be produced perfect in all their parts. That was the first point to be ascertained. Then to ascertain whether it was needful for the farmer, with such soils as were within our reach, to use all the elements of plant-nutrition, or whether the soil could be relied upon to provide certain elements in sufficient abundance so that the farmer need not apply them.

The experiments for four years seem to indicate that, with such soils as we were using, gathering them on the college farm and for miles around, we need not apply to the plant carbon in any form, state, or condition; that that was provided by nature, and always would be; that we need not feed any other organic element of nutrition but nitrogen; that nature had not provided nitrogen in sufficient abundance, and that we must apply it. Among the mineral elements of the soil it was found that we need only use potash and phosphoric acid for our vegetable crops. There were one or two crops where we decided that we should use not only potash and phosphoric acid, but magnesia. Tobacco was one, oats was another, where we decided that it was necessary to use magnesia; but for the ordinary crops on such soils, mark you, as we had to experiment with, nitrogen, potash, and phosphoric acid were the only elements needed to be used. And we also noticed that there was a remarkable relation existing between the amount of crop produced and the quantity of the elements applied, which led to the thought that, perhaps, with a certain quantity of nitrogen, potash, and phosphoric acid given to the plant in the form of absolute food, a plant might be produced which should contain as much nitrogen, potash, and phosphoric acid as we gave artificially to the plant we cultivated. The results of open-field culture in 1873-'74 seemed to sustain that belief. The crops experimented with this year have been corn, oats, hay, beans, and the general garden-vegetables.

First, I will take the experiments with corn. Two plots of land were taken this year, so far as we could determine, exactly alike in their quality. It was proposed to make, over and above the natural product of the land, 50 bushels of corn to the acre. Elements containing as much nitrogen, potash, and phosphoric acid as would be contained in 50 bushels of Indian corn, and the natural production of stalks for 50 bushels of Indian corn, were therefore applied to the land. The result of that experiment was this: The land without the manure yielded 25 bushels of corn, in round numbers; the land with the manure yielded 74 bushels. That is, the crop was one bushel less than the statement, being 49 bushels instead of 50 bushels.

For potatoes, two plots were taken. These two plots were the plots which were planted with potatoes last year; the same plot without manure, the same plot with manure, as in 1874. The statement was, the materials should be applied to make 100 bushels to the acre more than the natural production of the land. The land without the manure made 128 bushels of potatoes to the acre; the land with the manure made 279 bushels to the acre, or 51 bushels more than the statement. I will not stop to answer the question why.

Now I will give another experiment with corn, which will, perhaps, answer this query, why the land yielded 51 bushels more of potatoes than the statement called for, and I will answer another question which will by and by be asked me. * * * *

In 1874 we were trying the experiment of growing corn according to this principle, and we raised 104 bushels to the acre. In 1875 we took the same plot and planted it with corn again and did not give it any manure at all, the object being to see if the land was ruined or whether the manure of 1874 reached over into 1875 and affected advantageously the crop of 1875. On that plot this year we harvested 64 bushels to the acre, without any manure. The normal bearing of the land in 1874—that is, on the plot where the manure was applied—was 34 bushels to the acre. Now, then, (if it will be accepted as such,) the manure of 1874, after producing its 104 bushels to the acre, reached over into 1875 and gave us 29 bushels and a fraction of corn to the acre this year as the effect of last year's manuring.

Oats.—A presumptuous statement was made in relation to the growing of oats. It was said that we would grow 50 bushels to the acre over and above the natural product of the land. I ought to stop here and say to gentlemen present that we have got the poorest land apparently—rocky, drift soil, discouraging in every way—on which to try our experiments. The plot without manure gave us 15 bushels of oats to the acre. The statement was 50 bushels more than the land would naturally produce. The yield of the manured plot was 62 bushels to the acre, or 3 bushels less than the statement; the land with manure producing 62 bushels, the land without manure producing 15 bushels.

Hay.—Two plots of land were selected for the experiment with hay. The land had not been plowed or manured for many years. The statement was that there should be made on that land one ton of hay to the acre more than its natural product. The elements were accordingly applied by top-dressing in the spring, which was wrong, perhaps. The yield of the unmanured land for both crops was 1,700 pounds to the acre.

The yield of the manured land was 3,000 pounds to the acre, or 1,100 pounds to the acre less than the statement.

Beans.—The statement in regard to beans was that we would make 20 bushels to the acre more than the natural product of the land. Twenty bushels of white beans is a pretty good crop to the acre; but that was the statement, 20 bushels to the acre over and above the natural product of the land, which it was supposed was nothing, the land being about as poor as could be. The result was that the land without manure yielded 4 bushels, the land with manure yielded 25 bushels. We got one bushel to the acre more than the statement.

Certificates were read from a number of farmers who had used his formulas with the same gratifying results as those detailed above.

Formulas for supplying the elements of plant-food for the different crops named above are published in this report.

In a discussion on corn and grain crops, Mr. Hapgood stated that he grew 80 bushels or more of shelled corn to the acre. Explaining that he preferred for corn sod-land, plowed in the autumn, six inches deep, he exhibited some ears of corn and said:

The field on which the samples were raised was plowed last autumn.

In the spring I spread on 5 cords, or 15 two-horse loads of stable-manure to the acre, which I worked in with a Boston horse-hoe and a Geddes harrow. I then furrowed the field $3\frac{1}{2}$ feet apart each way, and laid a moderate shovelful of stable-manure to the hill, which takes about 10 two-horse loads to the acre, making 25 two-horse loads of manure to the acre of corn, which is as much manure as I think is economy to use. From my experience, I am confident that for every additional load of manure the yield of any kind of grain is not increased more than one bushel to the load, and the yield of hay not more than 100 pounds to the additional load of manure. In seeding, I plant five kernels to the hill, no more nor less; this is pretty sure to make four stalks to the hill, which is as much as I intend shall grow. When 6 to 8 inches high, I hoe it. Once hoeing is enough, if the field is free from weeds. My corn this year was hoed but once. The mode of cultivating corn is various. Some farmers spread manure on grass-land and plow it under 6 inches or more; some never lay manure in the hill; some hoe when it is no more than three inches out of the ground, and hoe two or three times, and so on; but the test of excellence in farming is always in the yield of the crop. I never adopt any new mode of cultivation, however simple or however elaborate, which yields a smaller crop than I now raise, or that does not produce definite results in bushels or pounds. * * * The variety of seed-corn planted is a very important consideration. It is not possible to raise a large yield of corn from a small variety of seed; and yet many New England farmers persist in raising these small varieties, which, with high cultivation, will produce scarcely more than 50 bushels to the acre; when, with a large variety of corn, and at the same cost, they might raise 80 bushels or more to the acre. They claim that their corn has many stalks with double ears; but the proportion of stalks with two good ears is not very large. Then they argue that small corn has a small cob, and is filled out well; it makes good meal, and they like it; that big, coarse corn has a great cob, and they do not like it. Some farmers stick at the cob, as if that was the first object, without regard to the corn. After all, there is but little difference in the weight of cob to a bushel of corn, in the large or small varieties; 72 pounds of ears of my corn will make a bushel, or 70 pounds when it is well dried; so there is not much weight in the cob argument, after all. With one dressing of 25 loads of manure to the acre, I raise 80 bushels of corn. Then I sow to barley, and seed down to grass; the next year after, corn. I have 30 to 40 bushels of barley to the acre; then the two following years, about 2 tons of hay to the acre, after that, $1\frac{1}{2}$ tons; then $1\frac{1}{4}$ tons—so I raise five or six crops with one dressing of manure.

Perhaps the most interesting part of the transactions at this session was the address delivered by Rev. William H. H. Murry, on the "Breeding and management of horses." Referring to the maxim of the Arabs, that "the foal follows the sire," he says:

To account for it, in the first place, the Arabs always select their dams with great care. Now, it may be that the word "best," as applied to their dams, you do not apply to yours. That is, the dam that you would consider the best may not be the best in the eye of the Arab breeder. What is the best dam in the eye of the Arab breeder? May it not be the one that will allow its foal to bear the stamp of the horse? I think so. I have two dams on my farm that could not be sold by a religious man for over $300, in a matter of trade, and yet $3,000 could not buy either of them. Why? Three colts have come out of each, and every colt has looked precisely like its sire; has put its feet, when eating its oats, precisely like its sire; has smelled of the water and muzzled around it before drinking, precisely like its sire; has done everything like its sire. The dam simply carried it, as a mother holds her baby in her lap, and never marked it at all. Now, may not the old Arabs have such facts in mind? May they not, when they laid down the maxim, "the foal always follows the sire," have had this in mind, that there should be no dam bred to a sire that would interrupt the sire in propagating himself? I know a man that has a mare that has foaled two colts. He bought her for $87. And yet she is invaluable. Why? Because each of the colts that came from her are not only like the sire in a general sense, but they are the sire in miniature. In interior habits of the stable, in the way they move about in the stall, the way they toss their heads, and the way they feed and drink, they are the sire over again.

You may take all my fashionable, high-bred mares out of my stable, if you will leave in their places such mares as that, for you have eliminated for me in doing it half the difficulty out of the problem of breeding, namely, the difficulty which the temperament, structure, and habits of dams bring to the breeder. For instance, I could select an animal that is perfect—one I know is perfect—one that can transmit himself if he is not bothered and interrupted in doing it by the dam. I know I can, I say, select such a stallion in New York, in New England, and in six or eight stables in the Middle States; and if I can find a dam that will not trouble that sire in the offspring, I can repeat the sire in every colt. The Arabs may have selected their dams in that way.

Now, then, will you see the possibility of this old Arab maxim being true in our practice? First, select a dam that will simply carry the foal, feeding it with its blood and milk, but not affecting it at all, and then select a horse that has, first, the general excellence that you want, then the special excellence, and then the power to transmit both the general and special excellence, and would not the maxim be true that "the foal follows the sire?"

Mr. Murray states that, in breeding for the market, the first great point to be considered is pedigree; second, size; third, color; fourth, health; fifth, temperament; sixth, speed. The order in which he breeds in his own stables is, first, beauty. A beautiful horse, he says, will always find a buyer, and at a good price. The second thing he breeds for is docility; the third, speed. If he can get the first two in large degree he has no fears but he can secure an early sale, but if he secures speed without these two points prominently developed, he will have to wait four or five years, or until the horse makes a record, before he can get his money back.

In a discussion on cattle-husbandry, Dr. G. B. Loring gave his ideas of a good cow as follows:

If you ask me, "What is this animal called an Ayrshire?" I say, it is a good cow, but the law will apply to any other class of cows as it will to Ayrshire cows. I mean a cow of such moderate size that she will not interfere with anybody, to begin with; a cow that manages herself handily, easily; a cow that possesses that vigorous, elastic, powerful constitution which never belongs to a coarse-boned, overgrown frame.

An Ayrshire cow, then, is a cow made up, anatomically, physiologically, upon the best model for a cow; that is, a good cow, generally. She has that structure of the head which indicates a contented, placid disposition and a powerful constitution; a calm and steady eye; a face that is as expressive as a cow's face can be; as much of an intelligent look as an animal of that description can have. A horn not too large at the base, but large enough to indicate that there is a strong constitution there; a head wide between the eyes, and pretty high above the eyes to the root of the horns. I think a cow that has a broad base to her head is the best. And if she has a large, luxurious mouth, that looks as if it was made for business, and can fill her stomach rapidly, so that she can lie down and rest and repose, she will be all the better fitted for the business of the dairy. I would have a cow's neck small enough to be graceful, but not too small; not a ewe-neck, that is not necessary, but gracefully, delicately, and elegantly set on, without a waste muscle in it, but with muscle enough to make it a strong, vigorous, and powerful part of the animal's body. The shoulder of an animal of this description should be as near like the shoulder of a good trotting-horse as it can be; not straight up and down like a thoroughbred's. The shoulder of a good dairy-cow should be a little loose, with the blades not rising above the backbone, with strong, powerful muscles, and a good, substantial base, with a fore quarter under it as straight as a plumb-line. Crooked-legged, knock-kneed cattle are never graceful, and seldom profitable. The legs should be strong and well defined, and the cords and muscles should stand out clean and prominent. The milk-vein should indicate a good superficial vascular system, which means simply this: it is an organization in which the superficial circulation of the blood indicates that what are called the secretory organs are active in the interior. The next sign of a good cow is an open, bony structure; not a coarse or loose-fibered, bony structure, but a bony structure that is so articulated or hung together that there is elasticity and ease of motion about it. Now, where are you going to find the indicative point that will tell this story? Put your finger into the point of the shoulder, and see if the cow has a cup-like cavity there. If she has, ten chances to one she will be a good milker; but if not, if her shoulder is hard and compact, even if she is milking well to-day, she will be likely to fail to-morrow.

You next come to the ribs. Upon a good chest-development depends almost everything else in a dairy-cow. She must have a finely-shaped chine, and the spring of her ribs, from the spine down through her heart, must indicate that she has a strong circulation; but you do not want her brisket as deep as a steer's, or like a short-horn bullock; you want the shape I speak of, and you want it with a certain delicacy of organization which indicates that the circulatory system is a strong one and that neither the heart nor the lungs are impaired. But go back to the ribs. You want a rib, not round, like your finger, but flat and wide. When you put your hand on it, it should feel as flat as a lath; and if you can get at the edge, you should find the edge sharp, and not a round bone, like the rib of swine. A round rib will answer for a beef animal, but not for a good dairy-cow. Her backbone, moreover, should be open and loose, so that if you run your hand along it you will feel those little cup-like cavities. Let her hips be strong, not too wide, and her hind quarters upright, substantial, vigorous. Let her have a long hind foot. I never saw a short-toed cow in my life that would perform the work of the dairy well. A long hind foot and a good, broad, ample fore foot. Then if, in addition to all this, you can get a hide that is elastic and soft, covered with a warm substantial coat of hair, with a good milk-vein and an udder which is packed up well between the thighs, and so organized that there is no danger of inflammation, there you have got a cow that will produce all the milk you ought reasonably to ask, and which, when she has completed her dairy-work, can be so fattened as to produce in an economical way your 550 pounds of as good beef as can be fed on a mountain pasture or in a stall.

In an interesting discussion on the cultivation of fruits, the proper season for pruning apple-trees occupied a portion of the time. As to the most favorable season, Mr. T. S. Gold, of Connecticut, said: "We are advised to prune in June, but as that is a time when a farmer never will prune his trees, we accept what is considered to be the next best time, which is the mild weather in winter."

Mr. Ordway took issue with him, and said:

If you trim a tree in the fall of the year, at this time, or any time during December, January, or February, and go to it in May or June of the year following, and take your thumb and scratch upon the bark where you have taken a limb off, you will invariably scratch off dead bark of the thickness of an eighth or quarter of an inch. All the bark would have grown if you had cut it off in April, May, or June. I tried that in my orchard in 1856. There were some places, where I cut off a limb, that the bark died back a quarter of an inch, which had never been known when the trees had been pruned in the spring or in the summer. It is a mistake to trim your trees in the winter, and it is a mistake to head-in your trees in the fall; they will die back just as surely as you do it.

Mr. Wetherell referred to the practice of Mr. Pierce, of Arlington, indorsing him as one of the most successful fruit-growers in Eastern Massachusetts. He stated that his time for pruning, in ordinary seasons, was the first two weeks in June; but if he is too busy then, he takes off a limb at any time he may have leisure after harvest, a foot or more from the tree. Then in June he takes a fine-cut saw and cuts off the stump close to the tree. The final pruning is thus done at the time he considers most desirable, and the wound, he says, heals over smooth and sound, leaving none of that canker referred to. In reply, Mr. Ordway said:

I have no doubt every nurseryman will agree with me, that there is no time in the year when you have got to trim with as much caution as in June. If you are not very careful in pruning, you are just as sure to start the bark at the lower part of your stub as you live. June is a good time, but July is better. I have had experience all my life in trimming trees, and in grafting and budding all kinds of fruit, and I never saw but one year when I could not trim in April and the first of May. After you get your trees trimmed, mix a bucket of clay and hair, just the same as a man would mix mortar, and rub the mixture over the place where you have cut off a limb, and you will have no trouble. I did that, after 1856, to prevent the sap running down and turning black and killing the bark, and I have never had any trouble since. Therefore, if you trim in June, you must be very careful that you do not start the bark. You cannot put it back and make it stay, and there will be a dead place when you leave it.

Mr. Hills, of New Hampshire, was satisfied that June was the best season, for this reason: If the pruning is early enough, the wound will heal over almost completely the first year; but if it is too early, as in April or May, before growth commences, the tree "will bleed almost as surely as a grape-vine pruned in spring, and the sap will run down and poison the tree. It will run not only that season, but the next, and the tree is liable to be ruined." To prevent bleeding, Mr. Hills uses an application of gum-shellac, dissolved in alcohol to about the consistency of molasses, which, he said, will harden in half an hour as hard as glass, and will not only keep out, but will also keep in, the wet. As to the best mode of using it, he says:

The most convenient way I have found of using the preparation is to fix a sponge on a piece of wire and put it into the stopple of a large-mouthed bottle, which you can fill with the preparation, and when you have cut off a limb take out the stopple and brush the sponge over the wound, just as you would use sponge-blacking. If it is a bright day, in half an hour it will harden so that you cannot make any impression on it with your thumb-nail. The sap cannot get out, and it will exclude the wet from the outside.

Among the other topics of general interest treated in this volume are: "Co-operation among Farmers;" an extended paper, by Dr. J. R. Nichols, on the "Origin, History, and Utilization of Bowlder Rocks;" "Vegetable Culture and Market-gardening;" "Restoration of Forests," (24 pages;) "Tree-Planting in Massachusetts," (33 pages;) "Devon Cattle;" reports by Professor Goessmann on the "Reclaimed Salt-marshes in Plymouth County," and on "Fertilizers," the latter occupying 50 pages; "Mental Faculties of Domestic Animals;" "Origin and growth of associated effort in Massachusetts for promoting agricultural industries;" "Relations of Science to Agriculture;" "The Texas Cattle-Disease;" and "Chemical Corn-Growing."

MICHIGAN.

Reports of the Michigan State Board for the years 1873 and 1874 were issued in one volume. One of the interesting features is a series of articles, by Mr. Henry S. Clubb, on the fruit-belt of Michigan; another, a detailed account of the experiments in feeding and fattening hogs, by Mr. M. Miles, superintendent of the college farm. These articles are in the report for 1873.

Mr. Clubb begins with a description of the pioneer peach-region of the State. It is located sixty-one miles northeast of Chicago, on the Saint Joseph River. The village of Saint Joseph is built on the south side of the stream, on a fine eminence, and extends a mile or more along the lake shore. On the north side the Paw-Paw River enters the Saint Joseph, immediately opposite Saint Joseph village. On the east bank of the Paw-Paw the village of Benton Harbor is located. The harbor of Saint Joseph is one of the naturally good harbors of Lake Michigan. Owing to the large increase of business in Benton Harbor, a separate custom-house was established there in 1871. In the tabular statement given below it will be seen that the shipments of fruits are greater at Benton than at Saint Joseph. This is owing to the wide extent of land devoted to fruit-culture on the north and east sides of the Saint Joseph, which for several miles runs parallel with Lake Michigan, leaving Saint

Joseph on a comparatively narrow belt. This fruit-region covers an area of about fourteen by eighteen miles in extent, and is occupied by the eight townships named in the following table of statistics for 1873:

Townships.	Acres in—				Number of—							
	Fruit.	Strawberries.	Raspberries.	Blackberries.	Grape-vines.	Cherry-trees.	Peach-trees.	Pear-trees.	Apple-trees.	Plum-trees.	Quince-trees.	Fruit-growers.
Benton	3, 172¼	214⅓	109⅜	134	32, 110	5, 427	204, 721	10, 935	67, 092	1, 223	1, 453	295
Bainbridge	832½	6⅛	4½	3¼	736	479	29, 185	928	28, 693	23	300	114
Hogan	626¼	26¼	12½	5¼	4, 847	2, 694	40, 195	1, 600	15, 970	526	231	70
Lincoln	1, 973	288½	103⅛	223⅜	35, 154	4, 092	140, 987	11, 108	28, 567	2, 327	4, 631	49
Royalton	623¾	37¾	8¼	28¼	3, 050	671	45, 140	4, 098	20, 685	324	1, 214	91
Saint Joseph	1, 221¾	71⅝	33⅛	106½	31, 240	5, 013	96, 668	17, 168	23, 514	2, 860	5, 193	115
Sodus	342½	10⅓	2⅝	2⅞	1, 167	508	17, 724	771	8, 330	20	172	32
Watervliet	462½	1¾	⅝	1⅝	1, 331	471	20, 447	913	18, 785	....	....	75
Total	9, 254¼	656¼	273⅞	505⅛	109, 636	19, 355	594, 467	47, 621	211, 636	7, 503	13, 094	841

Mr. Clubb says that the first peach-tree planted in this region was raised from seed by Mr. Burnett, who located in this section about a century ago. Mr. B. C. Hoyt, who settled here in 1829, found the tree, which continued to bear fruit until 1839. Mr. Hoyt was the first to raise peaches which found their way into the Chicago market in 1839. They were bought by a cook of a steamer, packed in barrels, and taken to Chicago as a speculation. In 1834, long before Saint Joseph commenced the peach business, Mr. Brodiss, who lived six miles from Niles, on the Saint Joseph River, brought peaches down the river on a canoe, and sold them in the village of Saint Joseph. They were all seedlings. About 1834 a family named Abbee planted some improved varieties of peaches and apples, which were obtained from Rochester, N. Y. These trees were afterward transplanted from the village to Royalton township, and fruit was sold from them in Saint Joseph in 1837. In 1840, Capt. Curtiss Boughton commenced the business of transporting peaches in barrels and dry-goods boxes on his vessel to Chicago, where he sold them at enormous profits, sometimes realizing $45 per barrel. This high price naturally drew attention to the business and led to the settlement of the country, especially in the vicinity of Saint Joseph and Benton Harbor, resulting in the above statistics in about thirty years. This extension of peach-growing has been gradual. Mr. George Parmalee planted his orchard in 1848. He subsequently enlarged it to ninety acres. Captain Boughton planted 130 budded peach-trees in 1849. In 1850 his shipments were 10,000 baskets. The Cincinnati peach-orchard, of sixty acres, was planted in 1857. It is now owned by Messrs. Perkins & Sheldon, of Chicago. Notwithstanding the destruction of some of its trees to prevent the spread of the yellows, there were 40,000 baskets of peaches shipped from this orchard during the season of 1874. No less than 3,360 baskets have been shipped from this orchard on a single day. The average net price obtained was 40 cents a basket.

The following is his estimate of this fruit-region:

On the whole, I regard the Saint Joseph fruit-region, which includes Benton Harbor and all the towns named above, as a most complete demonstration of the success of fruit-culture in Michigan. It is claimed that a total failure of the fruit crop has not occurred, except after the extremely cold weather of 1861, and although the peach crop does not always grow so abundantly as it has the season of 1874, taking one season with another it is as sure as almost any fruit crop is anywhere, either in Europe or America, while the grape crop is as sure as corn and potatoes, with the variety mostly cultivated, the Concord. The soil in the limits mentioned is so varied as to render it difficult to describe, for on the same farm will be found sand, sandy loam, rich black soil, loam and clay, each being adapted for particular kinds of fruit and vegetables, rendering the fruit-farmer capable of producing fruit for market, commencing his harvest with strawberries the first week in June, and continuing with raspberries, currants, gooseberries, cherries, summer apples, early peaches, late peaches, grapes, fall and winter apples, until the frosts and storms of December render shipment by lake dangerous.

Twenty miles north of Saint Joseph is South Haven, another great fruit center. Black River enters the lake here, forming at the mouth quite a good-sized harbor for steamers and lake-shore traders. From Benton Harbor to within three or four miles of this harbor the shore is lined with sand-hills, mostly covered on the east side with forests, not much settled, but presenting many good sites for fruit-growing. These hills terminate in a fine level bluff of clay subsoil and sandy and gravelly loam, interspersed with clay and rich black vegetable mold, averaging, perhaps, 40 feet above the lake. In this region are some fine fruit-farms, among them that of Mr. A. S. Dyckman, president of the State Pomological Society. It consists of 65 acres, within and adjoining South Haven. In 1873, when peaches were a very short crop along the lake-shore, Mr. Dyckman had an excellent yield, for which he obtained good prices, aggregating over $10,000 net profits.

Twenty miles north of South Haven are Kalamazoo River and Lake. This is a much newer, but still a very prolific, fruit-region. The Kalamazoo Lake, which is only an enlargement of the river, constitutes the harbor. The villages of Saugatuck, on the north, and Douglas, on the south, are shipping-places for the products of the circumjacent region. In this neighborhood Mr. Perattet realized, in 1872, $1,700 net profit from the peaches on six acres.

Eight miles north of the mouth of the Kalamazoo is Black Lake Harbor. It is accessible for good-sized vessels during the season of navigation. Inside is a beautiful lake about six miles long and from half a mile to a mile in width. Around this lake are numerous orchards and vineyards, and at its head is the city of Holland, the commercial metropolis of the Holland colony. Spread over the territory covered by the surrounding towns and villages are hundreds of farms, mostly small, but thoroughly cultivated, and almost every farm has its orchard and vineyard, while not a few make the cultivation of peaches and grapes the principal feature.

Still farther north, opposite Milwaukee, Wis., is Grand Haven Harbor, near the mouth of Grand River, a fine stream of water, 300 feet across at its mouth, and widening within to 400 or 500 feet, with depth of water sufficient for the largest craft that float on the lakes. The principal fruit-growing townships in this region are Grand Haven, Spring Lake, Ferrysburgh, Peach Plains, Fruitport, Midway, Eastmanville, Nuncia, Coopersville, Nortonville, Spoonville, Lamont, Berlin, Oconto, West Olive, Robinson, Allendale, Lake Pottawattomie, Bass River, Little Black Lake, and Pigeon Creek. There are now about 300 fruit-farms embraced within these townships, varying from 5 to 100 acres in extent, furnishing the principal support to about as many families. All the points named are reached either by navigation or railroad, and some by both.

Another fruit center is Muskegon City, 11 miles north of Grand Haven. It is on the south side of Muskegon Lake, near its junction with Lake Michigan. Four miles above is Black Lake, four miles long by half a mile in width. This is surrounded by one of the best fruit-regions along the lake-shore. Nine miles north of Muskegon is White Lake Harbor. During the season of 1873 there were shipped from this point 6,000 baskets of peaches, 200 bushels of strawberries, and 6 tons of grapes. This section is a comparatively new fruit-producing region, yet it is claimed that the finest apples, the choicest plums, and very good peaches and grapes can be grown here. Pentwater is located twenty-seven miles farther north, in Oceana county. The country is comparatively new, but sufficient experiments have been made to demonstrate that a great variety of fruits can be produced in abundance. Pere Marquette Lake is 12 miles north of Pentwater. This lake is nine miles long and from one-half mile to one mile broad. On the north side is Ludington, the shipping-point for the commerce of this section. Pears, plums, strawberries, apples, &c., do well in this region, which promises to be as prolific for most of the standard fruits as other parts of the fruit-belt. Manistee, twenty miles north of Ludington, is on Manistee Lake, which is four miles long and from one-half to one mile broad. Around it are to be found some old orchards, and a large number of new ones. The writer says that the fruit-growers in this region were more or less discouraged on the peach question by the severe frost of 1872, but he thinks that frost taught the most observant an important lesson in regard to peach-growing, viz., that the peach-tree will not bear prolonged cultivation or heavy fertilization; that its greatest danger is in overgrowth, leaving sappy and unripe wood, which cannot stand the severity of an unusually cold winter.

A large section north of Manistee gives promise of soon becoming as great a fruit-region as the country farther south.

Mr. Clubb gives, near the close of his series of articles, a tabular statement showing the number of crates of small fruit and peck-baskets of peaches, pears, plums, summer apples, crabs, cherries, grapes, and tomatoes produced at the places named during the season of 1874. The following is a recapitulation of this table:

Fruit-region.	Packages of fruit.	No. of farms.
Saint Joseph	1,243,407	841
South Haven	146,118	200
Saugatuck	200,989	250
Holland	62,000	300
Grand Haven	397,000	350
Muskegon	96,000	150
Whitehall	30,000	50
Pentwater	26,000	145
Ludington	25,000	140
Manistee	40,000	135
Traverse	44,000	160
Total	2,310,514	2,721

He concludes as follows:

Fruit-growing is the specialty of these lake-shore counties, and while the peach is the leading fruit of Berrien, Van Buren, Allegan, Ottawa, and Muskegon counties, and is grown successfully in Oceana, Mason, Manistee, and in some favored spots in Benzie, Leelenaw, and Grand Traverse counties, these northern counties are taking the lead of the southern in winter apples, pears, and plums. Grapes appear about equally successful in all the counties named, where varieties suited to each locality are selected. All those counties north of Allegan are but thinly settled, and the land capable of producing these choice fruits is probably forty times more extensive than that which is yet used for that purpose; there is, therefore, a wide field opening for those who desire to engage in a pursuit which is not only profitable in its ultimate results, but which is healthful and ennobling in all its practical details.

The experiments in pig-feeding, by Mr. Miles, began in 1868, and extend through a period of four years. As to the object and extent of these experiments, Mr. Miles says:

The first series of pig-feeding experiments, now completed, have been conducted for the purpose of ascertaining the value of raw corn-meal when fed by itself. The exclusive use of raw meal in pig-feeding is not to be recommended as the best paying method, as better results can undoubtedly be obtained with a proper admixture with other foods. The leading object in view in the experiments already made was to obtain a reliable standard of value with which to compare the results with corn in other forms and when mixed with other foods. The complexity of the conditions involved in experiments with mixed foods seemed to require this preliminary experiment with a single article of some standard food as a starting-point.

Forty-two pigs of different kinds have been under experiment, and the gross amount of raw corn-meal consumed has been over 10 tons. The greatest care has been taken to secure accuracy in everything relating to the experiments, and every precaution has been taken to eliminate elements of error. From the close agreement of the numerous experiments embraced in this series, it is believed that the results on the whole may be accepted as approximately correct.

In summing up the results of the entire series, it would be desirable to make a comparison as to the relative merits of the different breeds under experiment, were it not for the fact that the conditions are so varied as to age as to prevent any grouping of breeds that would be satisfactory. The experiments all show that the age and ripeness (degree of fatness) of the animals have an important influence on the amount of food consumed in proportion to weight, and on the return received for feed consumed. The younger animals eat more in proportion to their live weight, and they likewise require less food to make a given increase in live weight. As animals ripen they consume less food in proportion to live weight, and they likewise require a larger amount of feed to make a given increase in live weight. It is possible that the size of the animals may have an influence on consumption in proportion to weight, and upon the amount of food required to produce a given increase; but this is a difficult matter to determine by experiment, and the data for its discussion have not as yet been obtained.

The incorrectness of the prevalent opinion, that the animals that consume the smallest amount of food are the most profitable, is conclusively shown in the results of these experiments. It will be safe to say that the animal capable of eating the most is the most profitable, provided the digestive organs are capable of assimilating a large amount of food and converting it into animal products. In such cases the proportion of food required to supply the waste of tissues and keep the animal machinery in working order is less than when the amount consumed is but little. It is only, in fact, from the excess of food over what is required for repair of the tissues that a profit in animal products can be obtained.

For the purpose of showing the influence of age and ripeness upon the amount of feed consumed and upon the return obtained for it, the results of the entire series of experiments have been tabulated in periods of four weeks, and in groups of ages over six months and under six months, together with the general average of all ages for each period. In the table which follows, pen 9 of 1870 and pens 14 and 16 of 1869, have been entirely omitted, for the reason that the irregular progress of these animals indicated an abnormal condition of the digestive organs that rendered their record of no value. The weights are all given in pounds and decimals of a pound.

Summary of results of pig-feeding experiments of 1868, 1869, 1870, *and* 1871.

Periods of four weeks each.	Ages of groups.	Meal consumed per week for each 100 pounds of live weight.	Meal required to produce 1 pound of increase of live weight.
1st period	Under six months, (omitting first week)	33.52	3.86
	Over six months	17.74	3.91
	Average of all ages	20.45	3.93
2d period	Under six months	26.60	3.81
	Over six months	19.07	4.08
	Average of all ages	20.57	4.00
3d period	Under six months	23.22	4.55
	Over six months	17.23	4.64
	Average of all ages	18.50	4.61
4th period	Under six months	21.27	5.71
	Over six months	15.19	6.59
	Average of all ages	15.94	6.43
Average of 1st, 2d, and 3d periods.	Under six months, (omitting first week)	26.54	4.08
	Over six months	17.83	4.22
	Average of all ages	19.57	4.19

As the table stands, it will be seen that the digestive organs did not fully adapt themselves to the work required of them until the second period, when the best results were obtained. It was undoubtedly a mistake to put such young animals at once on a full feed of raw meal. They should have been fed smaller amounts for several days before commencing the experiment, to give their digestive organs a chance to adapt themselves to the new situation. Another singular fact was obtained in tabulating the first period of feeding of the animals over six months old. If the first week of feeding is omitted from their record, the results for the second, third, and fourth weeks would show that 18.58 pounds of meal were consumed for each 100 pounds of live weight per week, and that 4.57 pounds of meal were required to make a pound of increase in live weight.

The average amount of meal consumed per week for each 100 pounds of live weight is shown to be greater for the period of 3 weeks than for the period of 4 weeks, while a larger amount is required to make a pound of increase. The first week of the experiment the digestive organs of these older animals appeared to be capable of assimilating all the meal consumed, while at a later period they showed that they had been overtasked, so that with an increased consumption of food (showing no impairment of the health to affect the appetite) they were unable to assimilate and lay up in increase as large a proportion of their food as they did during the first week. The fourth period is not included in the general average given at the bottom of the table, for the reason that in all of the experiments the last period of feeding shows a rapid decrease in the amount of food consumed, and a corresponding increase in the amount of meal required to produce a pound of increase in live weight. As the averages during the periods of profitable feeding were thought to be of the greatest value, they were therefore inserted in the table.

The incorporation into the Michigan State Agricultural Society of the Northern Michigan Agricultural and Mechanical Society was effected at Lansing on the 6th day of February, 1873. Mr. George W. Griggs, of Grand Rapids, was elected president. In his inaugural address he said:

A State society should have a State policy, and one embracing the whole State and every interest of that State. Michigan has a diversified industry, and all her industries should be encouraged. Her mines and lumber cover a large portion of territory. Her wool products now rank third among the States. Her stock interests are of growing importance. As a fruit State she is attracting attention from all directions. Her cereals and grasses and dairy products are of great value. These all demand the fostering care of a State society. Each should have a place, and be given the consideration which is its due. Let the people of Michigan understand this to be the policy of the society, and let them prepare to receive our State fairs. I do not believe it to be a sound financial policy for this society to own a rod of ground or a stick of timber. Let the local organizations own and prepare the necessary grounds and buildings. Let Lansing, Jackson, Detroit, Kalamazoo, East Saginaw, Adrian, and Grand Rapids own sufficient grounds and buildings to accommodate a State fair. The State Agricultural Society ought not to be obliged to expend one cent for such grounds and buildings. With such accommodations these places will always be sure, with wise management, to secure good county exhibitions; and with such accommodations ready for it, the State society should move from place to place, dispensing its benefits all around the State. This policy, a few years ago, might not have been convenient or possible. The extension of our railroad system now makes it possible. Lansing to-day is a railroad center. So are Jackson, East Saginaw, Grand Rapids, Kalamazoo, and Adrian. Detroit is acknowledged to be the commercial emporium of the State, and for one I delight to commend her great progress in population and wealth. To hold a State fair it is necessary to have railroad facilities for the transportation of passengers and stock, hotels for the accommodation of visitors, and a people who will strive to provide necessary accommodations at reasonable prices. These guaranteed, I believe it the best policy to hold the fairs of the State society in different localities of the State—north, south, central, east, and west.

The State fair for 1873, held at Grand Rapids, was reported as successful in every respect. The net earnings for the year aggregated $14,567.

Report for 1874.—This report contains addresses and original papers of vital interest to the farmers and fruit-growers of Michigan.

The Board at its annual meeting, September 17, 1874, elected the following executive officers: E. O. Humphrey, president; F. C. Kimball, secretary; A. J. Dean, treasurer.

An address by Prof. R. C. Kedzie before the house of representatives, on "The application of chemistry to practical agriculture and the laws of health," is published in this report. He thus describes the duties of an agricultural chemist:

One duty often assigned to the agricultural chemist by those who know little either of chemistry or agriculture is to "analyze the soil," as if the chemical analysis of the soil would determine every question of its agricultural capabilities, the kind, amount, and quality of the crops it would raise. In the early history of the science, analyses of certain barren soils revealed the cause of the barrenness in the sulphate of iron present. When this was removed or decomposed by lime, the soil was fruitful. A few instances of this kind gave great hopes of benefit from soil-analysis. But such instances of barrenness from purely chemical causes are rare and exceptional. * * * But it is often found that the most careful chemical analysis will not distinguish between a fertile and a barren soil. One reason is that the barrenness may be due to physical causes, *e. g.*, want of drainage. Chemical analysis can only determine the chemical conditions of the soil, and will not always reveal physical evils. Agricultural chemists now regard the analysis of the soil as of only secondary importance.

One duty of the chemist is to explain the facts which are already known in agriculture. By knowing the reason why we do a thing we may discover better ways of doing it, or that some other and easier process may accomplish the same result. We thus sift our processes and eliminate needless elements or introduce better ones.

But there is another benefit of knowing the reason of our actions. When the mind comprehends and watches the wonderful chemical processes which are always going on in earth, in air, and in the growing crop, the body forgets half the weariness of toil. Nothing is so wearisome as work without thought. It is mere drudgery, and every man, and especially every boy, hates it. Let the boy know that in handling the hoe, holding the plow, in harrowing and cultivating, he is providing the conditions of wonderful chemical changes. Let him understand those changes, the chemistry of plant-growth, of ripening of grains and fruits, why the bitter and austere apple of July becomes the golden pippin of September. Let such thoughts fill his brain, and the weariness of the body is forgotten. Glorified and loving nature walks by his side in the fields of toil, unfolding her wonderful mysteries, and loneliness and discontent have fled.

Again as to analyses of manures:

The chemist may benefit the farmer by making analyses of manures and determining their nature and value. Artificial manures are being largely introduced into this country, and farmers may want to know whether it will pay to buy and use them. The Sheffield Scientific School of Connecticut has done the farmers of the East good service by analyzing these manures—the superphosphates, guanos, &c.—showing their composition and real cash value. The same kind of work must be done in this State, if farmers are to receive the assistance which they have a right to demand. * * * *

The chemist may aid the farmer by showing the value of manural matters within his reach, enabling him to secure at home what is now imported at such great expense from abroad.

Of a recent important discovery in agricultural chemistry he says:

Three years ago, Dehcrain, of France, made the important discovery that when vegetable matter undergoes decomposition in presence of some alkaline substance, it combines with free nitrogen and retains it in a fixed form. This has been confirmed at the Sheffield Scientific School, and science will yet point out the means by which the farmer may make at home all the combined nitrogen he wants. This discovery will be worth more than the discovery of a thousand guano-beds in the far-off Pacific.

Prof. A. J. Cook, of the State agricultural college, contributes an illustrated paper on insects injurious to the farm, garden, and orchard.

In an essay on the breeding and improvement of horses, Mr. G. W. Sherman speaks of the importance and profits of rearing better horses, as follows:

First, call our common stock of horses worth on the average $150 each. Compare this with the price Mr. Bonner paid for Dexter, $34,750, and you have a surplus of $34,600 in favor of fine breeding. This is no stretch of imagination. The line is correctly drawn, even if it should overtax credulity. Neither is this an isolated case, nor drawn at its full extreme. There have been sales made since Mr. Bonner purchased Dexter where parties have paid $50,000. Time would fail me in going over the list of sales running into thousands. While on this head, it might be the proper place to mention some of the breeds of these famous equines and the fabulous prices paid to some of these noble sires. First on the calendar is Mr. Rysdeck's Hamiltonian, and the sire of Dexter. This horse has been standing in Orange County the past season for $500 a mare, $250 required to be paid down; while many of his descendants are standing in other places and States for $200 and $300 per mare. I shall not have time to call your attention to all the notables in the horse family. Their names are being handed down to us on pages of history. I will pass over the history of the American Eclipse and the Old Messenger—rival horses in their day—whose very names are almost hallowed to all horse-connoisseurs. Next I will mention the Old Hill Black Hawk and Wadsworth Henry Clay; few of the latter-day horses have left a more numerous or better grade of colts. The old Green Mountain Morgan, the Bulrush Morgan, the Stockbridge Chief, and Kimball Jackson head the list among the prominent horses, and have bequeathed to us a legacy we ought to cherish and to regenerate. Had we not been derelict in obeying the organic laws of horse-physiology, we should not have allowed the race to become so degenerated. There is no truer saying than like begets like. Had we, as a nation, been as mindful in propagating our brute creation as we have in selecting and propagating our vegetables, we should have none of those walking dictionaries of all the diseases that horse-flesh is heir to, in one volume, badly bound.

Mr. O. F. Miller, in a paper on poultry-raising, contributes some valuable suggestions. After alluding to the small cost of raising and fattening chickens, he gives directions for their proper care, the kind of food they should have, and the most profitable varieties to raise. He says that a poultry-house should be located on gravel or dry sandy loam. Stagnant water should be avoided. It should be built facing the south, if possible, and if on a side-hill sloping to the south, all the better. It should be made warm and dry, and so constructed that it can be easily cleaned out, which should be done quite often. Fowls should be permitted to range at liberty a greater portion of the time. Their nests should be constructed so as to admit of easy access, and should be kept comparatively dark, and so made that they can enter them unperceived and lay without fear of being disturbed. They should not be confined to one variety of food the whole winter. The food should be changed every few days, or two kinds of food a day is still better; say a feeding of corn in the morning and a feeding of oats or barley in the evening, with now and then a meal of some sort of cooked food. They should have, once or twice a week, some meat and some kind of vegetables. There should always be some dry ashes near the poultry-house for them to wallow in, as it is good to keep them free from vermin. There should be a box of lime or old mortar, and one of dry gravel, where the hens can get at it, especially in the winter season. Fowls over fat or lean seldom lay. Food that will keep them in the best working trim, as is said of the horse, is the best, and they should be fed regularly. The variety of fowls that are the most profitable to be kept is a matter of some importance. If near large markets, where eggs could be shipped without making the freight so high, then perhaps those that produced the greatest number of eggs during the year would be the best variety to keep. In most of our large cities the price of eggs is seldom, if ever, below 25 cents per dozen, and often as high as 40 cents, while the price paid to the producer is seldom more than one-half that amount. Therefore, that variety should be selected that will produce the greatest number of eggs during the season of the year that they bring the highest price, and, at the same time, are of the most value for their meat. It is generally conceded that for winter laying, and for meat for the table, the light Brahma takes the preference. Mr. Miller gives the following illustrations of profit in raising poultry:

Mr. Nelson Ritter, of Syracuse, N. Y., in the first three months of 1869 received eggs from fifty-six hens, as follows: In January, 868; February, 891; March, 984; with fourteen of the hens sitting from about the middle of the month. The eggs were sold for $66.98; the expense of keeping was $26.13; the profit on eggs for three months was $40.85. The hens were a cross of Brahmas. L. P. Trimble, of Newark, N. J., kept for six months ending July 1, 1870, an average of eighteen hens and two cocks. They produced 1,290 eggs, which, at market value, were worth $40.49. There were also thirty-two March chickens, worth July 1, $8, making the value of the product $48.49. The cost of feed was $19.45; net profit for six months, $29.04, or $1.45 per fowl.

Among the other contents are full reports of all departments of the State Agricultural College, and two addresses by its president, T. C. Abbott; one before the students, on manual labor, and an extended one before the house of representatives, on agricultural education.

Pomological.—The fourth annual report of the State Pomological Society, for the year 1874, constitutes a volume of upward of 500 pages. Reports of the parent association and its auxiliaries give a most encouraging view of the progress of pomology in this comparatively young commonwealth.

The president, George Parmelee, in his inaugural address, February 9, 1875, says:

Is there any reasonable objection to specialties in countries where favorable peculiarities fit them for the most profitable production? Is there any reasonable objection to the State of Michigan making the most out of what nature has done for her? If there is, it will be hard for her farmers to see it while the money profit stands prominently before their eyes. There is no such objection. With our unequaled water influences, with our location in the midst of the populous and wealthy Northern States, and with profitable markets open to us on all sides, we shall drift more and more into fruit production. Our fruit interest has already advanced to considerable proportions. Starting from the old Dousman apple-orchard on Mackinaw Island, and the old French apple and pear trees on Detroit River, all seedlings, we have gone to net results of many millions. Within the memory of some of us here our present great interest has grown from nothing. We have passed the day of wild speculation in fruit-lands, the "belt" proving to be too wide a matter for speculation, as from center to circumference various valuable fruits can be grown profitably. Our constantly increasing and cheapening transportation facilities are opening to us a great number of good markets. Our best-keeping apples can go to Europe in good condition, and to Louisiana or Texas, while the nearer eastern and western markets are ever ready to take the bulk of the crop. Our peaches, pears, sweet cherries, and grapes do not have to go far for good markets, and the increasing demand will admit of a very great increase of production.

* * * Surely no State east of the Rocky Mountains has such an extended area suited to the production of first-class apples, and with our nearness to non-producing regions giving us the best of markets, and with our adaptation to the production of the other staple fruits of the temperate clime, we are not behind. We are surely favored beyond the adjoining States.

A catalogue of "popular and valuable varieties of fruits, compiled from the best authorities"—having respect to the climate of Michigan—is given.

At the February meeting held at Lansing, Mr. Emmons Buell read a short essay on fruit-growing. He advises top-graft winter varieties on Northern Spy-trees two to three years old. He regards the Red Canada, in tree and fruit, as approaching more nearly all the requisite qualities desired in a winter apple of any on the Michigan list. He says:

The tree is hardy, a fair grower, and in style of top all that can be desired. In fruit it is a good bearer, a good handler, and keeps well; in quality unexceptionable, while its bright red color makes it very attractive, as the high price it brings in market fully attests. But if you must add the Baldwin, Wagener, King, &c., do not fail to put them on Spy stocks. Give the ground good cultivation in the early part of the season, and wash the trees with soft soap about the 1st of June for a number of years.

As to profits in Michigan, Mr. Buell says:

An orchard will contain about 50 trees to an acre. I think they may be safely estimated to produce one barrel per tree for a great number of years, or while in good condition. This would give 50 barrels per acre for each year, and at $2 per barrel would be $100 per acre. I think a good orchard, with care, and composed of the best varieties, will exceed, rather than fall short, of these estimates.

Mr. William L. Webber, in an essay on "The destiny of Northern Michigan," says:

An erroneous idea is entertained by many concerning the character of the soil on which the pine is found. In most cases the pine grows intermixed with hard wood, or in clumps surrounded by beech and maple, sometimes found in belts interspersed with other timber; but even where pine is almost the only timber upon the ground, it has been found that the soil is capable of producing excellent returns to the agriculturist. It is true the pine stumps are an incumbrance and somewhat difficult of removal, but time and labor will remove them; and as the soil is capable of producing good crops, the time will come when as good returns will be had from land once covered with heavy pine as from the average lands covered with hard wood.

Of the extent of these lands and of the advantages likely to accrue to the people of the State from the unlimited amount of lumber they will yield, Mr. Webber says:

In considering the future of the agricultural interests of the northern half of this peninsula, the fact that a large portion of it is covered with valuable timber is not to be lost sight of. Of pine alone there is probably sufficient to make 50,000,000,000 feet of lumber. The wealth of the State will be promoted by handling this immense quantity only so fast as the timber may be required at remunerative rates, and erecting and operating such manufactories as will fit it for the consumer's use before transportation, so that Michigan may receive the full benefit of its native wealth; and that policy which should cut this timber and force it upon the market faster than demanded, or which should send it in a coarse and unfinished condition into other States for the finer manipulations, would be an unwise one. Properly treated, the lumbering interest and the agricultural interest should go hand in hand and support each other. A home market is always more valuable to the agriculturist than a foreign one, and the lumbering which goes on in the immediate vicinity will not only furnish a market for the surplus products of the farmer, but also employment for himself and his teams when their services may not be required upon the farm, and at remunerative prices. Growing, as the pine does, in belts and groups intermingled with hard timber, probably two-thirds of the space may be reclaimed for agricultural purposes without material injury to the pine timber.

In speaking of the advantages of Michigan as they relate to agriculture, manufactures, and commerce, the writer says that, aside from its long lake-coast line and from its navigable rivers, the construction of railroads has added largely to its commercial facilities. In 1854 the

State had 444 miles of railroad; in 1864, 898 miles; in 1874, 3,253 miles. Ten years ago Northern Michigan had not to exceed 15 miles of railway; it now has 590 miles.

During the past decade Michigan has advanced to the front rank of fruit-producing States. Its soil and climate seem to be specially adapted to the greatest production of many of the more valuable varieties, and hence every year shows a largely increased interest in the cultivation of such fruits as have proved most profitable. In a paper on the effects of Lake Michigan on fruit-culture, Mr. Henry S. Clubb says:

The spring season finds Lake Michigan a mass of water nearly covered with floating ice. The storms of March and the rains of April having broken up the ice in the rivers, large quantities of it finds its way to the lake, where it is driven hither and thither at the mercy of the winds and waves. Sometimes there are drifts and gorges of this ice on the west side, but more frequently it hugs the east shore, and is so extensive that the blue, open water beyond is scarcely distinguishable from a dark cloud on the horizon, as one stands on the east shore. None but the most daring navigators, with the stoutest-built propellers, will venture through this terribly seething mass. Milwaukee and Grand Haven are, at present, the only harbors kept open throughout the ice season. The shore is usually protected by a pile of ice from 20 to 50 feet in height, thrown up during the winter by the action of the waves.

The effect of this floating ice, and the ice and snow piled on the shore, is to retard the season. The prevailing winds begin from the west, southwest, and northwest; the east shore is kept backward by the cool breezes, which permeate the fruit-trees and prevent that early expansion of the peach-buds, so much deplored on the west side of the lake, and which renders the destruction of peach prospects so common every spring in the Western and Southern States. Not until summer weather is fairly established and danger of late frosts over, does the water of Lake Michigan become warm so as to melt the ice, and the sun dissolve the ice-wall so as to allow the breeze which passes over the lake to permit the expansion of the fruit-buds on the peach-trees of the eastern shore.

As the season advances the water of the lake, which has hitherto been so much cooler than the atmosphere received from the south and west, gradually warms under the influence of the sun's rays and the land breezes. It is much less changeable in its temperature than the land breezes. It warms slowly, but when warmed it retains the heat proportionately with its depth and volume. The effect of this warm condition of the lake water is to prevent sudden changes on the lee shore. Regularly as the tides of the ocean, the summer breezes traverse the land and water along the lake shore. In the forenoon the breeze is usually toward the lake, and in the afternoon a lake breeze comes over the land, modifying the temperature and making the hottest days of July and August pleasant and agreeable, healthful alike to animal and vegetable life. This is the true system of ventilation, of atmospheric drainage, and, where the sloping hillsides are favorably formed, almost certain is the exemption from summer frosts.

As summer proceeds with its work of perfecting fruit, the lake has not only a protecting but a fertilizing influence. The intense heat of the sun is exerted on a large expanse of water, and the atmosphere is laden with the moisture drawn up during the day, and in the dryest season dew comes to the aid of exhausted nature, and, wherever cultivation of the soil is properly attended to, the cooled earth condenses the moisture and absorbs it, producing the best possible condition for growth. In calm, summer weather, this condition is probably best secured along the lake-shore, as during strong winds the moist air is apt to be carried farther inland before the earth, cooled by cultivation, can condense and absorb the moisture, and immediate proximity to the lake during strong summer winds may be no great advantage; but as summer is the period of calm and the winds are seldom strong or violent, the moist lake air is an important element of fertilization. It is a fact, well established in my observation of Ottowa County, that land within six to ten miles of the lake is less liable to suffer during a long period of dry weather than land farther east.

Mr. Clubb states that the gradual flow of water from the southern extremity or head of Lake Michigan to its northern exit at the Straits of Mackinac, has the effect of reversing the usual experience in northern latitudes. Instead of cold and frost setting in earlier in Northern than in Southern Michigan, the very opposite is experienced, and several weeks after peach-trees have been denuded of their foliage at Saint Joseph and other regions south, they are in full leaf at Northport, in Leelenaw county, and other places around Grand Traverse Bay. The influence of the lake stream seems to be as well marked here as is that of the Gulf Stream in England and other portions of Northern Europe, where the temperate season is prolonged, along the sea-coast, many weeks longer than in the same latitude on the western shore of the Atlantic, or even in the interior of Europe.

In an article on plum-culture, Mr. T. T. Lyon gives the following preventive against the depredations of the curculio:

Some three or four years since, Mr. Windoes, of Kamalazoo, accidentally discovered that some of his plum-trees, which had been subjected to the dense smoke of burning coal-tar, were not visited by the curculio, while those adjacent, and not so treated, lost their crop as usual. Taking the cue from this fact, he for some three years in succession repeated the process, adding a little sulphur to the coal-tar and burning the mixture in an iron vessel under the trees. By the offer of the material gratis, a neighbor was also induced to make the trial upon his own trees, which resulted also in the saving of his crop of plums. Three years of success with this remedy has given Mr. Windoes so much confidence in its effectiveness that he has during the past year made it public, and quite a number of persons made trial of it upon their last summer's crop of plums; but we regret to say, as far as we have yet learned, with but indifferent success. As there can be no doubt of the actual and repeated success of Mr. Windoes, we can only account for these failures upon the supposition that a different quality of coal-tar was used, or, otherwise, that there may have been a lack of thoroughness in the application of the remedy.

As to the profitableness of plum-culture, Mr. Lyon states that a plantation of considerable extent will fully warrant the making of thorough arrangements for the care and management of the same, as well as the providing of all requisite facilities for the warfare upon the curculio in the most efficient manner; while in such cases the actual expenditure for these purposes will be found to be very small when compared with the value of even a very moderate crop. With a plantation of one hundred trees in bearing, two men would apply the jarring process (or that and the Ransom trap jointly) to the whole in about one and a half hours; and if this were required to be repeated three times a day, the whole would require but the equivalent of one man's time. This might be required for a period of six weeks at most, although during very windy or rainy weather no application would be needed. The cost of apparatus with which to prosecute the warfare against the curculio need not exceed \$10 or \$12, to which must be added the hire of a trusty man or boy for the above time. These two items will constitute nearly or quite the entire cost of management for the season in excess of that required for a similar orchard of apples. As to the relative values of the products of each when grown, we leave to those interested to estimate for themselves, only remarking that, so far as we have been conversant with the results in such cases, those derived from the culture of the plum, even with curculio warfare against them, have been highly satisfactory.

In planting an orchard of plum-trees, Mr. Lyon says that 16½ feet in the rows each way is a very good average distance, although in extensive plantations it may be found desirable, for the convenience of gathering the fruit and to facilitate the reaching of all parts of the plantation with a team and conveyance, especially while the trees are laden with fruit, to leave after every fourth or sixth row an increased width of perhaps 20 or 25 feet, as well as one or more such wider spaces in the transverse direction. The distance of the trees apart, however, should be determined with more or less reference to the habits of growth of the varieties to be planted.

Mr. Lyon also contributes a paper on new varieties of fruits, in which the leading characteristics of the following-named varieties are given: *Apples:* Shiawasse Beauty, Mann, Grattan, and Somerset. *Siberian Crabs:* Brier's Sweet, Byer's Beauty, Marengo, Lady Elgin, and Sylvan

Sweet. *Cherries:* Lieb. *Grapes:* Iona, Croton, Eumelan, Isabella, Martha, Walter, Kalamazoo, Senasqua, Worden, Champion, and Tolman's Seedling, Rogers Hybrids, Arnold Hybrids, Wylie Hybrids, Ricketts Hybrids, Campbell's Seedlings, Lady, and Ithaca. *Peaches:* Foster, Mountain Rose, Atlanta, Richmond, Solway, Southwick's Late, River's Peaches, (twenty varieties,) and Amsden's June. *Pears:* Dana's Honey, Clapp's Favorite, Edmonds, Mount Vernon, and Souvenir du Congress. *Plums:* Miner, Wild Goose, Weaver, and Jodoigne Green Gage. *Strawberries:* America, Black Defiance, Boudinot, Boyden's No. 30, (Seth Boyden,) Charles Downing, Colonel Cheeney, Cowing's Seedling, Cumberland Triumph, Dr. Warder, Early Queen, French, Golden Defiance, Golden Perpetual, Golden Queen, Keech's 2,200, Kentucky, Kissena, Kohocken, Kramer, Late Prolific, Lennig's White, Matilda, Monarch of the West, New Jersey Scarlet, Romeyn's Seedling, Springdale. Of these, Cowing's Seedling is spoken of as bearing the largest berry in cultivation; the vine is vigorous and hardy, and the fruit of fine flavor and great promise.

Mr. Frank A. Gulley contributes a brief article on the treatment and value of manure. Holding that success and profits depend upon the amount produced per acre above the cost price, he has been experimenting for years in the endeavor to bring his lands up to the highest practicable point of fertility. He states that fifteen years ago the livery-stable men of Detroit were glad to give away their manure, and frequently had to hire it removed. It now brings from 50 cents to $1.50 per wagon-load. Its rapid increase in value has caused Mr. Gulley to economize, as far as practicable, by manufacturing his own fertilizers, and in this he has succeeded by the rearing of pigs and the feeding of cattle on his own place. Previous to the past year he bought nearly all his own feed. He is now renting land for the purpose of raising feed, for which he pays an annual rental of from $3 to $6 per acre. He says:

If we can make our sales of pork and pigs and the amount received for the cattle, after deducting their cost, equal the value of feed consumed, letting the manure balance the work, we consider it a good investment. But we find we can do better than this by keeping the small-boned, fine-bred pigs. With judicious and heavy feeding, taking the value of the manure into consideration, we think we can compete with the western farmers in raising pork. Our pigs during the past year have returned $1,000 over the value of feed consumed on pigs sold for pork and feeding, while at the same time we are establishing a herd of thoroughbred pigs. But we expect a greater profit on the increased production of crops caused by the use of this manure.

We make a practice of buying thin steers in the fall, either two, three, or four years old, which cost us from $20 to $50 each. These are fed until in good condition, and then sold at from 50 to 100 per cent. advance. There are a class of farmers who raise cattle till they are two, three, or four years old, merely giving them feed enough to keep them alive and make them grow, and this class of farmers is found all over the State. We can buy these cattle, feed them heavily three or four months, and get nearly as much for feeding them that length of time as the man who raised them did for keeping them two or three years. But it is not done by a slipshod way of feeding. Our cattle are kept in warm stables and fed regularly on cut hay, straw, and stalks, mixed with pulped roots, and all the steamed corn-meal and mill-feed they will bear.

Mr. Gulley says there is probably no way in which manure can be made with less trouble, experience, and expense than in feeding cattle during the winter. It is a practice which could be adopted with success by gardeners in any vicinity where manure is scarce and feed can be bought at a reasonable price. It does not require a very great expenditure for buildings and machinery. An old barn or shed can be fitted up with gates and mangers at an expense of $1 or $2 per head, with stanchions; or, where cattle are tied with ropes, the expense would be less, but the extra amount of work will more than balance the cost of gates. He fitted up a shed-floor for 25 head with gates and mangers, at an expense of 75 cents per head for lumber and nails, and it was all made portable, so that it could be taken down and packed up during the summer. Some of his experiments, showing the profits of judicious manuring, are given as follows:

On a piece of land put in our hands to work last spring was a field of 21 acres, which the owners wished to have sowed to oats and seeded to clover. The field had been cropped several years without manure. The soil was of an average fertility all over the field. A crop of corn planted on it the previous year had made about an equal growth in all parts, and all so poor that it was considered not worth husking, and was fed in the stalk. On the farm was a pile of manure one year old, left from a cow-stable, which we were directed to put on this field. The pile would have made about 20 or 25 such loads as we buy for a dollar per load. I estimated it to be worth $35. After the ground had been plowed we spread this manure as evenly as possible over 12 acres on one side of the field, at an expense of $15 for handling the manure. The 12 acres manured yielded 543 bushels, or 49 bushels to the acre; the 9 acres unmanured yielded 180 bushels, or 20 bushels to the acre. The manure increased the crop 29 bushels to the acre, or 303 bushels on the farm, worth 50 cents per bushel, or $151.50. The cost of preparing ground, seed, sowing, and reaping was the same per acre on the whole field. The cost of binding, drawing, and thrashing was more on the manured portion, but as the straw was twice as heavy we will let that balance the extra work. The manure and drawing cost $60; therefore, $50 expended in manure made an increase in the crop of $151.50, or a profit of $101.50 in one season. In addition to this, the clover made a good catch on the manured land, while on the rest it hardly grew at all.

As to the beneficial effects of marsh-muck, he says:

There is something about marsh-muck that seems to have a remarkable effect on old land, especially on light soil, and particularly on garden-land that has been heavily cropped and manured for several years. It seems to have somewhat the same effect that is caused by plowing under green crops. I have known good crops of onions raised on sandy soil for two years by a heavy application of muck and a light sprinkling of leached ashes. On old onion-beds the tendency of onions is to ripen too early, or before they get their growth, thereby decreasing the crop. By using muck and a variety of other manures, we can raise good crops on the same land for years in succession. They will do better to change the crop, but as it is expensive fitting ground in proper shape for onions, and as it is the most certain and profitable crop that we raise, we find it does not pay to change often. We have raised onions on the same ground for seven years in succession, never having a profit of less than $175 to the acre.

Mr. A. S. Dyckman, in an essay on pruning peach-trees, strongly urges a judicious thinning out of the limbs and shortening in of the heads of the trees once a year. One of the effects of this thinning process is to induce a stocky growth of wood. This thinning is done, not by shortening the young limbs, but by cutting them out entire to their junction with the parent limb, leaving each remaining shoot in the perfection of its natural growth. Another effect is to distribute fruit-bearing wood through the interior of the tree-top, where the burden can be borne with less liability to break the main limbs than where the fruit is borne mostly on the extremities, as in case of a thick head, which will inevitably smother out the interior shoots. Another effect is not only to reduce the number of fruit-buds, but to materially increase their distances apart, thus performing an important part of annual fruit-thinning. Still another effect is to admit air and sunlight through the top, preventing mildew and rot, and imparting rich qualities and high color to the fruit. Where each individual shoot has its equal share of air, light, and warmth, it also promotes the general health and vigor of the tree, and makes the fruit more uniform in size, color, and quality.

Mr. D. B. Waters, in an essay on the same subject, quotes the following statement of Mr. C. Engle:

I commenced the shortening-in system of pruning the peach when the trees were six years old, and by trying a few trees the first season. The result was so very satisfactory, the trees so pruned yielding nearly as much in quantity and the fruit of double and sometimes treble the size, that I went over nearly the whole orchard the following season. A few trees have been left without pruning until the present, for the sake of experiment, although, after two years' experience, there was no doubt in my mind about its beneficial effects. The benefits accruing are treble: first, an increased market value of the fruit; second, a more handsome, vigorous, and healthy tree; and, third, a great saving of labor and time in thinning the fruit. We all know what an unsightly object an old peach-tree becomes when left to itself. A few long, lean, skeleton branches, with nearly all the foliage and fruit at the extreme ends, will correctly describe them. All this can be remedied, and handsome, round, compact heads, well filled with foliage and fruit throughout secured, by the simple process of shortening-in. I usually choose mild weather in the late fall or winter in which to perform the work. Early spring is just as good a time, only our duties are more pressing then, and if put off until that time is very apt to be neglected. Occasionally I have found it of great advantage to cut back some of the longer branches to where they are an inch to an inch and one-half in diameter, but usually it is only necessary to shorten the new growth from one-half to two-thirds—shortening the longer growths the most. My trees so treated exhibit all the beauty and vigor of form and growth at twelve years of age usually seen in trees of four and five years. When the season for thinning the fruit arrives, I find it takes only about one-third the time to do it. This of itself would pay if there were no other benefits, as at that time we are driven with all kinds of work, and are apt to neglect, or, at best, slight, this very necessary labor. For I hold that no man who raises peaches for market can afford to let his trees mature a great mass of small, inferior fruit, which will bring next to nothing, when, by judicious thinning, he can get the highest market-price. On my younger orchards I have commenced cutting back at four years from setting, but shortening only the leading shoots the first season.

This report contains many additional papers and discussions of interest and value.

MISSOURI.

The eleventh annual report of the Missouri State Board of Agriculture, for the year 1875, is one of more than average interest. In addition to the business transactions of the Board at its annual meeting, the volume contains many practical papers and interesting discussions on various important branches of agriculture. It also contains the proceedings of the sixteenth and seventeenth annual meetings of the State Horticultural Society, and an exceedingly valuable illustrated report by Prof. C. V. Riley, State entomologist. Additional papers, detailing the results of further investigations into the habits of the western locust, and of the history and habits of the grape *phylloxera*, are contained in Professor Riley's report. His thorough investigations into the habits of the last-named insect add much to the value of this report.

The State Board convened on the 1st day of December and continued in session four days. In his opening address, President Luman A. Brown briefly alluded to the devastation committed by the grasshoppers in the early part of the season on the growing crops of the northern counties of the State. He also alluded to the great prevalence of hog-cholera in various sections of the State during the past season, and urged upon the Board the importance of devoting a portion of its time to a consideration and discussion of this subject. At the afternoon session of the board the subject came up for consideration and was discussed at some length. Mr. Colman said the disease resembled a low fever of typhoidal characteristics, and he thought it was in some degree contagious. Hogs attacked by it die very suddenly, and it takes but a short time to carry off an entire herd. Mr. Monteith said that in the higher portions of the State, among the Ozark hills, where there is an abundance of clear running water, the hog-cholera, so called, is scarcely known. He regards the disease as a kind of low typhoid fever, and attributes its prevalence largely to the absence of pure water. Speaking of preventives of the disease, he stated that he had once cured a bad case of fistula by an application of dry earth, after trying a great many other remedies, and he believed there were many properties in earth which, if properly applied, would cure many diseases. As to the good effects of new earth, he said:

> Where hogs trample constantly over earth, the fresh soil disappears. We find in poultry-breeding that where we keep large numbers of fowls together, we must keep the ground stirred to bring up fresh earth. In the poultry-house there should be no less than six inches of dry earth, which should be raked over three times a week, and removed once in six months, and then you can keep fifty fowls together without danger. I have kept dry earth in barrels by my pig-pens, spreading it frequently. It is a good absorbent, and keeps my pigs in excellent health.

Dr. Claggett stated that in several cases where hogs had died with so-called hog-cholera, *post-mortem* examinations had revealed diseased lungs. In such cases the disease was not hog-cholera. He then alluded to the absorptive powers of different soils, and agreed with Mr. Monteith as to the beneficial effects of dry earth when applied to wounds and sores.

Mr. T. A. Charles thought a great many hogs got sick without having hog-cholera, and he regarded it as much a mistake to say that every sick hog had the hog-cholera as that every sick cow had the hollow-horn. He had lost fifty-seven hogs by some disease, and had but three left, and two of the three had been sick. He thought the disease was the quinsy, or winter fever.

Mr. L. A. Brown said his farm had been visited by this disease, which had caused him to lose seventy hogs. He believed the disease to be contagious. His hogs had been kept in a clover pasture of two hundred acres, with good running water. His neighbors' hogs had been turned into the road, with no water to drink; they took the disease, ran along the fence where his hogs were confined, and imparted to them the disease of which they died.

A resolution providing for the appointment of a committee to investigate the subject was adopted by the board.

Mr. C. W. Murtfelt read a paper urging the establishment of experimental agricultural stations, which eventually resulted in a protracted discussion on the subject of the duties and responsibilities of the State Agricultural College. On the last day of the session a resolution was adopted calling the attention of the farmers of the State to the importance of forest-tree culture and to the law passed by the legislature to encourage the planting and cultivation of timber-trees.

Horticultural.—The sixteenth annual meeting of the Missouri State Horticultural Society was held at Saint Louis, on the 12th, 13th, 14th, and 15th days of January, 1875. The meeting was well attended, and the proceedings marked with much interest to the fruit-growers of the State.

President Henry T. Mudd, in his opening address, gave a brief history of the organization and progress of the society. From this address the following facts are gleaned: A small number of Missouri fruit-growers met at Jefferson City on the 5th day of January, 1859, and organized the present society. Prof. George C. Swallow presided, and Mr. F. R. Elliott, (shortly after elected secretary of the American Pomological Society,) acted as secretary. A constitution was framed and adopted, and Mr. N. J. Colman was elected as the first president of the association. A vice-president for each of the then seven congressional districts was designated, and Mr. F. R. Elliott and George Husman were respectively elected as recording and corresponding secretaries. The first exhibition of the society was held on the 27th day of September, 1859, at which a fine display of grapes and some native wine was made. The first annual meeting of the association was held in conjunction with this exhibition. Mr. William Minor was elected recording secretary in place of Mr. Elliott, who had removed from the State.

The second annual meeting was held at Saint Louis, on the 8th day of January, 1861. Many varieties of fruits, wines, &c., were exhibited at this meeting, and such exhibitions have since annually occurred. Dr. C. W. Spalding was elected president at this meeting for the ensuing year. The third annual meeting was held in the same city, on the 14th day of January, 1862, as were also the fourth and fifth annual meetings of the two succeeding years. No material changes were made in the officers of the society at these meetings. Since the year 1864 the association has more than doubled in numerical strength, and now numbers among its members a majority of the leading fruit-growers of the State. The later history of the society is not given.

During the afternoon session of the society a debate occurred on the subject of peach culture and the varieties best adapted to the climate and soil of Missouri, at the conclusion of which the following-named sorts were adopted and recommended for general cultivation: Troth's Early, Yellow Rareripe, Stump the World, Old Mixon Free, and Salway.

Mr. Foster read a brief paper on the subject of pear culture. He stated it as a fact that of the half million pear-trees sold and planted annually in Illinois and Missouri, scarcely one in a thousand survives the tenth year. This, he thinks, is owing to errors committed in the early stages of pear culture. He advises great care in the selection of seeds; for, if collected from fruit of diseased trees, they are certain to carry the germs of disease with them. Sound and perfectly healthy seeds can be procured only from trees three or four hundred years old. Trees from such seeds will invariably prove healthy. In Saint Louis county there are trees over two hundred years old which are still sound and healthy. They are over 70 feet in height, and bear prolifically.

First-class seedling stock, properly cultivated, will cost 50 cents per tree in the nursery. Bad stock causes more trouble and disappointment in pear culture than all other causes combined. The trees have the foundation of disease in them from the beginning—a disease fruitful of blight and mildew. The blight commences in the leaf and descends through the branches to the body of the tree, and thence rapidly to the roots, when the tree dies. The writer said there were three conditions essential to the health of the tree, viz., sound, good stocks, from healthy seeds of long-lived trees, proper working, and an ample supply of food essential to the growth of the tree. Lime, ashes, cinders, and bones all contain elements of value to the growth and longevity of the tree. Trees should be well grown in the nursery before planting out, and the soil well drained.

In the course of some remarks on the same subject, Mr. Malinckrodt said:

I was raised on the banks of the Rhine, where pear-trees grow like oaks. There are two principal causes why culture in general and pear culture in particular is more difficult in this country than in Europe. One is the great prevalence of insects here, the other the uncertainty and severity of the climate. Still another is found in the soil; it is too new, too recently reclaimed. Two years ago a piece of land near me was in timber; now it is in fruit-trees, largely in pears. In Europe they have small plantations, and give much more care in cultivation. From the Black Sea to Naples the pear-tree grows like an oak, and 40 to 50 bushels per tree is quite a common product. In Europe they take a long time to do everything, and try to do it well. They very frequently plant the seed where they want the tree to stand. This gives a vigorous, hardy tree that is able to resist the attacks of insects and other troubles, and bear heavy crops of fruit for several generations.

Mr. John B. Brooks presented a paper on the subject of the cultivation of small fruits, in the course of which he gives the following directions for the prevention of depredations by the curculio on the plum crop:

In the cultivation of plums, of which I have an orchard of about thirty trees of eight different kinds, I experienced disappointment every year from the ravages of the curculio, although the trees were loaded with plums. I did not get a ripe plum until three years previous to last summer, but since then I have had an abundance every year. The remedy is salt scattered under the trees as far as the limbs extend. I scatter the salt about the time the bloom is falling, and the plums are about the size of peas; for the curculio begins his work as soon as he can find a plum large enough to bite. I also throw salt up among the branches, as a little will lodge there. I think one taste of salt is enough for the most ravenous of these pests. About half a bushel is enough for twenty trees.

In the course of his annual report, Prof. C. V. Riley states that the grape *phylloxera* has made its appearance in California and some of the Southern States, where it is already doing considerable damage. In the first-named State, in the neighborhood of Sonoma, many vineyards have been seriously affected. Hundreds of vines have been taken up the roots of which were found crowded with lice. In North and South Carolina, Georgia, and one or two other Southern States, where they are known to exist, they have not as yet seriously affected the vines.

NEW HAMPSHIRE.

The third annual report of the State Board for 1873 constitutes a volume of over 500 pages. Its general excellence is prefaced with a prime defect, the lack of a table of contents, for which an index is by no means a proper substitute; both are needed. Besides a report of transactions at the annual meeting, and at nearly thirty meetings held in different sections of the State, in order to bring the influence of the Board within reach of all farmers, the volume contains essays, addresses, and discussions on a great variety of subjects pertaining to agricultural industries and rural life. Among the topics are: food, physiology, and force; sheep, wool, and mutton; manures and fertilizers, with the report of commission to test special fertilizers; the farmer's position, and how to improve it; farm-labor; agricultural knowledge; good farmers; pay or no pay; the better culture; swine-breeding; grass-culture and manures; culture of fruit; of the apple; of the potato; and of soil and mind. Condensed reports of co operating organizations are also given, including the New England Agricultural Society, the Milk-Producers' Association, the State Agricultural and Mechanical Association, and the State Poultry Society. An interesting report of the semi-centennial of the Merrimack County Agricultural Society includes a historical address by Joseph B. Walker, and a poem by George Kent, who was one of the founders.

In his annual review, the secretary, J. O. Adams, states that the record of the year has been one of "unusual freedom from disease for both man and beast, a moderate loss of property by storm and tempest, and an average harvest of the ordinary products of the soil." The winter was one of frequent storms and excessive cold, snow falling to an unprecedented depth, and remaining on the earth until many days later than in recent years. In some portions of the State there were eighteen weeks of uninterrupted sleighing. The season was therefore much later than usual, not less than ten days on an average throughout the State. Notwithstanding the severe weather and the lateness of the season, however, the crops were regarded as a full average. The secretary thinks that local returns warranted the following estimates: Grass, 20 per cent. better than in the year 1872, and 10 per cent. better than an average of four or five years; and the hay made was regarded as 10 per cent. better in quality than ordinary harvests." Wheat was scarcely an average, but the oat crop was reported 10 per cent. better than usual. Corn was an average; rye not extra. The other crops in the list of grains and pulse were only fair; while potatoes, except early varieties, generally advanced 25 per cent. in amount and 50 per cent. in quality. All root crops were extra. In dairy products, while the quantity of butter and cheese was less, the amount of milk sold was much greater than average. The amount of beef and mutton fattened did not exceed the average, and pork fell considerably short. Prices of farm products were fair. The secretary closes his review as follows:

There are certain old practices that farmers are gradually abandoning, the most important of which seems to be that of plowing and hoeing more than can be well manured or well tilled. New Hampshire farmers are growing more grass and roots and less corn. They can find a greater profit in raising stock or selling hay than in growing wheat, barley, oats, or Indian corn. They are also beginning to adapt their culture to the demands of the market, and are growing more and better fruit, and producing vegetables for the towns and villages or to feed out to stock.

Farmers are reading and thinking more. They find wisdom in books and in farmers' clubs and agricultural organizations more valuable than that which they inherited from their fathers. They manifest a greater desire to dress the soil, and are more economical of fertilizing material, and are learning to save much that has been accustomed to run to waste. This desire has led them to invest largely in superphosphates and other commercial fertilizers, and to apply them with so little care that now they declare they are losing confidence in them, and reject many articles that are of real value.

The meetings held by the Board in various sections of the State were generally well attended by the farmers of the vicinity, many of whom participated in the discussion of subjects presented. Papers of more than ordinary interest were read.

At the meeting at Lancaster, the subject of breeding and rearing neat-stock being under consideration, Mr. Buffum said:

Everybody concedes the hay crop to be important; and surely, to all thinking men the stock which consumes the hay and converts it into a fertilizing material—without which there can be no considerable vegetable or grain product—cannot be less so. You may, indeed, have good pastures and fine grass-lands, and yet be exceedingly deficient in valuable stock. To illustrate: By the census returns it appears that the cattle in Coos county are rated at $28 the head, while in Cheshire county the valuation is $50 per head. The average through the State is about $35. Hence, it will be seen, you are considerably below the average, and do not add your fair proportion to the aggregate valuation of the commonwealth. The total valuation of stock within the limits of the State is put at about $7,000,000. Now, with proper care in the selection of breeds, and the best methods of rearing and feeding, the people of this county can add at least a million dollars to their valuation in the course of two or three years. You will also increase the amount of hay and grain produced upon your farms, and, by your largely increased manurial products, not only keep up the fertility of your fields to the present standard, but render them still more productive. The more manure, and the better its quality, the greater the amount of hay, grain, corn, and other crops to the acre. With the right machine (and in this regard cattle may well be called machines) for converting farm products into nutritious plant-food, you can make your own manures far cheaper than you can buy commercial fertilizers of the manufacturers, who are not always reliable men. Indeed, every ton of hay you raise will bring you a higher price if consumed upon the farm than if sold for money and laid out in superphosphates or other manures.

Continuing, Mr. Buffum zealously advocated the rearing of only pure-blood stock. His experience and observation had both confirmed him in the opinion that crossing of breeds for any considerable length of time will not pay. Such practice must eventually result in loss of symmetry, size, form, color, and quality. The system of breeding in and in he regarded as unreliable.

Mr. Lucas, a farmer of Lancaster, gave his experience in farming. He had raised this year from his orchard $115 worth of apples, and had made 17 barrels of cider, which sold at $6 per barrel. On 2½ acres of land he had grown 1,000 bushels of potatoes. From 4 bushels of sowing, on 2 acres, he had gathered 65 bushels of wheat.

In an article on fruit-culture, Mr. A. Leavens names the following as choice varieties suitable for the climate of New Hampshire: APPLES.—*Early:* William's Favorite, Foundling, and Duchesse of Oldenburg. *Fall and winter:* Hubbardston Nonesuch, Grimes's Golden Pippin, Fameuse, Baldwin, and Red Canada, or Old Massachusetts Nonesuch. PEARS.—Clapp's Favorite, Bartlett, Louise Bonne de Jersey, Flemish Beauty, Buffum, Beurre Bose, Beurre d'Anjou, and Duchesse d'Angouleme. GRAPES.—Eumelan, Creveling, Concord, Iona, Worden's Seedling, and Allen's Hybrid.

The writer says that according to the census report of 1870 the fruit crop of this State, estimated at $743,500, exceeds in value each of the other crops, except corn, oats, and potatoes. He says:

> This estimate is only for apples and pears, and did not include other sorts of fruits, which no doubt would have increased the amount to near a million of dollars. * * * A good orchard is a permanent improvement to a farm, adding just so much to its real value, and, if well cared for, will always yield an annual income. Let us go back to the nursery. Suppose 1,000 apple-trees, and say 500 pear, are started in the nursery rows. In 5 years, if cared for properly, the apple-trees would be worth at least $300, and the pear-trees as much more; in 10 years these trees would be worth at least $3,000; in 15 years at least $5,000. The cost of raising that number of trees, reckoning the highest price paid for labor, ought not to exceed $400.

As to the best location for apple-orchards in New Hampshire, Mr. Leavens says:

> In this latitude it is generally conceded that an orchard will do the best on a south-eastern exposure. If practicable, it should be placed under the shelter of a belt of wood, to protect it from the strong northwest winds. The apple can be grown in any soil, except dry sand or land excessively wet. It will fruit best in a deep, rich, sandy loam, but can be grown successfully on cheap hill-side lands or in rocky pastures—land which may be nearly useless for other purposes. This is a point worthy of special attention, for with proper care such land can be made profitable and the best parts of a farm saved for other crops if desired. Any soil that will retain sufficient moisture to maintain continued growth through the heat of summer will answer for the apple. A great deal is being said and written on the importance of subsoiling and under-draining fruit-lands, both of them very useful practices, no doubt; but the fact is, not one fruit-grower in a thousand will undertake it. If they attempt fruit-culture at all, they will use such lands as they have prepared as best they can without an extraordinary expense. Now, sloping land usually has sufficient natural drainage for the site of an orchard, and in most instances such land will produce less wood and more fruit than deeper and richer soil. A clay soil can be greatly improved by subsoil plowing, and it should be done at least a year before planting the trees, if possible. For the pear it is usually conceded that the soil cannot well be too rich or too mellow, or too well prepared, for the best success. Still, for want of a better, the pear and the apple both can be raised on poorish sandy lands, but with an added amount of labor in mulching around the trees, top-dressing the land, and thorough cultivation. With so much thin soil as we have in this State, we must often make the best use of what we have.

In an article on sheep, wool, and mutton, by Mr. J. W. Lang, alsike clover is highly recommended as a pasture or forage plant: First, because it is not liable to be winter-killed; second, it stands severe droughts well; third, it makes a superior hay; fourth, it will grow on both dry and wet land; fifth, the stalks and leaves keep green when seeds are ripe; sixth, it is richer in the constituents of honey, consequently makes better bee-pasturage than common clover.

Mr. Noah W. Hardy, in a paper on potato-culture, states that he has been in the habit of experimenting with many different varieties, with the view of discovering those best adapted to the soil and climate of New Hampshire, Last year he planted 27 different varieties. He thinks that the earlier the variety the quicker the potato loses its good eating qualities, or, in other words, the longer it is maturing the longer it will remain good for the table. The late varieties are not so liable as the early ones to be cut off by drought. Varieties will not mix when planted together. He gives the following with respect to the connection between seed and product:

For the past twenty years my practice has been to plant the largest of the small ones cutting two eyes on a piece and putting three pieces in a hill; and, as every eye will not come, I intend to have three or four stalks to a hill. If you get twelve or fifteen stalks to a hill, you will surely have small potatoes, for there is just as much impropriety in overseeding potatoes as corn. If seeded light, the vines will grow strong and erect, admit the sun and air to the ground, thus tending to prevent disease and blight. When overseeded, the vines grow slender, are liable to break down, retain the moisture of the ground, mildew, and prematurely decay. I believe the only advantage derived from planting large potatoes is the extra amount of starch secreted, and that, on the other hand, is more than made up by the gain in seed and the slight cost of the small ones. In other words, if you plant a potato the size of a marble, that produces but one sprout; and cut a piece of the same size from one weighing two pounds, what advantage has one over the other? None. As an experiment I once planted in my garden a potato the size of a pea. It produced one sprout, with a vine three-fourth, of an inch through, and several potatoes, one weighing a pound.

Mr. Hardy reports that he has been successful in planting potatoes with a plow, and describes the process as follows:

First, spread your manure broadcast on the grass or sward land; a piece a little sloping is preferable. Begin by turning a straight furrow up the hill on the lower side of the field; let the team pass back without plowing, and turn another furrow 40 inches from and parallel with the first. If the plow turns a 10-inch slice—the most convenient size for the purpose—there will be left a strip of grass 20 inches wide between the two furrows. On this plat of grass, along the edges of the overturned sod, the potatoes should now be dropped, one or more sets in a place. Let the team pass back now, one of the team in the first furrow, the other one on the strip of grass between the furrows, and turn the upper half of this strip of grass upon the other part, leaving two furrows lying close together, inverted, covering an equal space of unplowed sod. The plow would naturally turn back the first furrow, but you must bear hard on the handles, and allow long traces or chains. Care should also be taken to plow a good deep furrow on the upper side, that enough soil is raised to cover the potatoes, and if the lower furrow-slice should break or fall back, it must be replaced by hand before the upper furrow is turned. Forty inches from the second the third furrow is turned, and the second row of potatoes dropped and covered like the first, and so on till the piece is finished. Then take a broad hoe, level the top of the ridges, filling the crevices, and leaving the rows smooth, like a bed. If necessary, some earth can be drawn from the furrow-bottoms. Thus the seed-potatoes are lying on a level with the top of the ground, as they should, planted the usual way. A light sward is preferable to a heavy one, as the latter would be liable to lie too heavy on the potatoes. The advantages derived from planting in this way are, first, a great saving of labor, as they need no hoeing; second, you can plant either late or early in the season, for the grass is readily killed, the inverted sod retaining the moisture in a dry time; third, you can haul the manure on at your leisure, using the long manure, or the highly fermented, like horse or sheep, as it will not lie in bodies sufficiently large to heat; fourth, all the vegetable matter is turned in and decays, becoming accessible to the roots; fifth, you get a better quality of potatoes, as they grow smooth and handsome between the grass, cracking the sod, leaving it quite open and porous; sixth, your ground is thus well prepared for future use with as little labor as would have been required in breaking it up.

OHIO.

The twenty-eighth annual report of the State Board, for 1873, constitutes a volume of over 600 pages. Its table of contents, if it had one, (and it ought to have,) would, at first glance, by its attractive variety, encourage the agricultural reader to go forward, and guide him to points of special interest. Such a table would refer him to reports of the transactions of the board, of the State agricultural convention, of the State fair, of the commissioners of fisheries, of the Ohio and the Western Reserve Dairymen's Associations, of cheese-factories, of agricultural experiments by the Georgia State Agricultural College, and condensed reports from the county agricultural societies. It would also refer to a history of the settlement, resources, and products of Holmes county; the organization and achievements of Ross County Horticultural Society; addresses by Professor Johnson, of the Sheffield Scientific School, on "The guiding idea in the use of fertilizers," and by J. R. Dodge, on "European breeds of sheep;" statistics of acreage and production in Ohio agriculture; and essays on parasitic diseases of sheep; the wild cattle of Scotland; milk and its typical relations; rise and progress of Devons; market-gardening; importance of humus, (with analyses of the Nile deposits;) function of potash in vegetation; the farmer as a citizen; milk-sickness; caponizing; Kentucky blue-grass; cranberry-culture; preservation of forests; points in judging of live stock; plans and specifications for a farm-house; and a new seedling grape.

This report for 1873 includes the transactions of the twenty-ninth annual agricultural convention, held in Columbus, January 7, 1874. Representatives were in attendance from seventy-two counties. The discussions were of more interest than usual. In his opening address the president of the board, L. G. Delano, alluded to the financial crisis then passing over the country, and congratulated the farmers of the State on being well prepared to go through it, and their good prospect for paying prices.

Reports from county societies, farmers' clubs, patrons of husbandry, live-stock conventions, &c., showed that marked and renewed interest was being taken in agriculture. The reports from county societies represent them in a healthy and, in most cases, flourishing condition; the fairs of this year being fully up to the standard of previous years in point of attendance, stock, articles, &c. County and State fairs seem to be fully appreciated by the people, not only as a place for the exhibition of their products and handiwork, but as places for recreation.

The State fair at Mansfield, in September, 1873, was satisfactory in every respect. The arrangements were unexceptionable, the weather fine, and the attendance over an average for a *second* fair in the same place. The exhibition of horses was very large, but somewhat deficient in quality. With sheep it was just the reverse. Cattle, hogs, and poultry were largely represented, and by specimens which showed a great advance in qualities. The departments of fruit and of the fine arts were well represented, and the fair as a whole was a gratifying success.

The report contains a valuable paper by Dr. E. L. Sturtevant, on "Milk; its typical relations," &c. He says:

> The cow, in a state of nature, is incapable of yielding much more milk than is required by her calf, and the surplus furnished over this amount is increased with domestication, and the skill and art of the breeder who seeks to secure the fulfillment of uses.
>
> In our domesticated breeds we have a variety of types, in accordance with the views of the owners of many generations and the requirements of locality. The gray Swiss cow, useful for draught and accustomed to feed on Alpine pastures, differs widely in form from the short-horn, a breed nurtured with the most artificial care, and supplying in perfection an artificial demand; and these in turn from the Ayrshire cow, the symbolization of the dairy type. Each separate breed has not only its own type, but also includes individuals who depart more or less from the typical form. Under one aspect this type may be considered as the average of all the superior cows of the breed. This, in the short-horn, is the brick-set-on-edge form, tail and legs added more from necessity than desire of the breeder, and with certain other requirements suited to the

fancy or supposed needs. The type of the dairy-cow is the wedge-shape, that results from the superior development of those parts concerned in the production of milk. These two forms may be considered the most perfect representation of animals fitted for the two requirements of civilization: cheap and therefore abundant meat, and cheap and therefore abundant milk.

In describing a breed, therefore, we must describe the typical animal, and not the exceptional cow which departs from these shapes. The typical cow, again, is an embodiment of the forms considered the most profitable by the owner; or, in other words, is an expression of the average opinion of the best breeders of the form which is co-related with their uses. The corollary to this proposition is, that the more simple are the requirement of uses, the better defined is the type of the breed in its shapes. For illustrations we may bring forward the well-known breeds. The short-horn, massive and square-built, is designed by his breeder for beef, and we have accordingly the form most economical for this purpose.

When a family of this breed has been bred for generations for the dairy, we have a departure from this massiveness of form and an approach toward the type of the dairy breed. In the Ayrshire cow we have the form most economical for the production of milk, and this form is one of great uniformity, except in localities where, under the influence of the ideas of beauty adapted for short-horn breeders, the fancy has allowed a deviation from type.

Of milk, the writer says, the approximate elements are butter, cheese, sugar of milk, salts, and water. The water, on an average, is about 87 per cent.; the caseine or cheese, in its natural condition in the milk, is recognized as being insoluble by the addition of acid or rennet. The butter, the proportion of which is very variable, occurs in the milk in the form of small globules inclosed by an enveloping membrane, and these globules are what give color to the milk, and affect in a large degree its weight. As the result of a large number of experiments with milk from different breeds, Mr. Sturtevant presents the following conclusions:

First. The butter-globules of the milk show a certain and definite relation between the quality of the milk and the breed.

Second The breed determines, to a large extent, the composition of the butter.

Third. The breed determines, to a large extent, the most economical and advantageous manufacture of cheese.

In the Ayrshire and Jersey breeds he considered his experiments fairly complete; in the Dutch or Holstein breed, more limited. As to the characteristics of the milk of these different breeds, as indicated by his experiments, Mr. Sturtevant says:

The milk-globule of the Jersey breed is larger than is the corresponding globule of the other breeds mentioned, and there are fewer globules under a certain size, one twenty-seven thousandth of an inch, and such, for convenience, I shall call granules.

The milk-globule of the Ayrshire breed is smaller than that of the Jersey, and intermediate in size between those of the Jersey and Holstein, and the milk from individual cows of the Ayrshire breed can be grouped into two classes or grades, according to the size and distribution of the globules. This milk abounds in granules.

The milk-globule of the Holstein is the smallest of the three. The globules are more uniform in their size than in the Ayrshire milk, and there are fewer granules.

The globules determine some of the physical characteristics of the milk. If samples of the Jersey, Ayrshire, and Dutch milk are placed in a percentage-glass, under like conditions, it will be noticed that the cream will rise in each sample with a different rapidity; the larger globules, on account of their less specific gravity, reaching the surface first. As a matter of experiment, some Jersey milk threw up its cream in four hours, leaving a blue skim-milk; some Ayrshire samples, in about ten hours, leaving a white skim-milk scarcely recognizable as such; some Dutch milk, in about five hours, leaving a blue skim-milk.

The larger milk-globules and few granules being in part the explanation of the first, the evenness of size of milk-globule and few granules the interpretation of the reaction of the third, and the numerous granules and unevenness of size of globule offering a solution for the appearance and action of the second sample. * * * The milk of these breeds acts differently in the churn. The larger the globule, the quicker is the butter produced from the milk; and the more uniform the size of the globule, the larger the yield of butter from a given quantity of cream of equal richness by analysis. The globules of similar size appear to be evenly affected by the process of churning, and break at about the same time. This was well illustrated by an experiment made of churning a portion of milk from two cows separately, and weighing the produce. The amount of butter was largely in excess of that gained by churning the same quantity of the same milk mixed, and the microscope revealed the cause.

A curious feature brought out by these experiments is, that the mixed milk from two breeds will not produce as much butter as will the same milk churned separately. The explanation is in the variation in the sizes of the globules. When a large-globuled milk and a small-globuled milk are churned together, the larger globules separate first into butter, and the breaking of the smaller globules appears to be retarded. When, therefore, a Jersey cow is kept in an Ayrshire or Dutch herd for the purpose of influencing the color of the butter, the large globules of the Jersey milk are broken first in the churn; and while the smaller globules are being broken, the butter which first came is being overchurned, and theoretically, at least, the quality of the result is impaired, if not the quantity lessened. When a few Ayrshire or Dutch cows are kept in a herd of Jerseys, and the milk churned together, both theoretically and practically a large portion of the butter of the small-globuled milk is left in the buttermilk in the state of globules.

Dr. Sturtevant arranges the breeds in the order of the average size of the milk-globules, as follows:

Jersey, Ayrshire, (butter family,) Ayrshire, (cheese family,) Holstein, or Dutch. Likewise we can arrange the breeds in accordance with certain properties of the milk: the rapidity with which the cream rises—Jersey, Ayrshire, Dutch; the rapidity with which the cream churns—Jersey, Ayrshire, Dutch; the completeness with which the cream rises—Jersey, Dutch, Ayrshire; the value of the milk for cheese—Ayrshire, Dutch, Jersey; qualities desirable for the milk-retailer—Ayrshire, Dutch, Jersey.

Dr. N. S. Townshend, professor of veterinary science in the Ohio Agricultural College, contributes a brief paper on "Parasitic diseases of sheep." The writer says that, in Ohio, sheep are subject to an affection known as white-skin, paper-skin, pelt-rot, &c. In the British Isles the same disease is called hoose, or husk, and in Germany, Lungenwurmseuche, or Lungenwurmhusten. In its early stages the disease is characterized by fits of coughing and sneezing, with discharge of mucus from the nostrils. The affected sheep stretches the neck, gapes, rubs the nose upon the grass, and gives other evidences of difficult breathing or of irritation of the air-passages. After a time the animal loses flesh and strength, the eyes and mucus membranes are unusually pale, a diarrhea comes on, and rapidly hastens the general emaciation. The wool becomes loose, is easily pulled off, or comes off in patches spontaneously, leaving the skin peculiarly pale and bloodless, and hence the name white-skin, paper-skin, &c. Finally, the sheep dies from exhaustion, except in a few cases, when, in earlier stages, it dies from suffocation.

Dr. Townshend states that this disease is caused by white threadworms. In examinations he found the bronchial tubes full of these worms. Sometimes they were extended at length, but more frequently they were found rolled up in bunches. When fully mature, in the spring of the year, they are from two to four inches in length; the males scarcely exceed two inches, and are of a light yellow color; the females are considerably larger, and more nearly white. This parasite is known to zoologists as *Strongylus bronchialis*, *Strongylus filaria*, *Filaria bronchialis*, &c. It belongs to the class of nematoid or thread-like worms. He advises the following treatment:

The proper treatment for sheep suffering from this affection should have regard to two points: first, to support the strength of the sheep; and, second, to expel the parasites. To sustain the strength and vitality of the affected sheep is very important, and for this purpose the most generous feed is better than medicine. To expel the worms, fumigation in a close room has been employed; the sheep is compelled for several minutes to inhale the fumes of tar, burning sulphur, tobacco, or chlorine gas. This method is said to secure the expulsion of the worms in large quantities. A more convenient and equally effective treatment consists in the frequent administration of small doses of oil of turpentine. This article, given in large doses, passes off by the bowels or the kidneys, and is not as effectual to remove lung-worms as when administered in small and repeated doses that will be eliminated by the respiratory apparatus, and so come directly in contact with the worms. Oil, or spirits of turpentine, as the article is usually called, is probably the best anthelmintic known, but it should be used with circumspection. If administered by force, and in the pure state, a few drops passing into the windpipe may occasion serious trouble; it is therefore better that it should be diluted either with whisky, which converts it into an essence, or with linseed-oil, which partly conceals its extreme pungency and renders it less irritating to the throat. To remove lung-worms from sheep, the dose of turpentine should never exceed a teaspoonful, and less will answer equally well if given daily for a week or more. A convenient form for the administration of turpentine to lambs is to mix an ounce of the oil with half a pint of whisky, shake them together thoroughly, and give a tablespoonful once a day so long as necessary.

Mr. George W. Campbell gives a brief history of a new Concord seedling-grape known in Ohio, where it originated, as the "Lady" grape. He says:

This valuable new grape was first brought to notice by W. S. Imlay, of Muskingum county, who has now fruited it for six or more years. Its character may therefore be considered well established, and it will mark a new era in grape-culture as the first introduction of a very early grape of really excellent quality. It is a true Concord seedling, and seems to have all the hardiness, health, vigor, and productiveness of the Concord with greatly improved quality, and a period of ripening at least two weeks earlier. I have fruited it for three years at Delaware and have found it to ripen invariably in advance of the Hartford Prolific. The present season it was in good eating condition August 15, before the Hartford was colored. Its extreme earliness, combined with its perfect health and hardiness, will also render it specially adapted to northern localities where the season is too short for the Concord.

The "Lady" is a white grape, handsome and attractive in appearance, with large, round berries and medium large bunches. When fully ripe, of a light, greenish-yellow color, covered with white bloom; skin thin; seeds few and very small; pulp tender and wholly without coarseness or impurity of flavor, and of uniform character from the outside to the center; in quality much more delicate and refined than Concord; peculiarly sweet and rich, with just enough of sprightly vinous acid to prevent cloying the appetite.

The tenth annual convention of the Ohio Dairymen's Association was largely attended by representatives of dairy interests in Ohio and neighboring States. Among the various subjects of interest discussed, the first was the adulteration of milk. Mr. Anson Bartlett regarded the graduated cup and cream-gauge as the surest means of detecting skimmed milk, and the lactometer as less reliable. By skimming all the cream from different samples of milk, the remainders ought to be substantially alike, and it was then easy to detect adulteration by water or otherwise. Mr. Welton thought the cream-gauge was as good a test as had yet been discovered. Mr. Pope believed the test of the lactometer generally accurate, and said there had been an effort to have it established as the legal test. Mr. Wire said he regarded the evidence of the lactometer in cases of adulteration as fully conclusive. The following resolutions were adopted as the sense of the convention:

1. That this convention recommend each cheese-factory, before opening in the spring, to notify all patrons, in writing or by printed circular, just what its rules will be as to skimming, and that the person in charge of each factory should, during the entire season, make regular and careful use of the lactometer, microscope, per-cent. tube, and cream-gauge for the detection of skimmed and adulterated milk.

2. That this convention regards the testimony of these instruments, when carefully and repeatedly used, as trustworthy and conclusive, and that it recommends the most rigorous enforcement of the penalties of the law against every patron of a cheese-factory detected in watering or fraudulently skimming his milk.

During a discussion as to the best manner of saving, curing, and using rennet, Mr. Wire said:

Calves should be "deaconed" in the morning without having been recently fed, and they should be so muzzled as to prevent their reaching the ground so as to get dirt into their stomachs. The rennets should be cured with fine salt and kept in paper sacks. When preparing for use they should be soaked for 24 hours before using, being frequently squeezed with the hand and handled from one crock to another. They should be soaked in the cleanest whey with so much salt that it will not quite all dissolve. Keep them in earthen vessels, with a weight to keep them under the liquor.

In discussing the best manner of saving, curing, and using rennet, Mr. Wire said he would not kill a calf for the rennet under six days old, and if it was three weeks old it would be better, if it had not been upon the ground. Being asked why whey was better than water for soaking rennets, he said he could not give the scientific reason, but experience had shown him that it was decidedly better. Messrs. H. N. Carter and A. Bartlett both indorsed Mr. Wire's statement that in preparing rennets for use they should be soaked in whey 24 hours.

The Western Reserve Dairymen's Association held its annual meeting at Garrettsville, in February, 1874. Mr. Cornelius Baldwin opened a discussion on the selection of the best cows for the dairy. He said:

There are but three breeds of milkers in America—the Dutch or Holstein, Alderneys, and Ayrshires. There are but few of the former found. As the Alderneys are especially known for their butter-producing qualities, the question narrows down to the Ayrshires. On the average you can scarcely meet with a poor Ayrshire cow. You may select good cows from any breed, but such uniformity cannot be found in any other breed as the Ayrsh re develops in her milking qualities. As dairymen we must only consider milking qualities and let other considerations go. Every dairy has good cows, good feeders, well built, and good milkers. If your bull is selected from such stock, you can soon produce a breed of good milkers; but from a failure to comply strictly with the latter requirement, the stock is not improved.

Mr. Baldwin then proceeded to illustrate his subject by large drawings of cows, showing the points and marks relating to the good qualities for milk-stock. He reckoned sixty-five points or marks that indicate a good cow; some are of minor importance, while others are infallible guides to be observed in the selection of good milkers. The principal features of a good cow are a small bony head, slender horn, a symmetrical neck, not large shoulders, straight back, heavy hips, not too straight hind leg, thin thighs, large milk-veins, and very crooked, large veins on udder; udder large and yielding, with homogeneous texture, covered with fine hair, and shrinking much when milked; a greasy dandruff in the hair is also a good sign. In reply to a question, he said:

How to select dairies that will produce forty pounds of milk per day to each cow is what dairymen want answered. More money is paid for poor cows than is paid for good ones. Milking qualities are inherited. A bull from a line of milkers and a cow that is a good milker will almost always have an offspring that will be a better milker than its dam. n fact, any farmer can produce a breed of thoroughbreds that will entirely answer all purposes of higher-priced and more celebrated breeds.

Report for 1874.—This is a volume of over 600 pages. As the preceding volume reports the transactions of the agricultural convention held in January, 1874, so this of that held in January, 1875. Besides the transactions of the board, it also contains reports of the county and district societies, and a full account of the exposition and reports of committees at the State fair, including a list of the premiums awarded.

At the thirtieth annual agricultural convention sixty-nine counties were represented. In his opening address the president, L. G. Delano, gave a brief history of the organization of the State board, and of the State convention under it. He said:

The first meeting of this board was held in Columbus April 1, 1846. At that meeting the board elected Allen Trimble, president, Samuel Medary, secretary, and Michael

L. Sullivan, treasurer. The first meeting of the board and delegates of county societies was held December 9, 1846, and from that time until the present there has annually assembled in the city of Columbus a convention of the leading agriculturists of the State, for the purpose of comparing views, procuring facts in relation to agriculture, and to give such information respecting its condition and wants as their deliberations might suggest.

The first State fair, which was suggested by President Trimble, was held in Cincinnati in September, 1850. As evidences of the inventive genius of the age, President Delano states that since the holding of this fair the following implements have been brought into use: "Harpoon hay-fork, steel-spring hay-rake, grain-drill, portable saw-mill, steam feed-boiler, log crosscut and drag saw, and others of equal merit." Tile underdraining has also been introduced into the State since this date. A statement prepared by Secretary Klippart gives the following exhibit of the premiums offered and paid by the society from 1850 to 1874, inclusive:

Horses, $48,424; cattle, $39,920; sheep, $18,944; swine, $10,473; poultry, $2,776; machinery, $17,932; manufacturers' and mechanics' products, $13,719; domestic manufacture and textile fabrics, $14,540; farm-products, $15,454; fruits, $9,616; flowers, $5,988; fine arts, $4,731; field-crops, $8,992; essays, $4,650. Total amount, $216,159, besides 8 gold medals, 497 silver medals, 217 bronze medals, and 2,315 diplomas.

Mr. J. C. Stevens read a paper in opposition to the ratification of the Canadian reciprocity treaty. Mr. Millikin delivered an elaborate address on the present condition of agriculture. Prof. N. S. Townshend discussed the requisites of successful farming. This address contains many valuable suggestions. President Orton, of the Ohio Agricultural College, addressed the convention in reference to the question, "Is the agricultural and mechanical college duly supported by the people of the State?" From the tenor of his remarks, it would seem that the college is making fair progress, but is not as liberally patronized or in as flourishing a condition as some of the institutions of a like character in neighboring States.

The twenty-fifth State fair is reported as one of the most successful ever held. The list of entries and awards in the live-stock divisions showed no diminution of numbers. There was a slight decrease of entries in the divisions of machinery and of worked metals; but in the department of fruits they were considerably in excess of former years. Favorable weather during the fair secured excellent attendance.

As the result of investigation, Secretary Klippart reports that few localities produced as high as 40 bushels of wheat per acre, while no county averages 20.

Sixty-seven county and district associations report their conditions as flourishing.

The eleventh annual convention of the Ohio Dairymen's Association, held in Cleveland in January, 1875, was well attended by representatives of the dairy interests in this and neighboring States. Some of the papers read were of a very high order. Mr. Cornelius Baldwin read one on the "Selection of cows for the dairy." The lecture was illustrated by large drawings. Mr. Baldwin seems to have established a reputation in his neighborhood for accuracy in the selection of good milkers by observation of the points which he describes. He claims such accuracy for his observation that he can go into a dairy, and, being informed what one or two of the cows can do at the pail, can name the amount of each of the other cows within four pounds in the day's milking. He claims it is necessary to know only what one or two of the cows are doing in order that he may form a decision concerning the quality of food and care which the cows receive. He proceeded to illustrate the Guenon theory of the escutcheon, explaining it in detail, as he had proved it in a series of careful investigations, extending over a term of years. He claims for this system of marks that he can, almost without fail, read the real value of a cow for the dairy, not only in regard to quality and quantity, but also in respect to holding out her milk late in the season. He analyzed the system, and pointed out its leading features as mentioned in the books, and also some features discovered by himself not laid down in the books, but which would seem to be of great value in determining judgment. The contrast between the extremes, one of which gave sixty-four pounds per day and the other eighteen, on the best pasture, was strikingly apparent. Mr. Baldwin then gave the following points to be observed in the selection of dairy-cows:

The head of an extremely good cow should be small, as the best milkers are fine-boned; it should also be long and "cut-up" under the neck, with a dishing face. The neck should be thin and comparatively long. The hips should be high. The hind legs of the cow that is best for dairy purposes should be somewhat crooked, and it was here that the breeders, in making selections, often made mistakes by preferring cattle with a leg quite straight up and down behind, like the best short-horns. There should be a slight "sag" to the belly, but the animal should be, on the whole, a little wedge-shaped from back to front, the hips being higher than the shoulders, and the line from the belly to brisket inclining upward. The tails of the dairy-cattle are generally of pretty good length, with a considerable taper. The eyebrows of the best cattle are light and somewhat flattened.

There are four points which should be especially studied, and which serve as infallible indications of milking qualities in cows. First, the milk-veins, so called, passing from the forward side of the udder along the under side of the animal toward the front. They are either small or large, straight or very crooked. Consider the size of these veins, for the size is one of the infallible tests of a good milker. Be careful to see whether the vein is double or not, for it sometimes branches out, and, if double, the two should be added together, because they may be equal to one large vein. The veins sometimes form an angle on the front side of the udder. This seldom occurs, except on a very good cow. On calves and fleshy cattle it is difficult to find these veins; therefore the test can only be applied to cows in milking condition. A net-work of veins on the perineum is a good test, and indicates milk. The chine, reaching from the shoulder half-way to the hip, should be examined. If it be double, the cow is above the average. Sometimes, with a single chine, there is a depression into which two fingers can be laid, if the animal is not too fat. This is good. It indicates a lax physical condition in the animal, and this is favorable either for milk or beef.

The fourth test, which is regarded as infallible, consists in observation of the escutcheon, the milk-mirror. The escutcheon extends from the front of the bag, where the hair begins to grow, backward over the bag and up and around the thighs. Cows with escutcheon well marked have strong constitutions, digestion rapid and complete, a restless and nervous disposition.

Mr. Baldwin divides the rear mirror into two parts: the vertical mirror, which extends from the bag toward the root of the tail, and the thigh mirror, which extends around the thigh outward. It is a mistake to take the straight vertical mirror alone as a guide, and to say that when there is a wide vertical mirror there is good milk. The thigh mirror must be large and well marked. Oval spots of large size on the back of the upper part of the bag are indications of a large flow of milk. The front mirror is the space between the front teat and the place where the bag joins the body in front. If this space is large, the indication is of good milking qualities.

Another test, which he pronounces infallible, is the color of the dandruff which gathers chiefly in the upper part of the thigh mirror. If the dandruff be oily and lemon-colored, there will be rich milk; if dry and brown, like the dust of the floor, poor milk may be expected. Exceptions to these tests should be made in the case of blemished cattle—cows which give a large mess and then drop off one-third within a month after connection with the bull. These cows may be distinguished by coarse hair growing upon the broad escutcheon behind. Cows with these crests of coarse hair will lose their milk after being in calf, and should not be bred from.

Quite a lengthy debate in regard to the use of skimmed milk in cheese resulted in the adoption of a resolution deprecating such use.

Mr. Edward J. Wickson, in an address on the future of dairying, said:

I have authentic reports from ninety cheese-factories and creameries, located in widely different localities, giving the average net return per cow to patrons, the highest average per cow to a single patron, and lowest average per cow to a single patron. The figures are drawn from the actual records of the yields of more than 36,000 cows. In these factories, during the season of 1874, the average yield per cow was $39.57. In the individual factories the highest average per cow reported was $55.07, and the lowest per cow in a factory running the same number of days was $31.22. Taking all the cows into the account, it appears that the average return per cow for the season of average length was $39.57. It will be remembered that these figures are factory averages, not average yields in single herds.

It appears from comparing the reports of these ninety factories that the average return net to patrons per 100 pounds of milk has been $1.22. The highest net yield is $1.38, and the lowest 99 cents. I have been much interested in comparing the average returns per cow with the average selling-price of the factory, and the pounds of milk required to make a pound of cheese, in order to determine how much of the large yield per cow was due to the dairymen and how much to the cheese-maker and salesman. In the factory reporting the highest average per cow, ($55.07,) the selling-price of the season averaged 14.11 cents, and the milk taken was 9.76 pounds to a pound of cheese. Comparing this with the lowest average per cow, ($31.22,) I find that the latter sold cheese for one-quarter of a cent less per pound through the season, and used nearly one-half a pound more milk to a pound of cheese on an average. But this difference in manufacture and price can form only a small part of the difference between the low mark at $31 and the high mark at $55.

The main points in the profitableness of dairies are vested in the farm, not in the factory, as the following figures show. Of the dairies sending milk to the sixty factories, the best season's average per cow is $82.17, and the average of all the highest dairies reported by the factories is $50.04. The lowest yield in a single dairy carrying to the factory during a long season is $14.50 average money to a cow, and the average of all the poor dairies reported is $29.34 per cow. * * * Now, the question arises, and it is of the utmost importance to the man who is working for the profits of the dairy, whence comes this great difference in the returns from the dairy-herds? Is it in the soil, the pasture, the cow, the feed, and care in the factory, and how much influence does the final resort, the market, exert upon the dairyman's receipts? I believe that all of these things are factors of the result, and that every one of them should be scrutinized to see whether there cannot be some element of improvement introduced.

The fourth annual convention of the Western Reserve Dairymen's Association convened at Garrettsville, February 10, 1875. In a discussion on the comparative merits of sweet-cream butter and ripe-cream butter, Mr. Green stated:

He had formerly operated a creamery in the State of New York, and had made careful experiments in the uses of cream. Very much depended upon skill in handling. Sweet-cream butter would melt down at a low temperature, but sour-cream butter (*i. e.*, cream taken from sweet milk, but held before churning until chemical action had begun) would stand. Some preferred the flavor of sweet-cream butter, others much prefer the flavor and aroma of sour-cream butter. The yield from sour cream may be put down at 5 per cent. more than from sweet cream, and the butter has a better texture. The 5 per cent. additional yield may be overbalanced by the greater value of the buttermilk from sweet cream. * * * Butter would lose its exquisite flavor in two or three weeks, and after that creamery butter was no better than dairy butter, while fresh creamery butter would command from 5 to 10 cents a pound more than dairy butter.

Mr. S. D. Harris, in a discussion on grasses, said:

It has been too much the custom to depend upon timothy alone for hay. There is no better crop than timothy when the circumstances are all favorable, but it is a dangerous crop to depend upon. The roots are so much exposed that in a dry time, upon land that is hard run, the crop receives a back-set from which it will scarcely recover. What is needed is a mixture with the finer fibrous rooted grasses. If it is sown with clover, and the clover has the ascendency, it will kill the grass. Clover is a great grass-killer. Close shaving with the scythe and close pasturing will not answer with timothy, for timothy will not suffer much abuse. There should be sufficient variety of grasses to take full possession of the soil and make a strong sod. If fibrous-rooted grasses are mixed with timothy, the bulbs of the timothy will be protected.

Kentucky blue-grass or June grass, with orchard-grass, makes a good mixture for pasture, but not for meadow, as they do not mature at the same time. Red clover and orchard-grass go well together as to time of ripening for hay. Some say they do not like orchard-grass because it goes into bunches, leaving barren spaces between. When it operates in that way it is because of a want of fertility in the soil. * * * As a green crop for soiling early in the season, rye comes in first, but some farmers say that rye is not good feed for milch-cows; that they fall off in their yield of milk as soon as they begin to feed on green rye. The earliest and best grass-feed for soiling is orchard-grass, and this will do to use until red clover is ready. Red clover will last until sowed corn is large enough to use, and then you are safe. Hungarian grass is a good crop for green feed and also for hay, as it can be sown late in the spring upon land where oats or other crops have failed, or when it is apparent that there will be a short crop of perennial grasses. * * * Hay that is made just right is as fragrant as choice tea, and farmers cannot afford to make it any other way than just right. Grass should never be cut when it will be rained on, and partly cured hay should never be exposed even to a night's dew while spread over the ground. Grass cuts easier when it is wet with dew or rain, and this is often a temptation to go into the meadow, when the farmer had better be asleep than spoil his hay. In the harvesting and curing of corn-fodder there is an immense waste of what might be a very valuable material for cow-feed; but as it is usually done, the fodder from corn-stalks is badly damaged from long exposure to the weather in the worst part of the season. It would pay farmers to have sheds and lofts in which to stow away and cure this valuable material before it is nearly ruined by exposure to autumn and winter storms.

The report contains an article by Prof. N. S. Townshend, on hog-cholera. After detailing the symptoms, he gives the following directions for the treatment of the disease:

In the first stage of hog-cholera, while there are copious and dark discharges from the bowels, two things are desirable: First, to give some absorbent, or alkaline substance, to correct the irritating character of the contents of the bowels. For this purpose one or two drachms of bicarbonate of soda, dissolved in milk or mixed with a warm mash of wheat-bran, will be useful. Some secure the same object by putting cinders and ashes within reach of their swine, which they will often eat greedily. Ears of corn burnt almost to a charcoal are also a popular remedy in some localities. Charcoal and the small of stone-coal are also said to be useful. The other indication at this stage is to give some cathartic that will excite the liver to activity. For this purpose 20 grains of powdered mandrake-root may be given to a hog weighing from 100 to 150 pounds, or from 10 to 20 grains of calomel may be used instead, and repeated if necessary. If the disease has passed to the stage of constipation, the sulphates of soda or magnesia, in doses of half an ounce for hogs of the size above mentioned, may be dissolved in half a pint of water, and given once or twice a day until their effect is secured; or castor-oil in doses of an ounce, mixed with a drachm of spirits of turpentine, may be substituted. Sometimes it may be more convenient to give sulphur with milk, in doses of an ounce or more. When difficult breathing and cough have come on, the sides of the chest and throat should be rubbed with spirits of turpentine or some other strong liniment, and half a drachm of saltpeter, with a grain or two of tartar emetic, may be given two or three times a day, either with bran-mash or dissolved in water, and poured down the throat, the snout being first elevated by a noose in a small rope. It should not be expected that one or two doses of any remedy will effect a cure, or that any article, however valuable, will be equally suitable in all stages of the disease.

The contents embrace Dr. E. L. Sturtevant's article on physiological considerations concerning feeding for butter and cheese, reproduced from the Connecticut report, and articles on the population of the apple-tree; history, pedigree, and habits of the grasshopper; (these three articles are illustrated;) history of our common cultivated vegetables; epizootics; Devons; Short-horns; the food of birds as related to agriculture; tubercular consumption in cattle; pork-packing in the West; the eighth annual report of the State Horticultural Society, including the annual address by the president, Dr. J. A. Warder, and addresses or essays on the influence and mission of horticulture, forest-tree planting, home-adornment, and gardening as a fine art.

VERMONT.

The third biennial report of the State Board of Agriculture, Manufactures, and Mining, for 1875 and 1876, contains, in addition to official records, no less than fifty distinct papers on subjects pertaining to various phases of the three branches over which the board has supervision. Most of these are necessarily brief, as they are included in a volume of 700 pages. One of the longest and perhaps most valuable is an illustrated article on insects injurious to the potato and the apple. The related subjects of farm-management and farmers are discussed in no less than seven separate essays; matters pertaining to dairy-husbandry in five; the horse, in four; sheep-husbandry and the grass crop each in three. Among the other topics presented are fertilization, fruit-culture, horticulture, bee-culture, poultry-keeping, application of "the sand-blast" in lettering head-stones for the national cemeteries, the potato-disease, sanitary reform, water-power in Vermont, report of the State geologist, and, not least, "the merits of Vermont."

The secretary alludes to the work of the Board during its brief existence in arousing attention and securing the co-operation of the farmers of the State in many needed reforms. During the year 1875 the Board held seventeen public meetings in different localities, at which papers were read and addresses delivered, followed by discussion of the topics presented.

The analyses of artificial fertilizers, by Prof. Peter Collier, under the direction of the Board, are still prosecuted. In evidence of the benefit of this work, it is stated that as a result the average value of the fertilizers offered in the market has been advanced 33 per cent.

Discussions on dairying, the great interest of the State, occupy a large space. Among other topics worthy of special notice are those relating to grass-raising and the introduction of new forage-plants; the seeding of land, and the genuineness, purity, and vitality of seeds; and stock-raising, food-rations, and the comparative value of different kinds of food.

Mr. Gardner S. Fassett, in an article on the selection of cows for the dairy, gives the results of some interesting experiments made with the milk of different cows. He states that he owns a high-grade Jersey heifer that exhibits as good a percentage of cream in one hour, when the milk is set in test-tubes, as at any time thereafter. He also owns a fine-grade Ayrshire cow, eight years old, the milk of which shows the best percentage of cream in about twenty-four hours after it is drawn. In order to satisfy himself as to the facility with which butter could be made from the milk of different cows, he selected the cream from these two cows with which to make the experiment. The milk, cream, butter, and buttermilk of each cow were separately and carefully weighed, and the time required to churn each noted. The experiment was made on the 23d day of October last, when the cows were in the barn at hay, having two quarts each of oats per day.

The Ayrshire cow gave 22 pounds 4 ounces of milk; weight of cream, 2 pounds; time in churning, 40 minutes; weight of butter, 1 pound 1 ounce; weight of buttermilk, 15 ounces. Buttermilk appeared rich, as though there were butter-globules left in it. The Jersey heifer, two years old, gave 10 pounds 8 ounces of milk; weight of cream, 1 pound 4 ounces; time of churning, 20 minutes; weight of butter, 12 ounces; of buttermilk, 8 ounces. This buttermilk, he states, was as blue as skimmed milk.

The next day he mixed the milk of the two cows. Weight of milk, 32 pounds 4 ounces; weight of cream, 3 pounds 1 ounce; time of churning, 30 minutes; weight of butter, 1 pound 12 ounces; of buttermilk, 1 pound 5 ounces.

Mr. Fassett regards the Jerseys as the best butter-producing cows, for the following reasons: Their cream rises quicker, simplifying the process of setting milk; their butter is yellower, can be churned from cream in very much less time, and can be churned at higher temperature with good results; their butter commands a higher price in market than that of most other breeds. He gives the points of a good cow, as follows:

A soft, velvety skin, (and good feed helps to make a good skin;) full eyes; small horns; wide escutcheon, a place to put a bag; well-spread teats of good size; large, crooked milk-veins, with large orifice at their source. A slim neck is a good sign, also a slim tail and clean limbs. Almost all good butter-cows are bright and sprightly. A good, vigorous constitution is very important.

Of the size of cows, he says:

I have never considered it one of great importance, and yet it demands some attention. A cow consumes of good hay about 3 per cent. of her live weight daily, to support life and repair the waste. If a large cow will, when not used for the dairy longer, make enough more beef than the small one, that makes the same amount of butter, to pay for the greater amount of fodder consumed during the years she is kept for a dairy-cow, she is worth the same, and this is the best rule I know of by which to judge of the relative value of large and small cows in the butter-dairy.

Mr. E. S. Wood contributes a paper on the value of meal as feed for milch-cows. While he is usually supplied with a sufficient amount of good grass and hay for his stock, he thinks his cows need something more than that to keep them in good physical condition. By feeding them two quarts each per day of meal, with the addition of shorts in winter, a uniform flow of milk is kept up the year round, and a good quality of butter is made during those months when there is no pasturage.

In an article on breeding and rearing farm-stock, Mr. C. H. Hubbard says:

A cow that has, in growing to maturity, consumed an undue proportion of the nutriment in her food in the manufacture of a large, coarse head, with a great pair of horns, and a coarse, masculine frame, which must be vitalized and warmed by food every day, or one that expends much vital force in roaming about the pasture, running and fighting, is not an economical machine. One that fails to draw the nutriment out of her food and make anything out of it may be a good machine to manufacture manure, but must be regarded as a wasteful one.

On the subject of breeding and training, he says:

The natural tendency is toward deterioration. If any function is not cultivated by breeding and training, it will be very sure to grow less in power and activity. The cow that is not milked loses the capacity to give milk, and transmits a tendency to the same incapacity to her offspring. I do not intend to reflect upon any particular breed of cattle, or other animals, for the same thing exists among all. The Jersey breeder, who goes for a particular color of hair, horns, tongue, or switch, hurts his stock every time. The Ayrshire breeder, who endeavors to imitate the lordly form of the short-horn, impairs the value of his Ayrshire cow; and the short-horn breeder who, in breeding stock for New England, neglects to perpetuate and improve the dairy qualities for which that breed was once so celebrated, is doing an incalculable injury to the dairy interest. * * * The relative influence of the parents in determining the character of the young depends, in my opinion, largely upon the degree to which the qualities of each have been fixed and intensified by judicious breeding, and on their comparative vigor and stamina. It is thought by some writers on the subject that the male parent exercises a controlling influence in the external form, covering of the skin, and the locomotive powers, while on the mother depend the vital and digestive functions. This rule must, I think, be accepted with a liberal allowance for circumstances. It is certain that the sire exercises a marked influence over the character, as a dairy-cow, of the young. It is not enough that one parent possesses the qualities it is desired to perpetuate. Both must have them, and both must be descended from families that exhibit them. Then the character of the issue is measurably certain.

In a brief paper on the winter management of neat-stock, Mr. L. C. Fisher gives his method of raising calves. At the age of two days old he takes the calf from the cow, and teaches it to drink its own dam's milk mixed with skimmed milk twelve hours old. At the age of ten days he feeds it exclusively skimmed milk twelve hours old; at fifteen days, twenty-four hours; at two months, thirty-six; at three months, thick milk, with what dry shorts it will take. As often as once in six weeks he dissolves a piece of saltpeter as large as a robin's egg in the milk. "With plenty of milk, shorts, early-cut hay, water, and exercise, a calf can be grown from 2 to 3 pounds a day for a year."

Mr. Albert Chapman, in a paper entitled "Horses for Vermont," gives the following points as deserving the greatest attention:

> The horse that has such multifarious duties to perform must be of medium size. If he is too large the travel up and down our hills, at any gait Vermonters will be satisfied with, will soon shake him to pieces. He must be medium in height as well as weight. Sixteen-hand horses may all be very fine to talk about, perhaps to sell to some parties, but they cannot, as a class, endure the road at a lively pace with horses of a hand lower measure, especially in a hilly country. * * * Another very important qualification of the Vermonter's horse must be a good, kindly disposition. While he should be a willing, quiet, peaceable worker, he must not be a lazy dolt, or the requirements for a good horse will not be answered. Although quite as many farmers' sons as is desirable are becoming professional trainers and breakers, still it is, perhaps, quite as well that all cannot be, and so long as so many of our horses have to be broken and driven by farmers and their sons, who are comparatively unused to this work, this item of disposition is one of great importance. Another requisite for the Vermonter's horse is early maturity, or, at least, the ability to perform much of the work of the farm while he is growing, maturing, and becoming fitted for market, without breaking down or becoming unsound by such use. And lastly, under this head, Vermonters should raise such horses that, as they arrive at maturity, will bring good prices in market; and the nearer they come to gentlemen's stylish driving-horses and fulfill the other requirements, the better, and the more they will bring. This horse should be of medium size, well proportioned, clean, flat limbs, strongly made, but not coarse or gross; good color, bay, brown, black, or chestnut; he should have a good, easy road gait that will take along a buggy with two men in it a mile in four minutes, ten miles in an hour, or from sixty to eighty miles in a day; with a courageous, free disposition, that will not require more work to get this performance out of him than it is worth when you get it. Withal, he should have a bottom or endurance that will not make it impossible to sometimes repeat these performances, and enable him to perform a reasonable amount of driving every day. With these, a good kindly disposition, free from all tricks or vices, is indispensable. Any horse that possesses all these good qualities is worth anywhere from $300 to $500; and the more beauty and style in performing this work you can combine in them, the more can be added to the prices, with a reasonable expectation that the draft will be honored. * * * A horse may have a fine form and beautiful color, but if he has not a good gait or good courage, if he is ill-tempered or tricky, the man that buys him at any price that will pay for his raising and breaking will be cheated.

In size, color, docility, activity, and endurance, he regards the Morgan horse, when crossed with dams of larger size, as the best breed of horses for Vermont. Some of the best horses ever raised in the State, as well as those that have brought the highest prices, were sired by Morgan stallions from such mares as were sired by Post Boy, Henry Bishop's Hambletonian, Harris's Hambletonian, and others of that class, and he thinks that if it is desirable to increase the size of the horse it should be done by the use of a larger dam, not a larger stallion.

Mr. J. F. Hemenway, in an article giving the history and pedigree, as far as known, of old Justin Morgan, speaks as follows of this breed of horses:

> First, the Morgan is the strongest-blooded family of horses in the country, and can, therefore, be bred more uniformly than any other breed; secondly, they possess the grandest combination of beauty, tractability, speed, and endurance; and lastly, his thorough acclimation and adaptation to our soil and uneven country.

Mr. John H. Mead, in an article on sheep-husbandry, gives some facts which will no doubt prove of interest to many persons engaged in rearing sheep. As to the mode of determining the age of sheep, he says:

The age of the sheep is generally determined by their teeth. When they are about one year and a half old, they shed their two center teeth of the incisors, and two wide ones grow out and take their place. The next year the next two are shed, and when the sheep is three years old the four central teeth are fully grown. At four years they have six teeth, and at five years the teeth are perfectly developed. This is one year before the horse or ox can be said to be fully mouthed. This rule for the age of sheep will hardly ever fail in ewes; but sometimes will in the case of rams. If not too old, their age may be determined by the growth of their horns each year. The difference caused in the shedding of their teeth may be by the manner in which the sheep are cared for. If well fed and kept in a thriving condition, they will shed them faster, and *vice versa*. Some sheep with the full mouth will hold their teeth much longer than others. The natural age of sheep is about ten years, to which time they will thrive and breed well.

In regard to the peculiar skin of sheep, the formation and growth of wool, &c., Mr. Mead says:

The skin of sheep is composed of three textures. Externally is the cuticle or scarf-skin, which is thin, tough, devoid of feeling, and pierced by innumerable minute holes, through which pass the fibers of the wool and the insensible perspiration. It seems to be of a scaly texture. This is plain to be seen when the sheep have the scab. Below this is the *rete mucosum*, a soft structure, its fibers having scarcely more consistence than mucilage, and being with great difficulty separated from the skin beneath. This seems to be placed as a defense to the terminations of the blood-vessels and nerves of the skin, and these are in a manner enveloped and covered by it. Beneath is the cutis or true skin, composed of innumerable minute fibers crossing each other in every direction, highly elastic, in order to fit closely to the parts beneath and to yield to the various motions of the body. Judging from the mixture of wool and hair in the coat of most animals, it is thought by some that the primitive sheep had a hairy covering. It is said that there are at the present day varieties of sheep that are clothed outwardly with hair of different degrees of fineness, and underneath the external coat is a softer, shorter, and closer one that answers to the description of fur, but which really possesses all the characteristics of wool. It is, therefore, highly improbable that the sheep, which has now become by cultivation the wool-bearing animal, should, in any country, have ever been entirely destitute of wool. Sheep of almost every variety have at times been in the gardens of the Zoological Society of London, but there has not been one on which a portion of crisped wool, although exceedingly small, has not been found at the bottom of the hair. The filament of the wool has scarcely pushed itself through the pores of the skin when it has to penetrate through another and singular substance, which, from its adhesiveness and color, is called the yolk. It is found in greatest quantity about the breast and shoulders, the very parts that produce the best and most abundant wool, and in proportion as it extends to any considerable degree over other parts, the wool is then improved. It differs in quantity in different breeds; it is very abundant in the Merino.

The yolk being a true soap, soluble in water, accounts for the comparative ease with which the sheep that have the natural proportion of it are washed in a running stream. The fiber of the wool having penetrated the skin and escaped from the yolk, is of a circular form, generally larger toward the extremity and also toward the root, and in some instances very considerably so. When the animal is in good condition and the fleece healthy the appearance of the fiber is brilliant, but when the state of the constitution is bad the fiber has a dull appearance, and either a wan, pale light, or sometimes scarcely any, is reflected.

Mr. Henry Lane, in a paper on breeding and feeding sheep for the market, says:

For breeding ewes for early lambs, I prefer the grade Merino, avoiding the wrinkly, short, gummy-wooled ones, selecting those of a vigorous constitution, broad, wide-hipped, short-legged, tendency to early maturity, prolific breeders and good milkers, of an age not less than three or more than six years. Such a selection requires good judgment. To serve the ewes I prefer a Southdown ram to either a Leicester or Cotswold. Rams should be put with the ewes in September, that the lambs may be dropped in February. It takes about ninety days to make a lamb sufficient size and fatness for market. At this age they should weigh 60 pounds. The ewe should have food that will keep up her condition and produce an abundance of milk. During the suckling period she needs as heavy feeding as a grain wether when fattening—corn to keep her in flesh, oats, bran, oil-meal, buckwheat, and a free feeding of roots to produce milk.

Mr. Lane details some of his experiments to ascertain the rate of gain in lambs. He says:

I will give the weight of one, which will give about the average gain. This lamb was dropped February 9, and weighed 8 pounds; February 19, 13½ pounds; February 26, 17½ pounds; March 5, 21¾ pounds; March 12, 24½ pounds; March 19, 26¾ pounds; March 27, 31¾ pounds; April 2, 35¾ pounds; April 9, 39 pounds; April 16, 42 pounds; April 23, 45½ pounds; April 30, 49 pounds; May 7, 54 pounds; May 11, 56 pounds. At ninety-two days old, deducting the weight at birth, the gain was 48 pounds, a trifle over one-half pound per day. My ewes were too old to be good milkers; the lot should have been at least 10 pounds heavier. The fleece should bring $2 and the lamb $6, making $8 per head. Lambs dropped in April will be found the most profitable for winter and spring feeding. During the last part of the fall, by the middle of October, I commence feeding this class of sheep, giving, during the month of November, grain liberally, and they should have access to a daily feeding of hay. Their food should be fat and flesh forming substances, such as will produce growth as well as fat. To full-grown sheep feed corn; to lambs, oats, pease, corn, and bran; and I think it pays to raise roots to feed any fattening sheep. * * * This class of sheep generally are more profitable to feed than full-grown ones for three reasons: the first cost is not more, and sometimes is less per pound; the gain is greater on the same amount of feed, and the selling price higher per pound. From my sheep-book I copy the following: Forty-four yearling grade Merinos cost, in the fall, $2 per head; average weight December 1, 55 pounds; sheared and sold April 15; average weight after shearing, 72 pounds; gain in four and one-half months, 17 pounds; sheared 225 pounds; sold for $5.25 per head, including wool. Two winters ago I fed a lot of half-grade Cotswolds; average weight when commenced feeding, 50 pounds; cost, 6 cents per pound. January 8, average weight, 62½ pounds; February 16, average weight, 69 pounds; March 30, average weight, 75 pounds. Sold at that time at 8 cents per pound, or $6 per head. The past winter I fed 104 lambs, half-blood Cotswolds. From December 1 to April 1, one hundred and twenty-two days, I fed 9,100 pounds of grain of the following variety and proportion: Of each 100 pounds, 65 pounds were corn, 25 pounds oats and pease, and 10 pounds bran. Nearly all the grain was ground.

Weight of lambs.	Time between each weighing.	Gain.	Average per head.
December 3—7,034 pounds			67 66-104.
January 4—7,633 pounds	32 days	599 pounds	73 41-104.
February 6—8,154 pounds	33 days	521 pounds	78 42-104.
March 11—8,985 pounds	34 days	831 pounds	86 41-104.
April 1—9,505 pounds	21 days	520 pounds	91 41-104.

During the month of December I fed 50 pounds of grain per day; first fifteen days in January, 60 pounds; last half of the month, 70 pounds; from February 1 to 20, 80 pounds; from the 20th to the 10th of March, 90 pounds; the remainder of the time, 100 pounds per day.

Mr. C. G. Pringle, in a paper on the hybridization of cereals, details some successful experiments in cross-fertilization of wheat. He commenced them in the spring of 1870, by impregnating a few ovules in a head of the Black Sea variety with pollen of the Golden Drop, or Siberian. He selected the Black Sea variety because of its extreme hardiness, and crossed it with the Golden Drop in order to unite the hardiness of the first with the finer flour-producing qualities of the latter. The fruit of this cross, a half dozen grains, was sown the next spring in a drill and cultivated with the utmost care. This first year the plants showed great uniformity of character. They were, speaking in a general way, intermediate between their parents. Except for a few short awns on the upper part of the heads, they were beardless like the Golden Drop, though they had sprung from seed borne on the Black Sea, a full-bearded variety; the chaff had taken a reddish tinge from the Black Sea; and the kernels were larger, plumper, and of lighter color than those of that variety, evidently partaking strongly of the character of the Golden Drop. Great vigor was displayed by the plants, and the heads were of unusual length. Possibly this great vigor was in part due to the good effect of crossing; certainly good cultivation had something to do with it. The selected product of these plants was the second spring sown in drills and kept separate by numbered stakes. Of this experiment the writer says:

As the plants grew luxuriantly and tillered freely, I counted on a rapid increase of my stock of these new varieties, which, judging from the character they exhibited the previous year, would, beyond question, be valuable gains to agriculture. But as the heads issued from the sheath of the upper leaf, great was my astonishment and dismay to observe among the plants of each class a wide diversity of forms. There were heads of various lengths and of many forms; there were awnless heads, and heads bearded in every degree. As the other characters, those belonging to the kernel, developed it became manifest that the several characters of both original types were jostling together in complete confusion. Reversion was playing its part, and, struggling against inheritance, was gaining for certain characters the ascendency in one plant, while in another it was giving the advantage to those quite different. It was apparently seeking to resolve the hybridity I had effected, and to carry back a part of the plants to one parent form and a part to the other. That it did not in some instances completely succeed in this, showing me from this union resolved the Black Sea and the Golden Drop pure again, I cannot deny. Usually, however, it failed to gather up again all the characters peculiar to either type, so effectually had hybridization segregated them and dispersed them through the direct offspring of the cross, the plants of the previous or first year, and was compelled to leave them scattered irrecoverably and entering without law into new combinations innumerable.

When I saw this medley among my crosses I relinquished my expectation of speedy advantage from the experiment, and but for the aid which selection offered me would have remitted altogether a work involving so much of care and patience and yielding such perplexity and disappointment. Selecting, however, a few of the most distinct and promising forms, and beginning again the third year with the product of single plants, as before, planting in separate drills, and if any sporting appeared in the drill, as was almost invariably the case, though the degree of variation became less and less, selecting from the drill in such event the best plant, the one which approached nearest the ideal appointed for that drill, to yield seed for the next year, I have succeeded, after four years, in fixing the character of several varieties. The sway of inheritance in them is no longer disputed, and they come true from seed. No. 6 is a bald, red-chaff variety, with its kernel small, scarcely longer than broad, and very tawny in color. No. 7 is bald; red chaff; kernel large and plump; reddish. No. 9 is bald; chaff nearly white; kernel large, red, very plump. No. 13 is bearded; white chaff; kernel large, oblong, rather light colored. No. 15 is bearded; red chaff; kernel large, plump, dark. No. 15½ is bearded; white chaff; kernel of good size, almost spherical; not deeply colored. Assorted from No. 15. Only three years ago the two sorts were contained in one kernel.

It is interesting to trace each of the several characters of these six varieties to its origin either in the Black Sea or the Golden Drop. I will add that all of these new varieties are remarkably vigorous and productive, carrying heads from five to six inches in length. All have resisted mildew or rust the past year.

WISCONSIN.

The annual report of the Secretary of the Wisconsin State Agricultural Society, for the year 1874–'75, contains, in addition to the routine and business transactions of the association, a full report of the proceedings of the State agricultural convention held in January, 1875, and numerous interesting and valuable papers on subjects of special interest to the farmers of the Northwest.

Secretary Field, in his preliminary report to the governor of the State, says that the season, as compared with the past five years, has been one of general prosperity among those engaged in the varied branches of agriculture, except, perhaps, the growers of wheat. Throughout the State the season seemed to be unfavorable to the production of this cereal. The greatest loss was from the chinch-bug; in some localities they entirely destroyed the crop. Much depression was consequently caused in the large wheat-growing districts, where, for years past, but little else had been cultivated. All other products gave a full average yield and commanded remunerative prices.

The success of dairy boards of trade, as inaugurated and conducted in the eastern section of the country, has stimulated the people of Wisconsin to efforts in the same direction, and already the system is in successful operation in various sections of the State. Regular market-days have been established, and the purchaser has been practically brought to the very door of the producer. The result has been so satisfactory that farmers in other leading branches of agriculture are urged to co-operate with each other in the sale of their products. Societies, including State, county, and so on, down to town-club and grange, are complimented as having accomplished much good, and as being capable of conferring yet greater benefits as educators of the industrial masses. The secretary says:

A mutual interchange of ideas, an intelligent co-operative action on the part of those whose interests are identical, is much needed. Farmers must move with the age, keep up with the other professions, not years behind. Individual effort can accomplish but little. Organization is what now moves the world Combinations of capitalists go before legislatures and get all they ask, or prevent what they do not desire. Were we farmers ever known to organize and ask the legislature for special privileges, or to prevent the enactment of class laws against our interests? Farmers should not be legal food for other organizations to feed upon, without preparing to devour in return for self-protection. They can at least be just to others, and at the same time generous to themselves, if they will but combine and work together for their interests as other classes do. The more intelligence, the more successful and better will the organization be Agricultural papers are doing much to stimulate and build up the industrial interests of the State, and they should be encouraged and sustained; but "a face to face talk" will do more good in an hour to educate and impress upon the mind facts and principles than all the articles read in a paper during the year. Hence, farmers should organize, give their experience to each other, read, talk, counsel, advise, become more intelligent, and be better prepared to govern and direct the affairs of State and nation.

The first annual report of the commissioners of fisheries of the State is contained in this volume. The commission received, through Professor Baird, 100,000 spawn of the California salmon. Mr. Palmer, one of the commissioners, who owns a private hatching-house at Boscobel, undertook the hatching process and the distribution of the young fry. From these spawn he hatched some 61,000 fry in excellent condition, and when distributed they were unusually strong and healthy. Nineteen thousand of these fry were distributed in the waters of Grant, Crawford, and La Fayette Counties, and the remainder in the northwestern counties and among the lakes and rivers of Sheboygan, Fond du Lac, and Winnebago. The commissioners affirm that there is no other State in the Union, disconnected from the seaboard, so well adapted to fish-culture as the State of Wisconsin. There are two hundred and twenty-five lakes in the following-named sixteen counties: Kenosha, Racine, Walworth, Waukesha, Jefferson, Dane, Washington, Dodge, Columbia, Sheboygan, Fond du Lac, Green Lake, Marquette, Waushara, Waupaca, and Winnebago. These lakes cover 388 square miles, or 248,320 acres of water, which large surface is now comparatively unproductive.

The State agricultural convention was held at Madison, (from January 27 to 30, inclusive,) and was largely attended by the leading farmers and fruit-growers of the State. The session was opened by President Eli Stilson, who read a paper entitled, "How shall we improve the agriculture of Wisconsin?" During the sessions of the convention the following-named papers were read, and, in many cases, commented upon at considerable length: "Peat, a cheap fuel in the near future," by W. H. Newton; "Protection from lightning," by Prof. John W. Sterling; "Objects and methods of cultivation," by Prof. W. W. Daniels; "Some of the lessons of the past season," by J. W. Wood; "Economy in farming," by John Bascom, president of the University of Wisconsin; "The need of organization among producers," by M. K. Young; "Comparative advantages and disadvantages of machinery in agriculture," by E. H. Benton; "Gypsum, or land-plaster, and how to use it," by N. E. Allen; "Agriculture, a glimpse at its past, present, and future," by J. M. Smith; "Interest on money, a high rate ruinous to productive industry," by Secretary W. W. Field; "The future outlook of the dairy interest in Wisconsin," by Stephen Favill; "Horses," by John L. Mitchell; "Agriculture, or light in the bee-hive," by G. W. Maryatt; "Nature's methods of soil-formation, and the process of culture which these methods suggest," by Prof. John Murrish; "Soils of Eastern Wisconsin," by Prof. T. C. Chamberlain; "Live stock on Wisconsin farms," by G. E. Morrow. Several other interesting papers and two or three valuable reports from special committees are contained in this volume. Experiments on the university farm, under the direction of Professor Daniels, are also given. The experiments with seed from the tips, middle, and butts of ears of corn are interesting. These experiments were commenced in 1870. In this year, corn from the tips, butts, and middle of the same ears was planted, and each year since the tips, butts, and middle of that raised from like seed the previous year were again planted. The yield upon adjacent plats of equal size this season was as follows: Tips, 466 pounds; middle, 414 pounds; butts, 422 pounds. No difference was visible in the quality of the corn. The result of five years' experiments demonstrates that it makes no difference from what portion of the ear seed is taken. Professor Daniels's experiments for the improvement of soils by mechanical means are given as follows:

This experiment was begun in 1871, upon four adjacent plats of an acre each, to be cultivated as follows: Plat 1, to be plowed to a depth of 5 inches only; plat 2, to be plowed 12 inches deep; plat 3, to be plowed 20 inches deep by trench-plowing; plat 4, to be plowed 20 inches deep by subsoiling.

Plats 1 and 2 have been cultivated in the prescribed manner from the beginning.

Plat 3, in 1871, was plowed 12 inches deep only; in 1872 and 1873, 17 inches, and in 1874, 18 inches, which is as deep as it has been found practicable to plow.

Plat 4 was subsoiled 16 inches deep in 1871, 17 inches in 1872 and 1873, and 18 inches in 1874.

The cultivation of these plats has been the same in all other respects than those mentioned. The soil is clay, with heavy clay subsoil; the land is level and rather low. In the fall of 1873, an underground drain was laid through each of the plats, to carry away water that formerly flowed over them all after heavy rains. These plats have been in cultivation to corn during the entire four years. The following table gives the yield of each, in bushels of ears, weighing 75 pounds:

Method of cultivation.	1871.	1872.	1873.	1874.
Plowed 5 inches deep	55.4	43.5	53.4	53.0
Plowed 12 inches deep	50.6	50.3	52.8	58.1
Trench-plowed 18 inches deep	44.9	54.7	51.3	65.3
Subsoiled 18 inches deep	42.2	56.8	51.1	60.8

The yield this year shows the benefit of deep cultivation in dry seasons, while the smaller yield last year, on the deeply plowed plats, illustrates the injurious results, in a wet season, of deeply plowed plats in a retentive subsoil, with no outlet for the superfluous water.

Report for 1875–'76.—This volume is not so large as its predecessor, nor does it contain as great a variety of papers on agricultural subjects. In his report to the governor, the secretary takes occasion to state that the closing year of the national century was somewhat discouraging to certain branches of the agricultural interests of the State. A greater breadth of corn was planted than in any previous year, but the unusually late season, followed by early frosts in August and September, entirely ruined thousands of acres, and seriously injured almost every field in the State. The loss of this staple cereal produced a marked effect upon the beef and pork product, as it was found necessary to ship many cattle and hogs to market in a half-fatted condition, and thousands of stock hogs were shipped to Iowa, Nebraska, Kansas, and other western States for want of corn to feed them.

Wheat was a fair average crop in the northern and western portions of the State, while in the more central and southern part the chinch-bug did serious damage, again in many instances entirely destroying the cereal. Oats yielded heavily, and the crop was of extra quality. Potatoes and vegetables generally were abundant and excellent. Prices of the cereals and stock-products ruled fair, and were highly remunerative where good crops were produced.

The secretary alludes to the work of the State Agricultural Society, the granges, and farmers' clubs of the State, and says they have done much during the past year to promote the interests of those engaged in the different branches of farm-work. Of the State society, he says:

> The Wisconsin State Agricultural Society is earnestly striving to better the condition of the farmers and all others engaged in industrial, productive, useful enterprises. By its annual exhibitions, it has stimulated better productions in all branches of farming. By its annual publication and conventions, it has caused a deep interest in other important subjects outside of the mere routine work of the farm, showing the intimate relations and connections the farmer bears to all other useful employments of the State. The society is to work for others, not for itself. It desires to reflect the sentiments and views of the industrial people, the classes it was intended by its founders to aid and encourage, and if possible it will take advance steps upon all questions it deems of vital importance to the useful industries, thus quickening thought and action among producers and leading them to a higher position in the social, political, and all other relations of the State. * * * This society has done much to raise the standard of education and intelligence and place the industrial workers upon a higher plane—in an intellectual atmosphere where they can think for themselves and keep step with the advanced, progressive spirit of the times.

In addition to the business transactions of the society and the list of premiums offered and awarded at the annual State fair, this volume contains well-written papers on the following-named subjects: "Finance," by George W. Cate; "Producers' Perils," by David Ward Wood; "Finance," by Sidney Myers; "The farmers of Wisconsin," by George W. Lee; "Better education of farmers a necessity for both the present and future," by J. M. Smith; "The farmer in politics," by William Orledge; "Our agricultural 'rag baby,'" by E. H. Benton; "Gold as a standard of value," by G. M. Steele, D. D.; "A consideration of the inconvertible note scheme," by E. B. Leland; "Dollars and sense," by S. D. Carpenter; "Butter-making and the care of cows," by F. C. Curtis; "Renovation of soils by rotation of crops," by A. A. Boyce; "Relation of the soil to water," by Prof. John Murrish; "A practical application of some of the lessons of the year," by C. E. Warner; "What kind of wheat shall we raise?" by J. W. Wood; "Original creation of the soil of Wisconsin, its past compared with its present condition; means of improved future fertility," by H. A. Tenney; "What Wisconsin farming demands of Wisconsin science," by Prof. T. C. Chamberlin; "Higher education on the progress of a State, or the people and their university," by Prof. J. W. Hoyt; "Grass is king," by Charles Seymour; "Self-culture," by H. C. Skavlem; "Farm-banks, or little things on the farm, and why some sell out and go West," by George P. Peffer; "Success *vs.* failure in Wisconsin orcharding," by J. C. Plumb. Many of these papers contain facts and suggestions of deep interest to the farmers of the Northwest.

INDEX.

A.

	Page.
Acreage in corn and cotton compared	120
of crops in European states	259
per cent. of, in corn, cotton, and other crops	121
under each crop in the several States	91
Agricultural and mechanical colleges	326
statistics of	358
appropriations, comparative extent of	89
exports	162
production in the several European states	255, 270
Agriculture, application of chemistry to	400
in Italy	283
in Spain	287
international statistics of	254
the future of, in Northern Michigan	403
Alabama, Agricultural and Mechanical College of	326
crops in	94
farm-animals in	112
loss of hogs in	111
Aleurodes	45
Alsike clover, excellences of	413
Amphiscepa bivittata	28
Analyses of American tanning-materials	52
wines	53
annoto	47
bat-guano	51
Borden's condensed milk	49
factory-cheese from different States	47
green-sand marl	55
Mesumbryanthemum crystallinum	54
oleomargarine cheese	48
Suæda Californica	54
Syracuse and Liverpool salt	47
varieties of butter	48
Animal warmth, utilization of, in Italy	284
Annotto, analyses of	47
Aphides	34, 73
Aphrophora parallela	31
quadrangularis	31
quadrinotata	31
Appendix	433
Apple, the Red Canada Winter	403
Apple-trees, the time for pruning	393
Apples, best varieties of, for growing in New Hampshire	413
Appropriations for the Department	15
Archasia galeata	30
Argentine Republic, agricultural condition of	272
exports to	273
imports and exports of	272
stock-raising in	274
Arkansas, crops in	95
farm-animals in	112
industrial university	327
loss of hogs in	111
Aspidiotus citricola	43
conchiformis	43
gloverii	41

	Page.
Aspidiotus Harrisii	43
pinifoliæ	43
Assistant Entomologist, report of	17
Aulacizus mollipes	32
Austria, statistics of farm-animals in	269
population, areas, and land-productions in	255–267

B.

Bacon and hams, exports of	239
Baden, statistics of farm-animals in	269
population, areas, and land-productions in	255–257
Bagging, extent of demand for	292
Baltimore, annual receipts of hogs at	236
flour and grain trade at	185–206
markets for live stock and stock-products at	213–252
prices of farm-products at	246
Barley, acreage, yield per acre, product, and value of, in the several States	91
crop	91–104
exports of	174–176
Bat-guano	49
analyses of	51
Bavaria, statistics of farm-animals in	269
population, areas, and land-productions in	255–268
Beans, increased yield of, from supplying the proper plant-food	391
Beef-cattle, full feeding and early maturity of	306
the profit of early maturity in	309
Beef, exports of fresh	320
markets for	211, 225, 242, 250
production in New York, the true system of	306
shipment of fresh, to Europe	312
steer, cost of, when two years old	310
the age of cattle for turning into	371
Beet-sugar, production of, in 1875	153
in the United States	157
Beets, mineral nutrition of	55
in poor soil, the best fertilizers for	56
Belgium, statistics of farm-animals in	269
population, areas, and land-productions in	255–267
Blue-grass	373
Boston, annual receipts of hogs at	236
flour and grain trade at	181, 206
prices of farm-products at	242
Botanical Division	13
Botanist, report of the	73
Brazil, exports to	271
imports and exports of	272
our trade with	271
Buckwheat, acreage, yield per acre, product and value of, in the United States	91
crop	91, 104
Bull, points and profits of a good	372
Butter, analyses of varieties of	48
and cheese, feeding for the production of	365
making, comparative profits of	380
comparative profits of making the best	387
from sweet cream and from sour cream, compared	422
in milk, chemical theories respecting	60
markets for	215, 225, 242, 250
the composition of, affected by breed of cow	416
the effects of feed upon	366

C.

California colleges of agriculture and mechanics	327
crops in	97
farm-animals in	112
Calves fed on skimmed milk	307
for dairy-cows, superiority of early	384
method of raising	426

Page.

Calves, advantage and mode of raising 384
value of whey and skimmed milk for 386
Canada, pork-packing in 238
Carbo-hydrates, formation of 57
Cattle, condition of 105
diseases of 105
proportion of thoroughbred, in Indiana 371
feeding, European experiments in 368
in New York 299
an experiment in 308
instances of 302, 307
present condition of 300
husbandry, a means of restoring and increasing fertility of soil 383
a source of increased fertility and of direct profit 412
importance and profits of 383
losses of 106
markets for 210, 224, 250, 252
products, markets for 211, 225, 242, 250
the greatest profits in fattening young 371
Centennnial exhibits of the Chemical Division at 46
Museum at 17
Cercopis bicincta 30
Cereals, total exports of 176
Ceresa bubalus 29
diceros 29
Chalk-beds of Kansas, utilizing the 378
Cheese from buttermilk, analyses of 48
different factories, analyses of 47
skimmed-milk, analyses of 48
Cheese and butter making, comparative profits of 380
markets for 213, 225, 242, 250
oleomargarine, analyses of 48
the composition of, affected by breed of cow 416
Chemical Division, exhibits of, at the Centennial 46
work of the 10
Chemist, report of 46
Chemistry, application of, to agriculture and the laws of health 400
Chicago, flour and grain trade at 190, 206
markets for live stock and stock-products at 218, 252
pork-packing at 234, 235
prices of farm-products at 248
Chili, civil condition of 277
imports from 278
Cicada pruinosa 24
septendecim, seventeen-year locusts 25
Cinchonas 65
Cincinnati, flour and grain trade at 187, 206
markets for live stock and stock-products at 214, 252
pork-packing at 217, 234, 235
prices of farm-products at 246
Clastoptera obtusa 31
proteus 31
Cleveland, summer pork-packing at 235
Coccus pinicorticis 44
Colidia sub-bifasciata 32
Coffee, success in cultivating, in United States doubtful 63
Colleges, agricultural and mechanical 326
Color of cattle subordinate to quality of 374
Commissioner, report of the 7
Coniomycetes ustilagine 81
Connecticut, crops in 92
farm-animals in 112
Sheffield Scientific School in 328
State board 363, 367
Corn, acreage of, compared with that of cotton 120
yield per acre, product and value of, in the several States 91
crop 93, 104
exports of 170, 172, 175
increased yield of, by supplying the proper plant-food 399

Page.
Corn, production, increase of 282
westward migration in area of 282
successful experiment in growing 391
Corn-meal, exports of 170, 175
per cent. of, exported compared with corn 175
Cost of packed hogs 233, 234
producing cotton 137
Cotton, acreage and rate of yield of 118
of, compared with that of corn 120
annual production of, in years preceding and succeeding the war 116
changes in modes of cultivating 127
cost and price of 137
crop 104
fertilizers for 122
increase in production of, since the war 115
investigation 114
summary of results of 151
large yields of 139
prices of American and Indian, in Great Britain 114
production of, tending westward 119
seed, varieties of 147
the area for growing 117
States, decrease in size of farms in 128
increased production of supplies in 148
increase in the number of small farms in 129
labor in 130
Cows, breeding and training for profit 425
different types of, for milk 415
milch, numbers, prices, and values of, in the several States 112
number and price of milch, in the United States 104
points of good 392, 421, 425
model short-horn 374
selection and treatment of, for milk 363
the best for the dairy 392, 419, 420, 425
the size of, for profit 425
value of meal as feed for milch 425
Crop-estimates for 1876 90
Crops, statistics of 99
acreage, yield per acre, product and value of, in the several States 91
average yield, value per acre, and price per bushel, pound, or ton in the United States 104
cash value per acre of, in the several States 103
in the several States, statistics of 91
price per bushel, pound, or ton in the several States 102
product, acreage, and value of, in the United States 104
yield per acre in the several States 102
yields of, in European states 264
Curculio on plum-trees, preventive of 405, 411

D.

Dairy factories, net return per cow to patrons of 422
husbandry in Italy 286
the best cows for 392, 419, 420, 425
Dairying, associated, in Maine 381
the future of 422
Dairymen's Association, Ohio 418, 420
Maine 385
Western Reserve 419, 422
Delaware College 329
crops in 93
farm-animals in 112
Delphax carinata 27
Denmark, statistics of farm-animals in 269
population, areas, and land-productions in 255–268
Diedrocephala quadrivittata 33
Diseases of cattle 105
hogs 107, 408
preventives and remedies of 109

Page.
Diseases of sheep ... 107
parasitic ... 417
Dorthesia cataphracta ... 45
Dundee, Scotland, manufactures of jute in ... 291

E.

Ecuador, exports of ... 280
our commerce with ... 280
Education, progress of industrial ... 326
Enchenopa binotata ... 28
England, exports of fresh beef to ... 320
Entomologist, report of ... 17
Entilia carinata ... 29
concava ... 29
Eriosoma lanigera ... 38
pyri ... 38
tesselata ... 39
Erythroneura basalis ... 33
vitis ... 32
Eucalyptol, composition of ... 86
Eucalyptus globulus ... 65
Eucalypti ... 82
Europe, annual production of cereals in ... 262
fresh-meat shipment to ... 312
European states, acres devoted to different products in ... 259
annual production of cereals in ... 262
per capita ... 260
potatoes per capita ... 262
areas and populations of ... 255
farm-animals in ... 268
per cent. of land devoted to different products in ... 256
tillage land in the several ... 255
yields of crops in ... 263
Expenditures of the Department ... 15
Experiments, European, in feeding cattle ... 368
for improving soils by mechanical means ... 431
in feeding cattle in New York ... 303
pigs ... 398
growing corn in Massachusetts ... 391
providing plant-food ... 389
with milk of different breeds of cows ... 424
Exports, agricultural ... 162
of barley ... 174, 176
corn ... 170, 172, 175
corn-meal ... 170, 175
Ecuador ... 280
flour and grain ... 164, 175
from San Francisco ... 205
fresh beef ... 320
hog-products ... 239
oats ... 174, 176
rye ... 173, 176
wheat and flour for 51 years ... 167
to Brazil ... 271
Peru ... 278
Rio Janeiro ... 272
Argentine Republic ... 273
United States of Colombia ... 276
Uruguay ... 277
Venezuela ... 279

F.

Farm-animals in the European states ... 268
number and condition of ... 104
per cent. of each kind in European states ... 269
receipts of, at different cities ... 210–223
Farm hands in Italy, wages of ... 285

	Page.
Farm-lands in Italy, ownership, taxes, and incomes of	285
products, market-prices of	242
Farmers, co-operation and mutual understanding among	430
Farming, improved modes of, in New Hampshire	412
in Maine	383
population in Italy, diet of	285
dress of	285
Farms in the cotton States, decrease in size of	128
increase in number of small	129
Feed for sheep and poultry, refuse of menhaden for	379
the best for butter and cheese	365
producing milk	364, 369
value of coarse	369
Feeding *ad libitum*, results of	370
cattle, results of European experiments in	368
theory and practice of	382
Fertilizer for beets on poor soil, the best	56
menhaden for a	379, 387
Fertilizers for cotton	122
the use of marsh-muck for	407
Finland, statistics of farm-animals in	269
population, areas, and land-productions in	255–268
Fish-culture in Wisconsin	430
Fisheries, menhaden and herring, on the coast of Maine	379
Florida Agricultural College	329
crops in	94
farm-animals in	112
loss of hogs in	111
Flour and grain, domestic trade in	177
movements	164
receipts and shipments of	206
wheat, exports of	167, 171
a new process in manufacturing	169
exports, per cent. of, compared with wheat	163, 175
France, statistics of farm-animals in	269
population, areas, and land-productions in	255–268
Freedmen land-owners	137
Fresh meat, condition of profitable shipments of, to Europe	318
shipment to Europe	312
history of	314
Fruit crop of New Hampshire, comparative value of	413
Fruit-growing in Michigan	394, 402, 404
Fruits, new varieties of, in Michigan	405
Fulgora, or *Scolops sulcipes*	27
Fungi, edible	79
microscopic, Centennial collection of	81

G.

Georgia College of Agriculture and the Mechanic Arts	330
crops in	94
farm-animals in	112
losses of hogs in	111
North, Agricultural College	331
Grain and flour, domestic trade in	177
movements	164
receipts and shipments of	206
grass, hints on growing	371
Grains exported, proportion of different	177
Grape, description of a new seedling	418
Grape-root louse	40, 70, 81
Grape-sirup, production of	161
Grapes, best varieties of, for growing in New Hampshire	413
cause of failure in cultivating foreign	71
Grass and grain, hints on growing	371
Grass-lands, successful mode of treating	384
Grasshoppers, natural history of	375
Grasses, a mixture of, for hay	422

Page.

Grazing in Indiana 373
the profits of 373
Great Britain, statistics of farm-animals in 269
population, areas, and land-productions in 255–267
Greece, statistics of farm-animals in 269
population, areas, and land-productions in 255–267

H.

Hams and bacon, exports of 239
Harvest-flies 24
Hay, acreage, yield per acre, product, and value in the several States 91
increased yield of, from supplying the proper plant-food 390
salt and fresh water marsh 296
Health, application of chemistry to the laws of 400
Hedge-plants 70
Hesse-Darmstadt, statistics of farm-animals in 269
population, areas, and land-productions in 255–267
Hides, dry, incapable of transmitting rinderpest 321
markets for 215, 226
Hog-cholera 408
the treatment of 423
Hog-products, exports of 239
markets for 214, 229, 242, 250
Hogs, cost of packed 233, 234
diseases of 107, 408
experiments in feeding 398
losses of 111
markets for 211, 228, 250, 252
number and prices of, in the United States 104
numbers of, packed 232, 234, 239, 241
prices, and values of, in the several States 113
receipts of, in the Eastern cities 236
weight of, packed 232, 234, 241
yield of lard from packed 233, 234
Holland, statistics of farm-animals in 269
population, areas, and land-productions in 255–267
Homes of farmers in Italy 284
Homoptera 24
Hop crop 91, 104
Hoplophora quadrivittata 30
Horses and mules, market for, at Saint Louis 224, 252
breeding and improvement of 401
condition of 105
for Vermont, points to be regarded in growing 426
market for, at Chicago 218
Morgan 426
number and price of, in the United States 104
points to be regarded in breeding for market 392
the breeding and management of 391
raising of, for Maine 386
Horticultural Society, Missouri State 409
Hungary, statistics of farm-animals in 269
population, areas, and land-productions in 255–268

I.

Illinois, crops in 96
farm-animals in 112
hogs packed in 232
industrial university 331
loss of hogs in 111
Immigration westward, results of 281
Imports from Brazil 291
Chili 278
Venezuela 279
of sugar 154
India, jute-culture in 289

Page.

Indiana Agricultural College ... 332
as a grazing State ... 373
crops in ... 96
proportion of thoroughbred cattle in ... 371, 372
farm-animals in ... 112
hogs packed in ... 232
loss of hogs in ... 111
State Board ... 370
Indianapolis, pork-packing at ... 234, 235
India-rubber plants strictly tropical ... 64
Industrial education, progress of ... 326
Insect-ravages, jute a protection from ... 293
Insects, inventions for destroying ... 323
Inventions for destroying insects ... 323
Iowa Agricultural College ... 333
crops in ... 97
farm-animals in ... 112
hogs packed in ... 232
loss of hogs in ... 111
Ireland, statistics of farm-animals in ... 269
population, areas, and land-productions in ... 255–267
Irrigation in Maine ... 380
Italy, agriculture in ... 283
identity of farm dwellings and stables in ... 284
rotation of crops in ... 285
rural homes in ... 284
statistics of farm animals in ... 269
population, areas, and land-productions in ... 255–266

J.

Japan persimmons ... 68
Jute, a protection from insect-depredations ... 293
culture ... 289
development of, in India ... 290
experiments in ... 291
in the United States, economy of ... 293
importance of ... 292
extent of manufactures of, at Dundee, Scotland ... 291
profits from the domestic manufacture of ... 293
uses of ... 291
yield of ... 291

K.

Kansas Agricultural College ... 334
crops in ... 97
farm-animals in ... 112
hogs packed in ... 232
loss of hogs in ... 111
State Board ... 374
textile and dairy production of ... 378
the mineral resources of ... 377
physical features of ... 377
rivers of ... 376
Kentucky Agricultural and Mechanical College ... 335
farm-animals in ... 112
hogs packed in ... 232
crops in ... 95
loss of hogs in ... 111

L.

Labor-contracts in the cotton States ... 131
in the cotton States, per cent. of black and white ... 136
prices of ... 130
rations for ... 135
white ... 136
Laborers, interest of the National Government in the prosperity of ... 87
Lachnus caryæ ... 37

Page.
Lachnus strobi 38
Lambs, the rate of gain in 428
Land owned by freedmen 137
Lard, exports of 240
markets for 218, 229, 242-250
Lecanium acericorticis 44
hesperidum 44
Live-stock markets 209, 250
Louisiana Agricultural and Mechanical College 335
farm-animals in 112
crops in 95
loss of hogs in 111
sugar-production in 156
Louisville, pork-packing at 234
Louse, the grape-root 40, 70, 81

M.

Maine, associated dairying in 381
College of Agriculture and the Mechanic Arts 336
crops in 91
Dairymen's Association 385
farm-animals in 112
farming in 383
irrigation in 380
menhaden and herring fisheries on the coast of 379
State Board 378, 386
Pomological Society 385, 388
the raising of horses for 386
Manures, advantages of chemical analyses of 400
advantages of feeding pigs and cattle for 406
production and value of 406
Maple-sugar production 159
Market-prices for farm-products 242
Markets for live stock and live stock-products 209, 250
Marl, analyses of green-sand 55
Marsh hay, salt and fresh water 296
Marshes, reclamation of, in Massachusetts 388
Maryland Agricultural College 336
crops in 93
farm-animals in 112
Massachusetts Agricultural College 337
crops in 92
farm-animals in 112
Institute of Technology 337
reclamation of marshes in 388
State Board 388
Maturity in beef-cattle, the profits of early 309
Meat, firms engaged in shipping fresh, to Europe 316
shipment of fresh, to Europe 312
mode of 314
Mesembryanthemum crystallinum 53
Michigan Agricultural College 338
crops in 96
farm-animals in 112
fruit-belt of 394
fruit-growing in 394, 402, 404
the profits of 403
hogs packed in 232
new varieties of fruits in 405
State Agricultural Society 399
Board 394, 400
Pomological Society 402
the future of agriculture in Northern 403
the season longer in Northern than in Southern 404
Microscopic Division 11
investigations 74
Microscopist, report of 74
Milk, analysis of Borden's condensed 49

	Page.
Milk, conditions of securing the best quality of	363
feeding for the production of	364, 369
from different types of cows	415
means of detecting the adulteration of	418
of Jersey and Ayrshire cows, experiments with	424
pounds of, per pound of cheese	422
prevention of taints and odors in	382
sources of taints and odors in	389
the constituents of	416
the value of skimmed, for calves and pigs	386
Milk-globule of different breeds of cows	416
Milwaukee, flour and grain trade at	194, 206
pork-packing at	234, 235
Minerals poisonous to plants	56
Minnesota colleges of agriculture and mechanic arts	339
crops in	97
farm-animals in	112
hogs packed in	232
Mississippi Agricultural and Mechanical College at Rodney	340
College of Agriculture and the Mechanic Arts at Oxford	340
crops in	94
farm-animals in	112
loss of hogs in	111
Missouri Agricultural and Mechanic College	341
crops in	97
farm-animals in	112
hogs packed in	232
loss of hogs in	111
School of Mines and Metallurgy	341
State Board	408
Horticultural Society	409
Molasses, cane, annual consumption of	155
per cent. of domestic and foreign, consumed	155
production of sorghum	158
Mules and horses, market for, at Saint Louis	224, 252
number and price of, in the United States	104
numbers, prices, and values of, in the several States	112
Museum, donations to	8
erection of a gallery in the hall of	7
exhibits of, at the Centennial	17
report on the	17
Mushrooms	12, 74
how to grow	77

N.

Nebraska Agricultural College	342
crops in	97
farm-animals in	112
hogs packed in	232
loss of hogs in	111
Nevada, crops in	98
farm-animals in	112
New Hampshire College of Agriculture and the Mechanic Arts	343
crops in	91
farm-animals in	112
improvements in farming in	412
State Board	411
New Jersey, crops in	93
farm-animals in	112
Scientific School	343
New Orleans, live-stock market at	252
prices of farm-products at	248
New York Colleges of Agriculture and the Mechanic Arts	344
crops in	92
farm-animals in	112
cattle-feeding in	299
feeding cattle purchased from without in	300
the true system of beef-production in	306

	Page.
New York City, annual receipts of hogs at	236
exports of fresh beef from	320
flour and grain trade at	180, 206
markets for live stock and stock-products at	209, 250
prices of farm-products at	242
Nitrogen, organic and atmospheric, as sources of vegetable nutrition	56
North Carolina College of Agriculture and the Mechanic Arts	345
crops in	93
farm-animals in	112
loss of hogs in	111
Norway, statistics of farm-animals in	269
population, areas, and land-productions in	255–268

O.

Oats crop	91, 104
exports of	174, 176
increased yield of, from supplying the proper plant-food	390
acreage, yield per acre, product, and value of, in the several States	91
Ohio Agricultural and Mechanical College	346
crops in	96
Dairymen's Association	418, 420
farm-animals in	112
hogs packed in	232
loss of hogs in	111
State Board	414, 419
facts in the history of	419
Oleomargarine cheese, analysis of	48
Oliarius	28
Olive, European	66
French varieties of	68
Spanish varieties of, for colder localities	67
warmer localities	68
Orchards in New Hampshire, best localities for	413
Michigan, profits of	403
Oregon Agricultural College	347
crops in	98
farm-animals in	112
Ormenis pruinosa	28
septentrionalis	28
Otiocerus amyottii	27
coquebertii	27
Oxen and cattle other than milch-cows, number and price of, in the United States	104
numbers, prices, and values of, in the several States	113

P.

Pastures, benefits of underdraining	337
Peach-trees, pruning	407
Peaches, varieties of, for culture in Missouri	410
Pear-trees in Europe, size and yield of	410
the culture of	410
Pediculus capitis	45
pubis	45
vestamenti	45
Pemphigus vitifoliæ	39
Pennsylvania, crops in	93
farm-animals in	112
State College	347
Peoria, flour and grain trade at	197
Persimmon, the Japan	9, 68
Peru, agricultural condition of	278
exports to	278
Philadelphia, annual receipts of hogs at	236
exports of fresh meat from	320
flour and grain trade at	183, 206
markets for live stock and stock-products at	212, 252
prices of farm-products at	244

Page.

Phylloscelis atra 27
Phylloxera vastatrix 40, 70, 81, 411
Pigs, value of whey and skimmed milk for 386
Plant-food, providing proper 389
Plants, the collection of economic 10
Plum-culture, the profitableness of 405
Plum-trees, preventive of curculio on 405, 411
Poisons, mineral, affecting plants 56
Pomological Society, Maine State 385, 388
Michigan State 402
Pork, exports of 239
markets for 218, 223, 242–250
the amount of, produced 235, 239
Pork-packing 217, 229, 230
in Canada 238
the principal cities 234
West 230
increase in 241
on the Pacific coast 237
results of summer and winter 236, 239
summer 235
winter 230, 239
Portugal, statistics of farm-animals in 269
population, areas, and land-productions in 255–267
Potato crop 91, 104
the kind and quantity of seed for a 414
Potatoes, acreage, yield per acre, product, and value of, in the several States.. 91
increased yield of, from supplying the proper plant-food 390
planted with a plow 414
Poultry-raising, hints on 401
profits of 402
Prices of barley and of oats exported 176
corn and corn-meal exported 175
cotton 138
crops 91-104
farm-animals 112, 209, 250
farm-products in market 242
flour and wheat exported 175
grain at Chicago 191–194
labor in the cotton states 130
sugar 154
rye and rye-flour exported 176
Proconia undata 31
Pruning apple-trees, the time for 393
peach-trees 407
Prussia, statistics of farm-animals in 269
population, areas, and land-productions in 255–267
Psyllidæ 33

R.

Rations far laborers in the cotton States 135
Remedies and preventives of diseases in farm-animals 107, 109
Rennet, best manner of saving, curing, and using 419
Report of the Botanist 73
Chemist 46
Commissioner 7
Entomologist and Curator of the Museum 17
Microscopist 74
Statistician 87
concluding statements of 281
Superintendent of Gardens and Grounds 61
Rhode Island Agricultural and Mechanical College 348
crops in 92
farm-animals in 112
Rhododendrons 63
Rhozobius 39
Rinderpest 321
preventing the introduction of 322

	Page.
Rio Janeiro, exports to	272
Rotation of crops in Italy	285
Roumania, statistics of farm-animals in	269
population, areas, and land-productions in	255–268
Russia, statistics of farm-animals in	269
population, areas, and land-productions in	255–267
Rye, acreage, yield per acre, product, and value of, in the several States	91
crop	91, 104
exports of	173, 176

S.

Sacking, extent of demand for, in the United States	292
Saint Louis, flour and grain trade at	198, 206
markets for live stock and stock-products at	224, 252
pork-packing at	229, 234, 235
prices of farm-products at	243
Salt, analyses of	47
San Francisco, flour and grain trade at	203
prices of farm-products at	250
Saxe-Altenburg, statistics of farm-animals in	269
population, areas, and land-productions in	255–268
Saxe-Weimar, statistics of farm-animals in	269
population, areas, and land-productions in	255–268
Saxony, statistics of farm-animals in	269
population, areas, and land-productions in	255–268
Scab in sheep, remedy for	107
Scotland, exports of fresh beef to	320
Seed, purchase of, by special commissioner	8
quantities and kinds of, distributed	14
varieties of cotton	147
Servia, statistics of population, areas, and land-productions in	255–265
Sheep, condition of	106
diseases of	107, 417
for market, breeding and feeding	427
wool and mutton, characteristics of	427
losses of	107
markets for	211, 226, 250, 252
mode of determining the age of	427
number and price of, in the United States	104
numbers and prices of, in the several States	113
parasitic diseases of	417
remedy for scab in	107
Sheep-husbandry, hints on	427
Sheep-products, markets for	212–227, 242–250
Short-horn fatted calf, history of	308
twins, history of the Ellsworth	308
Short-horns	371
for exhibition, feeding	374
Similia inornata	30
vau	30
Soils, advantages of chemical analyses of	400
Sorghum, production of, in the United States	158
South America, our relations with	271
South Carolina Agricultural College and Mechanics' Institute	349
crops in	94
farm-animals in	112
loss of hogs in	111
Spain, agricultural productions of	287
agriculture in	287
statistics of farm-animals in	269
population, areas, and land-productions in	255–267
State reports, digest of	363
Statistical Division, the	8
clerical force in	282
crippled for want of means	9
inadequate provision for investigations by	281
investigations begun in	281

Page.
Statistical Division, work of the 88
exhibits at the Centennial 9
investigation not duly appreciated and provided for 88
Statistician, report of 87
Statistics, international 87
of agricultural colleges 358
agriculture, international 254
areas and population in European states 255
cane-molasses consumed in the United States 155
cane-sugar consumed in the United States 155
corn and corn-meal exports 170, 175
crops in the several European states 259
States 91
domestic trade in flour and grain 177, 206
exports of fresh beef 320
farm-animals 112
in European states 269
flour and wheat exports 167, 175
jute-culture in India 200
maple-sugar production 160
production of sorghum sugar and sirup 158
productive lands in European states 256
seed-distribution 14
sugar-production 153
Stictocephala inermis 30
Suæda Californica, analysis of 54
Sugar, annual consumption of 155
cost of 154
beet-root, production of, in the United States 157
production in 1875 153
cane, produced in 1875 153
chemical process of purifying 61
from watermelons, production of 161
imported, sources and quantities of 154
per cent. of domestic and foreign, consumed 154
production 153
in Louisiana 156
the United States 155
of maple 159
statistics o 153
the amount of, for domestic use in 1875 and 1876 154
Superintendent of Garden and Grounds, report of 61
Supply-crops in the cotton States, increased production of 148
Sweden, statistics of population, areas, and land-productions in 255–267
Switzerland, statistics of farm animals in 269

T.

Tallow, markets for 211, 218, 220
Tanning-materials, American 52
analyses of 52
Tea-plant, the Chinese 70
Paraguay 69
Telamona ampelopsidis 29
Tennessee Agricultural College 349
crops in 95
farm-animals in 112
hogs packed in 232
loss of hogs in 111
Territories, crops in the 98
farm-animals in the 112
Texas Agricultural and Mechanical College 350
crops in 95
farm-animals in 112
loss of hogs in 111
Thelia bimaculata 29
Tobacco, acreage, yield per acre, product, and value of 91
culture in Europe 263
Trade, domestic, in flour and grain 177
with Brazil 271
Turkey, statistics of population, areas, and land-productions ina 255–265

U.

Page.

United States of Colombia 274
exports and imports of 275
to 276
Uruguay, exports to 277

V.

Vanilla 69
Venezuela, our commerce with 279
Vermont Agricultural College 351
crops in 93
farm-animals in 112
points to be regarded in growing horses for 426
State Board 424
Virginia Agricultural and Mechanical College 352
crops in 93
farm-animals in 112
loss of hogs in 111
normal and agricultural institute in 353

W.

Watermelons, production of sugar from 161
Water-plants introduced into the grounds of the Department 62
West Virginia Agricultural College 352
crops in 95
farm-animals in 112
loss of hogs in 111
Wheat, acreage, yield per acre, product, and value of, in the several States 91
crop 90, 104
and flour, exports of 167, 171, 175
culture in Italy 286
exports, per cent. of, compared with flour 168, 175
production, increase of 281
westward migration in the area of 281
the cross-fertilization of 428
Whey, value of, for calves and pigs 386
Wines, American, analysis of 53
Wisconsin College of Arts 353
crops in 96
farm-animals in 112
fish-culture in 430
hogs packed in 232
State Agricultural Society 429, 431
Wool, markets for 211–227, 242–250
Würtemberg, statistics of farm-animals in 269
population, areas, and land-productions in 255–267

Y.

Yields, former large, in Essex County, Massachusetts 389
increased by supplying the proper plant-food 390
large 413
of cotton, instances of large 139
crops 91
in European states 264