THIRD REPORT

OF THE

AGRICULTURE OF MASSACHUSETTS.
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ON

WHEAT AND SILK.

By Henry Colman,
Commissioner for the Agricultural Survey of the State.

Boston:
Dutton and Wentworth, Printers to the State.
1840.
To the Hon. Daniel P. King,

President of the Senate of Massachusetts:

Sir,

The Commissioner for the Agricultural Survey of the State, has the honor to submit to the Senate a Report on the Cultivation of Wheat in Massachusetts, prepared in compliance with the order of the Legislature of March 20, 1839, which is annexed.

The duty would have been sooner executed, but the Returns were not accessible to the Commissioner, until a considerable time after the passage of the order; and the season afterwards being that of active duty abroad, he was under the necessity of postponing the report. The number of individual returns to be looked over, amounting to nearly four thousand, have necessarily occupied a long time. The subject being of great importance, he has devoted to it much labor and inquiry.

Though not within the terms of the order, yet the Commissioner asks leave of the Senate to subjoin his Report on the Culture of Silk in the State. The information he proposes to give on this subject is of much consequence. Knowing the importance of this subject, and the impatience and curiosity of the public mind in regard to it, the Commissioner travelled more than sixteen hundred miles, the last autumn, that he might
make inquiries, in person, in places where Silk had been produced, and obtain information, which he could present in an authentic form. He desires, therefore, to connect it with his Report on the Culture of Wheat, instead of delaying it for his more general Reports.

He respectfully, through you, sir, submits the subject to the Senate; and has the honor to subscribe himself,

With the highest respect,

Your obedient servant,

HENRY COLMAN.
Ordered, That the Governor be requested to obtain from the Agricultural Commissioner, a full report of the cultivation of Wheat, in this Commonwealth, the last year; in reference to all those particulars specified in the act of 1838, offering a bounty upon the product of Wheat; which have a practical bearing on its culture; collating such facts from the returns, as will secure, as far as practicable, the great object of granting the bounty, by gathering the experience of the past year, as far as may be, to aid the future culture of Wheat in this Commonwealth; with such other information respecting the cultivation of Wheat, as may be deemed important; and lay the same before the Senate, when obtained; and that for this purpose, the Agricultural Commissioner be allowed the use of the Wheat Returns, in the office of the Secretary of State, as far as they may be needed by him.

Sent down for concurrence.

CHA'S CALHOUN, Clerk.

House of Representatives, March 20, 1839.

Concurred.

L. S. CUSHING, Clerk.

A true copy. Attest.

JOHN P. BIGELOW,
Secretary of the Commonwealth.
AGRICULTURAL REPORT.

WHEAT RETURNS OF COUNTIES.
1838-9.

BERKSHIRE COUNTY.

ADAMS.—No. of Claimants, 10. Acres not reported. Product, 310½ bush.
Average yield of 18½ acres reported, 11½ bush. per acre.
Largest crop reported, 15 bush. per acre.
Remarks. One crop highly manured, 14½ bs. per acre, injured by insects.

Average pr acre, 12½ bush.
Crops 20 bush.; 18 bush.; two 16 bush. each per acre.
Remarks. No manure for largest crop. In several cases 1¼ bushel of plaster applied per acre, without marked results. Two cases of grain insect.

Average, 12 bush. per acre.
Crops, 20 bush.; 18 bush. per acre.
Remarks. Seed, Tea wheat. Amount of seed generally, 1½ bs. per acre.
In two cases, two bushels were sown to the acre, but without marked advantage. One crop, 18 bs. received 20 bush. leached ashes; one, five loads leached ashes. The application of lime, not exceeding four bushels to the acre, without perceptible effect. Soil "loamy or sandy loam." Twelve crops suffered from drought, and three from wire worm.

Average per acre, 16½ bs.
Crops, 22 bs. 19 bs.; four, 16 bush. per acre.
Remarks. Best crops, on "slate soil," and "black muck." Six crops injured by grain insect. No lime excepting on the seed.
    Average per acre, 13½ bush.
    Largest yield, 20 bush, per acre.
    Remarks. Seed, the Leghorn. Injury from hail.

    Average per acre, 12½ bush.
    Crops, 23 bush. per acre; 22 bush.; two 19 bush.
    Remarks. Crop of 22 bush. with 15 bush. ashes per acre. Of 19 bush.
    with 1 cask of lime and 6 bush. ashes, and six loads long manure. Three
    cases of lime, two bush. per acre; without advantage. Seed, tea-wheat.
    Two crops blasted; four cases of grain worm.

    Average, 15 3-10 bush. per acre.
    Crops, 24 bush.; 20 bush.; 19½ bush.; two, 18 bush.
    Remarks. Largest crop, with ten loads stable manure, on gravelly loam.
    Plaster customarily applied; 1½ bush. per acre. Three cases grain insect;
    four of cut worm; one smut-wheat rolled in lime, but not soaked in brine;
    one case rust, one mildew. The soil of Egremont peculiarly favorable for
    grain. Five loads of coarse straw applied to an acre; the yield, 10 bushels.

    Average per acre, 17 1-6 bush.
    Remarks. Crop of 20 bushels per acre, with 50 bushels leached ashes,
    and 2 bushels lime per acre.

    Average, 14½ bush. per acre.
    Crops 26½ bs.; 25½ bs.; three, 21 bs.; 20 bs. pr. acre.
    Remarks. Crop of 20 bushels per acre with 4 loads of light rotten ma-
    nure spread on the grain. Twenty-eight crops with plaster; 1½ bushels
    per acre; twenty-nine cases of grain insect; one of worm at the root; one
    of grasshoppers.

    Average per acre, 16 bush.
    Crops, 24 bush.; 22; 21; 20 bush. per acre.
    Remarks. Crop of 24 bushels, had 8 bushels of ashes per acre; 21 bush-
    els, 15 bushels ashes, per acre; of 19 bushels with 3 bushels’ gypsum and 2 of
    ashes. With 8 bushels ashes, crop 15 bushels per acre.

    Average, 15½ bush. per acre.
    Crops, 28 bush.; 25 bs.; 24 bs.; two, 22; 21; two, 20; 19; 18 bush. per acre.
Remarks. Crop of 28 bush. with four bushels of lime per acre. Of 21 bushels with 25 loads of manure in 1837. One case of ashes, the crop 14 2-5 bushels per acre. One case of smut; the seed linned, but not soaked in brine.

LANESBORO'.—Claimants, 45. Acres sown, 85½. Product, 1183¾ bs. Average crop, 13 bs. per acre.

Remarks. With 100 bushels lime per acre, the yield 11½ bushels per acre. Saltpetre and lime applied, but quantities not given. Yield 15 bushels. In one case, land manured the year of the wheat. Plaster in 16 cases, 1 to 1½ bushels per acre. No definite results.


Crops, 20½ bs.; 24 bs.; two of 18½ bs.

Remarks. With 20 bushels lime to 1¼ acre, crop 11½ bushels; suffered from drought. Three applications of plaster, but no perceptible result. With four bushels of ashes to the acre, the crop 12½ bushels; suffered from drought. On the same farm, one acre of spring wheat, gave 18 bushels; 2 of winter wheat, 5 bushels each. Three cases of grain insect; one of rust from late sowing; one of smut; the seed soaked in brine, and rolled in plaster.


Crops, 26 bs.; three of 20 bs. per acre; two of 18 bs.

Remarks. Crop of 26 bushels, with six loads yard manure, and ten bushels of lime and ashes, amount not stated; sown on 30th April. Soil, a dark loam. Prevailing rocks of this locality, mica slate. A second piece on the same farm, with six loads of barn manure, and ten bushels of lime, and two bushels of plaster, produced 12½ bushels to the acre; sown on 22d May.

This farmer, Eldad Post, harrows his wheat repeatedly, after sowing, even after it has germinated; considers the exposure of the seed and soil to light and air, highly beneficial. His cultivation usually successful; two years since, his spring wheat was more than 34 bushels per acre.—Results in these returns quite various. One acre, with five bushels lime, and two bushels of gypsum, produced 11½ bushels to the acre. One with 60 bushels lime, 13 bushels wheat. Twelve cases of grain insect; four worm at the root. One of smut; seed rolled in lime, but not soaked in brine.


Crops, 20 bs.; 16 bs.

Remarks. Excepting one case, manured previous year. Six crops "shrunk."
Average crop, 14½ bs. per acre.
Crops, 29 bs.; 20; 19½; two, 18 bs.
Remarks. Crop of 29 bushels, winter wheat, on new land. Soil, “sili-
ceous.” Crop of 20 bushels, winter wheat; part of the same piece in spring
wheat. The spring wheat failed to come up; no manure in either case.
Soil, “a dark loam.” Plaster applied; in one case, 5 bushels of lime, and
1 bushel of plaster; in one, 12 bushels of ashes; without apparent effects.

Average, 16½ bs. per acre.
Remarks. Crop, 23 bushels; chip manure and lime; quantity not stated.
Chip manure is the refuse of the door yard, impregnated with soap-suds, and
the usual varieties. To the crop, 11½ bushels per acre, lime and ashes ap-
piled; quantities not given.

Average crop, 16 1-5 bs. per acre.
Crops, 24 bs.; 22 bs.; 17 bs.
Remarks. Largest crop, with 6 loads sheep manure, and 15 bushels ashes
to the acre. With 15 loads of stable manure, and 20 bushels of ashes per
acre, product, 10 bushels. Seed, in this case, three bushels. Two cases
20 loads of long manure, and 4½ bushels of lime, and 15 cords of yard ma-
nure, and 2 loads of refuse lime; crop 15 bushels each per acre. Best crop,
red bearded. Others, the tea wheat. No accident. Peru is among the most
elevated lands in the State.

Average crop, 13½ bs. per acre.
Crops, 4 of 20 bs. per acre; 4 of 19 bs. per acre; 7 of 18
bs. per acre; 5 of 17 bs. per acre.
Remarks. Crop of 17 bushels, received 5 bushels ashes per acre. An-
other piece with 6 bushels of ashes per acre, gave 14 bushels. Tea-wheat,
not injured by grain worm; bearded wheat suffered on same farm. With
12 bushels of ashes, crop 6 bushels. With 20 bushels per acre of ashes, crop
19 bushels per acre. With 10 bushels of ashes per acre, crop 15 bushels.
With 15 bushels of ashes, crop 10 bushels. With 4 bushels ashes per acre,
and 10 loads manure, crop 12 bushels. With 7½ bushels ashes per acre,
without manure, crop 13½ bushels. In 9 cases, plaster without manure, the
crops from 12 to 14 bushels. Several cases of grain insect. The appli-
cation of the marls in this vicinity has yet been followed by no marked ben-
fits to the wheat crop. Much is still hoped from them.

Average crop, 14 7-10 bs. per acre.
Crops, 22 bs.; 3 of 21 bs.; 20 bs.; 19 bs.
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Remarks. Largest crop with lime, ashes and plaster, quantities not stated. With 20 bushels of ashes, crop 14 bushels per acre; much injured by grain insect. Crop of 21 bushels per acre, was with horse and sheep manure, and 100 lbs. plaster. Fifteen crops with gypsum, but no definite result. Winter wheat injured by frost. Ten cases of grain insect. Three rust. Two drought.

Sandisfield.—Claimants, 7. Acres sown, 114. Product, 157½ bush. Average per acre, 13½ bush.
Crops, 22½; 20; 19¼, bush. per acre.
Remarks. Crops of 22½ bush. received 27 bush. ashes per acre, on dry loam. Crop of 20 bush. on moist loam, with one bushel gypsum. Crop of 19½ bush. to the acre, with 12 bush. ashes and 22 bush. of lime on 146 rods of land. On same soil, gravelly loam, six loads of leached ashes on 212 rods, produced 15 bush. per acre; 2 loads of leached ashes on 140 rods, produced 6½ bush. per acre. The town of Sandisfield is elevated. Leached ashes freely used in every case but two. No injury or accident.

Average, 15 bush. per acre.
Crops, 22; 20; 19; 17; bush. per acre.
Remarks. Seed soaked in beef brine twenty-four hours, crop slightly smutted. Of seed without preparation, one fourth smutted.* Stable manure, nine loads, and 3500 bushels, per acre.

Sheffield.—Claimants, 73. Acres sown, 249½. Product, 3902 bs.
Average, 11½ bush. per acre.
Crops, 31; 25; 21¼; five of 21; one of 22½; one of 20¼; ten of 20 bush. per acre.
Remarks. Largest crop, mostly winter wheat, with 15 loads of manure; “injured by the spring.” Crop of 25 bs., with 10 loads of manure. Crop of 20¼ bs. with 20 bs. of lime and one of plaster, per acre. In one case grain was winter-killed; thirty-five cases of grain insect.

Average, 11¼ bush. per acre.
Crops, 22 bs.; 20 bs.; two 18 bs., per acre.
Remarks. In one case winter wheat produced 12 bs., spr. wheat 11½ bs.
One case bearded wheat injured by grain insect; tea wheat not. Wheat seeded, 55 qts. per acre, “suffered from thick sowing.” A farmer states he can raise more bushels of wheat than of rye on same land. His soil is clay and sandy loam. He uses a small quantity of barn manure; and a top-dressing of one bushel of plaster and ashes, quantity not stated.
An entry made here, and premium paid, on 17½ bushels of India Wheat, i.e. Tartarian Buck Wheat.


Remarks. Crop of 28 bs. on loam, and ½ a bushel lime and plaster.—Other large crops without manure. In five cases, 1½ bushels of plaster applied per acre, without marked difference. Nine cases of grain insect. One of smut; wheat simply rolled in plaster.


Remarks. Ten bushels lime applied, crop 16½ bushels; thirty bushels lime applied, crop 13 bushels; crop of 20 bushels, manured with 20 loads chip manure. One case of grain insect.


Remarks. Crop 21½ bs., land the previous year had 20 loads of manure; 20 bs., land the previous fall had 15 loads manure, 5 bs. ashes. Land with 20 loads manure, 3 bs. lime, 5 bs. ashes, gave 14 bs. wheat. Soil sandy.


Remarks. Crops sowed from 12th of May to 1st of June, suffered from late sowing. Largest crop grown on a "slaty gravel." Four cases of wire worms; two in clay soil; one in green sward. Twelve cases of plaster, but no marked effect. One case of lime applied on the wheat when in flower, for destruction of grain insect; the crop injured by the insect, but no particulars given of the lime, quantity, or manner of application. Late sowing strongly disapproved by the reports of this town.


Remarks. Crop 28 bush. on a dark red loam and light dressing of sheep manure. 26½ bush. with sheep manure and 15 bush. ashes. 24 bush. with manure from cattle. The crops of 22 bush., 21½ bush., 20½ bush., two of 18½ bush. 17½ bush. with 12 or 15 bush. ashes. In Windsor a crop of Indian corn of 116 bs. per acre, received a premium from the Berkshire Agricultural Society. The success attributed to abundant application of leached ashes.
FRANKLIN COUNTY.

ASHFIELD.—Claimants, 59. Acres sown, 80 1/2. Product, 1259 1/2 bush.
   Average per acre, 15 47-80 bush.
   Crops, 21 bs. two of 20 bs. one of 19 bs. three of 18 bush.
   per acre.

Remarks. Largest crop without manure. Lime three bs. per acre, and
ashes applied, but no results given; three cases of grain insect; four cases
of injury by drought. The soil clayey loam.

BERNARDSTON.—Claimants, 9. Acres sown, 12 1/2. Product, 244 bush.
   Average per acre, 19 bush.
   Crops, 26 bs. 25 1/4 bs. 24 1/4 bs. one of 22 bush. per acre.

Remarks. Largest crops without manure. Two bs. lime and plaster ap-
plied; crop, 10 bs. Three cases of grain worm. Where winter and spring
wheat on the same farm; the winter wheat gave 19 bs. the spring 18 bs per
acre.

BUCKLAND.—Claimants, 11. Acres sown, 16 41-60. Product, 256 bush.
   Average per acre, 15 3-16 bushels.
   Largest crop, 21 bush. on an acre.

Remarks. This crop received 15 loads of barn yard manure. 5 cases of
grain insect.

   Average per acre, 15 19-46 bush.
   Largest crops, 22 1/4 bs. 22 bs. 21 1/2 bs. three of 16 1/4 bush.
   per acre.

Remarks. The largest crop, 10 loads of stable manure, on a “red loam.”
500 lbs. plaster, and 1 hhd. of lime applied to 2 acres; crop, 7 1/2 bs. per acre
This was winter wheat; and suffered much from grain insect. Land highly
manured the previous year, and 20 bs. ashes upon 1 1/2 acre, crop, 15 bs. per
acre. Nine cases of grain insect.

   Average per acre, 15 19-46 bush.
   Largest crops, 21 bs. seven of 20 bs. one of 19 bs. three of
   18 bs. per acre.

Remarks. Largest crop without manure; crop of 19 bs. with 30 loads
compost, and 30 bs. of ashes, on 1 1/2 acres; soil, dry loam. Four cases of
grain worm. Several crops suffered from hail storm.
CONWAY.—Claimants, 32. Acres sown, 49. Product, 666 bush. Average per acre, 13 3-5 bush. Crops, 24 bs. 23 bs. two of 20 bs. one of 19 bs. four of 18 bs. per acre.

Remarks. Largest crop, with 8 loads barn manure, and 9 bush. leached ashes. Crop of 20 bush. no manure. Two cases of smut; the seed not steeped. Three cases of grain insect. One case of wire worm.

DEERFIELD.—Claimants, 59. Acres sown, 149 73-480. Product, 2311 bush. Average per acre, 15\frac{1}{4} bush. Largest crops, 28 bs. 26 bs. 25 bs. two of 23\frac{1}{4} bush, per acre.

Remarks. Crop of 28 bs. on rich alluvial land, sown in October. Crop of 18 bs. with thirteen loads of muck. One of 23 received 20 loads of manure on rich alluvial land and after clover. One of 26 bs. after corn crop. Five cases of grain insect. One of smut, seed not prepared.

ERVING.—Claimants, 3. Acres sown, 4\frac{1}{2}. Product, 64\frac{1}{2} bush. Average per acre, 13 bush. Largest crops, 18 bs. 15 bs. 11 bush. per acre.

Remarks. Crop of 18 bs. had 18 loads of manure. One farmer reports uniform success in growing wheat, for three years. His wheat follows corn well manured. One case of smut; seed washed in clear water.

GILL.—Claimants, 12. Acres sown, 20\frac{1}{2}. Product, 293 bush. Average per acre, 14 1-20 bush. Largest crops, 23 bs. 20\frac{1}{2} bs. 18 9-32 bs. one of 17 19-32 bush per acre.

Remarks. Crop of 23 bs. with 26 loads of manure. One crop sowed late in October, winter killed, crop 6 bs. upon half an acre. Five cases of grain insect.

GREENFIELD.—Claimants, 8. Acres sown, 16\frac{3}{4}. Product, 228\frac{1}{4} bush. Average per acre, 13\frac{3}{4} bush. Largest crops, 16 bs. two of 15 bs. one of 13 bs two of 12 bush. per acre.

Remarks. Largest crops on new land; with 5 bs. plaster and 20 bs of ashes upon 2 acres; crop, 12 bs. per acre. Five cases grain insect.

HAWLEY.—Claimants, 17. Acres sown, 25\frac{1}{2}. Product, 301 bush. Average per acre, 13\frac{1}{2} bush. Largest crops, 27 bs. 20 bs. 18 bs. two of 17 bush. per acre.

Remarks. Largest crop 27 bs. with 8 loads manure, and 25 bs. of lime per acre. Crop of 20 bs. with 18 loads of manure. Two farmers in this town have produced a prolific and superior wheat, by a selection of promising and fine heads; and carefully sowing from their product. H. C.
HEATH.—Claimants, 44. Acres sown, 60 9-16. Product, 1006 bush.
Average per acre, 16\frac{1}{2} bush.
Largest crops, 25 bs.; two 24 bs.; four of 22\frac{1}{2} bs.; one of 21\frac{1}{2} bush, per acre.
Remarks. Largest crops without manure this season; but followed corn or potatoes well manured. Two cases of 30 bs. ashes applied; crops 15\frac{3}{4} bs. per acre. Crop of 25 bs. Italian; crop of 24 bs. Black Sea variety. Two hundred bs. raised more than returns, that were not in quantities to secure the bounty. Large portion of crops injured by smut; in such cases the seed not steeped in brine, but simply rolled in ashes.

LEVERETT.—Claimants, 3. Acres sown, 6. Product, 79\frac{3}{4} bush.
Average per acre, 13 1-6 bush.
Crops, 16 bs.; 15\frac{3}{4} bs.; 12 bs. per acre.
Remarks. The crop of 16 bs. with two bs. of lime, and one of plaster. Crop of 15\frac{1}{2} bs. with 13 loads of manure per acre. One injured by drought.

LEYDEN.—Claimants, 22. Acres sown, 37\frac{1}{2}. Product, 518\frac{1}{4} bush.
Average per acre, 13 25-37 bush.
Largest crops, three of 19 bs.; one of 18\frac{3}{4} bs.; two of 18 bs.; one of 17\frac{1}{2} bush, per acre.
Remarks. Crop of 17\frac{1}{2} bs. with 30 bs. ashes per acre. Others without manure.

Average per acre, 14\frac{1}{2} bush.
Largest crops, 20 bs.; 17 bs.; 16\frac{1}{4} bs.; 16 bush, per acre.
Remarks. Crop of 20 bs. received one cask of lime.

MONROE.—Claimants, 2. Acres sown, 2\frac{3}{4}. Product, 40 bush.
Average per acre, 13 5-6 bush.
Crops, 15\frac{1}{4} bs.; 13\frac{3}{4} bs. per acre.

Average per acre, 16 bush.
Largest crops, 30 bs.; 29 bs.; 18 bs.; 16\frac{1}{4} bs.; two of 16 bush, per acre.
Remarks. Largest crop without manure. Twenty loads of common manure applied; crop, 10 bs. Two crops injured by drought, one lodged.

NORTHFIELD.—Claimants, 42. Acres sown, 82\frac{1}{4}. Product, 1100 bush.
Average per acre, 13\frac{1}{2} bush.
Largest crops, two of 21\frac{1}{4} bs.; two of 20 bs.; one of 19\frac{4}{4} bs.; one of 19 bush, per acre.
Remarks. Largest crops without manure. A crop of winter wheat gave 11½ bs. without injury. Another crop of winter wheat gave 20 bs. without injury. The applications of plaster and lime in small quantities give no discriminating results. In case of 12 bs. of ashes, 16 bs. of wheat were obtained. In case of 9 bs. of ashes and lime, 17 bs. of wheat were obtained. One crop winter killed; sown 20 Sept.

Average per acre, 17 bush.
Largest crops, 25 bs.; 23 bs.; three of 20 bs.; one of 19 bush. per acre.
Remarks. Largest crop had 15 loads of stable manure. Crop of 23 bs. without manure; no accident or injury.

ROWE.—Claimants, 16 Acres sown, 22 2-5. Product, 353 bush.
Average per acre, 15½ bush.
Largest crops, 22 bs.; 19½ bs.; 18½ bs.; 18 bush. per acre.
Remarks. Largest crops without manure. The soil of Rowe is exceedingly rich in vegetable matter. Where 25 loads of barn manure applied, the product 15 bush.

Average per acre, 16 17-59 bush.
Largest crops, 37½ bs.; 25 bs.; 22½ bs.; 22 bs.; one 21½ bs. per acre.
Remarks. The largest crop is reported without remarks; but the farm presents a deep, rich, argillaceous soil and is exceedingly well managed. H. C. Crop of 25 bs. without remarks. Crop of 20 bs. received 20 bs. of ashes per acre.

Average per acre, 12 bush.
Crops, 14 bs.; 11½ bush. per acre.

Average per acre, 15 11-32 bush.
Largest crops, 30 bs.; 24 bs.; 21 bs.; 20 bush. per acre.
Remarks. Largest crop without manure; soil sandy loam. With 10 loads compost manure, the crop 17 bs. Several cases of the use of ashes, plaster, and lime; without discriminating results. Two cases of injury from worms, one from drought.

Average per acre, 16½ bush.
Largest crops, 28 bs.; 22½ bs.; 22½ bs.; 22 bs.; one 21½ bs. per acre.
Remarks. The largest crop with 16 lbs of ashes. The crop of 22½ lbs with thirty loads green barn manure, and seven lbs. of lime. Another crop of 22½ lbs. without manure. One case of grain insect. Soil "dry and various."

Average per acre, 11 bush.
Crops, 14½ lbs.; 9 bush. per acre.

Average per acre, 11½ bush.
Largest crops, 16 lbs.; 11½ lbs.; 10 lbs. per acre.
Remarks. Largest crop had 12 lbs. lime and ashes. One crop injured by worm; three by drought; ten bushels of lime per acre; yield nine bush. Five loads of stable manure and six lbs. of ashes; crop, ten bush.

HAMPShIRE COUNTY.

Average per acre, 15 15-19 bushels.
Largest Crops, 32 lbs.; 27 lbs.; 25½ lbs.; 24 lbs.; 23½ lbs.; 23 lbs.; two 22 lbs. per acre.
Remarks. 21 crops of winter wheat—one crop injured by grain-worm—one by storm, without other accident or injury. Largest crop of 32 bushels spring wheat—the other largest crops, winter wheat. The winter wheat, sown between 15th Sept. and 26th Oct. One acre with 10 loads yard manure and 10 bush. of ashes—Crop 23 bush. One with 9 loads of muck—Crop 24 bush. Two crops of 21 bush. each with 4 bush. of lime each. Largest crop, 32 bush. on an "old loam"; no manure. Two cases of smut, seed not prepared—one, where it was soaked and limed; but the kind of steep not mentioned. The soil is various—gravely, clay loam, and sandy loam—Two or three crops shrunk—one injured by storm. Spring wheat sowed from 31st March to 3d May.

Average per acre, 14½ bushels.
Largest crops, 22½ lbs.; 20 lbs.; 12 lbs. per acre.
Remarks. The largest crop with barn-yard manure—quantity not stated. Returns imperfect.

CHESTERFIELD.—Claimants, 42. Acres sown, 85. Product, 1333 bush.
Average per acre, 15½ bushels.
Largest crops, 25 lbs.; 21 lbs.; five 20 lbs.; four 19 lbs.; seven 17 lbs. per acre.
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Remarks. Largest crop without manure; a gravelly loam. With 15 loads sheep manure and 5 bush. ashes, yield 21 bush. One case of smut, seed "brined and limed."—14 bush. of lime in one case; crop 8½ bush per acre—20 bush. ashes, the yield 20 bush. per acre—20 bush. in another case, the yield 17 bush. per acre.

CUMMINGTON.—Claimants, 47. Acres sown, 78 ¼. Product, 1211 bush. Average per acre, 15½ bushels. Largest crops, 24 lbs.; 23½ lbs.; 22 lbs.; 21 lbs.; two 20 lbs. per acre.

Remarks.—Largest crop with five loads long manure, and seven lbs. ashes. Two cases of smut; seed steeped in brine, not limed. One case of smut, no preparation of the seed. The soil here rests on mica slate. The manures applied to the crop of corn or potatoes of the preceding year. In two cases the seed steeped in a solution of "vitriol." Two cases of injury from grainworm; several by drought. The seed used, the Leghorn or Tea Wheat.


ENFIELD.—Claimants, 3. Acres sown, 5 ¼. Product, 75 ½ bush. Average per acre, 14 bushels. Crops, 17 3-5 lbs.; 16 ½ lbs.; 9½ lbs. per acre.

Remarks. Largest crop with 15 loads barn-yard manure—"badly shrunk."

GOSHEN.—Claimants, 32. Acres sown, 52. Product, 646 bush. Average per acre, 12 11-26 bushels. Largest crops, 16 lbs.; 15½ lbs.; 15 lbs. per acre.

Remarks. One case of injury from drought. Returns imperfect.


Remarks. One crop, only half the seed vegetated—seed steeped, but no particulars given.


Remarks. On largest crop, 50 lbs. of plaster, sown after it was up. Winter wheat gave 12 bush. per acre—without injury.
HADLEY.—Claimants, 59. Acres sown, 140 19-24. Product, 1813\frac{1}{4} bush.
Average per acre, 12 5-7 bushels.
Largest crops, 23\frac{1}{2} bs.; two of 22 bs.; one 21\frac{1}{2} bs.; two 20 bs. per acre.

Remarks. Largest crop without manure; six bush. lime applied; blasted. Nineteen crops of winter wheat; one injured by winter. Two cases of smut; seed rolled in lime, not steeped. Two cases of Italian wheat; one kept in brine 30 hours; one said to have been injured by steeping. This agrees with the experience of some of the farmers of Northampton, who think that the seed of the Italian wheat, being thin skinned, is injured by remaining a long time in the brine. The Italian, in this case, yielded but 2\frac{1}{4} bush—the winter wheat, on the same farm, sowed Sept. 23, produced 16 bush. per acre. Three cases in this town of the cultivation of 5 acres and upwards by a single farmer. The soil a sandy loam and alluvial—one case with 20 bush. lime, plaster and ashes per acre—crop blasted.

Average per acre, 14 1-5 bush.
Largest crops, 25\frac{1}{2} bs.; 23\frac{1}{2} bs.; 22 2-13 bs.; 20\frac{3}{4} bs.; 20 2-5 bs. per acre.

Remarks. Largest crop on alluvial, rich loam; six bush. ashes. Crop injured by clover sowed with it. Another crop is stated to have been much injured by grass, (we suppose, sowed with it.) Three cases of winter wheat, from quarter to half killed by winter. Seventeen cases of winter wheat reported; most of them in same field with spring wheat, but no comparative results given, except as above. Several cases reported in which a part of the field manured and part without manure; yet no comparative results given, but all reported as one. These were favorable cases for determining important points; but we are left in the dark. A crop sowed 20th Nov. gave heavy growth of straw, but “did not fill.”

It is much to be lamented, that, with the Hatfield farmers among the best in the State, with so many favorable opportunities of arriving at important comparative results, the accounts are not definite and establish nothing.

Average per acre, 15 5-18 bush.
Largest crops, 21 bs.; 20 bs.; 18 bs.; 16 bush. pr. acre.

Remarks. Largest crop with seven loads manure and seven bs. of lime, Applications of lime in small quantities; but no decisive result. One case of smut; seed rolled in lime; not steeped.

NORTHAMPTON.—Claimants, 59. Acres 176 5-12. Product, 1938\frac{1}{4} bush.
Average per acre, 10 21-23 bush.
Largest crops, 20 bs.; 19\frac{1}{2} bs.; 18 bs.; two of 17\frac{1}{2} bush. per acre.
Remarks. Largest crop without manure on sandy loam. Sixteen loads of barn manure and four bs. of ashes upon two acres; crop, 16 bs. per acre. Several cases of application of lime; no decisive results. No accident or injury.

Remarks. Crop of 20 bs. with two bs. of lime and ten of ashes. No accident or injury.

PELHAM.—Claimants, 2. Acres sown, 3½. Product, 31 bush. Average per acre, 9½ bush. Crops, 21½ bs.; 6 bush per acre. Remarks.—In case of largest crop, part manured, part without manure; both after corn; no difference observable in the yield.

PLAINFIELD.—Claimants, 16. Acres sown, 26 13-24. Product, 372 bush. Average per acre, 13 11-13 bush. Largest crops, 21½ bs. 21 bs. 20 4-5 bs. 18 bush. per acre. Remarks. Largest crops without manure. Three cases of smut; one, seed without preparation; one, seed steeped in water and rolled in lime, one, seed soaked in brine.

PRESCOTT.—Claimants, 3. Acres sown, 2 9-80. Product, 52 bush. Average per acre, 24½ bush. Largest crops, 31½ bs. per acre; one 18 bs. to 108 rods. Remarks. Largest crop on black loam with four loads green manure, and 100 lbs. plaster.

SOUTH HADLEY.—Claimants, 16. Acres sown, 41. Product, 612 bush. Average per acre, 14 38-41. Largest crops, 25 bs.; 20 bs.; two of 16 bush. per acre. Remarks. Largest crop without manure. A crop stated to yield from 10 to 25 bs. per acre, received one bushel of plaster, and forty bs. of ashes upon five acres. Five cases of grain worm.

WARE.—Claimants, 10. Acres sown, 16. Product, 204½ bush.
Average per acre, 12½ bush.
Largest crops, 19½ bs.; one 16½ bs.; one of 15 18-32 bs.; one of 13 3-5 bush. per acre.
Remarks. Largest crop with eight loads of stable manure, and two bs. of lime. Seven loads of stable manure, and ten bs. of ashes; yield, 13½ bs. per acre. One case of grain insect.

Average per acre, 11 9-19 bush.
Largest crops, 18½ bs.; 17½ bs.; 16 bs.; 15 bush. per acre.
Remarks. Largest crop with a compost of ashes, earth and lime.

Average per acre, 13 2-9 bush.
Largest crops, 21 bs.; two of 16 bs.; one of 15 bs.; 14½ bush. per acre.
Remarks. The largest crop with 14 bs. of lime to the acre. One case of smut; seed without preparation. With one exception crops suffered severely by drought.

Average per acre, 17½ bush.
Largest crops, 26½ bs.; two of 25 bs.; one of 23½ bs.; 22½ bs.; 22 bush. per acre.

HAMPDEN COUNTY.

Average per acre, 11 6-19 bush.
Largest crops, 22 bs.; 21 bs.; 20 bs.; 19 bush. per acre.
Remarks. No manure on largest crop; 2 bs. of ashes. Crop of 21 bs. with 18 loads barn yard manure. 20 loads of yard manure upon two acres, gave 8 bs. per acre; sowed from 1 to 16th May.

BRIMFIELD.—Claimants, 10. Acres sown, 17. Product, 214½ bush.
Average per acre, 12 10-17 bush.
Largest crops, 18½ bs.; two of 17 bs.; two of 15 bs; one of 12 bush. per acre.
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Remarks. Largest crop no manure. Twelve loads of compost per acre; crop, 17 bush. Seven cases of rust.

CHESTER.—Claimants, 25. Acres sown, 39 11-12. Product, 554\frac{1}{2} bush. Average per acre, 13 34-39 bush. Largest crops, 20\frac{1}{2} bs.; three of 18\frac{1}{2} bs.; 17\frac{1}{2} bs.; 17 bush per acre.

Remarks. Largest crop with seven bush. of ashes; no manure. Eight loads of coarse manure; crop, 13 3.5 bush. One case of being lodged. One of being shrunk.

GRANVILLE.—Claimants, 2. Acres sown, 3 4. Product, 35\frac{1}{2} bush. Average per acre, 9\frac{2}{3} bush. Crops, 20 bs.; 6\frac{1}{3} bush per acre.

LONGMEADOW.—Claimants, 13. Acres sown, 30 4. Product, 349 bush. Average per acre, 11 3\frac{1}{2} bush. Largest crops, 21\frac{1}{2} bs.; 17 bs.; three of 16 bs.; one of 15\frac{1}{2} bush per acre.

Remarks. Largest crop on sandy loam; sowed after corn; winter wheat. Two cases of smut; no preparation of the seed. Six cases of winter wheat.

LUDLOW.—Claimants, 3. Acres sown, 5 23-10. Product, 107\frac{1}{2} bush. Average per acre, 18 3-5 bush. Crops, 26 bs.; 18 bs. 20 qts; 14 bush per acre.

Remarks. Largest crop on loamy old land; after corn which had 35 loads of manure per acre. All the crops affected by worm.


Remarks. Largest crop with 4 loads of horse manure on 4 of an acre. Four crops suffered by drought.


Remarks. The largest crop without manure.

RUSSELL.—Claimants, 1. Acres sown, 1 4. Product, 15\frac{1}{2} bush. Average per acre, 11 14-32 bush. Crop, 11 14-32 bush per acre.

Remarks. The largest crop, probably the largest grown in the state, was winter wheat sowed last of September on common loam, and dressed with fifteen or sixteen cart loads of common yard manure on 1/2 acre. One crop injured one half by the winter, sowed on 10th October. One case of injury by grain worm. The other crops without injury. Seven crops on “intervale.”


WILBRAINT.—Claimants, 19. Acres sown, 39 1/2. Product, 545 bush. Average per acre, 13 5-38 bush. Largest crops, 20 3/4 lbs.; 20 lbs.; 19 1/8 lbs.; 18 3/4 bush. per acre. Remarks. Largest crop with 15 loads of barn yard manure per acre, and 1 1/2 bs. of plaster sown with the wheat. After it came up one bush more applied. One case of smut followed no preparation of the seed.


Remarks. Fifty-three of these crops winter wheat. Largest crop followed corn which had been manured with eight loads per acre; sown the 2d Oct. The time of sowing of the crops varied from 15th Sept. to 16th Oct. The amount of seed varied from 1½ to 2 lbs. per acre. In one case on alluvial land, 12 Tons yard manure applied upon 1½ acre; crop 24 bush. per acre. In three cases the wheat injured by winter; 18 cases of injury from grain worm. Several by drought. One crop choked by weeds. In one case of 27 lbs. the crop dressed with "fine manure." 150 lbs. of leached ashes applied in one case; the yield 16 bush.

COUNTY OF WORCESTER.

ASHBURNHAM.—Claimants, 64. Acres sown, 100½. Product, 1459½ bushels. Average, 14½ bushels per acre. Crops, two of 23 bush. each; one 22 bush.; two 21½ bush.; two 20 bush.

Remarks. One of the largest crops with 8 loads compost manure. The other none, and condition of land not given. 21½ bushels with 8 bushels of ashes, and one cask of lime. Five cases of smut.


Remarks. Eight bushels of lime and 8 bushels of bone manure applied; the crop 15½ bushels; the soil wet and hard. Two cases of smut. In one, seed prepared in ashes. In other, washed in salt water.


Remarks. 2½ casks of lime applied to whole ground. On one half an acre 23½ bushels obtained from one bushel sown of the Black Sea variety. Soil, sandy loam. Land manured the previous year.

BARRE.—Claimants, 33. Acres sown, 40½. Product, 840½ bushels. Average 20½ bushels. Crops, 32½ bush.; 32; 28; 27 bush.; two of 24 bush.; one of 22 bush.; one of 21½; five of 20 bush.; one of 19½ bush.

Remarks. Largest crops with compost, 10 to 20 loads per acre. 42 loads of compost applied; the crop 11½ bushels. 12 bushels ashes, the crop 14 bushels. The land in some parts of Barre, is a deep rich loam, charged with vegetable matter, and strongly tenacious. The plain lands near the factory, light and sandy. Small applications of lime and plaster, but no decisive results. Two cases of grain-worm. One of injury from Roman wormwood. Four badly lodged. One blasted.
   Average, 184 bs.
   Crops, 204 bs.; 20 bs.
Remarks. 200 lbs. plaster spread; crop injured by drought.

   Average, 15 1-6 bs. per acre.
   Crops, 21 bs.; 19½ bs.; 19 bs.; two of 16 bs.

   Average, 18½ bs. per acre.
   Crops, three of 21½ bs.; two of 20 bs.; one of 18 bs.
Remarks. With 15 bushels ashes, the yield was 15 bushels. Crops of 21½ bushels, with 8 loads of barn manure. The soil loamy.

   Average, 19½.
   Crops, 28 bs.; 26 bs.; 25 bs.; 24 bs.; two of 22 bs. per ac.
Remarks.—Largest crop without manure on sandy loam. Crop of 19½ bushels had 7 loads of compost manure. Six bushels of lime, the crop 17½ bushels per acre. One case of grain insect. One rust. The hill lands in Brookfield, if properly cultivated, are favorable to wheat.

   Average, 18½ bushels per acre.
   Crops, 23½ bs.; 21 bs.; 20 bs.; three of 18 bs.
Remarks. Largest crop with "30 loads of summer manure, and 30 loads of green manure." The land is designated dry or moist; but the observations indefinite.

DANA.—Claimants, 6. Acres sown as returned, 54, the whole not reported. Product, 100 bushels.
   Average, 18 bs.
   Largest crop, 15 bs.
Remarks. Two hundred lbs. of plaster applied, the crop, 11 bushels.

DOUGLAS.—Claimants, 3. Acres sown, 4½. Product, 66½
   Average, 13½ bs.
   Largest crop, 17½ bs.
Remarks. Largest crop manured with 7 loads of long manure.
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DUDLEY.—Claimants, 1. Acres sown, 1½. Product, 23½ bushels. Average, 15½ bs. per acre.


Remarks. Crop of 20 bushels of the Black Sea variety; soil, deep loam; with six loads barn manure. This was on land of Payson Williams, who introduced the Black Sea wheat into the country, and received a premium from Massachusetts Society for a product of 55 bushels of this kind of wheat per acre. In the application of 6, 15, 8, and 20 bushels of ashes to the acre, the crops varied from 8 to 16 bushels per acre, without observable relation to amount of ashes applied. With 30 bushels of lime and 25 loads of manure, the yield 16½ bushels. In most cases, the land manured liberally the previous year. The Black Sea wheat gave, in general, the best crops; but it was not invariably so; in one it gave a crop of only 8 bushels, on a moist soil without manure.


Remarks. Crop of 25 bushels, no manure this season. Of 26 bs., 10 loads compost. Of 22 bushels, 36 loads of compost. 7 bushels lime and one of plaster without manure, the product 18 3-5 bushels. Six crops suffered by drought.


Remarks. Largest crop on hill land, without manure, one bushel of slacked lime sowed upon it, when three inches high, in potatoes previous year highly manured. With 15 loads of barn manure, yield 13 bushels. One case of rust, and one of wheat insect.

HARDWICK.—Claimants, 37. Acres sown, 45½. Product, 872 bs. Average, 18 7-9 bs. per acre. Crops, 4 of 26 bs.; two of 25 bs.; two of 24 bs.; three of 22 bs.; two of 21 bs.; five of 20 bs. per acre.

Remarks. Largest crops had no manure; but on one, one cask of lime and five bushels of plaster applied. Large part of the crops lodged. The soil in Hardwick is deep, loamy, and productive, full of stones; and no where is there more agricultural zeal, nor more resolution and industry in overcoming the natural obstacles.
### Harvard
- **Claimants:** 34
- **Acres sown:** 54
- **Product:** 751\(^\frac{1}{2}\) lbs.
- **Average:** 13\(^\frac{3}{8}\) per cent.
- **Crops:** 2 crops of 22 lbs.; one of 19 lbs.

**Remarks:** Lands highly manured; wheat followed corn or potatoes. Crops suffered from drought. With 20 bushels ashes on a sandy loam crop 22 bushels. On a gravelly loam with 17 bushels of ashes crop 12 5-6 bushels per acre. Crops suffered from worms and drought.

### Holden
- **Claimants:** 12
- **Acres sown:** 21\(\frac{1}{2}\)
- **Product:** 386\(\frac{1}{4}\) bushels.
- **Average:** 17 lbs. per acre.
- **Crops:** 25 lbs.; 24 lbs.; 21 lbs.; two of 20 lbs.

**Remarks:** With 65 loads of manure, 19 bushels per acre; 25 loads of manure 18 bushels per acre.

### Hubbardston
- **Claimants:** 6
- **Acres sown:** 74
- **Product:** 130 lbs.
- **Average:** 17\(\frac{4}{10}\) lbs. per acre.
- **Crops:** 20\(\frac{1}{4}\) lbs.; two of 20 lbs.; two of 15 lbs. per acre.

**Remarks:** Crop of 25\(\frac{1}{4}\) and 20 bushels, each ten loads of compost manure. Crop of 20 bushels, no manure.

### Lancaster
- **Claimants:** 24
- **Acres sown:** 51\(\frac{1}{2}\)
- **Product:** 640 lbs.
- **Average:** 12\(\frac{4}{10}\) lbs. per acre.
- **Crops:** 23 lbs.; two, 20 lbs.; one, 19 lbs.; two, 18 lbs.

**Remarks:** Largest crop on alluvial land without manure. With 20 loads of manure on one acre of sandy loam; crop, 10\(\frac{1}{2}\) bushels. Two crops overrun with wormwood. Many suffered by drought. With 275 lbs. plaster applied, crop, 12 bushels.

### Leicester
- **Claimants:** 4
- **Acres sown:** 4\(\frac{1}{2}\)
- **Product:** 68\(\frac{2}{4}\) bushels.
- **Average:** 16 1-7 lbs. per acre.

**Remarks:** Largest crop, 17 bushels, manured with 15 loads compost.

### Leominster
- **Claimants:** 80
- **Acres sown:** 143\(\frac{1}{2}\)
- **Product:** 2411 lbs.
- **Average:** 16|\(\frac{3}{10}\) lbs. per acre.
- **Crops:** 3\(\frac{1}{2}\) lbs.; 28 lbs.; 25 lbs.; two of 25 lbs.; one, 24\(\frac{1}{4}\) lbs.; three of 23 lbs.; seven of 22 lbs.; two of 21\(\frac{1}{4}\) lbs.; twelve of 20 lbs. per acre.

**Remarks:** The largest crop on a deep loam. Four cases of the application of horn shavings; but how applied or precisely what quantity not stated. On a deep loam, they yield 21\(\frac{1}{4}\) bushels per acre. On a gravelly loam, 17 bushels. Two loads of horn shavings applied on a gravelly loam, the crop was 16 lbs. per acre. These applied to the preceding crop. Seven cases of grain worm.
Average, 18% per acre.
Crop: 24 lbs.; 26% lbs.; 26 lbs.; 24% lbs.; three of 20 lbs.;
two of 19% lbs.; two of 19 lbs. per acre.
Remarks. Largest crop Black Sea wheat; land manured the previous year;
360 lbs. plaster on the grain. Crop of 26% bushels manured with 180 bushels
leached ashes. Of 26 lbs. had 4 loads of barn manure and 8 bushels of ashes.
24% bushels per acre had 2 loads of barn manure and 120 bushels of leached
ashes. 30 bushels of lime applied to an acre of yellow loam; the crop 17
bushels.

Average, 14 2-7 lbs. per acre.
Crops, 21 lbs.; 18% lbs.
Remarks. The largest crop on a black loam, with 9 loads compost, and
24 bushels ashes. With 20 loads coarse manure, and one hhd. of lime, on
light loam, crop 14% bushels per acre.

MILFORD.—Claimants, 4. Acres sown, 6%. Product, 76% bushels.
Average, 11% lbs. per acre.
Largest crop, 18 lbs.
Remarks. Infested by an insect which ate the stalk off, under the first
joint, (the Hessian fly.) Black sea-wheat and common spring wheat sown
upon the same land; the latter blasted, the former sound.

Average, 12 7-10 lbs.
Crops, 20 lbs.; 18% lbs.; two of 18 lbs. per acre.
Remarks. With 8 cords stable manure, and one cask of lime, on a light soil,
crop 18 bushels. In other cases, no manure; and only two failures
which were by drought.

NEW BRAINTREE.—Claimants, 12. Acres sown, 15%. Product, 265% bush.
Average, 16 4-5 lbs. per acre.
Crops, 21% lbs.; 20% lbs.; two of 20 lbs.; one 18 lbs.
Remarks. Largest crop with two loads of manure on dark loam. Crop
of 20 bushels received 30 loads of manure. Crop of 20 bushels with ten
loads of manure. One crop of 20 bushels, none. Two cases of grain insect.

NORTHBORO.—Claimants, 10. Acres sown, 24. Product, 311 lbs.
Average, 14 1-5 lbs. per acre.
Crops, 18 lbs.; 17% lbs.; 17 lbs.
Remarks. Crop of 18 bushels with 10 loads barn manure; of 16 bushels
with 15 loads to the acre.
### NORTH BROOKFIELD
- **Claimants:** 3.
- **Acres sown:** 4.
- **Product:** 60\(\frac{1}{2}\) lbs.
- **Average:** 15 lbs. per acre.

**Remarks:** Crop, 17\(\frac{1}{2}\) bushels with two hogsheads of lime per acre.

### OAKHAM
- **Claimants:** 2.
- **Acres sown:** 1\(\frac{1}{2}\).
- **Product:** 35 bush.
- **Average:** 20 lbs.
- **Largest crop:** 21\(\frac{1}{4}\) bushels.

### OXFORD
- **Claimants:** 6.
- **Acres sown:** 7\(\frac{1}{2}\).
- **Product:** 134 bushels.
- **Average:** 17.2-7 lbs. per acre.
- **Crops:** 34 lbs.; 18\(\frac{1}{2}\) lbs.

**Remarks:** Soil on which the largest crop, a gravelly soil; but no manure. With thirty loads green manure, one bushel lime and 7 bushels of ashes, on a gravelly soil, crop 15 bushels. Crops all sound.

### PETERSHAM
- **Claimants:** 49.
- **Acres sown:** 75\(\frac{1}{2}\).
- **Product:** 1304 lbs.
- **Average:** 17\(\frac{1}{2}\) lbs. per acre.
- **Crops:** 30 lbs.; two of 26 lbs.; one of 25 lbs.; 24 lbs.

**Remarks:** The largest crop sown on 30th April; clayey soil; without manure. The two crops of 26 bushels on a dry loam without manure; on one, two bushels of lime applied. The crop of 25 bushels with 12 loads green manure. Three cases of smut; in each, the wheat sown dry.

### PHILLIPSTON
- **Claimants:** 31.
- **Acres sown:** 30\(\frac{1}{2}\).
- **Product:** 722\(\frac{1}{2}\) lbs.
- **Average:** 18\(\frac{1}{4}\) lbs. per acre.
- **Largest crop:** 31 lbs.; two of 30 lbs.; one of 28 lbs.; three of 22 lbs.

**Remarks:** Largest crop on deep loam without manure. One crop of 30 bush. on a clay loam with 26 loads of manure.
- do. do. on light loam without manure.
- do. of 28 do. on "loamy land," without manure.
- do. of 22 do. on "" with six loads green manure.

Where 10 bushels of ashes spread at time of sowing the crop, 16 bushels. Six crops suffered from drought; one by wire worm; one sown May 10th, by frost.

### PRINCETON
- **Claimants:** 38.
- **Acres sown:** 58\(\frac{1}{2}\).
- **Product:** 987 lbs.
- **Average:** 17\(\frac{1}{4}\) lbs. per acre.
- **Crops:** 30 lbs.; 26 lbs.; two of 25 lbs.; three of 23 lbs.; one of 22 lbs.; four of 21 lbs.; five of 20 lbs.

**Remarks:** The crop of 30 bushels on a loamy soil without manure.
- " of 26; " " " " " With 8 loads of rotten manure to the acre, crop 14 bushels.
One case of injury from wheat insect.
" " " " striped worm—?

ROYALSTON.—Claimants, 42. Acres sown, 60. Product, 1011\frac{1}{4} bush.
Average, 16\frac{3}{4} bs. per acre.
Crops, 30 bs. per acre; 23 bs.; 22\frac{1}{2} bs.; 21\frac{1}{4} bs.; two of
20 bs. per acre.

Remarks. Crop of 30 bushels had 14 loads of green manure. Two oth-
er cases 20 loads of green manure applied per acre, the yield 13\frac{1}{4} bushels;
one 14\frac{1}{4} bushels per acre. One case of smut, the wheat soaked (it does not
name the steep) and brined; and one, the wheat sown dry.

RUTLAND.—Claimants, 22. Acres sown, 28. Product, 591\frac{3}{4} bushels.
Average, 15\frac{1}{3} bs. per acre.
Crops, 30 bs.; 25 bs.; 24\frac{1}{2} bs.; two of 24 bs.; two of 23 bs.;
two of 22 bs.

Remarks. Largest crop, with one load of manure and one hld. of lime.
This "bearded wheat," which is no designation. Second crop of 25 bushels,
with 20 loads of compost and one hld. of lime. This, Black Sea wheat.
One case of 120 loads of horse manure, in a green state, to five acres of
land; crop 15 1-5 bushels to the acre. One case of smut; wheat washed
in water and limed.

SHREWSBURY.—Claimants, 28. Acres sown, 44 5-6. Product, 587\frac{3}{4} bs.
Average, 13 bs. per acre.
Crops 19\frac{3}{4} bs.; two of 18 bs.; one of 17\frac{1}{2} bs.

Remarks. Largest crop, manured with 20 loads compost, 2 bushels of
plaster, and 6 of ashes, upon 2\frac{1}{4} acres. Two acres 1-16 of the crop smutted,
where the seed soaked in brine 24 hours.

SOUTHBRIIDGE.—Claimants, 22. Acres sown, 31\frac{3}{4}. Product, 621\frac{1}{2} bush.
Average, 19\frac{1}{2} bs.
Crops, 29 bs.; two of 24 bs.; one of 23 bs.; 22\frac{1}{2} bs.;
22 bs.; two of 20 bs.; one of 19 bs.

Remarks. The soil, on which 29 bushels to an acre, a hilly loamy soil;
without manure. In a case of application of 8 bush, of ashes, crop 17 bush.
" " of 25 loads of swamp mud, the
crop 20 bushels; the condition of mud not given.

SOUTHBOROUGH.—Claimants, 24. Acres sown, 38\frac{3}{4}. Product, 614\frac{3}{4} bs.
Average, 153 bs. per acre.
Crops, 22\frac{1}{4} bs.; 21 bs.; three of 20 bs.; one of 18\frac{1}{2} bs.

Remarks. Largest crop without manure on "loam." Seed, tea wheat.
Crop of 21 bushels with 20 bushels of lime, plaster, and ashes mixed in equal
proportions, and seed of the Black Sea wheat. Soil, a gravelly loam. Three
crops of 20 bushels each, without manure, and of the Black Sea variety. Several crops "slightly blasted and crippled." The latter designation not clearly understood.

   Average, 24½ bushels per acre.
   Crops, 33½ lbs. per acre; 23½ lbs. per acre; 20 lbs.; 18 lbs.

Remarks.—Largest crop after corn which received 20 loads of manure and one hogshead of lime. The wheat in general lodged. The soil, a deep loam mixed with gravel. Much agillaceous or clayey matter in these soils.

   Average, 13 8-9 lbs. per acre.
   Crops, 25 lbs.; 21 lbs.; four of 20 lbs.; four of 19 lbs.; one of 18½ lbs. per acre.; nine of 18 lbs. per acre.

Remarks.—Largest crop on moist black loam, with 80 bushels born shavings. 1¼ acres with 60 loads of compost, light and dry soil, gave 21 bushels per acre. Three cases of smut; seed sown dry or rolled in lime or plaster, without other preparation.

   Average, 14½ lbs. per acre.
   Crops, 25 5-7; two of 24 lbs.; two of 22 lbs.; one of 20 4-5 lbs.; one of 20 lbs.

Remarks. Largest crop, a black rich hill soil without manure. With 9 and 10 loads barn manure, crops 13 and 16 bushels per acre; soil light loam. No experiments with lime or plaster, except application in one instance of one peck of lime! Two cases of smut, seed soaked in brine and rolled in plaster. One case of injury from worms. Seven cases of blast without specification.

   Average per acre, 17½ bush.
   Crops, 24 lbs.; one of 23 lbs.; one of 21½ lbs.; one of 21¾ lbs.; one of 20 4-11 bush. per acre.


   Average per acre, 11½ bush.
   Crops, 25 lbs.; one of 26 lbs.; one of 25½ lbs.; one of 25 bush. per acre.

Remarks. Largest crop with three loads of manure. One case of injury from worms, and five from drought.
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UPTON.—Claimant, 1. Acres sown, 1. Product, 15½ bush.
      Average per acre, 15½ bush.
      Largest crop, 15½ bush.
      Remarks. Two bs. of plaster on the crop; moist soil.

      Average per acre, 13 3-7 bush.
      Crops; 25 bs.; one of 14 bs.; one of 11½ bs.; two of 10 bs.
      Remarks. Largest crop with 18 loads winter manure. With ten loads
      of barn manure and three hds. of lime per acre, on light, loamy clay; crop
      10 bs. Every crop suffered from drought.

      Average per acre, 15½ bush.
      Crops, 19 bs.; two of 18½ bs.; one of 18 bs.; six of 16 bush.
      Remarks. Four crops suffered from drought.

      Average per acre, 13½ bush.
      Crops, 15½ bs.; one of 19 bs.; one of 15½ bs.; one of 15 bs.
      Remarks. Largest crop on a very wet soil with ten loads of spring manure.

WESTBORO'.—Claimants, 17. Acres sown, 30 7-12. Product, 46½ bush.
      Average per acre, 15 1-10 bush.
      Crops, 21½ bs.; one of 20 bs.; one of 18½ bs.; one of 17½
      bush. per acre.
      Remarks. Largest crop without manure. Crop of 20 bs. 10 loads of
      green manure per acre. 15 bs. received two loads of mud per acre.
      Black sea wheat with 10 bs. lime and one of plaster per acre, produced
      16 5-6 bs. per acre.

      Average per acre, 13½ bush.
      Crops, 22 bs.; one of 21 bs.; one of 18 bs.; one of 17
      bush. per acre.
      Remarks. Largest crop on a very wet soil with ten loads of spring manure. Ten loads of spring manure from under the barn windows, gave 12 bs. on hilly land. One crop eaten by worms.

WESTMINSTER —Claimants, 32. Acres sown, 47. Product, 77½ bush.
      Average per acre, 16 10-47 bush.
      Crops, 26 bs.; one of 23 bs.; one of 22 bs.; one of 21
      bush. per acre.
Remarks. Largest crop no manure; the soil loamy. The crops of 23 and 22 bs. no manure; the soil "loamy." Two cases of blight.

WINCHESTER.—Claimants, 42. Acres sown, 66 5-24. Product, 972 1/4 bs. 
Average per acre, 14 1/2 bush.
Crops, 25 bs.; two of 24 bs.; one of 22 bs.; one of 21 bush. per acre.

Remarks. Crop of 25 bs. was on loamy soil with five loads of good manure. Twenty loads of barn manure and 20 bs. of ashes on three acres, on a deep loam; crop, thirteen bs. to an acre. Crop of 24 bs. no manure. The crops injured by drought.

Average per acre, 14 1-7 bush.
Largest crops, 29 1/2 bs.; 22 1/4 bs.; one of 19 1/2 bs.; one of 19 1/4 bush. per acre.

Remarks. Largest crop of the Black Sea and Italian variety on a clayey soil without manure. With 25 bs. of ashes and 20 loads of barn manure upon four acres; 14 1/4 bs. per acre. With 100 bs. leached ashes upon two acres on a gravelly loam; crop, 11 1/2 bs. per acre. With 10 bs. ashes and 10 loads manure per acre; crop, 16 bs. With 7 1/4 loads of night soil, 1 1/2 bs. of lime, and 1 1/4 bs. of ashes, the crop 14 1/4 bs. per acre on dry loam. With 7 1/4 bs. ashes and 1 half hhd. of lime per acre on dry loam; the crop 10 bs. One case of grain worm. Several cases of injury by drought and worms.

MIDDLESEX COUNTY.

Average per acre, 10 1/4 bs.
Crops, 17 bs.; 13 1/4 bs.; 13 bs.; 12 bs. per acre.

Remarks.—Crop of 17 bushels per acre had ten loads of manure, loamy soil. Crop of 13 bs. on moist loam, ten loads of manure per acre. Crop on dry soil with ten loads of manure, gave seven bushels per acre.

Average per acre, 14 13-128 bs.
Crops, one of 28; two of 20; three of 19; three of 18 bs. per ac.

Remarks.—In largest crop the soil "loamy;" and fifteen loads of barn manure applied. In most cases, lands highly manured with barn manure. No applications of alkaline manure deserving notice. Thirty-five cases of injury by drought. Six cases by grain insect.
<table>
<thead>
<tr>
<th>Town</th>
<th>Claimants</th>
<th>Acres sown</th>
<th>Product</th>
<th>Average per acre</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOXBORO</td>
<td>2</td>
<td>4</td>
<td>45 bushels.</td>
<td>11½ lbs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Crop, 13 3-5 lbs.; 10 2-11 lbs. per acre.</td>
<td></td>
<td>Both crops with green manure, 8 loads per acre; one suffered from drought.</td>
</tr>
<tr>
<td>CHELMSFORD</td>
<td>2</td>
<td>5</td>
<td>83 bushels.</td>
<td>16 3-5 lbs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Crop, 21; 9 lbs. per acre.</td>
<td></td>
<td>This largest crop on intervale land on the Merrimack. 20 cords of manure applied the previous year. The crop injured by drought. This farmer has been eminently successful in his wheat crop on his lands for twenty years. The soil, as analyzed by Dr. Dana, the result given in the Commissioner's Second Report, is destitute of the carbonate of lime, and contains a slight portion of lime, in the form of sulphate and phosphate. H. C. Seed wheat, soaked in limewater, and rolled in plaster. The smaller crop was on a highly manured &quot;light soil,&quot; and very much injured by drought.</td>
</tr>
<tr>
<td>CONCORD</td>
<td>6</td>
<td>15½</td>
<td>137½ bushels.</td>
<td>8 13-15 bushels.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Crop, 25 bs.; 10½ bs.; 10 bs.; 6½ lbs. per acre.</td>
<td></td>
<td>In largest crop, land manured with stable dung the previous year, and 2½ casks of lime applied to the acre. Soil, a dark loam. All the crops suffered from drought. From the raiser of crop above referred to, it is presumed it was on the margin of the finely redeemed meadows in this town, where the soil is deep and full of vegetable matter. H. C.</td>
</tr>
<tr>
<td>DRACUT</td>
<td>8</td>
<td>15½</td>
<td>174½ bushels.</td>
<td>11 lbs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Crop of 20 bushels received 50 loads of barn manure, and one cask of lime. The crop injured by grain insect. Some smut likewise; the seed soaked in water and rolled in ashes. The soil alluvial, on the banks of the Merrimack. In another case, 30 loads of manure and 2 hhd. of lime; the crop, 10 2-5 bushels. In another case of 20 bushels per acre, &quot;a light interval,&quot; no manure applied. With this exception, the crops all represented as &quot;shrunken.&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DUNSTABLE</td>
<td>3</td>
<td>3 97-165</td>
<td>62 lbs.</td>
<td>16½ lbs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Crop, 19 bs.; 17 bs.; 15 bs. per acre.</td>
<td></td>
<td>Nothing definite stated; and no accident nor injury.</td>
</tr>
</tbody>
</table>
Remarks. Nothing definite in regard to cultivation or manures, except in one case; 9 loads of manure applied and the land "limed;" the crop 16 bs. per acre.

Remarks. Crop of 15 bs. with 12 loads barn yard manure. Crop of 14 bs had 12 loads from hog's pen. No accident nor injury. Much soil of this highly improved town is favorable to wheat. H C.

HOLLISTON.—Claimants, 13. Acres sown, 20½. Product, 292 bush. Average per acre, 14 1-10 bush. Largest crops, 22 bs.; 21½ bs.; 20 bs.; 16½ bs. per acre. Remarks. Largest crop with eleven loads of green manure per acre. Crop of 21½ bs. with eight loads green manure per acre. Five casks of lime and twenty loads of manure in another case; crop, 12½ bs. Three cords of green manure and 15 bs. ashes; crop, 16 bs. per acre. No accident nor injury. The soil represented "good;" in one case "clay;" in one "sandy;" and "dry."


LITTLETON.—Claimants, 11. Acres sown, 12 5-6. Product, 216 bush. Average per acre, 16¼ bush. Largest crops, 19½ bs.; 15 bs.; 14 bs.; 13½ bush. per acre. Remarks. One case of smut; no preparation of seed. Small amount of lime applied in one case on sandy loam, "but no difference in this case perceptible" between the limed and the unlimed.

MARLBORO'.—Claimants, 7. Acres sown, 13. Product, 184 bush. Average per acre, 14 2-13 bush. Largest crops, 17 bs.; three of 16 bs.; one of 14½ bush. per acre. Remarks. The soils in this town in many parts of superior quality; but no extraordinary attention paid to this crop. H C.
NATICK.—Claimants, 4.  Acres sown, 4½.  Product, 65 bush.  Average per acre, 16 bush.  Crops, 16½ bs.; 16½ bs.; 15½ bs.; 14-7-10 bush. per acre.

Remarks. The crop of 16½ bs. with 5 cords of stable manure and two casks of lime. The crop suffered from weeds; flour "of the best quality." In one case the seed prepared in lime water, the crop perfect; but where seed sown dry, the crop "blasted." In every case the lands heavily dressed with green stable manure; in three cases an average of two hhd. of lime per acre. Three cases of blight.


Remarks. One case of smut; seed without preparation.

PEPPERELL.—Claimants, 15.  Acres sown, 26½.  Product, 428½ bush.  Average per acre, 16 bush.  Largest crops, 28 bs.; three of 20 bs.; two of 18 bs.; two of 15 bush. per acre.

Remarks. Largest crop with 20 bs. of ashes and 200 lbs. Gypsum; suffered much from drought. One crop of 20 bs. on 1½ acres, with 15 loads of green manure. One crop of 20 bs. on 1 acre, with 2 hhd. of lime. A case in which the seed was much smutted but before sowing soaked 18 hours in salt brine; the crop, healthy and fair. In one case in the same field, "the Black Sea wheat was plump; the bald blighted."

READING.—Claimant, 1.  Acres sown, 2.  Product, 28 bush.  Average per acre, 14 bush.

Remarks. "The crop here to which a premium was paid, was "Indian wheat," that is, Tartarian Buck wheat.

SHERBURNE.—Claimants, 6.  Acres sown, 15½.  Product, 159½ bush.  Average per acre, 10½ bush.  Crops, 16 bs.; 13½ bs.; 12 2-5 bs.; 12 bush. per acre.

Remarks. In three cases 6, 8, and 12 loads of unfermented manure applied; wheat suffered from rust. One sandy loam with five hhd. of lime per acre; the produce 8 bs. In one case half the wheat was winter-killed.


Remarks. Crop of 20 bs. land highly manured for previous crop. The crop of 18 bs. on land the previous year manured with 30 loads to the acre of good manure; and the year of the wheat crop with 6 bs. of lime and one of salt. No accident nor injuries. A "strong yellow soil."
Average per acre, 14 18-27 bush.
Largest crops, four of 20 bs.; one of 19½ bs.; two of 19 bs.;
two of 18 bs. per acre.
Remarks. Crop of 20 bs. manured with 25 loads of green manure and
5 bs. of lime. One crop of 19 bs. with 20 loads of green manure. One
crop of 19 bs. with ten loads of green manure. One case of grain worm.
One of smut; seed rolled in lime, but not steeped.

Average per acre, 19½ bush.
Crop, 19½ bush.
Remarks. No manure; soil, gravelly loam.

Average per acre, 9 1-6 bush.
Largest crops, 16½ bs.; two of 16 bs.; two of 14 bs.; one
of 11 1-7 bush. per acre.
Remarks. Crops highly manured; suffered universally from drought.
With 12 bs. ashes per acre; the crop 11 1-7 bs.

Average per acre, 15 5-7 bush.
Largest crops, 20 bs.; 18½ bs.; 17½ bs.; 13 3-5 bush. per
acre.
Remarks. On largest crop 1 cask of lime sown in June. On crop of
18½ bs. one third loss on account of lodging early.

Average per acre, 16 bush.
Crops, 20½ bs.; one 16½ bush. per acre.
Remarks. Crop of 20½ bs. on a dark loam with 150 bs. of soapboiler's
waste. Crop of 16½ bs. with 20 bs. bone manure; soil, dark loam. Seed—
Black Sea wheat.

Average per acre, 13 bush.
Crops, 15½ bs.; 13½ bs.; 13 bush. per acre.
Remarks. Crop of 15½ bs. no manure. Other crops largely with green
manure.

Average per acre, 12 4-7 bush.
Crops, 16½ bs.; 14½ bs.; 14½ bs.; 12½ bush. per acre.
Remarks. Two applications of lime in small quantities without effect.
COUNTY OF ESSEX.

Average per acre, 12 4-7 lbs.
Crop, 15 lbs. per acre.
Remarks. Half the crop destroyed by the grain insect. Seed, Black Sea variety. Sowed April 15th.

Average per acre, 13 1-5 lbs.
Crops, 15 lbs.; 12 lbs. per acre.
Remarks. 1½ cask of lime applied to an acre on crop of 15 bushels. On second crop, three cords barn manure.

Average per acre, 17 ½ lbs.
Crops, 24 bs.; 21 bs.; 20 bs. two of 19 lbs. per acre.
Remarks. Largest crop in clay and loam. 20 bushels lime and ashes mixed, applied upon 1½ acre. Seed, Black Sea variety. Crop of 21 bushels without manure, dark yellow loam. Crop of 20 bushels, 5 cords of stable dung, and 7½ bushels of ashes. With two exceptions, crops suffered from drought and grain insect.

Average per acre, 16 bs.
Crops, 20 bs.; 16½ bs.; 12½ bs. per acre.
Remarks. Largest crop, without preparation of seed or land, on a loamy soil. One case of grain insect.

Average per acre, 10 6-7 bs.
Crops, 15½ bs.; two of 13 bs.; three of 12 bs.; one of 10½ bs. per acre.
Remarks. In largest crop, 16 bushels leached ashes applied. Three loads of ashes and 9 casks of lime applied to a sandy soil of 4 acres. The yield was 12½ bushels per acre. In one case, 5 loads of coal ashes, (by this I understand hard coal,) applied upon a dark loam, of 1½ acres, yield 11½ bushels. Only one crop escaped the grain insect and drought; and "the farmers are of opinion, that by these causes their crops were diminished from one fourth to one half."

Average per acre, 10 bs.
Crops, 11 bs.; 10½ bs.; 8 26-32 bs. per acre.
Remarks. Largest crop, on a sand soil, with five cords of compost, one cask of lime, and ten bushels of ashes. Other crops well manured. In a case where red wheat soaked in brine, and tea wheat in a dry state were sown, the tea wheat injured by smut, the red wheat good.

West Newbury.—Claimants, 15. Acres sown, 40 93-160. Product 422| bs. Average per acre, 10 3-10 bs.
Crops, 16| bs.; 15 bs.; 14|^ bs.; 14 bs. per acre.
Remarks. Largest crop on a gravelly loam, with 4 cords of muck and 2|^ casks of lime upon 1| acre. One half the crop destroyed by grain insect. The grain insect was observed to make his appearance about the middle of July. The Black Sea and the tea wheat, planted in the same field, on the 20th of April; the Black Sea yielded 16 bushels per acre, the tea wheat less than two bushels. The crops in this town, without exception, injured severely by grain insect or drought. West Newbury, one of the most favorable locations in the State for the production of wheat, and for years an article of export from the town, to small extent. Soil, a deep, rich loam inclining to clay; the cultivation of the town highly improved. Loss by grain insect might have been prevented, had remedies been taken in season.

County of Norfolk.

Remarks. Largest crops with 18 loads of green barn manure. One case of smut; seed wet and rolled in lime.

Crops, 18 bs.; 16|^ bs. per acre.
Remarks. Largest crop with one cord of loam and five casks of lime on three acres.

Remarks. With barn manure, injured by rust.

Dover.—Claimant, 1. Acres sown, 1|. Product, 22 bushels. Average, per acre, 17 3-5 bs.
Remarks. Manured with barn manure.

Foxboro'.—Claimants, 2. Acres sown, 5. Product, 45 bushels. Average, per acre, 9 bs.
Crops, 10 bs.; 8 bs. per acre.
Average, per acre, 12 19-22 bs.  
Crops, 20 bs.; 13 bs.; 12½ bs.; eight of 12 bs. per acre.  
Remarks. Crop of 20 bushels, with 28 loads of green manure, and one bushel of lime on three acres. No disease nor accident.

Average, per acre, 14 2-5 bs.  
Crops, 24 bs.; 17 bs.; 15¼ bs.; 13½ bs. per acre.  
Remarks. In one case, on two pieces growing side by side, one manured with ten loads of green barn manure per acre, and the other with eight loads of rotten compost to the half acre, the latter gave at the rate of 24 bushels per acre; the former, at the rate of 13¼ bushels per acre. Soil, in former case, was a "yellow loam;" in the latter, "green sward."

Average, per acre, 12½ bs.  
Largest crops, 20 bs.; 19 bs.; three of 18 bs.; one of 13½ bs. per acre.  
Remarks. Crop of 20 bushels with seven bushels of ashes, and four casks of lime per acre. Crop of 19 bushels with 12 loads of green manure, and one cask of lime. Crops of 18 bushels with 15 and 16 loads of green winter manure. The seed steeped in lime water 36 hours, and "part of it never sprouted."

Average, per acre, 8 2-11 bs.  
Crops, 14 bs.; 11½ bs.; 8 bs. per acre.  
Remarks. Crop of 14 bushels with ten cart loads per acre of barn manure.

Average, per acre, 13½ bs.  
Crops, 18 bs.; 16 bs. per acre.  
Remarks. Largest crop without manure. In one case, two casks of lime and 15 bushels of ashes put on two acres, after the wheat was sown; yield, 9½ bushels per acre.

Average, per acre, 13 bs.  
Remarks. Soil light; the land in previous season in potatoes; suffered by drought.
<table>
<thead>
<tr>
<th>Town</th>
<th>Claimants</th>
<th>Acres sown</th>
<th>Product</th>
<th>Average per acre</th>
<th>Largest crops</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALPOLE</td>
<td>21</td>
<td>30½</td>
<td>450½</td>
<td>11½ bs.</td>
<td>18 bs.; 16 bs.; 14⅔ bs.; two of 14½ bs. per acre.</td>
<td>With 12 casks of lime to 2½ acres; yield 12½ bushels.</td>
</tr>
<tr>
<td>WEYMOUTH</td>
<td>1</td>
<td>1½</td>
<td>16</td>
<td>12 4-5 bs.</td>
<td></td>
<td>Two cords of barn manure and two casks of lime applied.</td>
</tr>
<tr>
<td>WRENTHAM</td>
<td>5</td>
<td>8¼</td>
<td>94½</td>
<td>10 2½-⅞ bs.</td>
<td></td>
<td>Largest crop with yard manure, amount not stated. Seed prepared by steeping in a solution of vitriol; the crop &quot;perfectly clean.&quot; Crops suffered by drought.</td>
</tr>
<tr>
<td>COUNTY OF BRISTOL</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATTLEBORO</td>
<td>4</td>
<td>10½</td>
<td>67</td>
<td>6-10 bs.</td>
<td>11 bs.; 6 bs.; two of 5 bs. per acre.</td>
<td>No manure; injured by drought.</td>
</tr>
<tr>
<td>BERKLEY</td>
<td>1</td>
<td>3</td>
<td>19</td>
<td>6½ bs.</td>
<td></td>
<td>1½ cask of lime per acre. Injured by drought.</td>
</tr>
<tr>
<td>DARTMOUTH</td>
<td>8</td>
<td>20½</td>
<td>314</td>
<td>15 3-5 bs.</td>
<td></td>
<td>Largest crop, with eight tons of &quot;sea muck and barn manure,&quot; and 1¾ barrels of lime on ¾ of an acre. One crop with 160 bushels of ashes, and ten casks of lime per acre, yield 12 bushels. Suffered from rust. With 35 tons of stable manure and &quot;drift stuff;&quot; (sea wreck,) crop 19 bushels.</td>
</tr>
<tr>
<td>EASTON</td>
<td>3</td>
<td>3½</td>
<td>5½</td>
<td>15 3-7 bs.</td>
<td></td>
<td>Largest crop with eight loads of &quot;tussac ashes,&quot; (presumed the ashes from the paring of bog meadows.) Second crop had 24 one horse loads of barn and hog manure.</td>
</tr>
</tbody>
</table>

Remarks. One crop of 16 bs. had no manure. " six tons of "fish and dirt," on an acre. " 12 thirty loads of "fish and dirt" upon 2 27-160 acres. All suffered from drought.

FALL RIVER.—Claimants, 3. Acres sown, 4½. Product, 77 bushels. Average per acre, 8 5-9 bs. Largest crops, two of 18 bs.; one, 17 bs. per acre.

Remarks. First crop of 18 bushels without manure. Second " with common barn manure.


Remarks. The largest crop manured with 85 barrels of fish mixed with earth. The grain "perfect." One case of smut; seed soaked in lime water; one, where seed was "brined and limed." Five crops suffered from drought.


Remark. Suffered from drought.

NEW BEDFORD.—Claimants, 7. Acres sown, 15½. Product, 172 bs. Average per acre, 10 12-15 bs. Largest crop, 23 bs.; 16 1-5 bs.; 13 77-100 bs.; 12 4-10 bs. per acre.

Remarks. Largest crop, without manure; yellow loam and gravelly soil. With 112½ bushels of ashes, and 5½ casks of lime upon an acre, the yield 74 bushels; struck with rust. Excepting above case no disease nor accident. With 20 tons stable manure, the yield 16½ bushels.

PAWTUCKET.—Claimant, 1. Acres sown, 1½. Product, 26½ bs. Average, per acre, 17½ bs. Crop, 17½ bs. per acre.

Remarks. Five and a half cords of hog manure on gravelly loam. Injured by drought.

RAYNHAM.—Claimant, 1. Acres sown, 2½. Product, 15½ bushels. Average per acre, 6 8-9 bushels.
Average per acre, 9 70-160 bs.
Crops, 10½ bs.; 10 bs. per acre.
Remark. Suffered severely from drought.

Average per acre, 12½ bs.

Average per acre, 12½ bs.
Crops, 15½ bs.; 11 2-5 bs. per acre.
Remark. Suffered from drought.

Average per acre, 13 1-5 bs.
Crops, 18 bs.; 10 bs. per acre.
Remarks. Largest crop had 6 loads hog yard manure and 4 casks of lime. Crops suffered from drought and rust. In both cases, the best wheat on the high and dry land.

COUNTY OF PLYMOUTH.

Average per acre, 11½ bs.
Largest Crops, 26½ bs.; 13½ bs.; 12½ bs.; 12½ bs. per acre.
Remarks. Largest crop, rich loam, with 46 loads compost with lime per acre. On the same farm, 46 loads barn manure applied to 2½ acres, on a sandy soil; the yield 8½ bushels. With 2 cords slaughter-house manure on 3 acres; product 12½ bushels per acre. No accident nor disease recorded.

Average per acre, 12 5-14 bs.
Largest Crops, 22 bs.; 20 bs.; 19½ bs.; 17½ bs. per acre.
Remarks. Largest crop with 26 loads of good stable manure upon 2½ acres. With 25 loads of soil from under a barn, upon 1½ acre; yield 10½ bushels. With 400 bushels ashes and 10 casks lime on 2½ acres; the yield 12½ bushels. With 40 loads of compost, and 12 casks of lime upon 2 acres; yield 11½ bs. per acre.
One case of smut, seed sowed with dry lime.
" " " wet and dried in unslacked lime.
" " " soaked two days in water and dried in ashes.
Crops suffered by drought and grasshoppers. On gravelly clay with 10 casks of lime on 1½ acres; the crop suffered from rust and spindle worm.

EAST BRIDGEWATER.—Claimants, 4. Ac. sown, 7 29-40. Prod. 104 b.s. Average per acre, 13 1-7 b.s. Crops, 17 b.s.; 16 b.s.; 12 b.s.; 9 1/2 b.s. per acre. Remarks. Crop of 17 bushels, with soap-boilers' waste at 175 bushels per acre; seed, Black Sea wheat. This respectable farmer has undertaken the purchase of ashes and the manufacture of soap, that he may have advantage of the leached ashes upon his farm. The effects on his grass are very encouraging.


KINGSTON.—Claimants, 7. Acres sown, 20. Product, 146 bushels. Average per acre, 7 6-20 b.s. Largest crops, 10 1/2 b.s per acre; 9 b.s.; 8 1-10 b.s. per acre. Remarks. "In the crop of nine bushels per acre, twenty tons of compost manure per acre were applied on half an acre being the low land; and three hundred bushels of leached ashes per acre on one and a half acre, being the sandy, loamy, gravelly and low land. The wheat was badly shrunk by the drought; "that on the low land suffering most." Crops suffered severely by the drought.
   Average per acre, 12 5-6 lbs.
   Crops, 19½ lbs.; two of 16 lbs.; one of 14 lbs.; 12½ lbs.
   per acre.

Remarks. The largest crop had seven loads of barn manure and 6 bushels ashes. Crop of 14 bushels with 20 loads barn and sea manure. Crop was smutty; the seed washed in clear water. Ten tons of kelp applied in one case; yield 12½ bushels.

MIDDLEBORO'.—Claimants, 64. Acres sown, 120 1-12. Product, 1441 lbs.
   Average per acre, 11 1-10 lbs.
   Largest crops, 23 lbs.; 21½ lbs.; 19 lbs. per acre.

Remarks. Largest crop on land with 40 loads of “common” manure, 2 hogsheads of lime and 4 bushels of ashes upon 1½ acre.
   One crop of 21½ bushels with 10 loads of compost per acre.
   “ 21½ “ 14 “ hog manure per acre.

Crops suffered from drought.

   Average per acre, 10½ lbs.
   Largest crop, 23 lbs.; 19 lbs.; 15½ lbs.; 13½ lbs. per acre.

Remarks. Largest crop with 5 cords of compost, and 4 casks of lime, injured by drought. Crop manured with 4 cords compost, produced 9½ lbs. per acre. With exception of this latter crop, injured by drought.

   Average per acre, 10 2-5 lbs.
   Crops, two of 11½ lbs.; one of 10½ lbs.; one of 10½ lbs. per acre.

Remarks. The largest crops on land dressed the previous year with 30 loads mud compost, and one cask of lime per acre. Soil, a sandy loam. The crops injured by drought, rust, and grasshoppers.

   Average per acre, 16 1-12 lbs.
   Largest crops, 25 lbs.; 19½ lbs.; two of 16 lbs.; one of 15½ lbs. per acre.

Remarks. Largest crop on sandy loam, with sixteen tons of barn manure. A dark loam manured the previous year with twenty tons of kelp, yield 13½ bushels. With two exceptions, the crops suffered by drought.

   Average per acre, 7 4-5 lbs.
   Crops, 8 lbs.; 7½ lbs. per acre.

Remarks. Crops suffered from an “unfavorable season.” No manure applied.

Remarks. Largest crop with 2 casks of lime, 20 loads of stable manure, and five bushels of ashes upon an acre and 7 rods. Soil, a moist loam. Crop of 17 bushels with five casks of lime. With 20 loads cattle and swine manure, mixed with 20 casks lime, and 20 loads swamp mud to 2½ acres, product, 7 bushels and 12 quarts per acre. The crops with one exception, suffered severely from drought. Lime was applied in all cases; manuring with above exception, very liberal.


Remarks. The crops, with exception of three, with barn manure. No marked difference in the results. The crops with the same exceptions, had lime, but no quantities given. The reports imperfect.

W. BRIDGEWATER.—Claimants, 8. Acres sown, 10 11-24. Prod't, 153 bs. Average, per acre, 14 1-10 bs. Largest crops, 21 7-10 bs.; two of 16 bs.; one of 15 bs.; 13½ bs. per acre.

Remarks. Largest crop with 20 loads compost. With 300 bushels of leached ashes to an acre; yield 16 bushels. Crops suffered from drought. One case of smut, the seed without preparation.

COUNTY OF BARNSTABLE.


Remarks. Eighty loads of marsh mud compost applied.

SANDWICH.—Claimants, 10. Acres sown, 18 33-40. Product, 187½ bs. Average, per acre, 10 lbs. Largest crops, 20 4-10 bs.; 16 4-5 bs.; 16½ bs.; 15 lbs. per acre.

Remarks. Largest crop with 15 loads barn manure, and 6 bushels lime per acre. On a sandy loam in two cases, 50 barrels of fish used per acre. In one, return was 8 bushels per acre; in the other, 7 1-9 bushels. One crop with 20 loads compost and 50 of swamp mud, the crop much injured by worms at the root. All suffered by drought and rust.
   Average, per acre, 13 7-16 bs.
   Largest crops, 21 bs.; 20 bs.; 18 bs.; 17 bs. per acre.
   Remarks. Largest crop with 12 loads barn manure. On sandy loam, stable manure applied, and 160 bushels ashes, yield 18 bushels. Sea weed and barn manure applied; the yield 17 bushels. Eighty tons of sea weed used; the crop injured by worms, product, 11 bs. Thirty-five tons of sea weed applied; the yield 16 bushels.

DUKES COUNTY.

   Average, per acre, 11½ bs.
   Crops, 13½ bs.; 12 1-10 bs.; 11 bs. per acre.
   Remarks. All suffered by drought.

   Average, per acre, 12 1-5 bs.
   Crops, 13 bs.; 11 bs. per acre.
   Remarks. The largest crop with 52 bushels ashes per acre. The other crop with 12 loads hog manure per acre. Seed of one crop, without preparation; blighted.

   Average, per acre, 12 bs.
   Largest crops, 15 bs.; two of 12 bs. per acre.
   Remarks. Largest crop with five barrels of ashes.

COUNTY OF NANTUCKET.

   Average, per acre, 10½ bs.
   Largest crops, 29 bs.; 19 bs.; 12 bs. per acre.
   Remarks. Largest crop with 60 common cart loads (one horse cart presumed,) stable manure per acre. One crop with 50 cart loads stable manure and four casks of lime; yield 19 bushels.

COUNTY OF SUFFOLK.

NUMBER OF ACRES AND AVERAGE YIELD OF WHEAT, RAISED IN THE RESPECTIVE COUNTIES.

<table>
<thead>
<tr>
<th>Counties</th>
<th>Acres sown</th>
<th>Average per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>BERKSHIRE</td>
<td>1569 3-5</td>
<td>14 2-5 bushels.</td>
</tr>
<tr>
<td>FRANKLIN</td>
<td>861 1-2</td>
<td>16 1-40 &quot;</td>
</tr>
<tr>
<td>HAMPSHIRE</td>
<td>1015 7-20</td>
<td>18 1-2 &quot;</td>
</tr>
<tr>
<td>HAMPDEN</td>
<td>450 1-2</td>
<td>13 1-2 &quot;</td>
</tr>
<tr>
<td>WORCESTER</td>
<td>1696 7-20</td>
<td>15 6-7 &quot;</td>
</tr>
<tr>
<td>MIDDLESEX</td>
<td>437 7-20</td>
<td>13 1-2 &quot;</td>
</tr>
<tr>
<td>ESSEX</td>
<td>109</td>
<td>12 1-5 &quot;</td>
</tr>
<tr>
<td>NORFOLK</td>
<td>126 3-5</td>
<td>12 2-5 &quot;</td>
</tr>
<tr>
<td>BRISTOL</td>
<td>103 1-2</td>
<td>11 1-5 &quot;</td>
</tr>
<tr>
<td>PLYMOUTH</td>
<td>350 3-5</td>
<td>11 3-5 &quot;</td>
</tr>
<tr>
<td>BARNSTABLE</td>
<td>15 1-2</td>
<td>11 1-5 &quot;</td>
</tr>
<tr>
<td>DUKES</td>
<td>15 1-2</td>
<td>11 1-5 &quot;</td>
</tr>
<tr>
<td>NANTUCKET</td>
<td>60 1-2</td>
<td>10 1-5 &quot;</td>
</tr>
<tr>
<td>SUFFOLK</td>
<td>No. of acres Amount raised not given. 35 bushels.</td>
<td></td>
</tr>
</tbody>
</table>

SUMMARY

Whole number of Acres sown—Suffolk not included, 6850

<table>
<thead>
<tr>
<th>Counties</th>
<th>No. of bushels produced.</th>
<th>No. of Claimants.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BERKSHIRE</td>
<td>27,784 1/2</td>
<td>646</td>
</tr>
<tr>
<td>FRANKLIN</td>
<td>13,501 1/2</td>
<td>519</td>
</tr>
<tr>
<td>HAMPSHIRE</td>
<td>15,035</td>
<td>522</td>
</tr>
<tr>
<td>HAMPDEN</td>
<td>60,914 1/2</td>
<td>198</td>
</tr>
<tr>
<td>WORCESTER</td>
<td>28,008 1/2</td>
<td>1099</td>
</tr>
<tr>
<td>MIDDLESEX</td>
<td>5063</td>
<td>247</td>
</tr>
<tr>
<td>ESSEX</td>
<td>1283</td>
<td>52</td>
</tr>
<tr>
<td>NORFOLK</td>
<td>1474 1/2</td>
<td>72</td>
</tr>
<tr>
<td>BRISTOL</td>
<td>1283 1/2</td>
<td>53</td>
</tr>
<tr>
<td>PLYMOUTH</td>
<td>42453</td>
<td>196</td>
</tr>
<tr>
<td>BARNSTABLE</td>
<td>4283 1/2</td>
<td>23</td>
</tr>
<tr>
<td>DUKES</td>
<td>188</td>
<td>9</td>
</tr>
<tr>
<td>NANTUCKET</td>
<td>160</td>
<td>5</td>
</tr>
<tr>
<td>SUFFOLK</td>
<td>35</td>
<td>1</td>
</tr>
</tbody>
</table>

108,570 1/2 3642

From the above are to be subtracted, in Stockbridge, 17 1/2 bushels:—In Reading, 28 bushels of Buck Wheat.—Total, 45 1/2 bushels.

Errata—on page 28—1st line—for 39 1/2 read 39.

" " 24th " 2587 " 2584
REPORT

ON THE

CULTURE OF WHEAT

IN MASSACHUSETTS, 1838.

The Senate, by their order of 20 March, 1839, having required of the Commissioner of Agricultural Survey, an examination of all the wheat returns made to the Government, with a view to obtain the bounty offered by the law of 1838, and with reference to any improvements which the culture of wheat in the Commonwealth may admit of, the Commissioner has devoted much time to that subject; and herewith respectfully submits his report—in the preceding analysis of the returns of all the towns, and in the subjoined general remarks on the whole subject.

The number of individual claimants, whose returns have been examined, have exceeded three thousand six hundred. The amount of bushels of wheat, upon which a bounty has been paid, is more than one hundred and eight thousand. The sum paid for this object by the State in the first year of the law, is $9,280 14 cts.

The objects of the law, proposing a bounty upon the raising of wheat in the Commonwealth, it is presumed, were two fold; the first, to ascertain the capacities of the State to produce this crop; the second, to learn the common modes of cultivating it, that if possible they might thence determine the best mode. It was therefore required, that claimants should report not only the number of bushels raised, but also the extent of land sown;
the average yield per acre; the quantity of seed sown to an acre; the kind of wheat sown; the time of sowing; the nature of the soil; the amounts and kinds of manure applied; the use of lime, gypsum, or ashes; and any disease or accident by which the crop was affected. For this purpose, prepared blanks were furnished to the several towns by the Secretary of State, and the returns made, with as much exactness as was to be expected.

From these returns, it appears, that the crops suffered almost everywhere from drought. The season in this respect was singularly unfavorable; the summer having been one of the hottest summers upon record, and the drought severe, long-continued, and universal. It appears, likewise, that the crop suffered severely from the grain insect or wheat fly—a scourge which until recently was not known in this State; but which seems to have widely extended his devastations. There were also many instances of smut; and of blight from unknown causes.

It appears, also, from the returns, that there is scarcely an instance named in which the use of lime or plaster has given any decisive and well authenticated favorable results. Wood ashes have been frequently used, and large crops have followed. Many cases, however, are reported in which their application also seems to have been without advantage. Large crops are returned where no manure whatever is reported to have been applied in the season of the wheat or the preceding season. No exact average of the amount of crops can be formed. I have carefully collated all the returns, and have obtained an average yield of each town and likewise of each county, dividing the number of bushels produced by the number of acres sown. This, however, will not give a just comparative result, as the result must be varied by the number of crops or number of acres sown. For example, in a town where two acres were sown, giving one 30 bushels and the other 15 bushels, the average would be called 23 bushels; but in another town, presenting four claimants of an acre each, one producing 30 bush-
els and three producing 16 each, the average of the town would be stated at 19 bushels only per acre. An approximation to exactness is, therefore, all which is to be looked for in the case. The average yield per acre through the State, may be set down as about fifteen bushels.

The bounty granted by the State has not been without its use. Advantages are likely to accrue from it, which will ultimately prove more than an equivalent for the expenditure. Public attention has been particularly called to the cultivation of wheat—a product of general and necessary use; and one of the most valuable crops which can engage the attention of farmers. Though to a certain extent the crop of this year may be considered a failure, yet this fact will itself awaken intelligent inquiry into the causes of failure; and, it is hoped, in the end, lead to its successful cultivation. There are few parts of the State where it cannot be cultivated; but, if we look for a profitable return, it must be under a different course of husbandry from that now pursued. It is my firm conviction, that there is indeed, allowing always for some particular local exceptions, nothing in the soil, or climate, or agricultural condition of Massachusetts, which forbids its extensive and profitable production. I shall ask leave, under the order of the Legislature, and as Commissioner for the agricultural survey of the State, to submit my views on this subject at some length.

The importance of the wheat crop to Massachusetts is very great. It is not necessary to go into any statistical returns of the number of pounds or barrels of wheat or wheat flour, which are brought from abroad and annually consumed in the State. Every one must perceive, that the amount is enormous, since the consumption is universal, and the quantity produced in the State can do little towards supplying the demand.* Public manners in this matter have undergone a considerable change within the last quarter of a century. Bread made of rye and Indian meal, was then always to be found upon the tables in the country; and, in parts of the State, was almost

* Appendix A.
AGRICULTURAL REPORT. [March,

exclusively used. Wheat flour was then comparatively a lux-
ury. Now brown bread, as it is termed, is almost banished
from use. No farmer gets along without his superfine flour,
his bolted wheat; and the poorest family are not satisfied, and
will not be satisfied, without their wheat or flour bread. This
general change in the habits of the people was nearly contem-
poraneous with the completion of the great Western Canal
in New York, by which the abundant products of those rich
wheat districts of country, which the canal opened, became
accessible; and the supplies of their finest wheat and wheaten
flour were brought directly to our doors, and carried, at the
expense of a heavy freight, into every part of the interior of
New England, even to distances of more than a hundred miles
from the sea shore. The brands of the Rochester mills are
almost as familiarly known on the upper waters of the Con-
necticut as on the Hudson; and are found as constantly in the
gorge of the White Mountains and the valleys of Vermont as
in the stores of New York and Albany. Indeed, wheat flour
has become among us as much an article of first necessity as
meat and clothing, and therefore, on grounds of sound political
economy, it is matter of the highest consideration to supply, if
practicable, our own wants.

This position has been strongly controverted. It has been
maintained, that instead of attempting to raise wheat, it would
be better to apply ourselves to some branch of mechanical or
manufacturing industry, which would give us the means of
purchasing our bread from countries whose climate and soil are
more congenial than our own to its production. There is
some plausibility and a measure of truth in this position; but
it cannot be admitted without material qualifications. The true
prosperity either of an individual, a family, or a larger commu-
nity, is not to be measured by any standard of dollars and
cents. We know to what a great extent an opposite opinion
has prevailed among us, and how disastrous its influence has
proved upon our habits and morals. Severe experience, it is
hoped, will disabuse us of this error; and we shall presently come
to understand truths long since established, and which are of
the highest practical moment, that the money which is not
industriously earned is seldom wisely expended; and that the
real prosperity of individuals and nations, is not in the accu-
mulation of mere wealth, but in those habits of industry, fru-
gality and self-dependence, which spring from the necessity of
labor and enterprise; and such a struggle with obstacles and
difficulties as will awaken, and strengthen, and expand all our
physical and intellectual energies. Temperance and frugality
likewise lie at the foundation of all substantial prosperity; and
neither the happiness nor the morals of men are safe, but where
there exists an imperious necessity for the exercise of these
virtues. Under such circumstances, it is clearly a principle of
cardinal importance in private and public economy, that indi-
viduals and communities should, as far as possible, depend
upon themselves for the supply of their own wants; should
seldom go abroad for that which they can produce without loss
at home; and in respect to matters of primary necessity, should
endeavor, though it might seem at first to be attended
with a pecuniary loss, to create resources within themselves
rather than live in habits of dependence on others.

If we look at families, we shall find that those are in truth
most prosperous, who rely most upon their own exertions,
enterprise, and skill. While it often happens, that persons
possessed of large estates, which have come to them by inher-
itance, accident, or some fortunate speculation, and who, be-
cause they have never known the necessity, have never formed
the habits of labor, in the inevitable vicissitudes of human
affairs, are wrecked and reduced to a condition of dependence
and beggary, the former have known neither want nor fear.
Rich in habits of labor, temperance, and frugality, of which,
without their consent, no one can deprive them, they have rode
out in safety the severest storms.

These principles, though they may seem remote, have a di-
rect connexion with the subject under consideration. The
moral welfare of a community is always advanced by the ne-
cessity and the habits of self-dependence. As an agricultural community especially, the people should, as far as possible, produce every article of first necessity, which they require for consumption. There may be products utterly unsuited to their soil and climate. It would be folly, where it is hopeless, to contend against nature. But in all cases, and always, where there is no obstacle absolutely insurmountable to persevering labor, success is always a moral gain.

In a pecuniary view, however, there can be no doubt that Massachusetts would find her account in producing her own bread from her own soil. Vast amounts of money are now sent out of the State for bread. This capital applied to the cultivation and improvement of her soil, would immensely increase its productiveness. Mechanical labor, in general, terminates in the article produced. Labor, judiciously and liberally applied to agriculture, produces not merely the immediate and particular crop which is sought after; but has a cumulative influence in preparing the same land for other and larger products. The value of the land thus cultivated, is often doubled, quadrupled, and increased tenfold, by being thus rendered the more productive.

It must be considered likewise, that where a community depends upon exchange or barter, for the supply of its primary wants, as, for example, where it exchanges its manufactured articles, or the cash proceeds of these articles, for bread, this bread must be subjected to the charges of freight and commercial commissions, and to the support of a class of men whose whole business consists in the transfer and exchange of these commodities. Now, without derogating at all from the respectability of this class of our fellow-citizens as a class, and from the usefulness and necessity of their agency, to a certain degree, wherever trade exists; yet it is plain that they are not a productive class; but that their support is itself a tax upon the labor and industry of the country. In an economical view, it is therefore desirable, that they should exist in no larger numbers than is necessary to transact the indispensable trade of
the country; and it will be acknowledged that the country has already suffered much from the fact of large and disproportionate numbers having been withdrawn from the laborious and productive classes in rural life, to engage in the unproductive pursuits of trade, far beyond what the commerce or mercantile business of the country require.

There are other considerations connected with this subject, especially in a moral aspect, upon which it seems excusable and seasonable to dwell. It may be assumed as an incontrovertible fact, that Massachusetts, throughout her whole territory, with a few inconsiderable exceptions, always, to labor intelligently and skilfully applied in the cultivation of the soil, an ample reward. It is not pretended, that her soils yield as large a return in quantity as the fertile alluvions of more genial climates. I do not say that agriculture, even under the most favorable circumstances, will produce as much money as many branches of mechanical industry. I am aware that it offers none of the chances of sudden and great accumulation, which speculation and commerce sometimes, perhaps not infrequently, present. But the rewards of agricultural labor in Massachusetts are ample, in that an industrious man may obtain by skilful and active agriculture, not only a comfortable subsistence, but his gains will prove so much more than his real and reasonable wants, that in ordinary circumstances, he may early, as is constantly done, enjoy the satisfactions of a domestic connexion, have the means of healthful and innocent luxury, raise and well educate a numerous family, exercise a generous hospitality, and lay up a competent provision against the casualties of human affairs and the decline of life. All this may be done in the exercise of a good conscience, with a single pair of hands; and with no other than the joint aid of a loving and growing household, and, in such cases, the ever sure blessing of a kind Providence. Hundreds of instances, throughout our favored Commonwealth, display these beautiful and enviable results. It is on this account, then, that agriculture deserves every encouragement which the State can give. It has likewise an in-
timate connexion with good morals, and the support and purity of our republican institutions.

Rural life in New England, where every man may be a freeholder, tends to inspire and encourage an honest pride of character, and a self-respect, which is a strong security to virtue. It is favorable to sobriety, industry, and an attachment to good order and quiet. It is exempt from those moral perils which exist in crowded villages; which are found in the concealment practicable in populous cities; in the indifference to the value of human life, which prevails there; and especially in the corrupt associations and multiplied crimes and vices, which there inevitably abound. It is more favorable to the manly spirit of liberty, and to the sentiment of a moral and political equality, than where the extremes of human condition, enormous wealth and abject poverty, power and dependence, luxury and squalidness, pride and servility, are, as in cities, brought into constant and immediate connexion.

Agriculture, in the view of every sound political economist, is the foundation of national wealth. It is not easy to see how trade or foreign commerce, legitimately pursued, contribute in any way to the actual increase of the wealth of a country, unless it be in the value of the labor employed when an equivalent is obtained from a foreign country for that labor. Agriculture creates wealth; and gathers its treasures without injury or diminution, from the exhaustless bounty of the Divine Providence in the earth and air. Every agricultural production is therefore a direct creation of so much additional wealth. This, however, is not all. It is not, as in manufactures, the mere using up of the raw material; but under good cultivation, the soil itself is put in a condition to become more productive. The land is raised in value, in proportion to the increased income, which can be obtained from it. Labor thus applied, may be regarded as a sure and permanent investment of a productive capital. It is known, that in many parts of the State, under a liberal and judicious husbandry, lands in a measure worthless, or valued at not more than five and ten dollars per acre, by improvements, the expense of which, the first crops
oftentimes fully repay, are made to yield an income equal to the interest on a capital of one and two hundred dollars per acre; and to pay at the same time, the expenses of keeping them in a productive condition.

In considering the moral influences of agriculture, the consciousness of independence, resting upon the basis of a conscious ability to supply our own wants, is not to be overlooked as a sentiment in the highest degree favorable to good morals. This conviction calls out the best powers of our physical and intellectual nature. There is a rich pleasure, not unmixed with an honest pride, in eating bread raised by our own hands. There is a duty and a pleasure in encouraging domestic industry under any and every form. The supplies of the products of foreign labor, come to us too often mingled with the painful associations of oppressed, defrauded, and unrequited toil. The products of our own honest industry and free labor, are subject to none of these painful abatements. Massachusetts will find the true foundation of independence only in rendering her soil productive; as far as possible cutting off her reliance upon foreign supplies; and abating, or supplying from her own resources and soil, those wants, which render her dependent upon a foreign power, for that which her own soil is capable of producing.

Above all things else, she should determine with honest pride, to raise what she eats; or else, to eat what she raises. She can produce her own wheat. On new lands there is seldom any failure, unless one, which proceeds directly from neglect; or from atmospheric influences, which no sagacity can foresee or control, and which are peculiar to no country. To accidents of this nature, all crops are liable. Wheat in general is, in all countries, considered a less hardy plant than many others; yet I have the settled opinion of at least six intelligent and practical farmers in the State, that, as far as their experience goes, and it has been the experience in each of these cases of nearly a quarter of a century, wheat with them is as certain as almost any crop which they cultivate. The returns will
show, even under one of the most unfavorable years which we ever have, that many crops yielded twenty and twenty-five, not a few exceeded thirty, and some rose to forty bushels per acre.

I shall now proceed to speak of the causes of failure, and of the improvements which may be made in the cultivation, by which, in my opinion, the certainty of the crop in ordinary cases may be secured, and its product vastly increased.

Causes of Failure.—The causes of the failure of the wheat crop are various. It fails from rust, smut, mildew, blight, the wire-worm, the Hessian fly, the grain insect, drought, wetness, character of the soil, condition of the soil, improper or imperfect manuring, and sundry errors of cultivation, which I must class under a general head. I shall speak of these in detail; and then proceed to point out the improvements which are desirable in our cultivation.

Rust.—The subjects of rust, smut, mildew, and blight, have occupied greatly the attention of intelligent observers; but the true causes have as yet eluded their inquiries. Rust is a well known disorder, in which the wheat-straw or culm becomes covered with a red powder like the rust of iron; the growth of the plant is stopped, and the grain is shrivelled and imperfect. This is found to occur under two conditions. The first is in severe drought, when the plant appears to suffer from want of nourishment. There is of course no remedy for this, unless the plant should be grown like corn in drills, and at such distances that the ground could be cultivated between the drills. This is a mode not likely to be adopted; and which is scarcely practicable for wheat on any large scale.* The second

* Of course no one can think here of cultivating wheat in drills, and ploughing between it; nor is it likely that the expensive scarifiers or cultivators used in England for stirring the land between the drills of wheat will be soon introduced among us; but I may here with propriety allude to the ascertained effects of such operations, and leave the principle implied in it to be considered and applied as any farmer may think best.†

Speaking of a crop of cabbages, Mr. Curwen says—"In the first week in June, the ploughs were set at work. As they started, Mr. — was present and saw the crop. It was with difficulty the ground was first broken; but

† Appendix B.
case in which rust appears, is where the plant seems to be excessively forced by high manuring and a peculiar state of the weather. Where the growth of the plant is very luxuriant, and there occurs a kind of weather common in July and August, half rain and half sunshine, oftentimes the sun and the rain alternately contending for possession and the heat intense, vegetation then is forced to its utmost speed, and it would seem as though the sap vessels were burst by repletion; and the exudation of the sap causes the rust which then appears upon the stalk. Against this there is no remedy known. This same disease or accident is common with herds-grass or Timothy, in time of drought, especially when the crop is thin and the ground light and scantily manured.

Mildew.—The second disease is blight or mildew, in which the plant assumes a purple or bluish cast, resembling the mould which collects in damp places in houses upon articles of furni-

by the end of the week it was brought into fine tilth. Notwithstanding the whole week had been dry with a strong sun and a severe east wind, yet such was the progress in growth of the cabbages, that when seen again by that gentlemen on the Saturday he could scarcely be persuaded they were the same plants. During these operations, I had been making constant experiments with glasses contrived for the purpose, to ascertain the quantity of evaporation from the land, which I found to amount, on the freshly ploughed ground, to nine hundred and fifty pounds per hour on the surface of a statute acre, while on the ground unbroken, though the glass stood repeatedly for two hours at a time, there was not the least cloud upon it which proved that no moisture then arose from the earth. The evaporation from the ploughed land was found to decrease rapidly after the first and second day, and ceased after five or six days, depending on the wind and sun. These experiments were carried on for many months. After July the evaporation decreased, which proves that though the heat of the atmosphere be equal, the air is not so dense. The evaporation, after the most abundant rains, was not advanced beyond what the earth afforded on being fresh turned up. The rapid growth of my potatoes corresponded perfectly with the previous experiments; and their growth in dry weather visibly exceeded that of other crops where the earth was not stirred. The component parts of the matter evaporated remain yet to be ascertained; the beneficial effects arising from it to vegetation cannot be doubted or denied; but whether they proceed from one or more causes, is a question of much curiosity and importance.”—Curwen's Hints, p. 274.
ture. This is supposed by many to be on the wheat a parasitical plant or species of fungus. After this disease attacks the wheat, the leaf presently turns black; the health of the plant is ruined, and the grain is shrivelled and worthless. This disease seems to be wholly atmospheric, or developed by the state of the air. It is produced by, or rather seems to follow excessive moisture or heavy dews, which collect and remain on the plant. It is most likely to occur to wheat growing in confined places, where the air has not a free circulation. The only remedy which has come within my knowledge, has been the sweeping of the field with a rope in the morning, when it is wet, and thus brushing off the wetness. This method is not unknown abroad; and is stated in my first report to have been successfully practised by a careful farmer in Essex County. By these means he has saved his wheat, when that of his neighbor was destroyed. Undoubtedly the best preventive, which could be adopted against this injury, would be the sowing of wheat in high situations where it might have the advantages of a free circulation of air.

Smut.—Another disease to which wheat is subject is smut. This is of two kinds. I shall enter into no minute examination of its character; nor into the conflicting opinions of many profound scientific observers as to its true nature. This the most critical observations have not yet fully determined. I shall deal only with its obvious and familiar appearances, and with remedies which experiment has found effectual.

The first kind of smut is often seen soon after the wheat has begun to form its grain in single heads scattered over the field. This gives no alarm to an experienced farmer. He regards it rather as an indication of the luxuriance of his crop. The heads of the affected plants soon entirely disappear, and leave nothing but the naked culm. It is seldom that a field is so extensively affected in this way, as in any considerable measure to diminish the crop.

The second kind of smut infects the ear with a black dust, and spreads itself throughout the field. The grain is not destroyed
by it; but the seed is covered with this black and offensive powder, and produces an impure, discolored and unhealthy flour. It can be to a degree removed from the grain by washing it after it is threshed; but this is an inconvenient and troublesome process, and not altogether effectual. This disease, as well as smut and mildew, has been attributed to the attacks of insects or animalcules; but late discoveries strongly lead to the belief that it is a species of fungus, the seeds of which become attached to the seeds of wheat, and are carried by some unknown process into the heads of the wheat, where they perfect themselves.

Against this accident or disease, there is a preventive which may almost be pronounced certain. The seed is to be soaked in strong brine, or in stale urine, and, while wet, sprinkled with finely slacked lime, and left in this state twenty-four hours before sowing. It is stated that its germinating power will be injured if it lays too long in urine; but this is not the case with brine, unless the temperature of the weather is very warm. Others recommend a solution of copperas or arsenic; but salt brine being a more simple preparation, and easily accessible to every farmer, is to be preferred. This application seldom fails to be an effectual preventive of smut. There are indeed, as will be seen, some few cases of smut stated in the reports in which the wheat is represented as having been brined and limed; but more exact statements are wanted, before we distrust the efficacy of this preventive, which has been established by numerous experiments of the most decisive character. Persons often question the rule, when the experiments, which they make, are too imperfect to test it. For example, they will brine the seed without liming it; or they will merely wet the seed in pure water and apply lime to it; or they will soak it in brine and apply ashes or gypsum to it. None of these modes are a security against smut. But where the seed is thoroughly steeped in strong brine, sprinkled with caustic or quick lime, and allowed to remain some hours after being thus dressed, and not suffered to become dry before it is sowed, the preventive,
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though it may not be absolutely infallible, may be relied upon with almost entire confidence.

That the two kinds of smut are different in their nature, is evident from a well established fact. An attempt to communicate the disease to other plants of wheat, by sprinkling the powder of some of the first kind of smut upon them, was not successful. But the application of the powder of the latter kind of smut referred to, has, in repeated trials, proved infectious.

There are other diseases to which wheat is subject, which may be only different aspects of those to which I have alluded; or which arise from causes not well ascertained. Natural science has done something in the investigation of their nature; but as yet, amidst the conflicting theories and conjectures which have been started, there is little solid ground to rest upon.

Insects.—Wire Worm.—Wheat, besides being subject to various diseases, has enemies to contend with among the insect tribes, which are formidable and often destructive. The wire-worm is well known to farmers; and several cases of injury from his ravages are mentioned in the reports. These are principally found in lands, which have been some time in grass and newly broken up. On this account where they abound, to sow wheat on green-sward ploughed up, would not be advisable. A farmer in Williamstown, whose land was much infested with these worms, and whose corn crop always suffered severely from them when it was planted upon grass land newly broken up, found great advantages in ploughing his land in the fall, by which operation he thought many worms were destroyed by the frost; and then taking a crop of oats, which they were not likely to injure, before he took any other crop. This was followed by corn, and then by wheat. They are not disposed to stay in cultivated land, but prefer that which is in grass. Another farmer in Templeton, whose statements seemed entitled to confidence, is in the habit of putting some salt in the compost heap, with which he manured his corn.
He says in this way his corn has escaped the depredations of the wire-worm, while his neighbor's corn over the fence, would suffer severely. He has been accustomed to do this for several years, but could give me no definite rule as to the proportion of salt used in the heap. As well as I could gather from his statements, however, it was not large. To all soft-skinned worms, such as slugs, &c., the application of caustic or quick lime, if a small amount comes in contact with them, will prove destructive; but this does not seem to be the case with those which are encased in an armor of horn. The application of lime, therefore, in the hill with corn, is not found a preventive against the injury from the wire worm.

E. Phinney, of Lexington, whose authority is entitled to the highest respect, "advises in the ploughing of green sward, to turn it over in the spring, say from the first to the middle of May, after the grass shall have started a few inches. The reasons are, that generally a greater quantity of vegetable matter is turned under; the sod will turn over smoother in the spring than in the autumn, the grass is much less likely to spring up between the furrow slices, which materially injures the crop; and lastly the worms which commonly abound in grass ground are less likely to injure the crop. The reason must be obvious. Finding no green substance in land turned over in the fall to feed upon, they invariably seize upon the growing crop. Where the green sward has been thus turned over in the spring, after the grass has started, it is affirmed upon experience that injury from the worm does not occur, but when this is done in autumn, it is rarely otherwise."

N. Bennet, of Framingham, thinks "turning over green sward in August, a perfect remedy for the corn or cut worm, which is the wire worm here referred to. By ploughing so early in the season, the grass has time to spring up and grow before winter between the furrows; and when he cross-ploughs in the spring, the young grass furnishes a sufficiency of food for the worms, and therefore the corn is not injured by them."

Robert Colt, of Pittsfield, whose farming as well as that of
Mr. Bennett, has been honored with the premiums of the Massachusetts Agricultural Society, says "that he is satisfied from experience, years since, that the ploughing of green sward or stubble in the autumn, is a loss in the following crop of at least ten per cent. Sward lands, that are ploughed in the fall become compact during the winter; the finer parts washed between the furrow slice, excluding the air, and preventing the surplus water from draining off, consequently the turf lies heavy and dormant, with but little benefit to the crop. On the other hand, if ploughed in the spring, the soil is light and receives the harrow kindly; and the furrow slice does not become so compact as to prevent the circulation of the air, and allows the excess of water to take its proper course; and the sward, when the crop comes off, will be in a more forward state of decomposition than if ploughed the fall before."

These various opinions, coming from practical men of much intelligence and long experience, deserve attention. It would not answer to delay the sowing of wheat until the middle of May, as there would be great risk in our climate of its suffering from mildew. If wheat is to be sowed on green sward, it should be ploughed much earlier. But this would not in that case afford the protection against the wire worm to which Mr. Phinney refers. I must dissent from the inference, (at least, I hold my judgment in suspense until I have farther light,) that this late spring ploughing is to be deferred on account of the superabundance of vegetable matter then to be turned under. Theory and experiment in this matter conflict with each other. I have been always inclined to the belief, which generally prevails, and which Mr. Phinney maintains, that the higher the state of luxuriance in which vegetable matter is turned in by the plough, the more the land will be enriched by it. But the experience of one of the best farmers in the State, has satisfied me, especially as it has been confirmed by another equally intelligent farmer, and wholly unbiased by the judgment of any other person, that the land is more benefited by the turning in of the clover crop after it is dried than when in a state
of greenness and full of sap. The opinion is, that if green it creates an acidity in the soil prejudicial to the succeeding crop. I do not know whether this theory be sound or not; but I have seen an experiment tried with a view to this point, in two adjoining lots of ground in the same field; and the result was conclusive in favor of turning in the crop when dried. Mr. Colt’s opinion in favor of spring ploughing or against fall ploughing bears on the same point. The conclusion, which seems to follow from these premises, is against sowing wheat upon green sward, on account of the wire worm. In such case, corn or oats then should be taken as a first crop; and corn may be taken, as Mr. Phinney advises, on a late ploughed sward, as the disadvantage, if there be any, in the comparison between turning in the herbage in a green instead of a dried state, may be more than compensated by the protection which it furnishes against the worm; but if wheat is to be sowed, on green sward or stubble, on account of the results of Mr. Colt’s experience, whether his notions be well or ill founded, it is to be advised to plough in the spring; but then as early as possible; because, as I am satisfied, of the expediency under all circumstances of sowing spring wheat as early as possible. In this case, the chances of the worm must be encountered, unless the mixture of salt with the compost, as mentioned above, may afford a security against him.

Hessian Fly.—The Hessian fly is another enemy from which wheat has heretofore suffered a great deal. His ravages constituted a principal reason many years since for relinquishing the cultivation of wheat in several parts of the State. This scourge was supposed to have been introduced into the country in the baggage of the German soldiers, who came as the mercenaries of the British, in the time of the American Revolution. Yet no such insect was known in the province of Hesse, from which these soldiers came.

The maggot is found between the leaf and the culm in the first joint of the plant; and beds himself in the stalk at that place, by which it is destroyed. At his first coming in the
country, his ravages were extensive and alarming; but his appearance is now of comparatively rare occurrence. Two broods are hatched in the course of the year. Late planting, both in respect to winter and spring wheat, seemed sometimes to carry the wheat beyond the time when from the habits of the fly, the plant was most exposed to injury, or when the fly was in a condition to inflict the injury; but no certain protection against this destructive insect is known. In some of the reports, the wheat is stated to have been injured by the Hessian fly; but I believe in all these cases, from some confusion of names, the grain insect is referred to.

**Grain Insect.**—The grain insect, as he is termed, is comparatively of recent appearance. He has extended his devastations very widely over the country. The reports abound with complaints of the injuries produced by him. In the report, which I had the honor to submit to the Senate by their order on the subject of Spring Wheat, I referred to this insect; and notwithstanding numerous cases of injury to the crops are reported, I am confirmed in the conviction, that a perfect remedy is within the reach of the farmers.

In the year 1835, I had the pleasure of submitting to the agricultural public through the columns of the New York Farmer, then published in the city of New York, what I believed one of the most important discoveries ever made; and whose value must be to the country that of untold millions; that is, an effectual security against the ravages of the grain insect. Letters received by me from the interior of New York, Saratoga, and Rensellaer counties, and from some of the most intelligent wheat growers in that part of the country, spoke of the ravages of this insect as utterly discouraging; and expressed their serious apprehensions that the cultivation of this crop must be abandoned until the pest should be stayed. One farmer in Rensellaer county, who had sowed thirty bushels of wheat, on threshing his crop obtained seven only; and the result with many others was similar. In a journey afterwards to the head waters of the Connecticut, and thence into the
north-easterly part of New Hampshire, I found the ravages committed by this insect most extensive; and, in some cases, fields, which promised an abundant yield, were cut up for litter.

These facts were seriously alarming, but an observing and experienced farmer in the interior of New Hampshire, informed me, that he had in two instances, prevented the ravages of the fly, by the application of lime, as I shall presently explain. Another farmer had tried this method with success, and showed me in a field of rye a perfect demonstration of its efficacy; the part, which had been limed, was free from the insect, while that part of the same field, to which no lime had been applied, had been severely injured by it. Soon after this publication, a distinguished friend of agriculture in New York, expressed his distrust of the efficacy of this preventive. But this was without having fully tried it, and a few months before his lamented death, he gave me to understand that his views on this subject were somewhat changed; and that he had received so many testimonies from farmers, entitled to the highest confidence, of its efficacy, that he could not gainsay them.

The evidences, which I have received in the course of my inquiries, being the result of the experience of several trials, leave no doubt that the preventive, if not infallible, may be relied on with strong confidence. The preventive consists in giving the grain a thorough coating of newly slacked lime, just as it is coming into flower, and while it is wet with dew or rain. It may be necessary to repeat this; but one application has proved effectual.

The fly is seen at a certain season, hovering over the field in thick multitudes. It is supposed he then deposits the germ of the maggot, which in the form of a little yellow worm, resembling a pepper-grass seed, are found afterwards in the heads of the wheat after having entirely destroyed the grain. It may not be easy to account for the operation of the lime. Whether by its caustic properties it destroys the egg, or whether it prevents the fly from alighting on the grain, or in what other way it operates, are interesting inquiries, which close observation
may presently solve. This, however, is of little moment, compared with the fact of its efficacy against this scourge.

There are other causes of the failure of the wheat crop, which the cultivator may guard against to a certain extent. Wheat is liable to suffer much from drought. Without doubt, where the early southern clover is sown with this grain, it will cover the ground, and operate, in a degree, to protect the plant from the heat of the sun. Spring wheat requires to be sown thicker than winter wheat, because it has not the same length of time to grow, and does not spread or tiller so much upon the ground. Where the crop is thin, the ground, of course, is liable to suffer more from drought than where it is thickly sown. The most successful farmers in Great Britain, seldom sow less than three, and sow oftener four bushels of winter wheat to the acre. The thinner the plants stand upon the ground, the more likely are they to suffer from drought. But where such heavy sowing as this takes place, the land should be in high condition.

Wheat often suffers from being lodged. This frequently happens, where the growth of the plant has been stimulated by green manures, or by weather, which gives an extraordinary impulse to vegetation. The stalk does not gain strength or stiffness in proportion to its expansion and growth, and is liable to become lodged, after which it will not ripen nor fill. Sometimes the wheat is blown down by strong winds. The only remedy I have known used in such cases, I have heretofore spoken of, where the farmer is in the habit of going into his fields, and with a rake-handle, carefully lifting the plants which are blown down. He says that in such case, a little aid given with much care, will so raise the plant that its seeds will perfectly ripen. This remedy would seem impracticable to any large extent.

Having spoken of causes and circumstances operating against the production of wheat, which may be considered as specific, and, in a popular sense, accidental, I proceed to treat of more general causes of failure. I must, however, in passing, express
my conviction that, separate from the causes to which reference has been made, wheat of the best quality, may be grown among us, with as much certainty, as any other crop cultivated, and that the prominent occasion or ground of failure, is imperfect or deficient cultivation.*

Soils for Wheat.—With respect to soils suitable for wheat, experience proves that some are more favorable to the growth of wheat than others; but experience has equally proved, that there are few or none on which a crop cannot be obtained under proper management. It will grow luxuriantly upon a pure peat meadow, if it be perfectly drained and thoroughly cultivated and reduced to a finely comminuted state; or it will grow upon pure sand with the application of manure, provided a sufficiency of moisture can be seasonably applied. It will grow likewise upon clays, if a due portion of animal or vegetable manure is furnished; the soil freed from superfluous moisture; and at the same time reduced to such fineness as to be permeable to the minute and fibrous roots of the plant. I do not mean to say, that in the cultivation of wheat, the particular kind of the soil is matter of indifference, or that the sole design of the soil is to furnish a mechanical support for the plant; but that the growth and health of the plant more than any thing else depend on the finely divided state of the soil, so that the fibrous roots of the plant may freely extend themselves in every direction; and upon the manure applied, by which I mean decayed organic matter, either or both vegetable or animal remains, in sufficient quantity and well distributed in the soil. Further it is especially requisite that the soil by careful cultivation, be laid open as far as possible to the reach and powerful influences of light, air, and moisture.

Philosophy of Vegetation.—I shall not enter deeply into the philosophy of vegetation or the nature of soils; but it is safe to say, however mortifying to our pride to realize the conviction, that a solution of many of the mysteries of nature, in the vegetable or animal world, is as yet not even approached. Theories respecting the different operations or influences in

* Appendix C.
nature are easily framed; but experience, confirmed by the long and repeated accumulation of facts, presents itself as our only safe guide. We advance in our speculations to a certain point, and then an impassable barrier rises before us. We eagerly grasp at explanations which have a measure of plausibility; but if we examine them they are in truth no explanations; and we are as far as ever from the unravelling of the problem whose solution we seek. There is a point where ignorance and philosophy are upon a level; because the darkness is so intense that neither of them can see at all. If we ascertain, for example, that the material creation is held together, and its wonderful relations and beautiful harmonies maintained by the force of gravitation, and by a centrifugal force, which balances the power of central attraction, where this power would act with too much strength, we certainly have made great advances in knowledge and achieved an attainment of immense practical value and utility, because we apply this truth at once to most important uses. But in what this secret force consists, and how it operates, even under the laws of quantity and distance, which we understand, we are as ignorant as when born into the world; not even a plausible conjecture can be started. So likewise when we are told that vegetation is the result of galvanic or electric influences operating upon the roots of the plant, I cannot see that any real knowledge is gained until I know what galvanism or electricity consists in. Still less, if possible, is the science of life approached. What is done when this bodily frame starts into life, and all its multiplied, wonderful and labyrinthine circulations begin their amazing round; what is done when, at a touch, the current of life is instantly stopped, or what takes place when the moistened and swelling seed rises from the ground in the form of a beautiful plant, pours out its fragrance and matures its fruit, and then passes into decay and dissolution, no mind is acute enough or sagacious enough to discover or imagine. It is with a similar conviction of ignorance that we look upon the contradictory opinions respecting vegetable physiology; and the confident
theories, as unsettled as they are confident, advanced respecting the peculiar nature and composition of soils, and the effects of manures.

How much science has done is wonderful; how little she has done, or rather how much remains to be accomplished, is still more wonderful; it is overwhelming. Mechanical chemistry has made great progress; and in all mechanical operations and many of the arts, an immense amount of power has been gained, which is constantly applied to useful purposes. In what may properly be termed vital chemistry, she has advanced no farther than to discover the circulation of the blood, and the ascent and descent of the sap. In respect to all organic matter she is impotent. What demonstrates her ignorance is, that, while she assumes to be able to resolve every thing into its original elements, she cannot put together what she takes apart. She reduces every thing to a few simple principles; and yet the composition of things is variously diversified, where the original elements exist in almost the same proportions. She can analyze the blood and the flesh; she can tell the constituents of bones and of leaves. But she cannot make a drop of blood nor an atom of flesh; nor a bone nor a bud; nor at her pleasure throw the coloring into a single leaf. These things are not said to undervalue or discourage the efforts of science, but in order to direct the attention of farmers to facts in cultivation and vegetation, which their own observation and experience must supply. The capacity of soils for the production of particular crops can be certainly determined only by experiment. The farmer should be often making these experiments, assured that the instructions which he gathers from them will be his safest guides. Agricultural chemistry may detect mineral ingredients in soils, which are poisonous to some plants; but there are facts which confound all her pretensions and assumptions, for she sees different plants extracting from the same soils opposite and entirely different properties, so that on the same spot and their roots intermingling, shall spring plants which are full of nourishment, and
those whose use would be fatal to animal life. Plants like animals have their instincts and aversions; and there is a secret power, whose foot-prints are not visible to mortal observation, which controls every thing. This ordinarily places within the reach of the plant, and directs its pursuit after that peculiar nourishment, which its peculiar nature demands, and teaches it to obtain from the earth, or the air, or the light, or the rain, the particular elements which belong to it, and arrange them under such forms and modifications as constitute its proper character, and, if we may so speak, its personal identity.

It is happy for us, that it is not necessary, in order to a successful cultivation, to be able to explain these subtle mysteries of nature; but it would be folly or infatuation to disregard actual knowledge and facts, which experience in multiplied forms and places has fully determined, whether we are able or unable to explain their causes and modes of operation.

Varieties of Wheat.—The plant of wheat, perhaps more than any other, requires careful cultivation. Its history is not known. It is classed in the family of the grasses, and is supposed to have been brought to its present condition by careful culture. This theory probably is mere assumption, as it is not unlikely that it was in the beginning a bread grain; but without doubt careful selection and culture have multiplied the varieties and improved the quality. It is found under two forms—the flint or dark colored; the white or thin skinned. It is sometimes found bearded or the seeds covered with long awns, and sometimes bald or without awns. Some varieties are early, and accomplish their growth in three and four months, while other kinds do not perfect their seeds under a period of eleven months. Of these varieties, it is believed, after careful observation, that the white and soft-skinned varieties succeed best in dry soils and warm climates. The red and flint varieties prefer a moist soil and a cool temperature. The downy varieties are more exposed to suffer from mildew from the circumstance of their retaining the mois-
ture longer; but the bald varieties seem more liable to the attack of the wheat insect; though this fact is not fully established. It appears from the reports, that in the same field one variety suffered from blight while another escaped; but this seems to have been accidental and not attributable to any known causes. The difference in the product in flour of different varieties of wheat is very considerable, in some cases equal to at least five bushels in a hundred. This may depend somewhat upon the cultivation; but it is well ascertained that the white varieties produce more fine flour to the same weight of grain than the red wheats.

The soil on which wheat is cultivated is not matter of indifference. As I have said, it will grow upon any soil which is not too wet, and which is reduced to a sufficient degree of fineness; yet, beyond question, a strong and tenacious soil, which is inclined to clay, is most favorable to its growth. Experience has well established this point; and though pure clay would be as unfavorable to the growth of wheat as pure sand, yet the best soils for wheat are those which are tenacious and unctuous, or soapy to the feel.

Manures for Wheat.—The soil for wheat cannot be too rich, by which I intend, that it cannot abound too much in vegetable matter, if it be perfectly decayed and thoroughly incorporated with the soil. The use of long, green and unfermented manures—though there are cases which seem to form exceptions—is highly unfavorable to the crop. It forces the growth of the plant too much, and renders it liable to blight and to become lodged. The land should be enriched by previous crops; and if any manure is applied in the year of raising the wheat it should be thoroughly decomposed and mixed as evenly as possible with the soil. Fresh liquid manure of urine, has been tried on wheat; but though it increased very much the growth of the straw, and gave it a deep green color, it was not found to fill out as well as was expected, and the wheat was not of a good quality. This is a remarkable but not unobserved fact in vegetable economy, that the luxuriance
of the growth of the straw, even where no accident occurs, does not insure the crop. The growth of the straw, and the filling or perfection of the grain, depend on different principles or conditions, not yet understood. This is a subject which deserves much investigation, but in regard to which we have nothing more certain than conjecture to rest upon.

Lime.—It is with some diffidence that I come in the next place to speak of lime in its application to the soil for wheat, because I shall be obliged to differ in opinion from gentlemen for whom I have the highest personal respect. But the object of all sound and useful philosophy is truth, and no authority whatever can rise above facts.

It appears from the returns presented, that lime has been frequently applied, but in no such form, as far as the information given extends, to lead to any decisive inferences in its favor. When lime is applied to a crop in conjunction with manure, unless comparative experiments are made under the same circumstances, by which it can be decided whether it were the lime or the manure which produced the effect, or whether it were from the combination of the lime and manure, no certain conclusion is reached. From personal inquiries made in various parts of the State and among farmers of great intelligence and observation, I have not found a single case where any direct benefit has been traced to the application of lime to the soil for wheat. I am not, however, disposed to question its utility; and while I care nothing for any purely theoretical views, I shall proceed to state what I think may be relied upon respecting it.

It has been said that calcareous matter has been exhausted from our soils by cultivation; and this is the reason why our wheat crops fail where they formerly succeeded. It is matter of reasonable inquiry whether there is much foundation for this opinion. It does not appear from any analysis of soils which has been made, that there is more pure lime existing in soils which are comparatively new, than in those which have been some time cultivated. It does not appear that even on
the rich alluvions of the western prairies, where it is said that sometimes sixty bushels of wheat are produced to an acre, that there is a larger proportion of lime in any form, than in the old soils of this vicinity. In an analysis by the geological surveyor of the State, of five specimens of the best soils of Illinois, the highest amount obtained of the carbonate of lime was 3.3 out of 100 parts. But, in Massachusetts, several soils have been found in parts of the country longest cultivated, where the amount of the carbonate of lime has been in a hundred parts as 3–5–5.4. No one pretends that any earth can ever assume a gaseous form; or in truth that the nature of this earth can ever be changed, so that with whatever else it may be combined it shall cease to be lime. But if absorbed or taken up by plants, since those products are again returned to the soil, it does not appear how the original quantity should be exhausted by the growth of plants. It may have been swept away in many situations by rains, which, where lands are under cultivation, carry away large portions of the enriched mould on the surface to deposite them on meadows and alluvions below. In this case, undoubtedly, many newly cleared lands and side-hill situations have suffered a material deterioration, and the lime has passed off with other fertilizing portions of the soil. Yet it will be admitted, at the same time, that our alluvial meadows, according to the analyses given, present a less proportion of lime than many other lands.

It has been said that lime is indispensable to the production of wheat, because it is always found in the wheat plant. Of the sulphate and phosphate of lime, some portion is found in wheat, so also in rye, in Indian corn, in the haulm of potatoes, and in various other plants, especially in clover; but these exist in either case in extremely minute quantities; and as it respects the existence of any earthy carbonate in wheat, it is not understood to be found at all in the grain; and in the ashes of wheat straw, it is found only in the proportion of eleven parts in a thousand.

But, in truth, there is no deficiency of lime in our soils, so
far as it may be demanded as a constituent of wheat. In
some plants, as I have said—in clover, for example—lime in
one combination, is found in abundance. But lime is one of
the most generally diffused substances in nature. The sea
abounds in it. The land abounds in it. The learned geologi-
cal surveyor states that lime in some form is to be found in
every soil which he has examined. We have other facts
which demonstrate its universal diffusion. Our wells abound
in it. The hardness of a large portion of our waters, which
renders them unfit for the purpose of washing, is commonly
owing to the presence of lime. The bones of all animals are
composed of fifty per cent. of the phosphate of lime. The shells
of birds and of domestic fowls are composed of lime. So
that in truth there is no deficiency; and it seems an established
principle in chemistry, that lime, in whatever combination it
may be found, whether used as a carbonate, sulphate or phos-
phate, marl, plaster, or bone dust, acts always the same.*

It has been stated on high authority, "that a soil is incapabe
of producing wheat of good quality, that does not contain
carbonate of lime." This position is at least questionable;
since on the farm of Wm. Adams, of Chelmsford, Middlesex
county, where wheat has been successfully cultivated for many
years, it appears from a chemical examination of the soil, that
not a trace of lime in this form is to be found. In the report
of the Geological Survey of Maine, it is stated that forty-eight
bushels of wheat have been raised to an acre; but it seems that
the carbonate of lime is not found in the soil on which this
wheat grew; and in the form of a phosphate it was found, only
in the small amount of 1.5 in 100 parts. These cases, as well
established as any thing of the kind can be, seem decisive on
the point of its indispensableness in our soils to the production
of wheat beyond what is already found there. Of its general
usefulness in many soils, though its operation is as yet only
matter of conjecture, there can be no doubt.

That the amount of lime required to produce an effect upon

vegetation is very minute is established by the effects produced, beyond all question, by the application of even so small an amount as half a bushel of the sulphate of lime or gypsum to an acre. It is a wonderful fact, and sufficient to confound the presumption of man in attempting to explain with confidence many of the mysteries of nature, "that in experiments made by Sir John Herschell, it was found that minute portions of calcareous matter, in some instances less than the millionth part of the whole compound, are sufficient to communicate sensible mechanical motions and definite properties to the bodies with which they are mixed."*

The deficiency of lime in the soil is not, therefore, the cause of the failure of the wheat crop among us. Proofs of this might be multiplied, if there were occasion. Yet, on the other hand, it will not be denied that the application of lime to some soils, unless the application be to a much greater excess than is likely to take place among us, produces a decided improvement. I have no theory to establish on the subject; and it cannot be denied that even with professed chemists, the particular operation of lime upon the soil is as much matter of debate and controversy, at this very time, in Scotland and in England, where it has been for many years, and most extensively applied, as any subject whatever connected with agriculture. Any solution of the mode of operation of gypsum, or the sulphate of lime, whose effects are often so astonishing, is not even approached. But I shall proceed to state some points which seem to be well established in regard to lime. It has been said that gypsum benefits vegetation by its attraction of moisture from the atmosphere. It does indeed attract moisture, but it holds it fast and does not give it out. Its effect on vegetation in this respect, therefore, must be the reverse of beneficial. It has been supposed to assist the putrefaction or decomposition of animal or vegetable substances. But this theory experiment has wholly disproved. It has been supposed to form a necessary food of plants; and some portion of it is always obtained in the

ashes of certain plants, especially clover. This use of it, therefore, seems established. It has been maintained that it acts as a stimulus to vegetation; but this is wholly conjectural, and in fact explains nothing. It is saying merely in other words that it promotes vegetation, for as to any direct agency in quickening the circulations of the plant in the proper sense of stimulus, this at least has not yet been detected. Its efficiency in many cases is demonstrated; but the soils which particularly demand its use, and the manner of its application, can only be determined by actual experiment.

Lime, if applied in a quick or caustic state, and in sufficient quantities, has a tendency at once to consume all soft or putrescible matters, of an animal or vegetable nature, by combining with the acids or the water which exist in these substances; but how next it operates to assist vegetation is not so easily determined. The woody fibre of vegetables it does not alter, or at most in a very small degree. Undoubtedly in this operation many gaseous substances are evolved, which pass off in the air without affording any aid to vegetation. To animal manure or putrescible matters, whose decomposition it is desirable should go on gradually in the soil, this application therefore is not approved. But where there is a superabundance of vegetable matter in the soil, or where there are acid plants, whose sourness it is desirable to correct, such an application will be beneficial. Quick lime, likewise, may be useful in the destruction of all soft skinned insects with which it may come in contact.

The action of effete lime or the carbonate of lime is undoubtedly very different. Quick lime, if applied to sandy soils, if water were present, would tend to combine with the sand, and form an insoluble substance like mortar. If applied to clay, its operation would be different, as it would tend to divide and reduce it to a fine state. This would be the effect of effete lime or powdered limestone; and, for ought as yet ascertained, these mechanical effects of lime upon tenacious soils, are the principal benefits to be derived from it. The particles
becoming divided, the soil is rendered permeable to the roots of the plants, and accessible to air and moisture. What influence the plant itself exerts upon the carbonate of lime, or upon lime in any other form of combination, is not determined. The amount of any earthy matter taken up by the plant is a very small quantity; and it is not supposed that the plant has the power of changing its nature. The carbonate of lime is a substance scarcely soluble in water, or under any common atmospheric influences; but it can be taken into the roots or vessels of the plant only in the most minute state of division.

The whole subject, indeed, is as much open to investigation as in the beginning. Beyond a certain quantity, the application of lime is decidedly prejudicial to soils, and the farmers in the best agricultural districts of Scotland, acknowledge that their soils have been materially injured by the application of lime to their farms. There, however, it has been applied in quantities of hundreds of bushels to the acre, and much beyond any amount in which it is ever likely to be applied here.

Berkshire Marls.—The application of the Berkshire marls, which contain more than ninety per cent. of carbonate of lime, has not been attended with those beneficial effects, which were anticipated. The experiments have as yet by no means been decisive. As yet these marls have availed little, but a hope is expressed that they may hereafter prove beneficial. The application has been made to gravelly loams, where the effects could not have been expected to be so beneficial as upon clay or peat soils. In the latter case, if applied, it may be expected to assist much in producing a fine division of the soil.

This mechanical division of the soil by the application of finely powdered carbonate of lime, either after it has been comminuted by calcination, and the pure quick lime has passed into the state of a carbonate, which it will soon do after being exposed to the air, or in the condition of finely powdered limestone, is that which is chiefly to be relied upon. The carbonate of lime is scarcely soluble in water, though it is decomposed by the access of several of the vegetable acids, and by the
carbonic acid which exists in rain water; but, as to its chemical operations, in the form either of a carbonate, sulphate or phosphate, science has not yet reached any satisfactory conclusion. She has knocked at the door, but has gained no admission; nor even been permitted to look through the key-hole. This, however, should not discourage her importunity.

Ashes.—With respect to wood ashes, there remains no doubt of their extraordinary efficacy in promoting the growth of wheat crops. Whatever theory may be adopted, the effects are almost certain. These ashes were themselves the constituent parts of plants, and reduced to a state of extreme fineness by incineration. They may well, therefore, serve to be taken up by other plants, or may be expected to furnish some of the elements which the plants require. They likewise attract moisture from the air, and mixing with vegetable acids, it is reasonable to believe, that combining with other substances in the soil, they may prepare them likewise to become the food of plants.

The theory of their operation is of little importance compared with the facts of their efficiency. The ashes of seaweeds, what is called in Europe kelp, and in the shops the carbonate of soda, have proved of great efficiency. I am not aware that it has been used here, to any great extent; but the accounts given of its use abroad commend it most strongly. One of the best writers known, on the subject of the wheat culture, says, "that two or three pounds worth of it (he means pounds sterling) per acre, spread about two months before sowing time, would always more than repay itself. It attracts moisture from the atmosphere; it materially increases the volume of the grain, and the fineness of the sample; but does not add to the weight of the straw, though rendering it whiter and more nourishing to cattle. It causes the wheat to assume a rich, healthy appearance, and is an excellent application after a crop of potatoes or parsnips, both of which require land to be richly dressed with stable or other strong manures, and has not the effect of decomposing them, (might he not say of consuming them?) as lime does."
It is also destructive to insects, and to their eggs which lie in the soil or turf. It forces the earth-worms and wire-worms from their lurking places, to come to the surface and die, particularly when laid on in a larger quantity than I have named; some farmers being in the habit of putting on double and even treble the quantity above stated; but, I believe, without having produced proportionately larger crops from inferior land; though it has been asserted that its effect is very permanent, being especially apparent on the succeeding clover crops.*

These statements come from the very highest practical authority. Whether our farmers would think of incurring so large an expense in manuring an acre of land, as is here mentioned, is doubtful. The expediency of its application must depend altogether upon the returns obtained from it. This with us can only be settled by actual experiment. The material is easily procured, and it is hoped that trials of it, at least on a small scale, will be made.†

Green Crops for Manure.—I now pass to the enriching land by green crops ploughed in. No experiments of this kind are reported in the returns, but the practice has prevailed in many cases, with apparently great advantage. Several remarkable instances of its advantages have come within my own observation. Clover has been denominated the mother of wheat. In many places it is the practice to sow clover with all grain crops, to be ploughed in with the stubble, and grain has been repeated on this land with supposed advantage. Under such a husbandry, it has been thought that the land was placed in a course of improvement. Some things in this matter are settled, and therefore deserve the particular attention of farmers.

Clover ley, as it is termed, seems to be a better preparation for wheat than any other green crop. The roots of clover are abundant and furnish a large amount of vegetable matter to the soil. In the next place the tap-root of clover penetrates the soil deeply, and the ground is kept more loose and friable than

* Le Coteur.  † Appendix D.
with any other grass. Clover, indeed, never forms an imper-
vious sward. There may be other reasons, but they are alto-
gether matter of conjecture. If clover is to be ploughed in,
however, it is advisable that it should be done after it has been
killed by the frost, rather than while in a state of greenness
and luxuriance. I do not undertake to assign any reason for
this; but actual observation of the comparative effects of the
two methods of ploughing in the crop green, or ploughing it
in after being killed by the frost on the same field, has sat-
sfied me which is to be preferred. The superior ease with
which the crop turned in is covered by the plough after it has
fallen, is another circumstance which recommends the practice.
It is a remarkable fact, already referred to in page 64, that in
a conclusion so different from the popular opinion, two highly
intelligent farmers in the State, situated many miles from each
other, and without any intercommunication, should have
strongly coincided.* There is a strong objection to waiting
for this perfect maturing of the clover crop where winter wheat
is to be sown, because it would carry the time of sowing too far
into the autumn; but this objection does not apply to the
ploughing in of clover for spring wheat.

It is, after all, questionable whether any other crop should
be sown with the wheat. There can hardly be a doubt that two
crops of any kind on the same land abstract from each other.
With our habits of sowing not more than one and a half bush-
els of winter, and two of spring wheat, to an acre, it is not so
objectionable to sow grass seed, as if we followed the practice
of many of the English farmers and sowed three and four
bushels of wheat to an acre.

Rotation of Crops.—The change or rotation of crops, is a
subject, which among our farmers has received little attention;
but if any truth is well established in husbandry, it is that two
crops of the same kind should not be allowed to perfect their
seed in succession on the same land. It is well ascertained
that a change even of the kind of wheat sown is preferable
to no change.

* Appendix E.
The importance of a rotation of crops is explained by a recent and curious discovery in vegetation, which striking and satisfactory experiments seem to have verified. The discovery, to which I refer, is that of the celebrated botanist De Candolle, in relation to the excrementitious powers and habits of plants. Of the nutriment, which they receive and digest, they exude an inconsumable or innutritive portion by their roots. This excrementitious matter, is supposed to unfit or poison the soil for a second crop of the same kind, until it is either consumed or neutralized by cultivation. But this very matter may prove nutritious to a different kind of plants. That plants discharge by their roots an excrementitious matter of the kind referred to, careful experiments have placed beyond a doubt; and it is, in his opinion, for these reasons that one white crop should not succeed another. This matter is understood to be discharged mainly when the seed is formed; but this point is not conclusively established. It is ascertained that it takes place more by night than by day.

One consideration ought not to be lost sight of. Wheat should never follow a crop which has not been thoroughly cultivated and in the cleanest manner. For this reason it is probable that it has been found to do better after a crop of corn than after a crop of potatoes, for with but few exceptions, nothing is more slovenly among us than our cultivation of potatoes. I have seen with chagrin many crops of wheat, which otherwise might have been expected to yield abundantly, completely smothered by a profuse growth of weeds.

Selection of Seed.—I come next to speak of the selection of seed wheat. More than one hundred and fifty distinct varieties have been ascertained, but the cardinal distinctions are few, and may be summed up into the flint and the thin skinned, the bearded and the bald kinds. These seem to be original distinctions; but the matter of one kind ripening in a shorter time than another is probably the effect of selection and cultivation. A spring wheat may be changed into a winter grain; and a winter grain into a spring grain, by careful selection. How much may be accomplished in this way, is well illustra-
ted by an experiment made by the Rev. Dr. Freeman, in Dor-
chester, some years since, who, with great care in selecting the
earliest ripe for planting, actually forwarded the ripening of the
common case-knife garden bean, and obtained his crop in twenty-
seven days less than the season required for its maturity
when he began the experiment. After repeated trials he found
he could not go beyond this, and came to the conclusion there-
fore that he had reached the ultimate practicable limit.*

In respect to the selection of seed, nothing can be worse than
the habits of our farmers. In this respect, however, two far-
mers in Hawley, Franklin county, have set a laudable exam-
ple. By a selection of the best heads of wheat they could find
in their fields, and planting these seeds by themselves, they
have succeeded, after three or four years' care, in obtaining a
superior variety; and have now not only enough for their own
use, but to sell. They raise wheat now in abundance, and of
excellent quality; all the product of the careful selection of
seed wheat from superior heads, in their own fields.

Wheat differs in its season of ripening; some winter wheats
being much more forward than others, and so with summer
wheats; in the length of the heads; in the hardiness of the
plants; in liability to disease or to blight; and to the attacks of
insects; in amount of yield, some kinds being much more pro-
lific than others; and especially in the quantity and quality of
the flour yielded from the same amount of grain. In all these
respects, there are cardinal differences which materially affect
the value of the crop.† These differences can be ascertained
only by careful trial; but where these trials cannot be made
we may avail ourselves of the experiments of others, upon
whose authority we can place reliance. In most cases among
us seeds are very much mixed. Different kinds are found in
the same parcel. It would be worth a great deal of pains to
obtain a pure crop. But this can only be done by a laborious,
patient and careful selection; and the cultivation of selected
varieties, under such circumstances that they cannot mix, either
in the flower or the seed, and the best plants of these varieties.

* Appendix F.
† Appendix G.
Nothing is more emphatically to be condemned, than the planting of imperfect or blighted seed. A deterioration in the crops must inevitably take place. The blasted wheat will germinate, but it will give an inferior yield. The plant of such wheat will come up feebly, for the wheat plant, in its first germination, is nourished by the milk placed by nature in the seed, for the early sustenance of the plant until it rises to the surface and extends its coronal roots, as they are termed, in search of food. If the seed be imperfect or shrivelled, it can yield this first and indispensable nourishment only in a very imperfect degree. Experiments in relation to this matter as stated in my former report, have shown, in the most decisive manner, that no practice can be worse than that of planting imperfect seeds. The great rule in relation to animals holds perfect in its application to vegetables. If you desire to breed the best races, you must breed only from the best animals; for defects and imperfections have always a tendency to propagate themselves, and are always in a greater or less degree transmitted.*

Quantum of Seed to an Acre.—With respect to the quantity of seed to an acre, it has been already remarked, that the practice of farmers, from the reports, is to sow two bushels of spring wheat, and one and a half of winter wheat, to the acre. In this case something may depend upon the condition of the ground, and the time of sowing. If the wheat is planted early, it will have more time to tiller, that is to spread its roots and throw up shoots; but I believe that in all cases where the condition of the land will admit of it, it would be better to seed our land more liberally than we are accustomed to do. The more thickly the wheat stands upon the ground, the shorter will be the culm or stalk, and the less likely is it to become lodged and broken down.†

Whether summer or winter wheat is to be preferred, is a question on which there has been not a little disagreement of opinion. Winter wheat, when it survives the winter, yields better, produces heavier grain and better flour, but the danger of

* Appendix II.
† Appendix I.
being killed by the frost has very much discouraged the cultivation of winter wheat. The returns, however, specify several abundant crops of winter wheat, and in some towns they have prevailed. I have no doubt that, were the cultivation of winter wheat, among us, as careful as it should be, it would be as safe as any crop that we raise. It would be sometimes advisable, where winter wheat has been killed in patches upon the field, to harrow the whole field in the spring and sow spring wheat in the vacancies. It is plain, however, that from such a crop as this it would not be expedient to obtain the seed of a succeeding crop.

Depth of Sowing.—With respect to the depth of sowing, several things are to be considered. The seed requires air, moisture, heat, and the exclusion of light, in order to its germination. The wheat plant has two roots, the first what are called the seminal roots, which are thrown out from one end of the seed; and there is provided in the seed the nourishment for the throwing out of these roots and the support of the stalk until it approaches the surface; when it throws out another set of roots, denominated the coronal roots, which extend themselves laterally in search of the nourishment in the soil. If the seed be planted too deeply, it suffers for want of air and moisture, and the nourishment or milk in the seed becomes exhausted in bringing the shoot to the surface, and it comes up in a weakly state. If it is planted too shallow, the coronal roots are thrown out on top or above the ground, and often perish from drought or frost; besides, in such case the seminal roots being too near the surface, they also suffer from exposure to atmospheric influences, and the plant is imperfectly fixed in the ground. The precise depth cannot be fixed, but these things are to be taken into consideration. If it be winter wheat, it should be sown more deeply than in the spring, as in such case the plant is less likely to be thrown out by the frosts.

It is true, that at any depth at which wheat is likely to be sown, when frozen the roots would be as likely to be broken in the one case as in another; but if broken when sown deeply, they would be less exposed to the external frost than if planted
near the surface and consequently liable to be thrown entirely out. There is danger, however, of sowing too deeply, so that the seed is placed beyond the reach of the warmth of the sun and air, as without this warmth no healthy vegetation can take place. From two to three inches would be deep enough, if it were practicable accurately to reach that depth.

It is often a question, whether wheat should be ploughed in or simply harrowed. Where the crop is to be winter wheat, it is well, when the ground is prepared and the wheat sowed, to plough it in at right angles with the course of the prevalent winter winds. In this way, the seed will be thrown into the furrow, and when it comes up will be sheltered and protected in a degree from the cold.

Winter wheat, after the ground becomes dry, and especially if the soil is close and heavy, may be harrowed in the spring, even once or twice, to advantage. Some of the plants may be torn up by the operation; but I know, from repeated trials, that they will be many fewer than would generally be apprehended; and a most ample compensation will be found in the loosening of the ground about the others, and rendering it open to the admission of light, and air, and warmth.

With respect to spring wheat, it is greatly benefited by the fine tilth of the ground, so that it may extend its roots freely; and by the accession of the air, from which it may imbibe the oxygen, which it then particularly needs. This solves the secret of the success of the farmer in Lenox, in harrowing his spring wheat for several days in succession after it was sown and after it had germinated, and thus keeping the ground quite loose and open. A very intelligent and successful farmer in Sheffield, upon whose authority I place great reliance, says, that by this process wheat may be forwarded in its growth at least five days beyond what it would be if left untouched. This renders it a matter of much importance.

Ploughing for Wheat.—Questions have arisen respecting the mode of ploughing for wheat; some preferring to have the furrow shut in so that the ground may be laid completely flat; and others preferring that the furrows should be laid lap-
ping upon each other. For fall ploughing and winter wheat my opinion is, that the latter method is decidedly to be preferred. If the ploughing is well done, and the ground thoroughly harrowed, there is no more evil to be apprehended from the starting of the grass, than in cases where the furrow slices are completely shut in. But it will be seen, that by this mode of ploughing a larger extent of surface is at first exposed to the influences of the atmosphere, which are unquestionably beneficial; and, in the next place, the land will lay more lightly, be less liable to suffer from wetness, which is always extremely prejudicial to winter wheat in particular; and the land in the spring may be more finely harrowed. Whether it would be equally advisable for spring grain, which it is not expedient should be planted quite as deeply as winter wheat is not so plain. In any case, however, the ground cannot be brought into too fine tilth; and, as the plant depends mainly for its nourishment upon its coronal roots, which are thrown out near the surface, it is plain that the manure, if any is applied, should likewise be kept near the surface.

Time of Sowing.—In respect to the time of sowing, winter wheat should be got in by the middle of September, that it may be well established before winter; and spring wheat cannot be got in too early after the ground is opened and sufficiently dry for the plough. It has been said that late sown spring wheat has escaped injury from the grain insect, when early sown wheat has been destroyed by it, the flowering season of the wheat having been coincident with its appearance. This has no doubt been the case. But the risk of mildew in late sown wheat is great; and as I conceive there is a simple and almost infallible preventive of injury from the grain insect within the reach of every good farmer, the sowing of wheat should not be delayed on that account. The chances are very many against the success of late sown spring wheat. Of the preparation of the seed, I need add nothing to what has been said in speaking of smut. Excepting for this object, it is not advisable to apply any steep; but thoroughly brining the seed and coating it with quick-lime, finely powdered before
sowing, and allowing it to remain in this condition some little time before sowing, will in general prove a certain preventive of smut.

Cleanness of Cultivation.—With respect to cultivation, too much stress cannot be laid upon having the ground as clean as possible from weeds. In this matter we are grossly negligent. In several parts of the State, I have seen frequent cases in which a crop of wheat of luxuriant growth has been destroyed by weeds. This often comes from the use of green manure directly from the barn yard, which is surcharged with the chaff of the barn floor. The practice, therefore, of applying manure in that state, is to be strongly condemned. But unpleasant as the statement of the fact may be, it cannot be denied, that little of our cultivation is of that clean character which it ought to be; and it would be better in many cases to have a naked fallow than to plant after a crop which has been infested with weeds. It is idle to expect to be successful in our wheat crops under such circumstances. But there are various crops, susceptible of a perfectly clean cultivation, which might precede wheat without losing the use of the land by a fallow, if we will only do justice to the cultivation. In this respect, the carrot crop may be strongly recommended; for besides the clean and rich cultivation to which it is, to say the least, entitled, its tap root serves to divide the soil and reduce it to a fine tilth.

Draining.—Another fault in the cultivation of wheat is the neglect of draining our soils. This is done to no considerable extent among us. The least measure of superfluous moisture or what amounts to wetness, is exceedingly prejudicial to wheat. Under ground draining is scarcely practised among us; and the practice of laying our wheat land in ridges, so that the rain may immediately pass into the intervening hollows, is not at all attended to in Massachusetts. This, indeed is a poor substitute for thorough underground draining, and is attended with considerable loss of surface besides rendering the crop uneven from the accumulation of the rich mould in
the centre of the ridges. Little hope of success is to be entertained in the cultivation of winter wheat without provision against standing water upon the field; and to spring wheat it is of almost equal importance.

Deep Cultivation.—But I pass to a point more material than any other to the success of the wheat crop as the most decisive experiments in this country and abroad seem fully settled; that is, the furnishing to the wheat crop deep cultivation, dry cultivation, and a fresh soil. The earthy constituents of the soil are, under certain qualifications, of little consequence, provided there is a sufficient tenacity to retain moisture, though not to excess, which would be positively injurious; and provided likewise the soil be reduced to that friable and permeable state that the roots can fix and spread themselves freely, and light, and air, and moisture have free access. The beneficial agency of light upon vegetation after the germination of the seed has been completed, has been established in the most decisive manner; and the part performed by air and moisture is too well settled to be brought into discussion. Several plants are known whose roots never touch the ground, and whose whole dependance is upon air and moisture.* A soil composed of one simple earth, whether pure clay, or sand, or chalk, is unfavorable to vegetation, though plants will live and grow in them where they are abundantly supplied with air and moisture. The intermixture seems most favorable of sand enough to render the clay permeable, and of clay enough to be tenacious of moisture. The growth of any vegetable must depend, in a great measure, upon the amount of decayed vegetable or animal matter in the soil; and of this, undoubtedly, light, air, and moisture, are the most powerful solvents. Nothing can be taken up by the roots of the plants unless it be in a state of perfect solution, and nothing can be absorbed by the leaves or the stems of the plant unless it be in a gaseous form. The great agents of vegetation then are not the earths—though these perform their parts—but air, light, heat, and moisture.

* Appendix J
and that cultivation which renders the earth most accessible to these great agents, will beyond question prove most efficient.*

I have already stated my conviction of the propriety and expediency of a rotation of crops, on the ground of the excrementitious matter ejected by a plant being unfavorable to the successive growth of the same plant or one of the same family on the same land. This, then, is also to be kept in view.

In my former report on the cultivation of spring wheat, I expressed my opinion of the necessity of deep ploughing for wheat, and the necessity of furnishing a fresh soil for its roots. This has been fully confirmed by the experiments and success of highly intelligent and practical farmers.

Recent English Improvements.—In my first report, too, I had the pleasure of laying before the government the extraordinary benefits produced by subsoil ploughing, and gave at that time a model of Smith's subsoil plough. Since that time the success which has attended this mode of cultivation, has fully confirmed all the notions and theories which I then gave on the subject; and is effecting a revolution and an improvement in the agriculture of England as extraordinary as has ever taken place in any of the arts, and which bids fair in its effects upon the agricultural welfare of the country, to rank next to the introduction of steam into the mechanic arts.

This improvement consists, in the first place, in a thorough draining of the soil by under-ground drains, which are sunk to the depth of three feet, and then filled up with loose stone to the depth of a foot; or the drain is made with tile resembling half a circle in their shape, and laid down directly at the bottom of the ditch. After this is done, the soil is ploughed and the ploughing is followed by a subsoil plough, which loosens the lower substratum without bringing much of it to the surface. At successive times more of this lower soil is mixed with the top mould, and the cultivation is constantly deepened and the ground enriched. On such soils, after careful cultivation, the crops of wheat are in many cases actually trebled, and the value of the land is vastly increased. The philosophy of its oper-

* Appendix K.
vation is understood to be, first; the perfect draining of the land, so that no superfluous moisture remains at the roots of the plant, second; the fine tilth and division of the soil, by which the roots of the plants are enabled to fix and expand themselves: third; the access of the air and light and warmth to the soils, by which simple process even the coldest and most gravelly subsoil becomes enriched and cabable of sustaining and nourishing a healthy vegetation. The bringing up of the subsoil, and the intermixing of it with the surface mould, must be done gradually and not in too large quantities at once. These improvements are placed beyond all doubt. The experiments have been made for a course of years in the most conclusive and satisfactory manner. The most incredulous are convinced. Examinations have been made before committees of both houses of Parliament, and leave not a doubt on the subject.*

Agricultural Improvements.—There is no circumstance in the condition of Scotland or in that of Massachusetts, which would not render the same system applicable to us. Fifty bushels of wheat to an acre, weighing 62 and 64 lbs. to the bushel, are not uncommon under this system of cultivation. The proceeds of the land early defray the expenditure made in its improvement. The crop of wheat is as important to us as it is to any country. We have only to see our interest in its true light. We want only the courage to invest capital judiciously in agricultural improvements. As yet this has scarcely been done at all; but in the few cases where it has been done, even to a small extent,—the return will be admitted to have proved as productive as in any investment whatever. The day is not distant, we express the strong hope, when Massachusetts will understand her duty and her interest; and for bread, the great and first necessary of life, will not rest satisfied under a precarious and exhausting dependence upon a foreign supply. The great objection likely to be made to the cultivation here proposed, is in the labor and expense required to render our lands thus productive. This objection may arise from timi-

* Appendix I.
dity or miscalculation, or want of calculation; but much often-
er from indolence and deficiency of enterprise, which are always barriers to the progress of any useful art, agriculture as much as any other, and to any distinguished improvement. Liberal returns can be obtained only from liberal cultivation. The traveller might, with equal reason, expect that his horse, without attention, and provender, without being carefully curried, and seasonably fed, and kindly lodged, would perform a long and laborious journey well, as the farmer to see his fields waving with luxuriant crops, and returning their golden harvest into his lap without cultivation, and cleaning, and draining, and enriching.

I should be among the last persons to recommend to the farmers any lavish expenditure of time or money in the improvement of their lands, without a prospect of remuneration. But I can say in truth, that in my various explorations in different sections of the State, I have not yet found a single well conducted instance of improvement or redemption of land, which has not given an ample return; and in instances without number it has happened that not only has the whole expense of the improvement been repaid by the first or the two first crops, but the land itself has been increased ten fold in value, estimating its value by its prospective returns for years to come. In all enterprises of permanent improvement of the land, the simple questions to be asked are, will the enterprise or project prove effectual? is it the best that can be undertaken? will it remunerate the expense? will it be profitable? Now there is scarcely a farm in Massachusetts, where improvements may not be made, and even at a heavy expense, in which every one of these questions would not be answered emphatically in the affirmative. Many a farmer in the State, who is careful to invest his moderate earnings of a few hundred dollars in bank stock or in private notes, where, making no allowance for the various risks incidental to all such operations, the most that he can expect is a return of six per cent. interest, by a prudent and judicious investment of the same in the redemption of his
peat-bogs and low meadows, or the general improvement of his arable lands, would often obtain a return of four times that amount in their increased and improved production.

I should regret, in this case, to be misunderstood. Agricultural improvements may be divided into two classes, productive and unproductive. With respect to the latter class, such as the erection of buildings beyond the absolute needs of the farmer, and of expensive and ornamental fences, where a plainer and much cheaper erection would serve every purpose of enclosure and protection, or any work of embellishment, they are only eligible under peculiar circumstances. They may add substantially to the intrinsic value of the farm, and be strongly commended where the rights of primogeniture and entail prevailed, and the estate was likely to remain in the same family through successive generations; yet in the moderate circumstances in which most of our farmers are placed, and under the rapid changes of property, which are continually going on among us, they can hardly be advised. On the other hand, where the means are ample, we hardly know a better appropriation of money, within reasonable limits, than to the purposes of rural embellishment; or one more gratifying to a cultivated and refined mind. But with respect to improvements, which may be denominated productive, the propriety and expediency of making such, resolve themselves entirely into a question of pecuniary profit or loss. In this matter, then, the Massachusetts farmers have an important lesson to learn. They have seldom, and in very infrequent instances, regarded agriculture as a proper subject for the investment of capital; but their great object has been to keep down their agricultural expenditures to the lowest scale. There are, indeed, some honorable exceptions. In my first report,* I referred to a case of this sort, remarkable for the boldness and success of the enterprise, and especially as having been undertaken by a poor man, who had to rely upon the credit of his industry and perseverance for the

* First Report of the Agriculture of Massachusetts, p. 79.
means of accomplishing it. At that time the work was in progress. It has since been completed, and I shall subjoin in the appendix a detailed statement of its course and accomplishment.* It cannot fail to be read with great interest and instruction, as showing what great obstacles spirit and perseverance can overcome; and with what confidence, under the guidance of sound judgment, even a comparatively large amount of capital may be applied to agricultural improvements.

I am, in conclusion, satisfied, that Massachusetts is capable of producing her own bread; and of producing it to advantage. I do not say that this can be done under our present imperfect and stilted modes of cultivation. I do not pretend that it is to be accomplished without labor, and capital, and time, and skill.

Agricultural improvements usually proceed at a slow pace; and farmers are proverbially among the slowest in the community to change their habits or practices. I do not look forward to wheat being raised among us beyond our own domestic wants, although, to those, who wait a quarter of a century, such a fact may not be surprising. I do not consider the wheat plant, as upon the whole, in all its uses and results, to be placed before Indian corn. But, under good and liberal cultivation, it will be found to succeed as often as most crops. Its great value is not a matter to be questioned; and it ought to have its place in a systematic rotation of crops. Indian corn, indeed, has proved an excellent crop to precede wheat; and where an early kind is cultivated, it may be ripened and harvested, so as to afford an early sowing of a wheat crop, where it is desired to cultivate a winter variety. The advantage of Indian corn as preceding wheat, lies to a considerable extent in the cleanliness of its cultivation, as there are few crops grown among us, where in general the weeds are more thoroughly subdued, than in a well cultivated field of Indian corn.

But the wheat crop may be made a safe and most valuable crop among us. With the exception of those influences and dangers, which no human sagacity or power can control, there

* Appendix M
is no peculiar impediment, none certainly which is insurmountable, to its cultivation. It does not oftener fail than a crop of rye. With the proper choice of soil, the careful selection and preparation of seed, the due preparation of the land, so as perfectly to drain it, to reduce it to a fine tilth, to have it well manured for the previous crop, and then deeply turned, without bringing the sub-soil suddenly to the surface; and by the addition of lime, where lime abounds, to clayey soils, or in a caustic state to land too abundant with crude or acid vegetable matter; and especially by a liberal application of wood ashes, there can scarcely remain a doubt, that the best of wheat may be raised among us at a fair agricultural profit, and to an extent to supply in a great measure our domestic wants. It is easy to see at a glance, that such a result would prove an immense gain to our comforts, to our pecuniary condition; and to our political and moral welfare.

Note.—It will be seen, upon examination, that there are several points in relation to the wheat crop, which, in the foregoing discussion, I have not touched, and others upon which I have remarked cursorily and slightly. The apology for this will be found in the fact, that, at the time of the passage of the law ordering a bounty upon wheat, I submitted by order of the Senate a full report on the cultivation of spring wheat, which was published and widely distributed; and I have deemed it proper, as far as I could do so, to avoid a repetition of the remarks then given.
REPORT

ON THE

CULTURE OF SILK.

I. History of the Silk Culture in the United States.—
The production of silk in this country has been repeatedly brought before the public; and presented in various forms as a subject of general interest to the agricultural community. When the state of Georgia was settled, silk and wine were recommended as particular objects of culture. In Virginia measures were taken as early as 1663 to encourage the general production of silk; and the failure to plant mulberry trees at the rate of ten for every hundred acres, was made by the laws a penal offence. In 1760, the society in London for the encouragement of arts, manufactures, and commerce, offered liberal premiums for the production of silk in Georgia, Pennsylvania, and Connecticut. "The society propose to give for every pound weight of cocoons produced in the Province of Connecticut in the year 1759, of an hard, weighty, and good substance, wherein one worm only has spun, three pence; for every pound weight of cocoons of a weaker, lighter, spotted, or bruised quality, though only one worm has spun in them, two pence; for every pound of cocoons, produced in the same year, wherein two worms are interwoven, one penny. These premiums will be paid on condition that a public filature be established in Connecticut, and that each person bring his or her balls to such public filature." This invitation, says Jared Eliot, in his remarkable essays on Field Husbandry in New England, is
not to a business to which we are wholly strangers; it is not to an empty, airy, and nutried project; for there has been something of this manufactory carried on for sundry years, and by a number of our people in divers of our towns by which we are assured that it is practicable.* As early as 1747, the governor of Connecticut, Mr. Law, wore the first coat and stockings made of New England silk; and in 1750, his daughter wore the first silk gown of domestic production.

In an almanac of Nathaniel Ames, for the year 1769, it seems the subject had been matter of much public discussion, and "a gentleman, whom posterity will bless, deposited one hundred dollars in the hands of the selectmen of Boston; forty dollars to be given to the person, who in the year 1771, shall have raised the greatest quantity of mulberry trees; thirty dollars to him that shall have the next greatest number; twenty to the next; and ten to the next; certificate being produced from a justice of the peace of the number, and that they belong to Massachusetts Bay." It is added that, "Justinian, the emperor, looking upon it as a great hardship that his subjects should buy the manufacture of the Persians at so dear a rate as a pound of gold for a pound of silk, dispatched two monks into India to discover and learn how the silk trade was managed there; and to bring a quantity of those insects from whom he was informed the silk was produced, when they brought at a second voyage, great quantity of silk worms' eggs." This writer adds, "It is but of late years that the Europeans fell into the way of cultivating any quantity of raw silk. The Italians led the way; and they have been followed with great success by the French; and the advantages thereof to these nations are amazing, as they supply Great Britain with raw silk for the thousands of spinners and weavers constantly employed in Spitalfields. It being certain that raw silk is plentifully raised in much more northern climates than this, we have a most promising prospect of one day turning the constant

* p. 129.
course of prodigious sums of money from Spain, France, and Italy into America."

It is further stated by Eliot, in 1762, "that by a late account from Georgia, it appears that the silk manufactory is in a flourishing way. In the year 1757, the weight of silk balls received at the filature, was only 1,050; last year produced 7,040, and this year already about 10,000; and it is very remarkable that the raw silk exported from Georgia, sells at London from two to three shillings a pound more than that from any other part of the world."* It is stated by president Stiles, that in 1762 Georgia exported to London 15,000 lbs. cocoons, deemed sufficient to make 1500 lbs. of silk.

Other remarks of Eliot, considering the time when he wrote, are particularly deserving of attention. He commends especially the cultivation of silk to the northern colonies, "who are destitute of any staple commodity by which they could make an immediate and direct return to England, for such goods as we want, and must always want, more abundantly than we have means at present by which we can refund. This seems to be the state of Georgia, Pennsylvania, and Connecticut."
The cultivation of the great staple of cotton was not pursued then to any extent in the southern states.

He goes on to say that, "those among us, who raise silk, say, that it is more profitable than other ordinary business. Some years past, I asked a man of good faith and credit, who had then made the most silk of any among us, what profit might be made of it. His reply was that he could make a yard of silk as cheap as he could make a yard of linen cloth of eight run to the pound. A woman of experience in this business told me, that, in the short time of feeding the worm and winding the silk balls, she could earn enough to hire a good spinner the whole year. I have not the least scruple of the informer's veracity, but how far their capacity might serve for an exact calculation, I know not."

"We labor under such difficulties to make returns for goods

imported, that many have thought it would be best that we should make our own clothes; and by this means lessen our importation, which indeed would be better than to run into an endless and irrecoverable debt; but there is now a way opened by which, if we are not wanting to ourselves, we may not only continue but increase our importation, for if the same cost, labor, and time, which we expend in making one yard of cloth, if laid out in raising silk will procure two yards of the same sort of cloth, and manufactured by more skillful hands, it is easy to see which is the most eligible method."

In 1772, as appears from the manuscript journal of president Stiles of Yale College, his family engaged, to some extent, in the culture of silk, and their production was sent to England to be manufactured, a sample of which cloth, presenting a singularly beautiful fabric, together with the journal itself, is now in my possession.

About the year 1770, a filature was established in Philadelphia, and it is a remarkable fact that from the 25th of June to the 15th of August 1771, 2,300 pounds of cocoons were brought to the filature to be reeled, or were bought by the managers. These came from Pennsylvania, New Jersey, and Delaware.*

About the year 1760, the culture of silk was introduced into Mansfield, Conn., and some of the neighboring towns. It has been pursued ever since that time, to a small extent, in several other places in New England; but it cannot be said to have maintained its foothold in any other situation than in Mansfield. In other places, where it planted itself with every favorable prospect of success, it presently expired. In Mansfield, Conn., it has continued to be pursued to the present time. The largest amount of raw reeled silk reported to have been produced in any one year in Mansfield, as was stated to me in that town, has been about seven thousand pounds. In general, however, it has not exceeded three thousand pounds per year. The inhabitants of Mansfield have been wholly dependent upon

* Hazard's Register of Pennsylvania, p. 64.
the white mulberry for feed for their worms; and a large proportion of these were destroyed by the severe winter of 1834–5. The silk culture became again strongly the subject of public attention in 1826. Congress encouraged it, by the publication and distribution of large editions of manuals and treatises, prepared with great care and fullness, and giving all the directions and details necessary to the prosecution of the business, from the raising of the trees, to the preparation of the article for use. The vast amounts of money annually sent abroad for the purchase of this article of universal use and almost of necessity, the increasing use of the article among all classes of people, and to an extent probably not known in any other country; and, at the same time, the acknowledged capacity of the country to produce silk, and of the best quality, gave new prominence to the subject in the community, and drew the public attention to it with an intense interest; but with no greater interest than in an economical view, in the opinion of many intelligent men, its national importance may justly claim.

In 1830, the introduction of a new plant into the country,* which promised from its extraordinary capacity of rapid multiplication, and its productiveness of foliage, to furnish superior advantages for the prosecution of the silk culture, gave a new impulse to the cause, and aroused public enthusiasm to a high degree of fervor. The disappointment occasioned by the almost universal destruction of these plants by the frosts, produced a revulsion in public feeling; and the progress of the silk culture was again arrested and set back in a strong ebb.

It does not fall within my province to detail more particularly the history of events in relation to this subject. The introduction of this extraordinary variety of the mulberry, the Morus Multicaulis or many stalked mulberry, or, as I think it should be called after the name of the spirited individual who brought it into Europe, the Perottet mulberry, led to the introduction of other valuable varieties. About this time the erection of a cocoonery at Northampton, in Massachusetts, of ex-

* The Perottet mulberry, or Morus Multicaulis.
traordinary dimensions and expense, and the reiterated and extravagant calculations of profit, which were to follow from the culture of silk, continually given to the public in the most imposing forms, and the establishment of societies in all parts of the country, with large capitals for this object, kept the curiosity and interest of the public constantly upon the stretch. The announced introduction of varieties of the mulberry, of such hardihood as to brave the severity of our climate, and especially the adoption of a plan for taking up the tender varieties and resetting them, or laying them down in the spring; and the practicableness in this way of obtaining in the same season from trees thus managed, an ample supply of food for the worms, seemed to give strong assurance that the bright hopes which had been indulged on this subject, were at least, in some degree, on the point of being realized.

In the year 1838, a new chapter in the history of the silk culture was to be unfolded. There is little reason to doubt, that, at this time, a conspiracy or combination of some principal individuals, deeply interested in the Multicaulis in the United States, was formed, in order to force the sales of this tree at high prices. By every species of finesse, and by the grossest impositions, the public pulse was quickened to a rapidity and intensity of circulation almost unparalleled in the history of the excitements of the human mind. The selling of spurious seed, the disposal of trees under false names, the selling for Multicaulis that which did not even belong to the species of the mulberry, and especially the villany, for it deserves no milder name, and should shut out its perpetrators from all community with honest men, of getting up extensive auction sales of Multicaulis trees, which were purely fictitious, and this with no other view than that of fraudulent wholesale imposition upon the public, present facts in the history of our community equally remarkable and disgraceful. They are instructive monuments to mark the extremes to which, under the influence of an unbridled avarice, the cunning of some men will proceed, and the credulity of others may be led. In these circumstances the public attention was directed exclusively to the growing of
trees. The production of silk did not enter into the calculation. Thousands and thousands of acres were planted with the Perot-tet mulberry; and immense importations of these trees have been made from foreign countries.

By the caprices and fluctuations incident to all human affairs, and by no means unexpected in a case of such violent and extravagant speculation, as that of which I have been speaking, it has happened that the ebb has gone down in proportion to the elevation of the flood. This speculation is at an end; and though all the growers and speculators in Morus Multicaulis from Florida to Maine should pump at the bellows together, they are much more likely to blow out the last embers that remain on the hearth, than to fan them into a flame. It is feared that in too many cases the exposure of the speculation, as it was termed, would present only humiliating examples of fraud and credulity; and it would be an invidious and ungrateful task to rake open the ashes for the sake of seeing the burnt bones and carcases of those, who have perished in the flames. The Multicaulis is no longer in quick demand, and may be purchased at a price far below its actual and intrinsic value. The tree having ceased to be an object of speculation, it is now hoped that public attention will be directed to the production of silk. The best trees of the best descriptions being obtainable, even by persons of the most limited means, it becomes matter of important inquiry, whether, to what extent, and under what circumstances, the silk culture may be conducted and encouraged as a profitable branch of agriculture.

II. Patronage of the State.—The State having in this matter offered the most liberal bounties,* it is on this, as well as many other accounts, a subject, which, in my official relations to the State, demands my particular attention. This has induced me to visit all the principal parts of the State, where silk has been cultivated; and as well as possible to possess myself of the best information which I could obtain from practical and experienced men.

* For Laws of the State, see Appendix N.
The amount of silk produced in the State, and the amount of bounty paid under the law awarding a premium on its production, are given in the subjoined tables, showing also the largest amount of silk and of cocoons produced by any one individual in each year.

Amount of Silk and Cocoons, produced in Massachusetts, and bounty on the same; as obtained from the office of the Secretary of the State.

<table>
<thead>
<tr>
<th>Year</th>
<th>Largest quantity</th>
<th>Lbs. Silk</th>
<th>Lbs. Cocoons</th>
<th>Amt. Bounty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>By one person.</td>
<td>By one person.</td>
<td>lbs. oz.</td>
<td>lbs. oz.</td>
</tr>
<tr>
<td>1836</td>
<td>9 lbs. Silk</td>
<td>296 lbs. Cocoons</td>
<td>36 10</td>
<td>613 02</td>
</tr>
<tr>
<td>1837</td>
<td>32 lbs.</td>
<td>210 lbs. Cocoons</td>
<td>109 01</td>
<td>1,001 03</td>
</tr>
<tr>
<td>1838</td>
<td>39 lbs.</td>
<td>311 lbs. Cocoons</td>
<td>184 01</td>
<td>1,254 15</td>
</tr>
<tr>
<td>1839</td>
<td>52 lbs.</td>
<td>615 lbs. Cocoons</td>
<td>190 06</td>
<td>2,031 00</td>
</tr>
<tr>
<td>1840</td>
<td>19 lbs.</td>
<td>235 lbs. Cocoons</td>
<td>15 00</td>
<td>270 00</td>
</tr>
<tr>
<td></td>
<td>Lbs. 757 3</td>
<td>Lbs. 11,990 1</td>
<td>$1,378 34</td>
<td></td>
</tr>
</tbody>
</table>

III. Mulberry Trees. Varieties.—In the silk culture it is perfectly obvious that the tree is matter of primary consideration. There are several varieties of the mulberry, on which the worms can be subsisted and made to produce silk, but the trees are of very different values.

1. The Black Mulberry, which is indeed a native of some parts of the country, is of different varieties, and will produce silk though not equally well; but the silk made from worms fed upon this tree is harsh and coarse. The tree will endure our climate well, but for the reasons above given, it is not an eligible variety.

2. The White Mulberry is not indigenous in the country; and was imported into Europe centuries ago from Asia, but it has now been for years so widely extended, that it is as familiar as any of our native trees. It is universally conceded that
the leaves of the white mulberry are as favorable to the health and growth of the worms, and to the production of silk, both in respect to quantity and quality, as any which is known. The white mulberry is comparatively a hardy tree, though in severe winters it is generally killed at the extremities of the smaller branches; and in the cold winter of 1834–5, when a great amount of the tender varieties of the apple were destroyed, the white mulberry suffered as severely as other trees. At this time nearly two thirds of the white mulberry growing in Mansfield, Conn., and, even trees of an advanced age, were utterly destroyed.

Among the white mulberry trees valuable selections in respect to the size of the leaf may be made with great advantage. Its thriftiness, like that of other plants, depends upon its cultivation, and it is susceptible of great improvement by a careful engrafting of scions from the best kinds, into others of the same species. This mode of improvement has been long practised by European cultivators, and with great success. Among the French, engrafting is considered indispensable.

3. The Boussia mulberry is a variety introduced into the country from Smyrna and Constantinople, and propagated without difficulty from the seed. The leaf of this tree is not larger than that of the white mulberry. Its foliage is very thickly set on the branches; and the leaves are thick and heavy, as well as abundant. They are healthy for the worms. They produce a good silk. They endure the climate of New England without injury. I have not seen trees of this kind of any large size; but those, which I have seen, threw up very numerous branches from the root, and yielded a large amount of foliage.

4. The Alpine denotes another variety, which has been greatly commended. The designation of this variety, if it is to be called a variety, belongs to this country. Samuel Whitmarsh, of Northampton, who has been prominent in his enterprising attempts to introduce the culture of silk into the United States, in 1834, visited Italy and France for the purpose of obtaining from the fountain head, and in the most authentic
form, the desired information in regard to the silk culture. In visiting in Italy the neighborhood of the Alps, he found there a species of the mulberry, said to have been introduced into that country from China, and called the Chinese mulberry, which was in high repute among the silk growers, and which had proved capable of enduring without injury the rigors of a climate as severe at least as that of New England. He brought a considerable quantity of the seeds to this country, and they have been extensively diffused. It is understood that, from the product of these seeds, he has made abundant selections, which he denominates the Alpine, by which name these trees are now generally known. The results from the planting of this seed have not everywhere given equal satisfaction, and many contend that they are not superior to the white mulberry. It is not for me to become a party in these disputes. There is little reason to suppose that the trees now called Alpine are an original variety. The leaf is of a large size, generally heart-shaped, but many of them with deep indentures or lobed. They endure the winter well. Of their influence upon the health of the worms, and of the quality of the silk, which they produce, I have as yet, no satisfactory information. I have not been able to hear of any exact experiment in the use of them; excepting a small one, to which I shall presently refer.

5. The Perottet Mulberry, or the Morus Multicaulis, that is, the many stalked mulberry, denotes another variety of which I have already spoken, and of such pre-eminent notoriety, that it is destined to be immortalized in the history of commercial transactions, if not of agriculture. This tree was brought from Manilla to France by M. Perottet, in the year 1820; and to this country more than ten years since. It is remarkable for its rapidity of growth and the shoots which it throws up; and from this circumstance derives its name. Its leaf is plainly distinguishable from other kinds of mulberry leaf. It is heart-shaped, and has a flaccid, loose, and on its upper side a concave appearance, looking as if the ribs of the leaf were not sufficiently spread to allow of the surface to be
stretched to its full extent, which gives it the appearance of dried clothes before they are ironed. It hangs vertically upon the plant, and to an inexperienced eye, would appear like a leaf in which the circulation had been arrested. I have seen silk of the finest description made from worms fed upon the leaves of this tree. This silk would not suffer by comparison with any other. The worms devour the leaves of this tree greedily, and as far as it has been tried here, it seems favorable to their health and growth. The leaf often acquires a large size, though the foliage would naturally be larger while the tree is small, and formed upon recently grown wood, than it would be if the tree were allowed to form a standard tree, and should attain several years' growth. The great advantages, which are relied upon in respect to this tree, are in the rapidity of its growth, the ease with which it can be multiplied, the abundance of its foliage, and the great facility with which the leaves may be gathered.

This tree has been so much the subject of speculation, that it has become matter of no little difficulty to determine what is true in respect to it. Individuals, under the influence of private interest, have indulged in calculations respecting it, so extravagant, that all sobriety seems at once distanced, and we are transported into the upper regions of pure fiction. The extraordinary value of the tree, however, is unquestionable; and the introduction of it into the country, must be considered a distinguished benefaction; but that it is the best tree for the cultivators of silk in New England, is not so well established.

The tree does not appear to be used, certainly it is not preferred, in China. A gentleman in the vicinity of Boston, who had been himself a resident in Canton for many years, and who could command the services and influence of the most intelligent and influential merchants of that city, ordered two thousand of the most valuable tree used in the country, to be shipped to him. Five hundred of these survived the passage; but the Multicaulis is not among them. The American missionaries, who have sent to this country seeds of the best mul-
berry which they could procure, did not, it is understood, find the Multicaulis in use in China for the production of silk. The proximity of Manilla, where this tree was found, to Canton, and the constant intercommunication between the two places, would long since have caused the introduction of this tree into China, had it been preferred; but it is understood to have been carried from Canton to Manilla. It is valued, but certainly is not preferred in Italy; nor in Germany, where the silk culture, which was given up about half a century since, is now reviving and strongly urged upon the people on the same grounds of public and private economy, on which it is advocated here.

I take the liberty of subjoining, on this subject, an extract from the private journal of a highly intelligent friend, entirely disinterested in the case, who with his family, have recently returned from Europe, and who made the silk culture matter of particular but merely incidental inquiry.

"When visiting the botanic garden, at Montpelier, Professor De Lisle gave us his decided opinion against the Morus Multicaulis as food for the silk worm. One of his reasons was that the leaves, in comparison with those of the French mulberry, are thin and weak, and will not bear a single day's wilting without becoming dry and crisp, and unfit for the worm. Although the Multicaulis is prolific, and the leaves are large, still it produces less in weight than the common French, which bears a red or black fruit, grows freely at Montpelier, sending up straight shoots even from old trees that have been topped down, as they generally are there. Of course the leaves are easily gathered by a sweep of the hand along the branches, an object of importance there, and still more so where labor is dear.

"The professor's reasons for condemning the Multicaulis is more important there than elsewhere, because the leaves when gathered are sold by the pound to the worm feeders; and a leaf which lasts good only one day is objectionable. The tender character of the tree too, is an objection at Montpelier, because
though the climate is milder than in the northern parts of France, the sudden changes from heat to cold in the early spring are too severe; whilst further north the leaves start late and suffer less in consequence. If the Morus Multicaulis suffers thus at Montpelier, how much more objectionable would it be in our climate that is so liable to these changes."

I will add in this place a quotation from a private letter from France to a commercial house in Philadelphia of the highest respectability, received last autumn:

"The mulberry tree, known by the name of Morus Multicaulis, which has been shipped from France to the United States in a very large quantity, and sold there to farmers throughout the country by speculators as the best species, is considered by the French and the Italians as the very worst; and it is now grown only to sell, not to cultivate, at the request of these crazy American speculators. There is no demand whatever for this tree to plant in Europe. It is throwing both money and time away to attempt the Morus Multicaulis."

The Chevalier Soulange Bodin, one of the highest authorities in Europe, in a recent private letter, speaks of the "Morus Multicaulis as a tree of which much good and much evil has been said; but like other gifts from heaven it is requisite that it should be managed with discretion, which is also a gift from heaven. The rapidity of its multiplication, the abundant product of its leaves, and the facility of collecting them, have certainly very much contributed, whatever may be the final result, to aid in the happy solution of a great question in agricultural and commercial economy, which has agitated with equal emulation the new as well as the ancient world."

These testimonies are certainly disinterested; and I shall leave them to have what force they may upon the minds of the inquisitive and intelligent. It is certain that the tree is not capable of enduring the rigors of our climate, under our present modes of cultivation. In this state it has been repeatedly killed, and in this way great losses have been sustained. I do not despair, however, of its being acclimated here. The peach
in its origin, is a tender plant from southern Asia; and as that is now sufficiently sure to warrant its cultivation, we may hope that the Perottet mulberry may in like manner become a denizen of our soil. The plant is, in itself, after all reasonable abatements are made, of such extraordinary value that every inquiry and effort should be made, by which its security might be accomplished.

The hazard of its destruction is not in proportion to the intensity of the cold. The season of greatest danger seems to be at the first coming of frosts. Then if the growth is luxuriant and the wood has not become matured, it perishes with the cold. Attempts have been made to preserve it by cutting the shoots near the ground in the autumn, and then covering the root with earth; this has not succeeded to secure them. Yet there are well authenticated cases in which the trees have been taken up, and then deposited under a wall with the roots merely covered with earth, and they have survived the winter well. This was done in Manchester, Conn. On the same farm, an attempt was made by cutting off the shoots and leaving the roots in the ground without covering, to test their hardiness. It was unsuccessful. The farmer attributed their loss in a degree, to a heavy rain immediately after they were topped, by which he supposed the cut ends became saturated with water which was followed by a severe frost. The fact of their destruction was undoubted.

John Macomber, in Westport, Bristol County, whose nursery I visited, reports, that in the cold year of 1835-6, about one half of his Perottet mulberry survived the winter; and of those which were engrafted upon the white mulberry, not more than eight out of a hundred perished.

William Kenrick, of Newton, near Boston, whose experience and skill, as a nursery man, are well known, in a recent private letter to me, says, "I have several trees of the Morus Multicaulis, standing on Nonantum Hill, in an elevated and bleak situation, trees now of considerable size, which, unprotected, have borne well the severity of our late winters. In
March, of this present year, two gentlemen of Windham County, Conn., called and desired to look at my trees, and brought me in a twig cut from the top of one of the trees, which had ripened to the very tip, and had stood the last most severe cold winter uninjured. Yet I have since discovered that in some parts of the tops of these same trees, some of the young wood did not wholly escape uninjured. Yet in all the low valleys of the northern rivers which have their sources near the boundaries of Canada, and in the low and extended plains of New England, the Multicaulis is liable to be injured in its tops by the extreme severity of the winter. In spring they rise up with a luxuriance of vegetation the most extraordinary. Hence the mulberry should be kept low like plantation of raspberries, as is the case in China and in India. In this last named country, the mulberry tree in all its varieties is an ever-green tree, but a deciduous tree in temperate regions. This same system is now extending itself in France, as has already the system of close planting and of low training, been adopted almost universally as to the vine in vineyard culture, in all the north and middle sections of that country."

Mr. Kenrick adds, "In my frequent visits to Portsmouth in lower Virginia, in lat. 37° 12', in the years 1838 and 1839, both during winter and summer, I have particularly observed extensive plantations; the trees at that place, in their hardihood, bearing perfect resemblance to the oak, the wood of the second year ripening to the very tip. At Middletown, in Monmouth County, N. J., lat. 40° 22', this same mulberry equally defies the severity of all their winters. This is nearly opposite Staten Island."

"The Morus Multicaulis is the only species of mulberry known which grows equally as freely from the cuttings as the willow. The variety called Canton roots not near so freely either from cuttings or from layers, while the Alpine, so called, is still more difficult to strike root, either from cuttings or layers."

Mr. Kenrick has been a highly successful cultivator and
seller of the Perottet mulberry. His character, where he is known, is a guaranty against any intentional misrepresentation on his part. His good fortune in the sale of his trees has enabled him, if so he pleases, to change the plain steel bows of his spectacles into golden ones; but whether it has had any effect upon the glasses themselves, we must submit to the judgment of others.

The Northampton cultivators, as far as I know, universally, and Timothy Smith, of Amherst—upon whose careful judgment and experience much reliance may be placed, as well as Calvin Haskell, of Harvard, who has been a long time engaged in the cultivation of the mulberry—unite emphatically, in the opinion that the Perottet is not sufficiently hardy for our climate; and that to cultivate it with any view to leave it exposed to the rigors of our climate would be a hazardous, and in all probability an utterly futile attempt. The testimony of many other cultivators of the Perottet mulberry, in this State, entirely concur in the opinions expressed above.

With respect to the value of the Multicaulis leaf as feed for the worms, D. McLean, of New Jersey, expresses the opinion that it may be too succulent for the health of the worms; though it does not appear that the worms fed by him on the Multicaulis or Perottet mulberry suffered in this way. This is the opinion of other cultivators of silk; but farther experiments are desired before this point can be established.

Miss Gertrud Rapp, of Economy, Penn., in a letter to the editor of the American Silk Journal, says:

"In regard to the mulberry, I would earnestly recommend, especially to the silk growers of the northern and middle states not to neglect the cultivation of the white Italian or a similar mulberry tree, as by raising the Multicaulis only, the best crops (which are produced in the fore part of the summer,) are lost. The Multicaulis is a most excellent addition to, but not a perfect substitute for, the other kinds. They ought to go together. Several years ago, we received among others a kind of mulberry under the double name of morus broussa or expansa.
which we now endeavor to multiply (by grafting) as fast as possible, as it possesses all the excellent qualities of the Italian, besides having large, heavy, glossy leaves, which are gathered with less than half the labor of the white Italian. Such silk growers as possess this kind, would undoubtedly do well to propagate it as fast as possible along with the Multicaulis." Miss Rapp's authority on this subject is as high as any in the country. The morus broussa and the morus expansa, or Roman mulberry, which have come under my observation, are quite different varieties.

Among us in general, the Perottet mulberry has been cultivated in low, moist, and rich soils, in which case the growth is continued until very late in the season, and the wood is not sufficiently matured to withstand the frost. If placed, however, in situations less favorable to a luxuriant growth, and to the thriftiness of the tree, the size of the leaf and amount of foliage will of course be lessened.

It is somewhat difficult, in respect to the hardiness of this plant to reconcile these conflicting testimonies, and I shall not attempt to do it. Without impugning, in any measure, the credit of any, however different the results to which they come, we may refer these different results to differences in aspect, soil, location, and cultivation; and encourage the hope that presently the tree may become naturalized and safe among us.

The weight of evidence, however, upon as fair a review of the case as I can take, and from my own extended personal observation, is altogether against its suitableness at present in a permanent plantation for the climate of Massachusetts. I shall speak presently of other modes of managing with it, by which the signal advantages which it proffers may be realized.

6. The Morus Expansa or Roman Mulberry is another plant which has been introduced among us, producing a large leaf, and of a hardy character. I have not known the leaf used in any instance for feeding worms, unless the case of Miss Rapp before referred to, is one; and though I have seen a
good many trees of this kind, yet they have all been subject to a decay or sort of gangrene in the bark, which, unless a permanent remedy can be discovered, will effectually discourage their cultivation.

It does not comport with my particular objects to treat at large of the various kinds of mulberry known; but only of those grown among ourselves, and upon whose culture and use for the feeding of worms experiments have been made.

7. The Canton Mulberry is that which I shall next speak of. This is an admirable plant. The history of the introduction of this tree into the country I am enabled to give in the most authentic form. D. Stebbins, of Northampton, the intelligent and active secretary of the Hampshire, Hampden, and Franklin Agricultural Society, and ready to lend his service to any and every good work, desired some of the American missionaries to China, to procure some seed of the best tree cultivated in that empire for the feeding of worms. They transmitted parcels of this seed at two or three different times, from which this tree has been grown. In another case, John P. Cushing, of Watertown, a long time resident in Canton, ordered a shipment to be made to him from Canton of two thousand of the best tree for feeding worms, known in that country. Of this importation, five hundred only survived the voyage. These have been carefully nourished; and with a liberality and public spirit, which has distinguished all Mr. Cushing's efforts to advance the cause of an improved agriculture, he has distributed these plants among his friends and others, and the tree has become extensively diffused. This tree produces a large, heavy, and beautiful leaf. I measured one among many equally large upon the same tree, which was thirteen inches in length by twelve and a half in width. Perhaps, in general, they are not so large as the Perottet mulberry, but they are in this respect little inferior; and, in proportion to their size, they are considerably heavier. An acre of the Canton mulberry would undoubtedly produce a greater weight of foliage than of the Perottet. They are a tender
tree but more hardy than the Perottet; and they may be propagated with about the same facility. There is little doubt that this tree may be acclimated among us; and it will then prove the most valuable tree, as yet known in the State, for the culture of silk.

Dr. Stebbins, who has entered largely into the cultivation of this tree, passes very high encomiums upon its merits. He writes me, under date of 9th November last, "I have preserved the foliage of the large leaf Canton in preference to the Perottet, having thought that leaf best adapted to the feed of worms, for by experiments of the present year, the result has been as 5 to 8 in favor of the Canton feed." This result was obtained by weighing in accurate scales the cocoons made from each kind of leaf. He adds, "that of the cocoons obtained by feeding upon the Canton exclusively, and the white mulberry exclusively, those from the Canton leaf were one third heavier than the other." Another person from Ohio writes to him, "that the produce of the Canton by the acre is twice as much as that of the Multicaulis."

These are strong encomiums; but I believe not undeserved, from what in regard to the cultivation of the tree has come under my own observation. I might add other testimonies in favor of the Canton; among others that of Edwin Newbury—a very exact observer and cultivator of Brooklyn, Conn.; and that of Timothy Smith, of Amherst, Mass., both of whom, from repeated experiments, give their decided preference to the Canton mulberry over all others.

Many persons are inclined to believe that the Canton is not more hardy than the Perottet; Mr. Smith's experience leads to a different conclusion. I have also the pleasure to add here the actual experience of D. Haggerston, of Watertown, the farm manager of J. P. Cushing; and on whose knowledge and skill in the management of these plants as much reliance can be placed as on those of any man in the country. His testimony likewise must be regarded as entirely disinterested.

He states, that with him the Perottet mulberry has been
killed three winters out of five, root and branch; and two winters to the ground. The Canton trees on the same lot, with the same exposure, have stood the winter, having been killed not below a foot from the ground. He adds, likewise, that of some Canton, which were taken up the last fall, and the roots only covered, in other respects exposed to the weather, all are now (March, 1840,) wholly uninjured. The Canton trees, which were not covered have come out better than those which had some covering thrown over them, besides having their roots buried. Of the trees referred to in the first case, two hundred of the Canton were left exposed and about twelve of the Perottet. Some of the Canton referred to were from seed imported from Canton; the remainder were part of the original importation of trees, of which I have before spoken. Upon weighing twenty leaves of the Canton and twenty of the Perottet, taken as nearly alike as possible, the difference in favor of the Canton was nearly an ounce. The Canton is as easily propagated as the Perottet; and as a plant nothing can be more beautiful. The leaf is large, lustrous, heart-shaped, and serrated; it is not pendant like the Perottet, and is not so thickly set on the tree as the Broussa.

In this discussion, however, having no private interests or partialities, I have nothing to keep back; and I must add, therefore, that there are some cultivators, who still deem it as tender as the Perottet. This may be accounted for, perhaps, in its particular location, if it be placed in a humid and rich soil, and in a situation liable to early frosts. The climate from which it comes is far north of that from which the Perottet is derived. Though from my own observation, and the numerous testimonies given me in the case, I cannot doubt its superior hardiness to the Perottet; yet it is not as yet to be regarded as acclimated; and it would be rash to expose any large plantation of the trees to the rigors of winter, until the habits of the plant are better understood.

The singular fact stated by Mr. Haggerston, that those Canton trees, whose tops were left uncovered, suffered more than
those whose roots and branches were both covered, is in a degree confirmed by a statement of Mr. Stebbins. "The last winter," he says, "I left out about half an acre of Canton roots, of some of which I covered the stumps with turf, grass under; others, with yard manure; others, with earth; others, with a little grass, hay, or leaves; and others had no covering; and these last were the best preserved; and the next, those with the slightest covering; and those with the deepest covering were most injured; and some entirely destroyed by heat."

The extraordinary and luxuriant growth of which these trees are susceptible under favorable circumstances, is illustrated by a fact communicated from the missionaries at the Sandwich islands in the Pacific ocean. "To show how fast trees grow here," the writer of the letter, to whom some Canton seed had been sent from this country, says, "a tree came up in my garden on the 9th of April. At the end of four months, measuring all the branches, it had grown 87 feet and had 533 leaves. At the end of six months, it had grown 153 feet, and had 939 leaves. It has now (9 January) been growing 9 months and 21 days; and has grown 461 feet and is now growing at the rate of two feet per day, which at the same rate would give 601 feet of wood to the year; has two main stalks from the ground; one is 5\(\frac{3}{4}\) inches in circumference; and the other 5\(\frac{1}{2}\). The greatest height is now 15\(\frac{1}{4}\) feet."

8. Sharpe's Variety.—I will in this place speak of a variety of the mulberry, which promises to afford what is much desired in Massachusetts; that is, a large leaf, suitable for the feed of the worms, and which also will endure the rigors of our winter. This is a tree which originated from seed imported from Canton and planted in Belchertown, Mass., ten years since. The original tree stood by the road side. The extraordinary character of the tree attracted the notice of Elias Sharpe, of Chaplin, Conn., who by budding and engrafting has considerably multiplied its product; and it is now designated as Sharpe's new variety. It produces a large and heavy leaf, heart-shaped—at least those which I have seen—and
strong; and is relished by the worms. The tree is nearly of an average size with the Multicaulis. Its growth is most luxuriant, where I have seen it engrafted into the stocks of the white mulberry, many of the upright shoots the last autumn measuring from nine to eleven feet, and the side shoots six and seven feet in length. This was the growth of the summer. The tree, from the testimony of the original proprietors, though standing in a most exposed location, has never suffered from the winter; and within my own knowledge the last autumn, after a frost which destroyed the Perottet mulberry to the ground, the shoots of this tree were uninjured even at the very points or tips. The specimens of reeled silk and of cocoons, which have been produced from the foliage of this variety, have been excellent. This tree appears to be an accidental variety; and should the expectations which have been formed of it be to any considerable degree realized, it will prove an acquisition of the most eminent importance and value to New England. It has been propagated hitherto only by budding or engrafting; and the plants, which I saw at Chaplin, in Conn., had been engrafted into stocks of the white mulberry three or four years old.*

IV. Mode of Managing and Cultivating the Improved Varieties.—It will be proper in this place that I should speak of a mode of management both in respect to the Perottet and the Canton, by which the caprices and rigors of the seasons may be defied. This consists in taking up these trees in the autumn and burying the roots in sand in the cellar for the winter; or in burying the roots and covering the branches, or indeed without covering the branches, burying the roots in some part of the field where they grow, where they will not be liable to be flooded with water, and especially to the alternations of freezing and thawing. For this purpose, a rough board shed would be highly useful. In the spring, the trees may be replanted. Thus the branches or shoots may be cut off, the root set out, and the branches laid down, in which case every bud may be

* Appendix O.
expected to send up a shoot; or the whole tree may be laid down in the spring. The plants will then form a kind of hedge, and a crop of foliage will be easily obtained for the feeding of the worms in that season. Until the foliage is ready for the worms, however, the hatching of the eggs must be kept back by a process which I shall hereafter describe. In this way a good crop of silk may be obtained, as I have seen in several instances, in the same season.

The idea of extraordinary trouble attending this process at once creates apprehension and objections. But the trouble is not beyond what the occasion will fully warrant. If the plants stand in a line, a plough in the autumn may easily be passed along near to them, and they may be pulled out by the roots, and covered in the field as I have described. In the ensuing spring a furrow may be opened, and the trees laid down root and branch in the furrow, and covered. The covering must be done lightly at first, and after the buds have started, a little more covering must be given to them; and for this extra labor, which will not indeed be much more than harvesting and planting and manuring an acre of Indian corn, there will be found a compensation in the great facility of gathering leaves from this low hedge of trees, instead of being obliged to climb a large standard tree. Indeed a child in this case would be able to gather as much foliage in an hour, especially as the young wood is flexible and can be bent by the hand so as to be stripped with facility, as a man would gather in six hours from a standard tree. If it shall appear upon further experiment, that the roots can be safely left in the ground, and the shoots taken off and secured in the cellar in the autumn, the advantages of such management may be preferred; but if otherwise, the removal and resetting of the shrub annually, need not be declined on account of the labor attending it. The experiment has been repeatedly and successfully made, and at the rate of fifty pounds of silk to the acre of the very best quality, as I have seen, have been obtained from the foliage of the Perottet mulberry, planted or laid down in the same sea-
son. This is a degree of despatch and facility in the production of silk highly encouraging. I will remark here likewise, that the roots of these trees, set out in the spring, have produced foliage much earlier than has been obtained from roots, whose shoots were cut off in the fall, and they left in the ground, in those cases where they have survived the winter. In the management above spoken of, the intervals between the rows may be three to four feet, and the trees when laid down in the furrow may be placed so that the top of one may extend to the root of the other; or perhaps it may be more proper to say that they may be laid at full length in the furrows in close succession. Under such circumstances, we may avail ourselves with great advantage of these extraordinarily valuable mulberries, both the Canton and the Perottet. The Canton may be propagated as the Perottet, by layers and cuttings; and the seed is procured without difficulty. The seed of the Perottet, which is a hybrid plant, is not to be depended upon to produce its like. Calvin Haskell, of Harvard, Mass., who has an experience of several years both in the growing of trees and the production and manufacture of silk, had two plants of the Perottet mulberry from among the first, which were brought into the country. From the seed of one of these trees, he has produced trees, which give a leaf not so large as the parent tree, but of large size, abundant, and excellent for the feeding of worms. These Multicaulis seedlings, as he denominates them, after being housed the first winter, endure the climate, are easily propagated, and yield abundantly. I shall give in the appendix some extracts of Mr. Haskell’s letter, fully explaining his management.*

From the best information that I can obtain, the Perottet mulberry can be expected to become acclimated only by growing it in high and dry situations, by avoiding to force its growth with too liberal manuring, and especially by preventing any water settling upon its roots. It is not safe to expose any seedling mulberries, certainly those of the tender varieties,

* Appendix P.
to the cold of the first winter. There are few, even of the hardy kinds, which are not likely to suffer by such exposure.

Private interests have been, and are still so much mixed up with the subject of mulberry trees, that great differences of opinion may be expected to exist. Without having the interest of one cent in any mulberry speculation whatever, I have endeavored to collect the most authentic information which I could obtain on the subject; and in cases where what I have stated has not been verified by my own personal observation, I have relied upon persons in whose credibility I know that I can place confidence.

V. Mulberries from Seed.—In attempts to produce mulberry trees from seed, severe disappointments have been often experienced. New varieties are often produced; but inferior plants likewise often show themselves. G. B. Perry, of Bradford, in an excellent essay on the culture of the mulberry, given in the Essex Agricultural Transactions for 1839-40, expresses an opinion that this may often arise from sowing improper seed, or the seed of inferior plants; and in a German treatise on the silk culture, which I have recently received, a caution is given not to sow seed from plants whose leaves have been stripped for feeding the same year. These are reasonable and valuable suggestions.

As far then as the trees are concerned, the farmers of Massachusetts have within their reach the best varieties yet known. These may be propagated with perfect ease and to an indefinite extent. It would be desirable even to increase these varieties; and for every farmer engaged in the culture of silk to cultivate some of the earlier kinds as well as the later, that he may begin the feeding of worms early, or that in case his eggs should prematurely be hatched, he may have a supply of food at hand before it can be expected to be obtained from the tender varieties. This is recommended by the experience of Miss Rapp, already referred to, as well as of many others.

It is not within my province to give a full treatise on the
VI. Amount of Silk to an Acre, and Cost of Production.—Questions of great importance come up here, respecting the amount of silk which may be produced upon an acre of ground, and the cost of production at the rates of labor existing among us. On these subjects conjectures abound; and calculations respecting the amount to be obtained so enormous and extravagant, that they are much better suited to form a chapter in the Arabian Nights' entertainment, than to enter into the thoughts of any sound mind. Conjectures, however, in matters of this kind, are not what we want; and it does not belong to me to present them to the farmers of Massachusetts. I have to lament, however, that few exact experiments in this case have been made in the country; and that many points, the decision of which, in my opinion, is more likely to have a favorable than an unfavorable influence upon the silk culture, remain to be determined. In my intercourse with the agricultural community, the mortifying conviction is continually forced upon me, of the very small number of persons, upon whose authority any strong reliance can be placed for that exactness of observation, which constitutes the first element of all true science, and all useful and practical information. It is said that in the map of the world in use among the Chinese, and to which they go to study geography, the empire of China occupies about two thirds of the whole surface. Too many of our farmers in their sketches of their own domains, and their own operations, are too prone to measure things by this Chinese scale. I shall have the pleasure, however, of referring to some authorities entitled to entire respect and confidence, to the extent to which they go.

1. Timothy Smith, of Amherst, who has had considerable experience in the production of silk, says in a letter to me, "I consider that one acre of white mulberry, set in hedge rows,
will yield foliage for fifty pounds of silk; and presume to say that an acre of Multicaulis (Perottet,) will yield double the quantity to an acre of white. I consider that reeled silk cost me about two dollars per pound, not over; although it was a year of experiments; but feel confident that in two or three years, by using the best kinds of mulberry and the better economy, that silk can be made for one and a half dollar per pound."

In subsequent letter, Mr. Smith remarks, "I consider the Multicaulis the most tender variety of any that I have cultivated. I consider the Canton as my best mulberry tree for raising silk, taking into consideration the hardihood of the tree, and the quantity of foliage it yields. I like the Italian white; and think it best to cultivate some of each variety."

I understand Mr. Smith here to estimate, in the cost of the silk, the value of the labor only; and to charge nothing for the use of the land and the cost and care of the trees; nor any rent for his cocoonery. These items would add something to the cost of the silk, but it is not easy to calculate them, from the imperfect elements which are given. It will be seen in this case, that although Mr. Smith has had some experience in the production of silk, yet that his statements are somewhat conjectural. In his supposition, likewise, that he could obtain one hundred pounds of silk from an acre, planted with the Perottet mulberry, and that he hoped to reduce the cost of the production of reeled silk to one dollar and a half per lb., a little allowance is perhaps to be made for the quickness of pulse, which in that time of excitement was felt by every cultivator of mulberry trees in his visions of the profits of the Multicaulis.

2. The next approach to the actual cost of the production, is presented by James Deane, M. D. of Greenfield, Mass. His admirable letter to me on the subject, I shall give in the appendix.* He estimates the cost of producing reeled silk at from two to two dollars and a quarter per pound. He produced the last year several pounds of silk of as fine a description as could be

* Appendix Q.
made. When he undertook the culture of silk, he had never seen a silk-worm nor a silk reel. He constructed a reel admirable for its simplicity and efficiency, of which I shall give an engraving; and his operations from the beginning to the end were crowned with perfect success. This demonstrates the great simplicity andfeasibleness of the operation. Dr. Deane is so remarkable for his carefulness, that his statements, where statements are given, may be implicitly relied on. The cost of producing the silk, however, is with him rather a matter of estimate or judgment, than of a careful observation of every minute charge; and, like Mr. Smith's, embraces only the labor applied.

3. The next authority to which I refer, is, that of D. V. McLean, of Freehold, Monm. Co., New Jersey. No experiment has been given to the country so numerous in its details and instructive in its results, as this. From the time employed and the wages paid for the production of twelve pounds of silk, he comes to the conclusion, that raw silk may be produced and reeled at the rate of two dollars to two dollars and one quarter per pound, though he admits, that "his cost him much more than this." This likewise is to be understood as the cost of the labor only applied to the production of the silk from the eggs; and without any allowance for land, trees, or cost or rent of cocoonery.

4. In Mansfield, Connecticut, it is customary with those who have trees, to furnish the eggs, to board the woman employed in the process, and to allow her half the produce in silk. She performs all the work, from the hatching of the worms to the reeling of the silk. The board of a woman in this case is estimated at one and a half dollar per week. I have no means of ascertaining how many worms a woman would be able to manage. The general estimate is, that one woman will feed 60,000 worms. It has been stated to me, that in one instance, one woman took the care of 120,000 worms; but I am unable to obtain the particulars of the case; and to learn whether she had any aid in picking the leaves or not. In the commence-
ment of the feeding, the time of one woman would not be occupied entirely by an amount of worms, which at the close of the feeding season would require her whole and exclusive attention. Various circumstances, likewise, must come into the account; such, for example, as the facilities for feeding the worms; whether the leaves are to be gathered from high standard trees or from shrubs; and whether they are to be plucked from the white mulberry or the improved varieties. In the improved cocooneries small cars fixed upon a rail-road are used to convey the leaves from one end of the room to the other; and at a great saving of labor and time. The use of hurdles, likewise, so as to facilitate the cleaning of the worms, will serve to lessen the labor. Practice and experience, as in all other cases, may be expected to bring with them their usual advantages. Under these circumstances, it is not easy to determine how large a family of these industrious and hungry operatives may be placed under the stewardship of one person. In Mr. Smith's operations, two women were occupied about five weeks in feeding the worms for the production of about twenty pounds of silk; but how long was required for the reeling is not stated. They received three dollars each per week, and board, which must be rated at one dollar and a half each per week. In Mr. McLean's experience, the labor of two women and a man twelve weeks each, would be required to attend upon one acre or 160,000 worms; and he estimates their expenses, including board, at three dollars per week each. These wages might be deemed ample for a woman's labor, but it is not more than half of the cost of man's labor in Massachusetts. Mr. McLean's cocoonery, which I had the pleasure of visiting, combines many advantages of construction; and his foliage was gathered from the Perottet mulberry, planted the same spring, and growing luxuriantly directly in the vicinity. His experiment, however, though conducted in a manner creditable to his remarkable intelligence and public spirit, cannot be said to determine in a satisfactory manner the cost of production; though I think it fully decides the question at the present prices of raw silk
and of sewings, in favor of the profitableness of the culture, within reasonable limits; and at a fair value of land, labor, and trees. Any very great increase of production must of course be followed by a reduction of price.

5. Calculations made by John Fitch, of Mansfield, Connecticut, are as follows. I have not the pleasure of a personal knowledge of Mr. Fitch; but his reputation is a guarantee for the correctness of his statement. It is, as will appear, somewhat matter of judgment, but, I presume, founded upon experience.

One acre of full grown trees, set one and half rod apart, will produce forty pounds of silk.

The labor may be estimated as follows.

For the three first weeks after the worms are hatched, one woman who is acquainted with the business; or children, who would be equal to such a person.

For the next twelve or fourteen days, five hands, or what would be equal to five, if performed by children. In this period, two men with other help would be employed to better advantage, than all women and children. This period finishes the worms.

For picking off the balls, and reeling the silk, it will require about the same amount of labor, for the same length of time, as the last mentioned period, which may all be performed by women and children. The aforesaid labor and board may be estimated at eighty dollars; spinning the silk at thirty-four dollars; forty pounds of silk at the lowest cash price, is now worth two hundred dollars, which makes the following result:

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 lbs. of Silk at $5 per lb.</td>
<td>$200 00</td>
</tr>
<tr>
<td>Labor and Board</td>
<td>$80</td>
</tr>
<tr>
<td>Spinning</td>
<td>34 114 00</td>
</tr>
<tr>
<td><strong>Net profit per acre</strong></td>
<td><strong>$64 00</strong></td>
</tr>
</tbody>
</table>

The principal part of the labor may be performed by women and children; but where the business is carried on to a
considerable extent, it is considered more profitable to employ some men for the last period of the worms."

This account of Mr. Fitch, it will be seen, makes no allow-
ance for any capital invested in trees, land, or buildings; or for expenses which the care of the trees, land and buildings may require; and it refers only to the use of the white mulber-
ry as standard trees.

6. The calculation of an intelligent silk-grower at Manchester, Connecticut, and who is a cultivator of the Perottet mulberry, is as follows. He estimates the value of the trees at 25 cents each, and he requires three thousand to stock an acre.

<table>
<thead>
<tr>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Of trees for an acre,</td>
</tr>
<tr>
<td>Value of Land,</td>
</tr>
<tr>
<td>Capital invested,</td>
</tr>
<tr>
<td>Interest on $50</td>
</tr>
<tr>
<td>Labor in picking leaves</td>
</tr>
<tr>
<td>Labor of feeding worms, and reeling silk,</td>
</tr>
<tr>
<td>Extra manure for land</td>
</tr>
<tr>
<td>Return</td>
</tr>
</tbody>
</table>

| 50 lbs. of Silk at $5 per lb.              | 250 00  |
| Deduct charges                            | 146 00  |
|                                           | $104 00 |

The labor here is undoubtedly underrated. The number of trees upon an acre, 3,000 is also underrated, unless upon the presumption that these trees are counted before they are laid down; if laid down in a furrow they would be multiplied many times. In Mr. McLean's case, there were 5,500 trees upon a quarter of an acre, or, 22,000 upon an acre. The price of silk, is in a considerable degree, capricious. The quantity pro-
duced upon an acre is matter of fair calculation. I do not rely
with much confidence upon this statement; but I give this example for the sake of showing how difficult it is, even with observing men, to arrive at any certain result.

7. T. W. Shepard, of Northampton, fed worms to an amount not known, but supposed from 75,000 to 100,000. Commenced feeding about the middle of August; and the worms wound in about five weeks. The worms were of the two crop kind. About 2,150 lbs. of leaves were picked from small Alpine and white mulberry trees; all the leaves were stripped off with many of the small branches; and owing to the lateness of the season, many leaves were very rusty. All the labor of picking leaves, tending the worms, and preparing bushes for winding, was performed by one man in five weeks, except paying a boy three dollars for picking leaves; and the first two weeks, the man was not engaged more than half the time. The cocoons measured twelve bushels; one bushel was saved for seed; and the remainder reeled by a young girl, totally ignorant of the business, having never reeled an ounce before. The amount of silk reeled was eight pounds. Under the most favorable aspect, the cost in this case, cannot be considered less than three dollars per lb. for labor only.

VII. Product of an Acre.—Of the yield to an acre, the most various calculations have been made. I should deem myself poorly occupied to go into the extravagances of some persons whose brains on this subject seem to have been turned, if in truth they had any brains to be turned; and should, in the present condition of the silk culture, deem it safe to rely only upon what has actually been accomplished.

Joseph Conant, of Mansfield, Connecticut, trained to the culture of silk from his childhood, and upon whose intelligent and calm judgment, I should place much reliance, says, that an acre of land may be expected to produce from thirty to fifty pounds of silk. D. V. McLean obtained at the rate of 48 lbs.; or, allowing for waste and accident, at the rate of 50 lbs. to the acre. He adds, that he should utterly despair of obtaining 104 or 128 lbs. to an acre. Mr. McLean's product, under the circumstances of the case, may be regarded as a medium pro-
duct; but how much more may be obtained it would be idle to state, until some exact experiments have determined this important point. I have before me various calculations of 100 lbs. 150 lbs. 167 lbs. 185 lbs. 333 lbs. 616 lbs., to an acre; but I have little sympathy in the hallucinations of those minds which prefer moonlight to clear sunshine. Fifty pounds of silk to an acre then affords the only safe basis on which at present we may make our calculations as to the profit of the business.

VIII. Quantity of Leaves to a Pound.—There are some other points connected with the culture of silk, to which it seems proper to refer. In all cases of this nature, well established facts are what we mainly seek after. When I speak of well established facts, it will be understood that I do not estimate testimony merely by the number of witnesses; for with respect to agricultural matters, as in other matters, a large portion of mankind in what they state only echo the sentiments of others, and they perhaps persons not very competent to teach; and are like parrots, who can utter only what they have heard others say.

It is often stated that one hundred pounds of leaves will feed worms which will make 1 lb. of silk. Aaron Clapp, of Hartford, states, that 80 lbs. of the Perottet mulberry leaves will do it, and this is asserted by many others. I do not learn from Mr. Clapp's conversation or his book, that this result has been reached by actual trial; but like the boy, who had learnt his multiplication table, when asked if he had been through his arithmetic, replied that he had been so far as to see through. The problem, however, has, perhaps been more nearly solved by some others, and to their authority we shall defer.

Ralph Storrs, of Mansfield, Connecticut, states, that it requires 200 lbs. of the white mulberry leaves for one pound of silk. Joseph Conant of the same place, says, from 100 to 120 lbs. of leaves will make one pound of silk. I cannot reconcile the difference in the testimony of these two gentlemen, both of whom are experienced in the silk culture; but by supposing that they have never made an exact measurement in the case; or that the
former in the weight of leaves included the weight of small branches or twigs, which were collected with the leaves.

I have, however, two testimonies, which rest upon exact measurement. Mr. McLean says, that the whole number of worms fed upon his quarter of an acre was 40,000. The weight of leaves consumed, 2,576 lbs. Amount of cocoons produced, 130 lbs., weighed just as taken from the shelves, without sorting or flossing. After they were sorted and flossed there was 1 lb. of floss and 4 lbs. defective cocoons, leaving 126 lbs. of cocoons. These produced 12 lbs. of merchantable reeled silk, 16 oz. to the lb., and 1 lb. wastage, ends, &c. From the above statement it will be seen, that it required between 19 and 20 lbs. of leaves to make 1 lb. of cocoons. Of these cocoons, without flossing or sorting, it required 10 lbs. and 10 oz. to make 1 lb. of reeled silk. After they were flossed and sorted, it required 10 lbs. and 5 oz., or about 214 to 215 lbs. of leaves, to make 1 lb. of reeled silk. These were the leaves of the Perottet mulberry. After making various allowances for waste leaves, Mr. McLean thinks it may require 190 lbs. of leaves to make 1 lb. of silk. The first statement is the result of an actual trial; the latter is matter of opinion.

Mr. Shepard, of Northampton, in an experiment made by himself, the last summer, found that it required 240 lbs. leaves and twigs of the Alpine and white mulberry to 1 lb. of silk. He adds, that had all the leaves been free from stem and rust, probably 200 lbs. would have been an ample supply for a pound of silk. These are the statements of a gentleman of perfect credibility, and the result of exact experiment. They are to be disproved only by more full, more exact, and repeated trials.

To his account Mr. McLean adds; "last year I produced at the rate of 510 lbs. of cocoons to the acre; this year I produced at the rate of 520 lbs.; and my deliberate opinion is, that more will fall below this standard than will exceed it; and in one case, where a less quantity of leaves will give the above quantity of silk, two cases will occur that will require a greater."
The exactness, caution, and frankness of this gentleman are worthy of all praise.*

IX. Varieties of the Worm.—Of the worms used for the production of silk, there are several varieties; some distinguished by the shorter or longer time in which they perform their work and pass the period of their existence; and others for the quality of the silk made from them. The sulphur cocoon makes a coarser thread than some other varieties. The six weeks worm will yield the most silk. The three weeks worms can be made to produce two crops, if they are carefully managed; if not particularly attended to they will require four weeks in which to complete their winding. The mammoth white require four weeks; and make two-thirds as much each time as the six weeks worm. A new and beautiful variety, forming, from its being depressed in the middle, what is called the pea-nut cocoon, has been much approved, both from the beauty of the silk produced from it as well as from the little waste to which it is liable in winding, it running off in reeling almost without leaving any thing.

X. Quantity of Cocoons for one Pound of Silk.—Of the number of cocoons required to weigh a pound, or the number required to produce a pound of silk, very different statements have been made. Cocoons are measured in Mansfield, Conn., by the bushel. The measures are evened, or as sometimes termed, struck, and four quarts additional are allowed to each bushel thus measured. The weight of a bushel of cocoons will vary from seven to nine pounds. The quantity of silk to be obtained from a bushel of cocoons will depend on the quality of the cocoons. The weight of cocoons will be affected by the time which has elapsed after the stifling of the moth or chrysalis.

With Mr. Smith, of Amherst, one bushel of pea-nut cocoons gave one and a half pound of reeled silk. Of the sulphur co-

* Appendix S.
coons, one bushel produced one pound of reeled silk. This shows an extraordinary difference. Mr. Haskell, of Harvard, requires ten to twelve pounds of cocoons to make one pound of silk. With Mr. McLean it required 10 lbs. 10 oz. of cocoons without flossing or sorting, and 10 lbs. 5 oz. after they were flossed or sorted, to produce a pound of reeled silk. He found likewise, that it required 19 to 20 lbs. of leaves to make 1 lb. of cocoons. With Mr. Shepard 13 bushels of cocoons produced 9 lbs. of silk. In Mansfield it is considered a fair task for a girl to pick 60 lbs. of leaves per day; this, it is understood, is from standard trees. From trees in a hedge row, or accessible from the ground, a very much larger amount can be gathered.

XI. Natural and Artificial Management.—We may yet expect great improvements in the culture of silk. The method of culture to which I have referred is denominated the natural method. In Mansfield the fixtures are of the most simple character. A rough shed or barn is used for a cocoonery; and no provision is made for artificial heat beyond the closing of the window shutters in damp weather. It has been said that electricity will sometimes destroy the worms. Mr. McLean informed me that a heavy thunder storm occurred during his feeding, and the lightning struck in the immediate neighborhood of his cocoonery, but his worms experienced no injury. In Mansfield the worms are ordinarily cleaned three times in the course of feeding, and are fed three times a day. The Mansfieldians are of opinion that a cold is more favorable to the production of silk than a warm season.

By what is called the artificial process, pursued with extraordinary success at the experimental farm in France, under the direction of M. Camille de Beauvais and with the patronage of the government, the whole operation is much abridged in respect to time, and the quantity of silk produced from the same number of worms is considerably increased. The plan is to keep up an even temperature in the cocoonery as high as 75° Fahrenheit, and to feed the worms day and night to the full extent which they can be made to consume. I shall sub-
join to this report a table most ingeniously drawn up, in which every step in the process is minutely and clearly detailed. This, in my opinion, will be almost invaluable to the cultivator of silk, as condensing in a small compass, the most important and useful information.*

The Messrs. Cheney, of Burlington, New Jersey, have experimented upon this artificial process, the last year, with success. The worms completed their winding in twenty-four days; and they have strong hopes to reduce the time required to twenty-two days. It is stated that, in proportion to the shortness of the time occupied in conducting the worm to maturity through the various stages, by incessant care, and the most liberal feeding, the quantity of silk is increased and its quality improved.†

In the German pamphlet to which I have referred, it is stated that "by this mode of management, M. Beauvais has obtained from every half ounce of eggs, sixty-eight pounds of cocoons, whilst, in the south of France, they commonly obtained only twenty-five pounds, and in the north of Germany, with proper care, from forty to forty-five pounds." By this method, they can bring four generations of silk worms to spin in one year, and so have four silk harvests.

These are certainly great points to be attained. Such refinements in the cultivation, and so much pains-taking, may, by some, be regarded as discouraging; but they involve no mystery, and the extraordinary advantages to be obtained promise an ample compensation for much expense and labor. How far they may be suited to what may be strictly called household arrangements, or where the silk culture is pursued altogether as an incidental or subsidiary branch of husbandry, is a matter of easy calculation, and which any one may determine for himself.

XII. Provision for Winding Cocoons.—For the use of the worms in the winding of their cocoons, various arrangements have been made. In some cases, strips of lathes raised upon

* Appendix T.  † Appendix U.
a board, leaving about an inch space between them and the board, and placed at proper distances apart, have been adopted; in some, small branches of rye straw, tied near the middle and spread at each end so as to form a shape like an hour-glass and forced between the shelves so as to spread the ends, have been much approved. Mr. McLean preferred oak branches, and Mr. Deane hemlock branches laid for the worms, as being a more natural resort for them, and occasioning little loss of silk in removing the cocoons. Benjamin Benson of Smyrna, Delaware, was kind enough to show me an invention for winding the cocoons, simple in its construction, and which is exceedingly well contrived. The subjoined is his description of it.

"Take two strips of board equal in length to the hurdle on which the worms are, and four inches wide; nail common plastering laths on the edge of these boards; the laths must be just as long as the hurdles are wide—to be one and a half or two inches apart; nail a lath at each end of the top edge of the boards; cut common wrapping paper into strips one and a half inch wide, and sufficiently long, and hang them over each lath about two inches apart, until the whole frame is filled; take waste paper or muslin, or any other material that will suit, and paste over the top, and on the laths and paper, which serves to darken the inside and secure the strips of paper; drive a small peg in your spinning frame at each bottom corner, which will bring the spinning frame near the top of the hurdle; when the worms wish to spin, slide in the frame upon the hurdle." I am doubtful whether this description will make the matter plain; but to me, the machine itself, if so it may be called, seemed extremely well designed and adapted to its objects.

XIII. Improved Cocooneries.—The same person has invented what he calls a revolving hurdle bottom, of which I have seen only a model. This is designed, by means of an apron or cloth performing an endless revolution to accomplish with
great facility the cleaning of the litter of the worms, and at the same time serving to ventilate them. This is adapted to perform in a few minutes the labor of hours under the old system.

Its utility, from trial, has been certified by the most respectable references. As well as I could judge from the model exhibited, it offers a great improvement in the management of the worms. It is difficult to describe machinery of this nature so as to be perfectly intelligible; but Mr. Benson has promised me a model of his revolving hurdle and other ingenious apparatus, which I shall take pains, as well as I can, to exhibit hereafter to the farmers of Massachusetts. They seem to me well deserving of their attention.

XIV. Mode of Delaying the Hatching of the Eggs.—In attempts to raise worms upon the leaves of the improved varieties, such as the Canton or the Perottet mulberry, and from trees planted or "layered" the same season in which the foliage is expected to be used, as in Mr. McLean's experiment, it will be important to keep back the hatching of the eggs until the leaves are ready for use. This has been a matter of no little difficulty. In Mr. Cheney's case, he speaks of having kept them in a refrigerator, an article of furniture well known. Mr. McLean's method of keeping them is well described by himself.

"My eggs were saved with great care from my best cocoons on muslin, the pieces of muslin rolled up in the fall or soon after the eggs were laid, and placed in a common farm bag, and this was hung to a beam in the cellar. In March, the muslins were folded up; and laid one on top of another in a small tea chest lined with lead, this was placed in another of the same kind, but a little larger; and the space between the two was filled with pulverized charcoal. Then a few thicknesses of old flannel were laid loosely over the top of the smaller chest, and a loose board over the larger. Then the whole was set in a still larger rough box with a loose board on the top, and this was put down in the ice house, so that the ice surrounded the sides of the box. In the inner tea chest was a
The thermometer; the box was examined every week; and the mercury was not allowed to rise above 45° Fahrenheit. The above plan succeeded with me to perfection; the last hatching, on the 27th of August, was as perfect as the first."

The same method was adopted with like success by a gentleman at Bristol, Pennsylvania, who informed me that he kept his eggs perfectly until September. I have known severe disappointments and losses experienced by bringing the eggs too suddenly from the cellar or ice house to a high temperature. The transition must be gradual or it may be fatal to the worms. In some cases the hatching has been commenced before the eggs were transferred to the ice house. This of course would be fatal. The eggs are hatched at a temperature of 82° to 86° Fahrenheit.

XV. Destruction of the Moth.—To destroy the chrysalis or moth various modes have been tried. The exposure to a hot sun will generally kill them, though this mode is not always certain. Baking them in an oven after the bread has been drawn, is sometimes done, though the silk is liable to be injured in such case by an excess of heat. I have known the moths destroyed by the steam of boiling water. In this case the cocoons are put into a sieve and covered with a cloth, and held a short time over the steam of boiling water; after which they must be dried. Putting them in a tin vessel and plunging them into a vessel of water heated to 202° Fahrenheit, will be found a convenient and effectual mode. Gertrud Rapp, of Economy, Penn., who, as much as any one, is in this case entitled to speak with authority, prescribes another method.

In a letter dated in February of this year, to G. B. Smith of Baltimore, the editor of the American Silk Journal, a gentleman entitled to the highest praise for the intelligence, perseverance, and public spirit, with which for several years he has urged the introduction of the silk culture into the country, Miss Rapp says; "Since we are killing our cocoons with camphor, we find them as easy to reel, at any time after the regular season, as
when freshly taken from the spinning shelves. We do it as follows; for 100 lbs. of cocoons in the floss, we take a well made box large enough to hold them; then we take about three ounces of camphor, which we moisten with as much alcohol as is necessary to rub it into a powder, a part of which we sprinkle on the bottom of the box. Then we fill the box by making five or six layers of the cocoons, and spread a proportional part of the camphor between each of them; then we screw on the lid and paste strips of paper on all the splits and joints to make it air tight. After three or four days we take them out and dry them in the shade, until perfectly light. They must be assorted before camphoring, or else the bad cocoons will spoil the good ones."

It would be desirable, if possible, to reel the cocoon immediately after the winding is finished, without the trouble of killing the chrysalis; but this, where any considerable amount is produced, cannot be always done; and a mode therefore of killing the moth without injuring the reeling of the silk, like that recommended by Miss Rapp, deserves consideration.

I have spoken of the high authority of this lady in what pertains to the silk culture. No individual in the country has probably done so much; and, in what she has done, has done so well. I have a vest pattern of black silk velvet, and as many as ten different patterns of wide silk ribbons, the material and the manufacture the produce of her own labor and skill, which for their texture, lustre, coloring and finish, would not suffer in comparison with the best foreign fabrics of the same description. I have great pleasure in paying this deserved tribute to distinguished industry and enterprise, much too rare not to be admired, in this most useful art.

XVI. REELING AND REELS.—The reeling of silk is not a difficult but a very nice operation. The objection to American silk has been in the imperfection or faults of the reeling. The perfection of reeled silk consists mainly in the evenness of the fibre. To effect this requires not only care but judgment. The worm
in forming his cocoon, pours out the viscid matter from which the silk is made from his nose, and this becomes hardened in the air. At its first coming out it is in its largest form, and becomes gradually more attenuated as the worm becomes exhausted. The filament or thread from a cocoon is from 750 to 1150 feet long. Whatever number of cocoons are taken, to form a thread, it will be larger at first than it would be afterwards unless care and judgment are used in uniting additional cocoons as the original fibre diminishes in size, in order to keep up the evenness and equality of the thread throughout. In doing this as it should be done, and in carefully uniting the filaments when by any accident they become broken, or are run off, consists the perfection of the art of reeling.

Various reels have been invented for the purpose of executing this work. I have seen three only in operation. The Piedmontese reel is universally admitted to combine simplicity of form with excellence of execution. Adam Brooks, of Scituate, Mass., has invented an ingenious reel by which the reeling and spinning are performed by one operation. It has much merit; but is liable to the objections, which usually apply to machines, which attempt too much. In performing two operations it does neither of them so well, as if only one were undertaken at once. The third reel to which I refer, is one made by James Deane, M. D., of Greenfield, of which I have already spoken. It is beautiful from its simplicity and the perfect manner in which it executes its work; and it is likewise recommended by the smallness of its cost. We must not, however, expect to find any machine so complete as not to require a vigilant and intelligent superintendence. Even the human hand, that most perfect of all machines, can very poorly discharge its office without the light of the eye and the guidance of the judgment.

XVII. Domestic Industry.—Mrs. Brooks, who claims some share in the Scituate reel, to which I have referred, has distinguished herself for her zeal and success in the culture of silk, in which for ten years she has been more or less engaged. She mer-
its most justly a part of that brilliant eulogium, which the author of the book of proverbs has pronounced upon a good woman. I do not say that she has not just claims to the whole; but it is not within my province to adjust that account. "She layeth her hands to the spindle; her hands hold the distaff. She maketh herself covering of tapestry; and her clothing is silk and purple."* Mrs. Brooks has produced and completed from the egg three full gown patterns of silk; and considerable quantities of sewings. She surprised me by saying, that if her silk cloth could be sold for one dollar per yard, taking in the whole affair of production and manufacture, she could get one dollar per day for her labor. My surprise, mingled with some incredulity, has not wholly ceased. Her veracity is beyond question; but something must be allowed for the enthusiasm with which success has inspired her; and if there be no error, yet I fear there may be a little poetry in the calculation. It is almost universal since the introduction and extraordinary improvements of manufacturing machinery, to mourn over the decline of household industry properly so called; to speak of it as we are accustomed to speak of the existence of some ancient cities, as a thing that was, but which has now become purely matter of history; what our grandmothers performed with their own hands, as only suited to point the moral of some story in a winter evening; to consider it now not the province of women to make the clothes but to wear the clothes; and like other beautiful flowers, referred to in the sacred book, with which nature is adorned, though they may array themselves in the gorgeousness of regal magnificence to regard them as no longer doomed "to toil and to spin." The eminent industry of Mrs. Brooks and Miss Rapp will do something towards redeeming the character of our own country-women from a reproach but too often cast upon them by those who seek to find an apology for their own indolence, extravagance, and want of enterprise in the imagined and magnified deficiencies and faults of others.

* Prov. xxxi. vs. 19, 22.
XVIII. Manufacture of Silk.—It does not properly belong to my report to say much of the manufacture of silk, excepting so far as it is a household concern; and as a manufacturing establishment would afford to the farmers a market for their cocoons. In some places, this would be a great advantage. Several establishments for the manufacture of silk have been erected in Massachusetts and New England. Many manufacturing establishments in New England, some silk among others, have been undertaken upon too large a scale, and too far in anticipation of the actual wants or capacities of the community. Some of them being thus top-heavy have fallen by their own weight; and others have remained like the leaning tower of Pisé, the wonder of spectators, how they sustained their position. The extraordinary caprices of public affairs, and the embarrassments and fluctuations of the currency, and the explosions of many of the banks, which like the bursting of pieces of cannon, prove often most destructive to those who have the handling of them and scatter their bleeding fragments in the air, have operated greatly against many manufacturing establishments among us.

The policy of the government has not been favorable to the production of silk, if an impost is to be considered as favorable. The removal of all duty upon silks, other than sewings, excepting a merely nominal duty of ten per cent. upon those from beyond the Cape of Good Hope, favors the cheap, ill-fed and unrequited labor of Europe and Asia; but it destroys all competition on our part. The imposition of the enormous duty of forty per cent. on sewings, which it was thought from its magnitude would amount to a virtual prohibition, in its large amount defeated its very object; for in an article embracing so large a value in so small a bulk, and so easy of being smuggled, it amounted, virtually, to a premium on its illicit introduction.

I had, however, the pleasure of visiting a manufactory of silk at Nantucket, on a small scale, but well conducted; and which it is thought will demonstrate the practicability of man-
manufacturing silk to a profit. The cost of the establishment in this place is about $15,000. It is calculated under full way, to manufacture 175 lbs. per week into sewings. It is understood that the investment in machinery should pay from nine to fifteen per cent.; that nine per cent. should be charged on the buildings; fifteen per cent. on all perishable articles; and six per cent. on the active stock. The cost of manufacturing, including all extra expenses, is estimated at $1,26 per lb.; or the manufacturer professes himself willing to take a lease of the establishment from the owner, paying as rent $2 per pound for the silk manufactured. The raw silk purchased from Smyrna, costs in Boston $4.28 per lb. cash; the manufactured silk sells for $8.10, and a credit of four months is allowed. What is technically called the weighting of silk, is increasing its weight by the dye-stuff, which is used. By the use of sumac, the weight is increased from 2 oz. to 3½ oz. per lb. It is said that abroad, a preparation of lead is often used with sewings, both to increase the weight of the silk, and render it more glossy and brilliant. I suppose this may be mentioned with safety, for certainly such an honest people as the Yankees, will never think of adopting the tricks of the old countries. It is gratifying to be told that this establishment is expected to give a satisfactory remuneration both to its conductor and proprietor. Yet with these favorable prospects, it does not appear to me, that a sufficiently long trial has been had to determine the points at issue.

The account of J. H. Cobb, of Dedham, which appears to be made with exactness, gives a somewhat different result as to the cost of manufacturing sewing silk. He makes it, after detailing all the various processes, $2.55 per pound; and here no consideration is made for interest upon the stock, for superintendence, or for any commissions; and undoubtedly, as in all such cases, there are a great many incidentals, which must somewhat increase the cost. We believe this gentleman was soon satisfied that this manufacture could not be carried on to advantage.

With respect to the introduction of silk manufactures, other
than sewings into the country, as long as foreign fabrics are admitted free from Europe, and from China paying only a small duty, it must be despaired of as matter of profit. The silk manufacturers in Europe, if we except the worms themselves, are the poorest fed and the poorest paid of almost any class of manufacturing operatives on the continent. In 1834, the prices of labor for weaving galoons 2/3 wide, was one shilling one farthing sterling per groce; this would be a great day's work. At Huddersfield, where 13,000 persons, mostly females were employed, the wages averaged 2½d. per day. At Totmaston, where they worked 14 hours per day, men's labor was at one shilling sterling per day. In the county of Kent, 30,000 persons were employed in the silk business, at 6d. per day. The prices, it is presumed, have not since advanced. In Lyons, the wages of men in the silk business, is less than six shillings sterling per week, and of girls not more than three shillings per week. The salary of an overseer is about seventy-five cents per day. The wages in the silk districts in England, when the condition of the business is spoken of as prosperous, varies for an adult, from three shillings to eight shillings sterling per week; and as the article is matter of mere luxury, though of almost universal use, the fluctuations in their condition to which these poor creatures are subject, from the changes and caprices of fashion, often reduce them to extreme distress. We can easily suppose, that in some cases, they may wish they had the power of the humble insect, whose winding sheet they unravel, of enclosing themselves in a cocoon, from whence they might emerge with wings which should bear them away from their ill-requited toils and unpitied sufferings.

We cannot contemplate such facts without exulting with religious gratitude, in the superior compensation, and, in general, the extraordinary prosperity of labor, in our own country. But if we undertake the manufacture of silk, while trade is free, we must come in competition with such rates of labor. Is it to be supposed that we are ready for this? The benevolent mind would relunct at taking the bread from those mouths which get nothing, excepting bread, and scarcely enough of
that to keep their teeth bright, or their hearts from aching; especially when our country offers to those who will work, fields of labor far more favorable to health, comfort, competence, and morals.

I am not disposed to enter upon any of the vexed questions of political economy. One great reason of the high price of labor among us is its scarcity, compared with the opportunities for its employment. This, to a considerable degree, is felt throughout the country. While as yet mechanical skill is so inventive and active; such an infinite variety of arts and trades are put in constant requisition, and private and public improvements are every where advancing; and especially while as yet the immense and fertile prairies of the unpeopled West, offer such powerful temptations to swarm from the parent hive, we ought not to lament that the manufacture of silk cannot advantageously be introduced among us. Certainly it need not be desired, until we ourselves produce the raw material in sufficient quantities to supply such establishments.

In discussing the expediency or inexpediency of introducing the manufacture of silk among us, I mean of course upon an extended scale, and not merely as a branch of household industry; it is folly to overlook the differences in the condition of the people of this country and of the old world. Here the population is sparse; there overflowing. Here it is difficult to find hands for the work; there as difficult to find work for the hands. Here it is what will men do; there, what can they do. Here in truth the laborer commands the employer; there the employer commands the laborer, and takes him up or throws him off at his pleasure. The sun shines upon no spot of this earth, where, with reasonable desires, and virtuous habits, and moderate and healthful industry, the means not only of subsistence but of competence are more attainable than in our own Massachusetts. What occasion then for the introduction of a branch of business, the manufacture of an article of mere luxury, which, carried on in the old world with all the advantages of centuries of experience and the most improved machinery, has made the most meagre and uncertain returns to those who have performed the labor! The Chinese are not surpassed in
the skill and beauty of their silk fabrics. Yet, I have it from the unquestionable testimony of a gentleman long a resident at Canton, that no class of manufacturers is to be found more severely tasked or more wretchedly sustained. The products of this labor therefore, unless prohibited by the government, must come into our markets at the very lowest prices.

That silk fabrics, being altogether an article of luxury, should pay a duty for revenue, would seem to be dictated by a wise policy, placing articles of necessity, which we cannot produce ourselves, for such tea and coffee have become almost as much as bread, within reach of the great mass of the people, burdened as little with expense as possible. To attempt by heavy impositions to prohibit silk fabrics, and so force the manufacture of silk among us, would be a mistaken policy. It would present in the first place, from the facilities of unlawful introduction, strong temptations to smuggling. It would withdraw from pursuits of primary importance labor that is now well applied, and direct it to a business, which, if it should pay well at first, would, just in proportion as the manufacture should become extended, decline in value.

We hear, continually, of the immense importations of silk into the country, involving us in a heavy debt to Europe. This creates an enormous drain upon the country, and is perfectly wasteful and prodigal. But would the production and manufacture of silk among ourselves, remedy this evil? If the persons, who mainly consume these articles, would themselves produce them, no one could doubt the immense saving and gain to the country. But who is insane enough to expect this? The persons, who must produce the silk, if it is produced at all, belong to that industrious portion of the community, who are now fully employed; and whose labor, if it is used at all in the manufacture of silk, must be abstracted from employments where it is now much needed. But as to those who merely flaunt in silks and satins, the children of mere luxury and fashion, the gay birds of paradise, we must be satisfied with the ornament and embellishment, which their graces and elegancies give to society, without expecting from them any more substantial contribution. Happy will the farmer be if
this spirit of luxury and indolence makes no inroads upon his own domains, and do not paralyze his own means of livelihood and success.

The increase of luxury among us, especially within a few years past, is most remarkable; and I may be allowed to refer to it, as not without a powerful influence upon the agricultural community and interests. We hear great and constant complaints, of the vast sums of money which we send abroad, or of the debts we contract to foreign nations, for silk and other articles of mere luxury. I agree in reprobating, with all the emphasis that can be used, the folly and criminality of such conduct. But the mistake lies not in the introduction of silk more than in any other article of mere luxury. The folly and the criminality lie not in buying silk, but in buying any thing which we can live without, and running in debt for any thing which we have not the means of paying for; and with the present habits of the community, are not likely to have the means of paying for.

The secret of much of the adversity of our condition, for it must be called adversity with nations as with individuals, whenever they are in debt and find it inconvenient, difficult, or impossible to pay, is our own neglect of production. Labor in some form or another is the creator of wealth. All wealth must come out of the earth or the sea. Credit is not wealth. Luxury and labor will seldom be found to subsist together. Luxury does nothing for its own support, but it is a parasitical plant, which, like the mistletoe, draws its nourishment from that to which it attaches itself, always to the injury of the health, and too often to the destruction of the life of the tree on which it subsists. Luxury is a direct tax upon labor. It can be sustained only by the fruits of labor. Now what is the state of things among us, of which we hear so much complaint? We are largely in debt to Europe. We are deeply involved at home. We have imported and consumed to an enormous amount, silks, laces, wines, artificial flowers, feathers, and gewgaws. Luxury of the most extravagant character has paralyzed
the arm of industry. We have been living, in a considerable degree, upon mere credit; for all currency which is not convertible into specie, or which does not represent specie, or otherwise available property of a productive character, or of a permanent value, is only credit. More than two-thirds of our population, including children and aged persons, idle young men, who do not earn the cigars which they smoke, and idle young women, who hardly mend, much less knit, their own stockings, and many of the professional classes and the trading classes, who, though to a certain extent, among the most useful in the community, and often among the most industrious yet are to be placed with the unproductive, produce nothing. Not more than one third of our population, this, indeed, is probably not an unfair estimate, can be considered as productive; and upon them devolves the necessity of supporting the rest. Now if the luxurious, or those who consume these articles of luxury, could be induced or compelled by their own labor to supply them, it would be indeed an immense saving to the country; and an immense gain in every way to the productive classes, whose labor, much of which now goes to pay for these luxuries, might then be determined into some more useful channel. But who can expect this? In the present condition of things nothing is less likely, and nothing will bring men to a sense, and what is of much more importance in the case, to the performance of their duty, but absolute necessity. The luxurious and spendthrift classes, who are the great consumers of these foreign luxuries, will not work; they will not produce the silks they wear. The production, then, if produced at all among us, must be from the laborious classes. There is, I admit, a large portion of labor which against its inclination is unavailable; or which would be applied if it could be profitably used. This I except, and of this I shall speak presently. The question then resolves itself into this. Shall our labor, now profitably occupied and in full demand through every part of New England, and where not even one tenth of our soil in Massachusetts is cultivated, and that which is cultivated not one fourth so
productive as it might be rendered, be diverted to the production and manufacture of an article of mere luxury? But suppose we should undertake and succeed in producing and manufacturing our own silks, so, as some lunatics imagine, not only to supply our own wants, but to make it a matter of large exportation. How are the luxurious to pay the producers here any better than they can pay the producers abroad? If the laboring and productive classes will be satisfied with a currency of which we have had too much, and we are to make money at our pleasure, and the luxurious and spendthrift classes can pay for their indulgences, and get on in their indolence and dissipation and wastefulness, with paying in borrowed notes, which in some parts of the country represent nothing but the promise to pay, written on the face of them, we can get along as we have done. But if, on the other hand, the experience we have had of the injustice, madness, and wickedness of such a course, has taught us any thing, we cannot get along as we have done. The laboring and productive classes will not remain satisfied that men should, at their pleasure have the means of expenditure and luxury, who do nothing towards earning or producing them; and they will require that that which passes as the representative of value, should not be a mere fiction, but in truth represent that which has a fixed, convertible, available, and permanent value, either in the form of specie or other real property.

The production and manufacture of silk among us beyond the availing of that kind of labor to which I shall presently refer, is not the remedy then for the evils of which we complain, the evils of involving ourselves in debt through the excessive consumption of foreign luxuries or even of home-grown or home-made luxuries. The evil consists in our using that which we have not earned; that which we do not pay for, and which we have not the means of paying for, and which we are not willing to labor that we may have the means of paying for. The production and manufacture of silk, unless it can be done by labor not now employed and yielding no profit, will not relieve us from our embarrassments. Indeed, try what art we will, there is only one effectual remedy,
and that is, the abandonment and disuse of these luxuries until we are able and have the means to pay for them; or by honest and productive industry, acquiring the means to pay for them.

The notions, too, entertained by many, of our making raw silk an article of export, and of our undertaking to supply Great Britain and France at an enormous profit, with a large amount of the millions of pounds of raw silk which they consume, seem closely bordering upon visionary. We cannot, even had we produced a large surplus, come into the European market with our silk without coming in competition with the cheap labor of Italy, France, Germany, India and China. Besides this, the culture of silk, with the advantages of the improved varieties of mulberry, has made an auspicious beginning in the Sandwich Islands, and large contracts for trees, if report be true, have been made in the British West India Islands, where the climate admits of getting three to four crops per year. Now, under such circumstances, is it to be supposed that we can go largely into the cultivation of silk with any expectation of prices remaining as they are. There is another law of trade, which necessarily applies itself here. In the first production of some extraordinary article, it may command a high price; or where by any peculiarity of location or any peculiar art or skill in cultivation, it can be produced with a degree of perfection, to which other persons or other places cannot attain, there a sort of monopoly may exist, and a high price be maintained. But an article of general production, and which may be grown to an unlimited extent, in almost an unlimited number of places will ordinarily bear a price proportioned to the cost of production and but little above it. If it fall below the cost of production, it will cease to be cultivated; if it rise much above it and pay the large profits with which alone the imaginations of some men can be satisfied, an extended production, stimulated by this high price, will soon bring it down to its level. It is worse than idle to delude ourselves with false expectations. The laws which regulate the affairs of men, which are indeed none other than the laws of Divine Providence, and which extend to all the departments
of life, are fixed and unalterable. Like water, they never cease their movements until they find their level. To attempt to interfere with their operation, or to control them in order to meet our wishes, is like attempting to bend by our own force a strong tree to the ground. We may break it, and then we get a severe fall; or its elasticity may presently cause it to rebound, and throw the person, who was thus trying his power, where he can make no further experiments. I am well aware that these views will not coincide with the popular sentiment; but having no party predilections and no private views to answer, I am willing to submit them to the calm judgment of the intelligent and reflecting, and to the sober results of experience.

XIX.—Raw Silk. The production of raw silk, is, properly speaking, an agricultural operation. The inquiry whether this may be made profitable, concerns directly the agricultural interest; and, under what circumstances it should be encouraged, is a question which I propose to consider.

It has been confidently stated, as I have already shown, that raw silk may be produced among us at current prices of labor, for two dollars or two dollars and a quarter per pound. In the cases referred to, however, no allowance was made for land, buildings, trees, manuring, and the superintendence of the proprietor; but only for the actual labor applied; and in Mr. McLean's experiment, the labor of the man was rated at not more than half its customary value. In Mr. Smith's case not only were these items not charged, but likewise the board of the young women employed was not brought into the account. It seems to me then only fair to rate the cost of raw silk at three dollars or three dollars and fifty cents per lb. At 50 lbs. of silk to an acre, this would be a liberal compensation for labor; and any increase of this product would be an increase of profit without a corresponding increase of the cost of production. But this again is making no allowance for accidents. With our inexperience in the silk culture in this country, we are not prepared to say what allowance should be made on this account. The worms are liable to various accidents. They are some-
times swept away by disease in vast numbers, to the sad disappointment and loss of the industrious cultivator. Hitherto, however, as far as my own knowledge extends, few such misfortunes have occurred. The profit upon the production of silk, must depend, of course, not merely upon the price of labor, but upon the value of the article in the market. This will of course again depend somewhat upon the supply. Any considerable increase of the product would, as I have attempted to show, inevitably reduce the value. Prices, too, are fluctuating, especially where there is a mixed currency; that is, a specie currency and a paper currency, which does not represent specie; and when promises to pay are interpreted and qualified at the pleasure of those who make them. No class in the community is more interested in a sound currency than those farmers, who are obliged to hire any labor, and are dependant upon the sales of their produce. The constitution of the country having fixed a standard of value in gold and silver, every other currency is sound so far as, and no farther than, it represents gold and silver. The defiance of their obligations, which has characterized some of the monied institutions of the country, and the persevering attempts in some parts of the country to uphold and force a purely paper currency upon the community, produce disastrous fluctuations; disturb all the sound calculations of honest industry; and in proportion to his means and concerns, the small farmer suffers as severely as those most extensively engaged in commercial pursuits. It is to the deluge of an irresponsible currency, which was by some institutions at one time poured out like water, that we must in a measure attribute those speculations in the Multiplicaulis mulberry, which brought ruin upon thousands. Attracted by the glittering illusion of sudden wealth, like insects round an evening bonfire, they rushed into the flames, where many perished, or escaped with their legs burnt off or their wings singed, maimed and crippled for life. To the same cause we owe every where the interruption and desertion of the quiet pursuits of wholesome rural industry, for the hazardous, and in many cases the immoral pursuits of speculation.
Under these circumstances, whether we undertake to manufac-
ture or to produce raw silk, we can at present make no very
safe calculations for the future of what the price of labor will be;
or what will be the value of the article after it is produced. The
attempt, therefore, to produce silk on any large scale, as well
as the attempt to manufacture silk, even sewings, must at the
present be an undertaking full of uncertainties, but one can
hardly say, of doubtful result. The absence of all duties,
upon foreign fabrics, exposes us, also, to all the caprices
of foreign labor, capital, and cupidity, and the ebb and flood of
foreign markets are felt equally upon our shores. Within the last
few months, as I have remarked, the prices of many articles of
silk have experienced a decline of more than fifty per cent.
The best of sewing silk which not long since commanded nine
dollars, now sells for six. Ribbons and lutestrings are even
much more reduced.

Some persons, on this subject of the profits of the silk cul-
ture, have had their imaginations raised almost to a white heat,
and have thought that the product of raw silk in the northern
states, might soon be made to equal the product of cotton in
the southern portion of the Union. Certainly they do not
mean in pounds, but in the value of the article produced. But
is it not obvious that any such increase of the product of the
article would proportionately reduce the price, though this
would again be affected to a degree by another element, which
must come into the calculation; and that is, the increased use
of the article which would follow any considerable reduction
of its price. This would not, however, raise the price, because
its free use depends on a low price, and bears a direct relation
to the diminution of the price. There is, however, no suffi-
cient reason to think that raw silk can maintain its present
price in the country, certainly not in the face of any con-
siderably increased production. The present price of raw silk
from Smyrna is not much above $4 per pound. Bengal silk is
lower.

But our silk is said to be much superior to the India silk,
as it is said, likewise, that silk raised in the northern provinces
of China is much superior to that in the south. I have not been able fully to satisfy myself of this fact; nor, if true, can I ascertain whether it be attributable to the influence of the climate, or the superiority of the reeling; but an intelligent manufacturer has stated to me, that, in his opinion, the Bengal silk would be found equal to any other but for the imperfection of its reeling. It is stated, likewise, on the most disinterested testimony, that the silk formerly raised in Georgia, whose climate, we know, is of a high temperature, was pronounced in England of an excellent quality. The perfection of the Italian silk is generally ascribed to the admirable manner in which it is reeled. It is at the same time, however, only just to state that the silk already produced among us, has fully demonstrated our capacity of producing as good an article as has as yet been seen.

In our calculations as to the price which silk is likely to maintain, we must take into consideration many new facts. The introduction of improved varieties of mulberry into Europe, and the great improvements which have been made in the engrafting of choice varieties upon the white mulberry, are not without their influence upon the silk culture, both in France and Italy. No longer ago than this very day, on which I pen this paragraph, I have received through a friend, direct information from one of the most distinguished agriculturists and horticulturists in France, of the introduction of a new species of mulberry from the northern parts of China, of a perfectly hardy character, furnishing an abundance of foliage, and promising, in its various good qualities, the most eminent advantages to the silk cultivators of France. If the tree fulfills the promises, which are held out, it will soon be ours. It is said not to be propagated with as much facility as the Perottet mulberry, yet, it may be propagated without difficulty by engrafting. In the present condition of society, all monopoly of advantages or improvements, excepting those, which, from the nature of the case, cannot be transferred, are at an end. Continents are brought into near vicinity to each other. The papers come to us from Europe, scarcely dry from the press; and the leaves of plants from the
gardens of the old world will hardly have time to wither, before they strike their roots anew into our own soil. This brings men into one common brotherhood; and what a delightful and mutual interchange of advantages will be continually extending itself, while the path over the hitherto trackless waters, is now easily marked out, as to the ancient Israelites, by a curling cloud by day and a pillar of fire by night; and a voyage which was of months, is now measured by days and hours.

The improvements likewise made in the management, or as it is professionally termed, the education of the silk worm, on the experimental silk establishment of M. Beauvais, to which I have already referred, and by which four harvests may be obtained in a year, and a larger yield from the number of worms fed than by any other process, will be extended, and produce their natural effects. It has occurred to me, likewise, that the culture of silk is likely to be increased in British India. Not an inconsiderable amount of persons in these provinces have been engaged in the production of opium, with a view to the Chinese market. If the noble effort of the Chinese sovereign to arrest this dreadful scourge, which has opened such a flood of misery upon his dominions, are to be successful, and a nation of barbarians are able to put a stop to the nefarious efforts of the agents of a nation calling itself Christian to force this deadly physical and moral poison into their veins; then the cultivation of this drug in British India, will be much abated; and why should not the labor of this population be turned into some other channel? Great Britain imports annually about 28,000 bales of raw silk of 162 lbs. each, or, in gross numbers, over three million and a half of pounds. Now, with the power, recently understood, of propagating the best varieties of the mulberry with a rapidity, which almost exceeds belief, and in a climate favorable to this kind of tree, where three harvests may be easily gathered in a year, why should not a portion of this population be turned to the cultivation of silk and cotton, with both which they are familiar?
sent condition of society, who can calculate the changes which may occur?*

The cultivation of silk is making great advances in Germany. It was commenced many years ago, and then was suspended for nearly half a century; but the success of the culture in France has attracted attention strongly; and it is now pursued with great vigor and success. Indeed, it may be considered as greatly on the increase in all the countries of Europe, where the condition of the country admits of its cultivation, with the exception of those which have been for a long time the theatre of the tragic exhibitions and cruelties of civil war.

Under these circumstances, I see no very strong encouragement for the erection of large establishments either for the manufacture or the production of silk. The country, indeed, has neither the experience, which is desirable in such case, nor labor enough to manage them to advantage. We have not the population to fill them, and are not likely to have for some years to come in New England. In what country does the price of labor bear a comparison with the price of labor among ourselves? Such establishments are in no respect to be desired; and are likely to fail from the extent and complexity of the business. When men talk about feeding several millions of worms in a year, they are in danger of deceiving themselves in regard to the amount

* "To show in a most instructive manner the changes which may occur under the active progress of improvement in the civilized world, of which indeed, we may have our full share of advantage as well as others, and which no people can monopolize to the exclusion of others, I refer to the changes, which have taken place in the manufacture of lace. This should at least admonish us that all mechanical ingenuity is not confined to ourselves. Such has been the progress of improvement and economy in this manufacture, that the cost of labor in making a rack, which was twenty years ago, 3s. 6d., or 42 pence, is now not more than one penny. The prices of this beautiful fabric have fallen in an equally remarkable manner. At the former periods, a 24 rack piece, five quarters broad, fetched 17l. sterling, in the wholesale market; the same is now sold for 7s."—Ure on Manufactures, p. 733.
of labor required; or these calculations are too often the stratagems of purely interested persons, who have only some private ends to accomplish, and are for inducing others to beat the bush that they may catch the bird. A highly enterprising and industrious cultivator told me, two years since, that the ensuing year he designed to make 5000 lbs. of raw silk. He certainly had no intention to deceive, and I believe deluded no person of sound mind but himself. The year passed on, but not 50 lbs. were made. He has since somewhat modified his expectations, and calculates this year upon making 2000 lbs. When the silk comes to be weighed, we can best determine the fulfilment of the prediction. Most certainly I should rejoice in such splendid results of domestic industry, if labor can be thus applied to advantage; but with the liberal bounties of the state, offering two dollars a pound upon reeled and thrown silk, sufficient as has been confidently stated to cover the entire cost of production, we have not yet reached in the whole State one quarter of that product in a year. This dreaming with our eyes open is prejudicial to the substantial and permanent success of any good enterprise. Successive disappointments and losses, almost inevitable under such circumstances, produce universal discouragement; create disgust; and throw back the cause, which occasions them, almost as far beyond its true position as the expectations of its friends had placed it in advance. The largest amount, as far as I can ascertain, ever made by any individual in the country, in any one year, was made by William Atwood, of Mansfield, Conn. This was one hundred and eight pounds. Such an amount has rarely been approached by any other person.

The attempts made to force the silk culture by legislative encouragement, bounties, and penalties, in Georgia, Virginia, and Connecticut, in former years, though urged by the same eloquent arguments by which its friends now commend it, proved utter failures. The country was not then, and it is not now, prepared to go into the cultivation of silk upon that extended scale to which the imaginations of some men, whose
good intentions and public spirit I do not doubt, would carry it. I should anticipate the same results, which followed in former cases, from any extravagant attempts to force its production at the present time.

It is said that the silk culture in France yields a profit of 20 to 40 per cent. But from the condition of things in France, we can predicate nothing of our own community. When we can obtain men's labor for $1.25 per week, and women's labor for sixty cents, and children's labor for a few sous and the laborers provide for themselves, and can be sure of obtaining the high prices, which silk now commands, there is no doubt that we could produce and manufacture silk to equal advantage with any nation. But let the profits be as they are described to be in these countries, who gets these profits? Not the growers of the silk; not the operatives in these establishments; but the owners of these large filatures and manufactories. They skim the cream; the producers of the silk, the operatives in these foreign manufactories, the living machines, they must be satisfied with the skim-milk, and that oftentimes somewhat diluted. It is not so, let us thank God, with us. Labor is not so abundant with us, that it cannot command a full compensation; nor as in the crowded manufactories of Europe, that it surrenders all claims to the perfected article, though perfected by its own toil, and is satisfied with the ends and the waste. In our favored country, manufacturing labor has been most liberally compensated. But it is said that our people do much more in a day than the laboring classes in Europe. If the labor consists mainly in attendance upon machinery, there can be no great difference, where the same number of hours is given. In Lyons, the silk manufacturers work 14 hours per day, exclusive of meals. In other cases of labor, the operatives or European laborers, do less because they are paid less, and miserably fed and housed. If we get more performed by an equal number of hands, the cost of this labor is increased in proportion. But it is said that we have superior advantages to counterbalance the comparative dearness of our labor, in what we are pleased to call Yankee ingenuity and contrivance. We should be led to infer from the style of speaking adopted, and too current among us, that no other people
on the globe ever had any ingenuity or contrivance, but ourselves. This comes of our ignorance and self-conceit. It is time we cultivated more a just self-respect, and abandoned a habit disreputable and offensive. We may boast indeed of a Franklin, a Whitney, a Fulton and a Perkins; and so may other nations boast of an Arkwright, a Watts, a Wedgewood, a Babbage, a Fisher,* and a Jacquard. These men belong to no geographical location. Such minds are the common property of human nature. The curious invention in 1830, of the loom, which bears the name of its inventor, M. Jacquard, of Lyons, constitutes one of the most important steps that has ever been taken in the silk manufacture, and the manufacture of other figured goods. Its ingenious mechanism, is not often rivalled, and scarcely exceeded in any country. But with all our ingenuity and contrivance, how far are we at present from being able to produce the exquisite and beautiful fabrics of civilized Europe, or even of barbarous China and Japan.

We are often admonished of the enormous amounts expended for the introduction of silks into the country. During the prevalence of that terrible epidemic, which prevailed throughout the country in the year 1836, the speculating brain fever, our imports of silk rose to the extraordinary amount of $22,000,000; some years they have reached to $12,000,000 and $13,000,000, but ordinarily, they may be set down as from $7,000,000 to $9,000,000. If silks were an absolute necessary of life, we ought, by all means, to be able to produce them, as otherwise, we might under contingencies, suffer through want of them. But as matter of mere luxury, though a useful luxury, there are not the same strong reasons for urging the culture and manufacture of silk against so many disadvantages. Should the government see fit to afford such a protection as the cultivators of silk might desire for their purposes, this would be a

* "Bobbinet may be said to surpass every other branch of human industry in the complex ingenuity of its machinery; one of Fisher's spotting frames being as much beyond the most curious chronometer, in multiplicity of mechanical device, as that is beyond a common roasting-jack."—Ure on Manufactures, p. 730.
hindrance to its manufacture. Should they, on the other hand, attempt by high duties, to protect the manufacture of silk, they must leave the admission of raw silk free, which would proportionately discourage the cultivation. A system of utter prohibition of foreign silk, or foreign silk goods, would be likely to result no better than did the same system of prohibition and monopoly, which was pursued in Great Britain for a very long period of years. It would enhance the price, but diminish the consumption. It would check enterprise and ingenuity in the improvement and the manufacture. It would tend to divert much labor into new channels of industry without any corresponding advantage. So far from putting a stop to smuggling, the temptation to the illicit introduction of silk would be vastly increased.

To the laying of a reasonable duty upon imported silk, whether raw or manufactured, for revenue, there can be no sound objection. Silk being wholly a luxury is a fit subject of tax, as the tax must of course fall upon those who are best able to pay it. But beyond this, any legislative enactments with a view to force its culture here, would be met by attempts to defeat or evade the law, which in such an article as silk in any form, from the small space which it occupies in proportion to its value, would be but too successful. As I have already remarked, the exorbitant duty of thirty-six, or forty per cent. as it was a short time since, upon sewings, has served not to benefit our own manufacture, but rather materially to injure the sale of the article, by the inducements offered, and the consequent illegal introduction of the foreign article.

XX.—Calculations respecting Silk Products.—I am aware that I oppose the popular opinion in speaking thus discouragingly of the manufacture of silk in our country. It would be more agreeable to float with the tide than to struggle against it; but whether the opinion of an individual be of little or much weight in the community, he is bound to respect his own judgment, and is at liberty to utter only his honest convic-
tions. Public sentiment and public actions can be affected but in a slight degree by the opinions of any individual; and addressing one's self to intelligent and reflecting minds, no evil can result from the freest discussion. No good will come from creating false expectations; and I should be glad to disabuse the public mind of some of the gross illusions by which it has been willingly imposed upon. In some of the documents before me, and those published under authority, it has been confidently stated, that an acre of land planted with mulberry trees, may be expected to produce the first year one hundred pounds of silk, and afterwards be increased to 333 lbs., and even to 666 lbs.; and that the profits of such cultivation would be $1170 per acre. Another person goes on to calculate that one hundred acres even at ISO lbs. to the acre, and silk at 4 dollars per lb., might be made to afford an income of $72,000. At present these must be considered as mere dreams. If this be practicable, why has it not been done? There has been ample time in other countries, and in this country, to have done it, if it could be done. There have been trees enough, and land enough, and capital enough; and in some of the states a bounty has been offered for some years on the production of silk, admitted by the most ardent friends of the cultivation, to be sufficient to cover the whole expense of production. In what country, at what time, was ever such encouragement to production held out before? But no such returns have been obtained or even approached; and with the exception of Mr. Atwood, before referred to, and Miss Rapp, at Economy, who, until new claimants appear, must be allowed the rank of queen of this branch of domestic industry, it would be difficult, I imagine, to find half a dozen individuals in the whole Union who have produced, either of them in one year, one hundred pounds of silk. I myself know not of one. I should have been glad of the honor of recording the names of hundreds who had accomplished it, if they were to be found. Mr. McLean, who has approached more nearly than any other man in the country towards determining what can well be done, admits, with
the most creditable frankness, that he despairs of ever seeing 104 or 128 lbs. of silk produced upon an acre. I cannot say with him, that I despair of such a result; but I shall wait for further trials before I am prepared to say, with confidence, that more can be done than what his remarkable intelligence, skill, and enterprise have effected. In respect to the actual cost of producing silk, that as yet is by no means settled. Mr. Mc Lean’s experiment, which has come the nearest to determining this matter with exactness, is, as I have shown, far from doing it. First, he made no allowance for land, trees, rent of buildings, cultivation and superintendence. Second, he charged the man’s labor and board at half the price, three dollars per week, which it would cost with us. Third, he states distinctly, that his silk cost him much more than two dollars a pound, though he thinks it may be produced for this sum; that is, as I understand it, the mere labor of producing it can be paid for by that sum, in his judgment.

XXI.—Manufacture of Silk.—With respect to the manufacture of silk, except in a small way, the attempt in New England, thus far, must be pronounced a failure. It has been followed by loss and bankruptcy in almost every instance where it has been undertaken. Unless the government should utterly prohibit its importation, it cannot be otherwise; and if the government should attempt this, and nothing is less likely, the rise in the price would produce only new efforts for its illicit introduction, which, as remarked, with an article admitting of so easy concealment as silk, would not be difficult, in a country accessible at so many points as ours. But would the introduction of the silk manufacture among us be desirable? I think not, in the present condition of our population. The manufacturers of silk in Great Britain, and on the continent, are wretchedly paid and wretchedly fed. Whatever wealth may have been accumulated, or whatever success may have attended the operations of the proprietors of these silk establishments, the wretched
men, women, and children, who perform the labor, have little more than sufficient to sustain life. In a business so liable to be suddenly and deeply affected by the caprices of fashion, they are exposed to the most painful revulsions, and are often reduced to the extremes of want and misery. Can we desire to see any of our own population placed in the same condition? Yet how otherwise can we come in competition with this foreign population in an article of this sort? Nothing can be more absurd than to suppose, that if the country were to go largely either into the manufacture or production of silk, as is proposed by some persons, that present prices could be maintained. In countries, where men are trained in particular departments of labor from their childhood, without any expectation or any practicability of a change, a different state of things exists from that which exists among us. Here, men at their pleasure can change, and are perpetually changing their condition. Here, excepting those pernicious influences, which result from a disturbed currency, and an uncertain standard of value, the relations of labor and its compensation in the various employments of industry will be continually seeking a level, and maintain a uniform proportion. If any particular branch of business promises extraordinary profits, and by extraordinary, I mean a larger compensation for labor than other employments afford, men will rush into that, until its profits are equalized with those of other pursuits.

I am not an enemy to manufactures; very far otherwise; but I believe no sagacious mind can doubt, that with a sound currency any considerable extension of them among us must tend to reduce the wages of manufacturing labor. In our condition of population, I have not been able to perceive the direct benefits of manufactures to our agriculture, excepting as far as they increase the productive capital of the country, from the manufacture of any article among us, the raw material of which we do not produce ourselves. If this capital were directly applied to the extension and improvement of our agriculture, the benefits would be obvious; but this has been the case to a very small extent;
and, in one respect, manufactures, by withdrawing a large portion of labor from our farms, and by the high wages, which by the amounts of artificial capital existing among us the manufacturers have been able to pay, have tended rather to the discouragement of agriculture in the State than to its extension. I do not mean that our agricultural interest has been depressed; but so large a portion of our population have turned their attention to manufactures, that our population and even many of our farmers have depended upon foreign sources, other states and other countries, for the supply even of the first necessaries of life; and cultivation and improvement have been narrowed rather than extended.

With our present population, a larger proportion are now occupied in manufacturing pursuits than can be spared from agriculture, without injury to its interests; and as, in the present state of things, is for the interest of the manufactures themselves. Our cotton manufactures certainly do not desire their extension. Our woollen manufactures cannot get on without a reduction of the price of labor with which the laborers are not satisfied, or of the price of wool with which the farmers are not satisfied. Why, under these circumstances, should we wish to see the manufacture of silk introduced—an article, in a great measure, of mere luxury.

XXII. Manufactures in England.—But the prosperity of England, we are constantly told, has been based upon her manufactures. It will not be questioned, that they have been to her the source of immense wealth. But who has had this wealth? Who has been benefited by this signal prosperity? Not the laborers themselves, whose toil has created it. They have seen the mountains of wealth rising up among them; and they have brought their contributions to increase these masses in the hands of the great proprietors; but they themselves have scarcely been permitted to reserve from the products of their own toil the means of sustaining life. Broken down with excessive toil they have been crushed between two mill-stones, low prices for labor on the one hand, and high
prices of bread on the other; for in an artificial system like theirs, the agricultural interest claims protection as well as the manufacturing; and corn laws must be maintained, the hardships of which fall almost exclusively upon the laboring classes. Under such circumstances, the only sovereign remedy against the complaints of their starving crowds has been bayonets and balls. Now with all her wealth and all her machinery, and all her magnificence, where, all circumstances considered, where on earth exists a more wretched, miserable, vicious, squalid population than are to be found among a large portion of the manufacturing population of Great Britain? We may add likewise the silk manufacturers of Lyons. Who would desire to see a standard of wages introduced among us like that which prevails in England or among the manufacturers on the continent? Hitherto among us, for various reasons, which it is not necessary to discuss, and especially from our sparse population, from the demands for labor made from other sources, and from the cheapness of land, manufacturing labor has been most liberally and sometimes exorbitantly paid. But in proportion as manufactures are extended among us, unless under a high tariff, amounting almost to a prohibition, the standard of wages must be in some measure conformed to that of Europe. It is idle to think of introducing the manufacture of silk unless we can produce it at the rates of labor which are paid there.

XXIII. Our own Condition.—But how are we to pay for the silks which we import from Europe? We cannot honestly pay for them. We ought not to use them. In our present condition we have no right to them. The enormous extravagance and luxury which have prevailed among us, have occasioned the bankruptcies and the distresses, and many of the flagrant crimes which darken the history of our community for the few past years. But cannot we make them ourselves? As I have already said, the luxurious and spendthrift classes might do it, if they would; but no one expects this of them. But may not much of the labor, which is now applied to other purposes
be withdrawn from them and applied to the exclusive production and manufacture of silk? Not without taking it from more important objects; and not without consenting to much lower prices for labor than we now receive.

But may not the production of raw silk be made profitable among us? I think it may. I recommend its introduction and culture; and I will show under what circumstances it may be pursued to advantage. But let me first premise that I have no confidence in any such enormous products and profits as have been predicted. I believe, under some circumstances, it will pay not only a fair, but a liberal compensation for labor. With this, we ought to be satisfied. I believe that more than fifty pounds of silk to an acre, can be produced, but I shall assume this amount as a safe basis of calculation, because this has actually been accomplished. I will suppose, likewise, in the calculation, that by the increased product of silk, a price is obtained for it barely sufficient to cover the expenses of production. It is often asked, whether, if we should go to producing raw silk, we should be able to find a market for it? This cannot be doubted, provided we are willing to sell as cheaply as other producers. The raw silk produced among us is universally admitted to be of a superior quality. We shall go into the market of the world, then, with this advantage; but we must come in competition with other growers of silk; and take such a price as the market offers. What this may be there are no means of determining. The demand for raw silk is not unlimited, but the use of the article is gradually increasing; and in proportion to its increased production and consequent cheapness, the demand may be expected farther to increase. It has one advantage, which is not to be overlooked. It is an imperishable article; and the sale of it, other circumstances being favorable, may always be discretionary; and it may be kept without other loss than that of interest on the cost for a good price.

XXIV. Production of Silk in Massachusetts.—Under what circumstances, then, may the silk culture be urged upon
the farmers of Massachusetts. There is, then, in the first place, no difficulty in raising the hardy kinds of mulberry in any part of the State. There is good reason to believe, that the tender varieties may be naturalized; and they may at least be cultivated to a certain extent, by taking them up in the fall and resetting them in the spring. Every farmer, therefore, in the State may have, at a small expense, his one, two, three, or more acres of mulberry trees, the leaves of which he may use as he pleases. A permanent plantation being once well established, it will require little care to keep it in good order, and the trees will endure for several generations. If he does not choose to use the leaves himself, there may be a market for them with those who are willing to use them. In France, the leaves are picked and carried into market for sale, as much as other vegetables. As in Mansfield, persons may be found, who will be willing to take the trees and eggs, upon condition of returning a third or two-thirds of the product in silk, as may be agreed upon. In this way the cost of the trees and the expense of setting and cultivating them will prove a profitable investment. Further, the trees may be planted at the road sides as ornamental trees, occupying no land to the disadvantage of any other purpose; and in this way may be made productive. The planting of the trees, therefore, the white, the broussa, the Alpine, or Sharpe's variety, ought everywhere to be undertaken and encouraged; and the tender varieties demand the particular attention of persons, who have the means of cultivating and using them. A mulberry orchard ought to be found upon a farm as constantly as an apple orchard.

The expense of other fixtures need not be much. Though undoubtedly the most perfect way of pursuing the business is the best way, and, as we see illustrated in the mode of treatment adopted by M. Camille Beauvais, which I shall give at large, effects a great saving of time and labor, and a larger amount of produce, than by what is called the natural method; yet the business may be pursued advantageously, because it has for years been pursued advantageously in Mansfield, with-
out any expensive fixtures. Vacant rooms in the house, vacant sheds or portions of the barn may serve as a cocoonery, or as the French often call it, a magnanerie or feeding house; and though artificial heat and an equable temperature to the cocoonery are desirable in order to the most perfect results, yet no such processes have ever prevailed in Mansfield, and therefore are not indispensable to a fair product. A cocoonery may be built upon a farm at a small expense, which may serve the double purpose of a feeding house for the worms and a granary. Mr. Haskell, of Harvard, has erected a building of this description, which is well contrived and not expensive. The dimensions of such a building may be forty feet by twenty, two stories in height, with a cellar under the whole; and the farmer will find it useful for various purposes.

XXV. Labor applicable to the Silk Culture.—Having the trees and the buildings, there remains only the labor to be applied. Now in almost every farmer's family in the country, there is considerable labor, which is comparatively unavailable. There are persons advanced in life, who have passed the season of severe labor. There are children, whose services might be made productive. There are young women, who cannot, or who, from filial duty or various considerations, are unwilling, to leave the paternal roof. There are many, who are averse to go out to service, and equally averse to go into a factory at a distance from home. There are many young women occupying a standing in society which, in the present condition of public manners, a condition which we cannot alter or transcend at our pleasure, necessarily shuts them out from various employments, of which otherwise they might avail themselves to aid in their own support; who are now comparatively without occupation, and whose necessary expenses it may be difficult for them and their parents to meet. Public opinion or fashion, is a despotic tyrant, whose rule is sovereign and inexorable. It must be considered likewise, that the introduction of machinery, the use of water power, and the large cot-
ton and woollen establishments raised up in different parts of the State, have entirely destroyed what may properly be called household industry. Even the humble knitting-needle, is in many cases, completely displaced by machinery. We complain that the music of the spinning-wheel, and the flying of the shuttle are no longer heard in our farm houses. We cannot expect it to be otherwise. This is not because our women are not as much disposed to be as industrious as their grandmothers, but because, in truth, it would be almost folly to contend by the ancient arts against the modern processes of manufacture. Then again, for want of this opportunity of domestic labor, thousands and thousands of our young women, forsake the parental hearth, and fly in crowds to our cities, to seek employment in the various trades and arts which are there practised; and, where unprotected and removed from the restraints of parental care, amidst the dreadful perils which surround them, they but too often find the grave of their honor and virtue: to themselves, and to those, whom they leave behind, a more dreadful sacrifice than that of life. To all these descriptions of persons, the culture and reeling of silk may furnish a necessary, easy, respectable, and profitable employment. Many a small farmer in the State, without difficulty, without expensive investments, without using any but the services of his own family, and without, in any measure, interfering with, or deranging his farming operations, may, under proper arrangements, produce his fifty, hundred, or two hundred pounds of raw silk per year. This, even at two and a half or three dollars per pound, a price below which it is not likely to fall, would afford a convenient and agreeable addition to his income. This seems to be entirely practicable. Here the calculations are all closely restricted; and founded not upon conjecture, but upon actual experience and determined results. This supplies a want, which is deeply felt throughout the country; and opens views most grateful to the philanthropic mind. In Italy and France, as I am informed, the production and reeling of silk, are almost wholly conducted in this domestic way. The ag-
aggregate amount in such a case throughout the State, would be immense; and this all obtained without any expensive advances or any great risks, or any labor, but that which is now comparatively unproductive and otherwise unavailable. It may be considered in such case, as almost a clear gain; and whether it pays as well for labor, as other branches of agricultural or manufacturing pursuit or not, is of little consideration, compared with the fact, that it pays something and a reasonable compensation, where otherwise nothing would be obtained.

XXXII. *Silk Culture for the Clergy.*—1. There is another class of persons, to whom the culture of silk would afford peculiar advantages, and prove in no way inappropriate to their condition, or inconsistent with their duties; I mean the clergy. Every intelligent person, acquainted by experience and intercourse with society in New England, especially in its rural departments, knows what an invaluable blessing, viewed merely in a social aspect, this order of men together with the religious institutions, which rise or fall in a measure as they rise or fall, have proved to the community; and how much it is indebted to them for the good order, the good manners, and the highly improved condition which distinguish it. But that the ministry may be useful, it must be, in a degree, independent; and that, at the same time, it may retain its hold upon the community, it must not be felt to be burdensome. In the present condition of society, nothing has become more precarious than the tenure of the ministerial relation; and nothing more discouraging in the discharge of their responsible duties, than the state of dependance upon public caprice, not to say public charity, in which they are now placed. To a truly pious and benevolent mind, it will be always grateful and delightful to dispense the gospel, as far as possible, without charge; and, if an apostle, that he might do this, served at his trade of tentmaker, a good minister will esteem it a privilege to be able, where it can be done without interfering with his professional duties and improvement, to supply, in a measure, by his own
manual exertions, his own and the wants of his family. To a 
clergyman, then, in the retirement of the country, living upon 
the uncertain, scanty, and too often begrudged support, which 
is allowed him, what a valuable resource may the cultivation 
and care of this invaluable insect afford.—By the labor of 
a few Aveeks in a year, and then only a part of the day, he 
may, with the aid of an industrious family, procure by his hon-
est exertions, a sum perhaps equal to that which his people 
feel able to afford; and thus obtain for himself, the means of 
many an innocent indulgence; perhaps too, of educating 
his children, and of providing for a dependant family, a comforta-
ble subsistence in the event of his removal or death. I hope, 
my brethren of the clergy, will not consider these suggestions 
as in any measure disrespectful. They are dictated by a feel-
ing, totally opposite to this. I should be the last to recom-
 mend to them the silk culture or any other business, as matter 
of mere pecuniary gain, but only on the ground of a just re-
gard for their own comfort and that of their families. A lit-
tle knowledge of human nature, will convince them that their 
people will be always the more ready to help them, as they find 
them able and ready to help themselves. The clergy, from 
the earliest times, have been the pioneers in agricultural im-
provements in our country; and among a rural population, I 
know not how, in a secular view, a minister can render a higher 
service to his people, or make a stronger claim upon their res-
pect and gratitude, than by promoting among them the study 
of the natural sciences, the exercise of the mechanic arts, and 
giving them an example of sound domestic economy, and fru-
gal, intelligent, skilful, and improved husbandry. There are 
too many such laudable examples within my own knowledge, 
to allow me to doubt that this may be done without in any 
measure interfering with his own intellectual improvement and 
the most conscientious, faithful, and useful discharge of his sa-
cred duties.*

2. For Pauper Establishments.—I cannot doubt, likewise, 
that the culture of silk may be introduced with advantage into

* Appendix V.
many of our pauper establishments, where farms are connected with them. Here, often, there is a great deal of light labor available, which it is difficult and impossible to apply to advantage in the common field operations of agriculture, and which, now applied to the picking of oakum or to knitting, amounts to little. This labor, under judicious superintendence, might be advantageously applied to the production of silk.

3. For the Shakers.—I take particular pleasure in recommending the culture of silk to my respected friends the Shakers. They have every element of success; intelligence, skill, exactness, perseverance, abundance of labor, land enough; and buildings already prepared for their operations. They, of any among us, would be the fittest persons to undertake the artificial method of M. Camille Beauvais. Their female aid is of the best description for this culture. They may pursue it to any desirable extent; and I cannot have a doubt, if they should undertake it with their usual care and determination, their enterprise would be crowned with success.

4. For Schools.—Attempts have been made in different parts of New England, to get up manual labor schools; that is, schools designed to aid poor young men and women in getting an education, by making their expenses light, and allowing them to defray a portion of these expenses, by some labor, rendered daily or occasionally, either in a work-shop, or a farm attached to the institution. This is a benevolent design. That it has not hitherto succeeded as well as could be wished, is not the fault of the scheme, but comes from improper management. Into such an institution, the silk culture may be introduced with singular advantage, if pains are taken previously, to have a sufficiency of food for the worms. The labor would be light. It would occupy, excepting for two or three weeks, a small amount of time. It may be expected to yield as fair returns as any branch of agriculture, which could be connected with such an institution. It may, under some circumstances, be favorably introduced into other schools. The occupation would prove as conducive to the intellectual and moral as to the physical health. The study of nature, in all her departments, is
among the most interesting and valuable of all pursuits to the young mind. Every thing that brings the young more immediately into connexion with other living beings, and especially makes demands upon their prudence, providence and kindness becomes at once an effectual teacher of the most practical, the most valuable, and the highest virtues.

XXXIII. Conclusion.—I have, as will be seen, mainly confined myself to the discussion of the silk culture in Massachusetts, and with our present knowledge of the business, and our present prices of labor. Under how much more favorable circumstances it may be pursued where slave labor abounds, where the climate admits of obtaining three or four harvests a year, and where the best trees require no care nor labor to protect them in winter, I shall leave others to determine. How well adapted this product must be to those farmers, whose situation is remote from market, and with whom the common agricultural products are too heavy to be transported, but with great loss and toil; how advantageously it might be substituted for that odious plant tobacco, which is an impoverisher of the earth as well as a poisoner of man, and which holds the miserable pre-eminence of standing next to that curse of curses, intoxicating drinks, it is not necessary for me to say. How much more productive it may hereafter prove than we have at present any certain grounds for calculating, will presently be determined; and I entertain the sanguine hope, under an improved cultivation, of a greatly increased yield.*

If under the circumstances which I have stated, and under the qualifications named, it can be introduced and extended in Massachusetts, not as a principal, but as a collateral and incidental branch of husbandry and domestic industry, it must prove a source of eminent comfort and wealth. That the machinery for reeling is simple and cheap, that the operation involves no mystery, and may be learnt and performed by a child, are other circumstances which commend it. Massachusetts, then, I cannot but hope, will see in this case both her interest and duty. As she increases her productions

* Appendix W.
and her wealth, she increases her real power; strengthens the attachments of her children to their home, and abates the desire of emigration. In introducing this article, so emphatically of domestic and household industry, she multiplies the sources of domestic comfort and competence; and affords no small nor inefficient contribution to the cause of good morals and philanthropy.

I should do injustice to my own sense of grateful duty, if I did not call the attention of my readers to the miracles of divine Providence in this wonderful animal, the silk worm; at his entrance into life, among the smallest of living existences, which come within the cognizance of our senses; in six weeks, at farthest, completing his work; and by his humble and unobtrusive labors, contributing largely to the clothing of half mankind, and creating yearly millions and millions of wealth. It would be curious to calculate the hands he fills, the mouths he feeds, the wheels he sets in motion, the ships he loads, and the vast riches to which his annual labors amount. This reads a striking lesson to the reflecting mind, on the immense results which spring from regular and combined, though minute and often a disdained labor. Nor are his changes the less extraordinary or striking to the thoughtful mind. Nature is everywhere full of mysterious transformations, which show that the power of death has its limits, and indicate the wonderful progress of animated existence. Having accomplished his appointed task, he wraps himself in his silken shroud, and with him death is only a transient sleep. If left to himself, he soon emerges from his tomb, no longer a reptile, but a winged chrysalis, to enjoy another existence. In the curious transformations of this humble insect, man may see an instructive indication and testimony of the progress of being; and a proof that death is not annihilation. May we, as men, exult in the hopes, gathered from such beautiful examples in nature, and confirmed by divine revelation, that with man also, death is only the threshold of life; and that for him to burst these earmants of the grave, is not like the silk worm, to pass rapidly through another form of being, but to enter upon an immortality.
APPENDIX.

A.

ANNUAL IMPORTS OF BREAD STUFFS.

"It is ascertained that the flour imported into Boston in one year, amounted to 418,000 barrels, and corn with other bread stuffs to 2,000,000 bushels. This quantity is the average annual amount imported into Boston for three successive years, by an accurate abstract from the documents. To this quantity must be added one third for the outports, which is a low estimate. At the price of 87 75 for flour, and 80 cents per bushel for corn; it would amount to $6,453,333 paid by the State in a single year. This was for the year 1836. The imports were larger in 1837; and at the prices then paid of $11 per barrel for flour, and one dollar per bushel for corn, with the addition of one third for the outports, the amount would be $8,797,338 paid for bread stuffs in that year. The western parts of the State are supplied directly from Albany, and the towns upon Connecticut river by way of Hartford. We may, therefore, estimate the sum paid by two thirds of the population of the State, in a single year, at nearly nine millions of dollars."

The imports of flour into Boston in 1839 was 449,068 barrels, and of corn 1,607,492 bushels.

B.

ON SOWING WHEAT IN DRILLS OR BROADCAST.

I subjoin here some extracts from an account of an experiment on the difference between drilled wheat and wheat sown broadcast, given in Hunter's Georgical Essays, vol. iii. p. 528:

"On the 12th October, the land was measured and equally divided;
on the 14th, began to sow broadcast, under furrow, with the usual quantity of this county, viz. two bushels and a half per acre; (our bushel is eight gallons and three quarts measure,) on the 15th, finished the broadcast; the two following days the six acres intended to be drilled, were ploughed, in order to give both an equal quantity of work, into lands nine feet six inches wide, a proper width for Cook’s drill; and drilled accordingly a few days after, with one bushel per acre of the same measure as above. To do the drill justice, I must observe that the young plants suffered very much from the rooks picking the grain out of the drill, which left the land so thin of plants that some of my neighbors went so far as to say I should have no crop. It was, also, I believe, injured one acre in six by a leading land ditch stopping, which overflowed that part of the field with water for some time, and being directly across the headlands, hindered me from scarifying as soon as I should have done.

During the winter the broadcast had by a great deal the best appearance; but in a little time, after the drilled wheat was scarified, which was done the second week in March, it evidently got the lead, being then of a darker green and more healthy color. In April, the drilled wheat was horse-hoed; at the same time the broadcast wheat was hand-hoed; and in May the drilled wheat was hand-hoed, as at that time I had not a horse-hoe of my own, nor could I at that time borrow one. The drilled now beat the broadcast much. It tillered well. I told from twenty to thirty stems from a single plant, with wonderful ears, containing from twenty to one hundred kernels in an ear. The broadcast became ripe first; but both were cut at the same time; that is, the same men cut the drilled immediately after it. The broadcast was carted two days before the drilled; but both were got without any rain, and laid in the same barn with a layer of drag-rakings between them, in order to thresh them separately. Both crops were threshed by the same man with great exactness. The produce of the six acres drilled, was twenty-five quarters six bushels; the produce of the broadcast, twenty-four quarters one bushel and a half. Produce of the drilled per acre, thirty-four bushels one peck and four quarts; produce of the broadcast per acre, was thirty-two bushels one peck; that is, two bushels and one quart in favor of the drilled, which with one bushel and a half of seed saved, is three bushels and a half and four quarts in favor of the drill.

This, though considerable, is but trifling compared with the benefit the land has received from being scarified and horse-hoed, which was
very visible when the crops were cut, the drilled stubble being very clean, and the broad-cast foul. I am decidedly of opinion that if I had not hoed the broadcast, and if the drilled had not suffered by the rooks, and by being overflowed with water as mentioned, the drill would have beat the broad-cast at least one fourth part."

I add an interesting experiment of much more recent date, on narrow and wide drilling of wheat, which the intelligent inquirer will find highly interesting.

"Trial of narrow and wide drilling of wheat on the 15th October, 1838.—The quantity of land drilled, was 7 roods and 27 poles, half of which was drilled with 13 rows on a stitch 10 feet wide; the other half with 19 rows on the stitch, the land being divided into 4 stitches.

The same quantity of seed was used at the rate of 3 bushels per acre which produced from the

<table>
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<tr>
<th>Rows</th>
<th>Sheaves</th>
<th>Bushels</th>
<th>Pecks</th>
<th>Stones</th>
<th>Lbs.</th>
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<td>19</td>
<td>348</td>
<td>23</td>
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<tr>
<td>13</td>
<td>374</td>
<td>21</td>
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Bushels, 2 1
Stones, 10 0

The 4 stitches were along side of each other, and were all cut by the same men; and no perceptible difference in the size of the sheaves. The 13 rows did not stand so well as the 19 rows; but were a shade the better sample, weighing about one sixth of a pound per bushel more.

The soil was mixed. The sort of wheat was Golden Drop."


C.

ON THE CULTIVATION OF WHEAT—BY ELIAS PHINNEY.

Lexington, Feb. 1, 1840.

Dear Sir,—Your favor of the 25th ult. was duly received. You ask my opinion as to the probable success of the wheat culture in Massachusetts, and request me also to give the results of my own experience in the cultivation of this crop. Allow me, my good sir, the yankee privilege of answering one question by asking another. Why may not wheat be successfully cultivated in our State? It succeeds
east, west, north, and south of us, and why not here? Our climate is certainly as favorable as that of any part of the country, and as far as atmospheric causes have a bearing, we have as little to fear from that source as the most favored region on earth. I am aware it may be objected that our lands are not so new as that of many parts of our country where wheat is grown, and that most writers upon the subject consider a granite or light free soil as less favorable to the growth of this crop, than a strong, deep aluminous or clayey soil. Supposing these objections to be well founded, they can be at once obviated; the first by deep ploughing, and the second by the application of manure and lime. Our old fields which have been subjected to the immemorial usage of shallow ploughing and stinted manuring, will neither produce wheat nor any other crop that will pay the expense of cultivating. The farmer suffers no greater loss from a blighted field of wheat, than from a starved crop of corn. I would recommend then, to farmers who would succeed in the cultivation of wheat, or any other crop, to plough deep, turn up and keep at the surface a liberal portion of the subsoil which our fathers have left undisturbed, let them nourish their hungry and exhausted fields with a bountiful supply of manure and lime, and rely upon it, they will no longer complain of blighted crops and unproductive harvests.

The parable of the "sower who went out to sow," contains much agricultural as well as moral and religious instruction. The seed that "fell upon stony ground which had not much earth," like that which is sown upon our shoal ploughed fields, sprung up and grew the better at first, "by reason of its having but little depth of earth," but as soon as the sun was up and the season advanced, "it was scorched, and because it had no root it withered away." Here is an admirable lesson for farmers, and the reasoning of the sacred teacher is as sound and unanswerable in an agricultural, as it is in a moral and religious point of view. Let the farmers then sow their seed upon "good ground," deeply ploughed and liberally and rightly manured, and we shall hear no more of the necessity of legislative bounty as an inducement to the culture of wheat.

My opportunities, however, for noticing the results of the attempts of others in the cultivation of wheat, and my means of judging of the causes of their failure, where they have been unsuccessful, may perhaps be considered too limited, to authorize me to express a decided opinion or enable me to become a safe adviser on this subject. It is, sir, to your experience, to your careful and laborious researches, that
the agricultural community must look for much valuable and satisfactory information in a matter in which their interest as farmers is so deeply involved. Allowing me, however, to judge from my own experience, I say without hesitation I have no doubt as to the successful culture of this valuable crop in all parts of the Commonwealth; I mean with a due application of skill in the management and cultivation of our grounds.

The soil of my farm consists of a thin loam upon a hard, gravelly subsoil, being what geologists call a granite soil, and is similar to that of a great part of the Commonwealth; and I believe by adopting a correct mode of culture, is capable of producing wheat with as much certainty as any other crop.

My first attempt in the culture of wheat was twelve years ago, upon a field of two acres. The soil, a pretty deep loam upon a gravelly subsoil. The field had been planted for two or three years previous with corn and potatoes. I ploughed shoal, and not knowing the necessity of lime, I used none. The crop failed, yielding me but little more than twice the quantity of seed sown. The seed was a common kind of wheat procured in the neighborhood. Three years after, I commenced again sowing wheat, but with a different method of culture, and for nine years past have not failed in a single instance of having a good crop. I will give you the result of my practice for the three years past.

In the spring of 1837, I sowed a field of six acres. The field having been then recently set to an orchard, had been under the plough for two or three years and planted with corn and roots. Early in the spring the field was ploughed deep, bringing to the surface a considerable portion of the fresh earth which had never before been disturbed. Two bushels of Black Sea wheat having previously been steeped twenty-four hours in strong brine, and rolled in slacked lime, were sowed to the acre upon the furrow. At the same time I had spread upon the field 100 bushels to the acre of lime and peat ashes, an equal part of each, which had been mixed and lay in a heap for some weeks. The field was then well harrowed and rolled. There was no appearance of blight or rust. At the time of harvesting, I gathered and threshed one acre, probably the best, and it yielded 25 bushels of remarkably handsome grain.

In 1838, I sowed a field of the same number of acres, which was in grass in the spring of 1837. The soil, a thin vegetable mould resting upon a gravelly subsoil, and alternately under the plough and in grass
for near a century. In the spring of that year, 1837, the sward was turned over flat, the plough running deep and bringing to the top from one to two inches of subsoil, which had never before been disturbed, and by never cross ploughing, this fresh earth was kept at the surface. The field was then rolled and harrowed, and twenty loads of compost manure spread to the acre, harrowed again, and planted with corn. I put in the drills which had been marked out for the corn, twenty bushels of lime and plaster of Paris. I had a pretty good crop of corn, seventy bushels to the acre. In the cultivation of the corn, not a foot of the sward was suffered to be turned back or disturbed. In the spring of 1838, the field was made smooth by the use of the cultivator and harrow, and two bushels of Black Sea wheat, prepared as in the previous year, three pecks of herds grass, and one bushel of red top seed sowed to the acre. I then spread on fifty bushels of slacked lime to the acre, and the whole was harrowed and rolled. The straw was large and clean. In consequence of heavy rains followed by strong winds, about the time of filling, it lodged in some places, and the produce was in some measure thereby lessened. It gave me, however, over twenty bushels to the acre of well filled grain.

In 1839, I sowed a field of eight acres, which until 1838 had been pastured for twenty-five years. The soil, an exceedingly thin and light one, with gravelly bottom, yielding hardly herbage enough to form a sward. Thin as this soil was, in the spring of 1838 I had it ploughed from four to six inches deep, turning it over as flat as the nature of the ground would admit. So much of the gravelly and apparently unproductive material was brought to the surface, that it gave the field a very unpromising aspect. After ploughing, it was rolled and harrowed, about twenty loads of manure from my hog-pens put on each acre, and planted with corn, which was cultivated without breaking up the sward. I had forty bushels of corn to the acre. A small crop, but considering the very poor quality of the soil, it was as great as might reasonably have been expected. The method of cultivating this field was more with a view to future operations than for the immediate crop. In the spring of 1839, I broke up the corn-stubble, and loosened the surface with the cultivator and harrow, spread one hundred bushels to the acre of barilla ashes, fifty per cent. of which was lime, sowed two bushels of the same kind of wheat to the acre, having previously steeped it fourteen hours in a strong pickle, and rolled it in lime. Intending the field for pasture, I sowed a large quantity of all he kinds of grass seed that could be procured, and finished with the
harrow and roller. There was no appearance of blight nor rust upon
the wheat. Though the heads were short, owing to the thinness of
the soil, the kernel was plump and well filled, and makes as white and
fine flour as the best Howard street. I cannot state the quantity pro-
duced on this field, as it is not all threshed. I judge there will be at
least from fifteen to twenty bushels to the acre.

I have now given you, my dear sir, all the practical information
which I possess on the subject of the wheat culture, and leave it for
you to judge whether my opinion as to its eventual success is well
founded.

With me, the wheat crop has as seldom failed, as any crop which I
am in the habit of growing. Less liable to be injuriously affected by
the vicissitudes of the season, or the alternation of dryness and mois-
ture, than a crop of corn or potatoes.

With great respect,
Your obedient servant,

E. PHINNEY.

MR. HENRY COLMAN.


"Mr. H. Colman:

Sir,—Agreable to your request, I transmit you some particulars of
my success in raising wheat. In January, 1838, I was induced to send
to Oneida county, N. Y., for some of the Italian spring wheat. I pro-
cured and sowed nine bushels upon six acres, soaking it in brine and
rolling it in lime; and harvested twenty bushels per acre, of very fine
plump berry, though the land was rather inferior, having received very
little manure the previous year.

I was induced to extend the cultivation still further the last year.
At Lockport, N. Y., in the fall of 1838, I purchased ten bushels of
seed, of the Indiana winter wheat. In October, I sowed six bushels
of this seed on three acres of new land, merely dragging it in, (har-
rowing.) From this I harvested 92 bushels of as handsome wheat as I
ever saw. This wheat I sowed without any preparation of the seed.
I also sowed, the same fall, about six acres more with winter wheat, on
old land turning under a second crop of clover. This wheat was very
badly winter killed; still I think I should have had a very good crop had it not been for the warm rains about the time of the filling of the berry, when it appeared to shrink one third; the straw was stout enough.

In the spring of 1839, I sowed seven and one half acres with the Italian wheat, soaking it in brine and rolling it in lime, as above stated. When the wheat began to spread, I sowed on about three bushels of wood ashes per acre. This was all the application I made to it. The land was planted with corn the previous year, and received about ten loads of manure per acre. I would observe that I have for a number of years practised overhauling my manure early in the spring, and mixing lime with it. This I think has been a great help to my corn crop; also to the succeeding crop. Thus, the last year, I harvested sixteen and one half acres of wheat, from which I have threshed 346¼ bushels, and have received a bounty from the State of $18 50. I think, though some of my winter wheat was blasted, it has been as profitable as any crop I have raised. The price of wheat here now is $1 50 per bushel. Of Indian corn, 83 cts. Of oats, 45 cts. The wheat will average 30 dollars per acre. Forty bushels of corn is a fair crop for this part of the State, and at 83 cts. would amount to about 33 dollars per acre; and taking out the extra labor for corn, and the balance would be in favor of the wheat crop. Oats would yield 50 bushels per acre. This is still a poor crop. I do not say that all wheat will yield as much as mine. Still we may generally calculate upon a fair crop. We sometimes fail in a corn crop as well as in wheat. On the whole, I think that by liming our lands and practising turning under green crops, we may restore the wheat qualities to our land which has been worn out by the old way of farming.

March, 1840.

D.

MANURES FOR WHEAT.

"The effect of different manures on wheat is very remarkable. Stable manure will in ordinary good soils have the effect of causing the plant to tiller much, or to make straw and grass, thereby diminishing the produce in grain and meal considerably."

"Liquid manure, one third stable drainings and two-thirds water,
which I caused to be poured over wheat that was just tillering, made the straw grow rank and coarse; the grain of every variety of wheat was dark and thick-skinned, hence containing less meal. The same quantity and mixture of liquid manure, poured a second time over another portion of wheat caused it to grow rank and full of leaves rather than straw, that only a few of the plants produced ears of wheat, some having run up into sharp points, with merely the rudiments of ears indicated. The few ears that produced corn, displayed it in its worst form, hardly in the shape of meal, of a doughy, soft texture, evidently unfit for the food of man, besides some of them were smutty. Thus an over application of manure, excellent when judiciously applied, becomes a poison, precisely in the same manner as in the human constitution a surfeit is usually the parent of disease."

"The wheat on either side of these experiments, which had only been manured with the ashes of kelp or sea-weed was healthy, productive, and farinaceous in the highest degree. Kelp or the ashes of rock sea-weed, that which is cut is the best of all."

"I am inclined to believe, that paring and burning an old ley, will almost produce as equally good effect, where the land is suited to it, with the ashes of kelp; for although the ashes may not be of that superior quality or possessing all those virtues peculiar to kelp ashes, still the much greater portion of ashes, that can by this means be spread, may make amends in quantity and quality."

"Kelp ashes should lay on the surface of the soil a month or two previous to sowing, in order to weaken their caustic power, or they are otherwise apt to burn the young and tender shoots of the corn as well as the larvae of insects; but by laying a certain length of time on the surface exposed to the action of the atmosphere, or perhaps what would be a better practice, merely lightly turned into the soil, they become eminently beneficial."

"From lands in a very bad state, infested with couch grass in 1832, by means of paring and burning previous to taking a crop of potatoes, which produced thirty-four thousand eight hundred pounds of saleable potatoes to the acre; and with an after dressing of forty bushels to the acre of kelp or sea-weed ashes, I raised forty bushels of fine wheat to the acre. One season I raised fifty-five, and last season fifty-one bushels; this year I hope to have reaped as much with drill husbandry, though on land in a very bad state, which had been much neglected."—Le Coutur.
"Kelp, in commerce; the ashes of sea-weeds or fuci. (Fucus serratus and F. vesiculosus.) The species used in the manufacture of this article, grow attached to rocks between high and low water mark, and are often termed rock-weed. On the Scottish coast, the sea-weed is cut close to the rocks, during the summer season, and afterwards spread out upon the shore to dry, care being taken to turn it occasionally, to prevent fermentation. It is then stacked for a few weeks, and sheltered from the rain till it becomes covered with a white saline efflorescence, and is now ready for burning. This is usually accomplished in a round pit, lined with brick or stone; but the more approved form for a kiln is oblong, about two feet wide, eight to eighteen long, and from two to three deep; the bottom of this is covered with brush, upon which a little dried sea-weed is scattered, and fire is applied at one extremity; the sea-weed is now thrown on gradually, as fast as the combustion reaches the surface, and should there be much wind, it is necessary to protect it by covering the sides with sods; after the whole is burnt, the mass gradually softens, beginning at the sides, when it should be slowly stirred up with a heated iron bar, and incorporated, till it acquires a semi-fluid consistence. This part of the process requires considerable dexterity; and, if the mass continues dry, a little common salt should be thrown on, which acts as a flux. When cold, it is broken up, and is now ready for sale. Notwithstanding that kelp contains but two or three per cent. of carbonate of soda, while Spanish barilla often contains twenty or thirty, the manufacture of this article has increased prodigiously on the northern coasts of Great Britain and the neighboring islands. Small farms in the Orkneys, which formerly rented for £40 a year, have now risen to £300, on account of their kelp shores; and so much importance is attached to this branch of business, that, along sandy shores, stones have been placed within the flood-mark, which, in a short time, become covered with sea-weed. Many thousand tons are thus manufactured annually, and are sold in the various ports of Great Britain, at the rate of from 7 to £10 per ton." "New England being the only part of the United States which has a rocky coast, would seem to be the only part of our country fitted for the manufacture of kelp. The greater rise of the tides north of Cape Cod, and especially in the more eastern parts, is also a favorable circumstance; indeed, this branch of business has been carried on in the state of Maine."

The carbonate of soda comes to us under the name of barilla from Spain; and the ordinary article is made abundantly on the shores of
Scotland and the islands of Jersey and Guernsey. Whether it can be purchased at a rate which will warrant a farmer here in applying it, can be determined only by trial, and the current price of the article at the time. I believe the ordinary article may often be purchased at a low rate; and I hope the experiment will be made. It may certainly be safe on a small scale.

Of the use of sea-weeds in a crude state, I shall treat fully hereafter.

"Leached ashes are found to succeed best on dry loamy lands, or loam mixed with sand. It is considered the cheapest manure that can be applied. Ten loads of this manure on poor land will produce, ordinarily twenty-five bushels of wheat. The land is then left in a condition for yielding a crop of hay. No manure continues so long in the ground as ashes."—*New York Agrl. Soc. Trans.* 1792.

On the use of ashes as a manure, I beg leave to refer to the very instructive letters of Dr. S. L. Dana, in the appendix to the second report of the Agriculture of Massachusetts, p. 157.

A. Nichols' statement to the Committee of the Essex Agricultural Society on manures:

Persuaded of the importance of the discoveries made by Dr. Samuel L. Dana, of Lowell, and given to the world through the medium of the reports of Professor Hitchcock and Rev. H. Colman, to the Legislature of Massachusetts, concerning the food of vegetables, geine, and the abundance of it in peat mud, in an insoluble state to be sure, and in that state not readily absorbed and digested by the roots of cultivated vegetables, but rendered soluble and very easily digestible by such plants by potash, wood ashes, or other alkali, among which is ammonia, one of the products of fermenting animal manures, I resolved last year to subject his theories to the test of experiment the present season. Accordingly I directed a quantity of black peat mud, procured by ditching for the purpose of draining and reclaiming an alder swamp, a part of which I had some years since brought into a state highly productive of the cultivated grasses, to be thrown in heaps. During the winter, I also had collected in Salem, 282 bushels of unleached wood ashes at the cost of 12½ cents per bushel. These were sent up to my farm, a part to be spread on my black soil grass lands, and a part to be mixed with mud for my tillage land. Two hundred bushels of these were spread on about six acres of such grass land
While it was covered with ice and frozen hard enough to be carted over without cutting it into ruts. These lands produced from one to two tons of good merchantable hay to the acre, nearly double the crop produced by the same lands last year. And one fact induces me to think, that being spread on the ice, as above mentioned, a portion of these ashes was washed away by the Spring freshet. The fact from which I infer this, is, that a run below, over which the water coming from the meadow on which the largest part of these ashes were spread flows, produced more than double the quantity of hay, and that of a very superior quality to what had been ever known to grow on the same land before.

Seventy bushels of these ashes, together with a quantity not exceeding thirty bushels of mixed coal and wood ashes, made by my kitchen and parlor fires, were mixed with my barn manure, derived from one horse kept in stable the whole year, one other horse kept in stable during the winter months, one cow kept through the winter, and one pair of oxen employed almost daily on the road and in the woods, but fed in the barn one hundred days. This manure was never measured, but knowing how it was made, by the droppings and litter or bedding of these cattle, farmers can estimate the quantity with a good degree of correctness. These ashes and this manure were mixed with a sufficient quantity of the mud, above mentioned, by forking it over three times, to manure three acres of corn and potatoes, in hills four feet by about three feet apart, giving a good shovel full to the hill. More than two thirds of this was grass land, which produced last year about half a ton of hay to the acre, broken up by the plough in April. The remainder was cropped last year without being well manured, with corn and potatoes. Gentlemen, you have seen the crop growing and matured, and I leave it to you to say whether or not the crop on this land would have been better had it been dressed with an equal quantity of pure, well rotted barn manure. For my own part I believe it would not, but that this experiment proves, that peat mud, thus managed, is equal if not superior to the same quantity of any other substance in common use as a manure among us; which, if it be a fact, is a fact of immense value to the farmers of New England. By the knowledge and use of it, our comparatively barren soils may be made to equal or excel in productiveness the virgin prairies of the West. There were many hills in which the corn first planted was destroyed by worms. A part of these were supplied with the small Canada corn, a part with beans. The whole was several times cut down by frost.
The produce was three hundred bushels of ears of sound corn, two tons of pumpkins and squashes, and some potatoes and beans. Dr. Dana, in his letter to Mr. Colman, dated Lowell, March 6, 1839, suggests the trial of a solution of geine as a manure. His directions for preparing it are as follows: "Boil one hundred pounds of dry, pulverized peat with two and a half pounds of white ash, (an article imported from England,) containing 36 to 55 per cent. of pure soda, or its equivalent in pearlash or potash, in a potash kettle, with 130 gallons of water; boil for a few hours, let it settle, and dip off the clear liquor for use. Add the same quantity of alkali and water, boil and dip off as before. The dark colored brown solution contains about half an ounce per gallon of vegetable matter. It is to be applied by watering grain crops, grass lands, or any other way the farmer's quick wit will point out."

In the month of June, I prepared a solution of geine, obtained not by boiling, but by steeping the mud as taken from the meadow, in a weak lye in tubs. I did not weigh the materials, being careful only to use more mud than the potash would render soluble. The proportion was something like this: peat 100 lbs., potash 1 lb., water 50 gallons; stirred occasionally for about a week, when the dark brown solution, described by Dr. Dana, was dipped off and applied to some rows of corn, a portion of a piece of starved barley, and a bed of onions sown on land not well prepared for that crop. The corn was a portion of the piece manured as above mentioned. On this the benefit was not so obvious. The crop of barley on the portion watered was more than double the quantity both in straw and grain to that on other portions of the field, the soil and treatment of which was otherwise precisely similar.

The bed of onions which had been prepared by dressing it with a mixture of mud and ashes previous to the sowing of the seed, but which had not by harrowing been so completely pulverized, mixed, and kneaded with the soil as the cultivators of this crop deem essential to success, consisted of three and a half square rods. The onions came up well, were well weeded, and about two bushels of fresh horse manure spread between the rows. In June, four rows were first watered with the solution of geine above described. In ten days, the onions in these rows were nearly double the size of the others. All but six rows of the remainder were then watered. The growth of these soon outstripped the unwatered remainder.

Mr. Henry L. Gould, who manages my farm, and who conducted all
the foregoing experiments, without thinking of the importance of leaving at least one row unwatered, that we might better ascertain the true effect of this management, seeing the benefit to the parts thus watered, in about a week after, treated the remainder in the same manner. The ends of some of the rows, however, which did not receive the watering, produced only very small onions, such as are usually thrown away as worthless by cultivators of this crop. This fact leads me to believe that if the onions had not been watered with the solution of geine, not a single bushel of a good size would have been produced on the whole piece. At any rate it was peat, or geine rendered soluble by alkali, that produced this large crop.

The crop proved greater than our most sanguine expectations. The onions were measured in the presence of the chairman of your committee, and making ample allowance for the tops which had not been stripped off, were adjudged equal to four bushels to the square rod, or at the rate of 640 bushels to the acre. In these experiments, 7 lbs. of potash which cost 7 cts. a pound, bought at the retail price, were used. Potash, although dearer than wood ashes, at $12\frac{1}{2}$ cents per bushel, is, I think, cheaper than the white ash mentioned by Dr. Dana, and sufficiently cheap to make with meadow mud a far cheaper manure than such as is in general used among our farmers. The experiment satisfies me that nothing better than potash and peat can be used for most, if not all our cultivated vegetables, and the economy of watering with a solution of geine, such as are cultivated in rows, I think cannot be doubted. The reason why the corn was not very obviously benefited, I think must have been that the portion of the roots to which it was applied, was already fully supplied with nutrient out of the same kind from the peat ashes and manure put in the hill at planting. For watering rows of onions or other vegetables, I should recommend that a cask be mounted on light wheels, so set that like the drill they may run each side of the row, and drop the liquid manure through a small tap hole or tube from the cask, directly upon the young plants. For preparing the liquor, I should recommend a cistern about three feet deep, and as large as the object may require, formed of plank, and laid on a bed of clay, and surrounded by the same, in the manner that tan vats are constructed; this should occupy a warm place, exposed to the sun, near water, and as near as these requisites permit, to the tillage lands of the farm. In such a cistern, in warm weather, a solution of geine may be made in large quantities with little labor and without the expense of fuel, as the heat of the
sun is, I think, amply sufficient for the purpose. If from further experiments it should be found economical to water grass lands and grain crops, a large cask or casks placed on wheels and drawn by oxen or horse power, the liquor from the casks being at pleasure let into a long narrow box perforated with numerous small holes, which would spread the same over a strip of ground, some six, eight or ten feet in breadth, as it is drawn over the field in the same manner as the streets in cities are watered in summer.

The piece of land mentioned in the foregoing statement, contained two acres, three quarters, thirty-one rods.

Danvers, December, 1839.

E.

ON PLOUGHING IN CROPS FOR MANURE.

Boston, March 25, 1840.

Dr. S. L. Dana,

Dear Sir,—Two successful and experienced farmers one in Franklin and one in Berkshire county, have come to the conclusion, that, in turning in crops by way of enriching the land, more benefit is derived, that is, the fertility of the land is more advanced by ploughing in a crop after it has become dried or dead, than by turning it in in its greatest luxuriance and greenness. One of them showed me the results of an experiment tending to this point, which appeared strongly to favor his conclusions. A well-established fact is better than the most elaborate hypothesis; and prejudices, however strong, must yield to facts.

Allow me under these circumstances, to inquire whether, upon your principles or philosophy of vegetation, there occur to you any good reasons for a result so much at variance with popular opinion. Your views in full on this subject, will add to the obligations under which you have already laid the public and your respectful friend and servant,

HENRY COLMAN.
The results referred to in your letter, are opposed to the common opinion. Common opinion, especially in agriculture, is not always founded on observation. It is oftener prejudice, than opinion; and, when inconsistent with well known facts, has not its source in observation or experiment. The whole resolves itself into this, dry plants give more green than green. This follows from the little we know of the process termed "fermentation;" I use the term as commonly expressive of the spontaneous decay of vegetables. It includes the three stages of vinous, acid, and putrefactive fermentation. These are not necessarily dependant, following in regular progression. They are not cause and effect. Putrefaction may commence first, and it is so different from the other two, in all its stages and products, that the term "fermentation" ought never to have been applied to it. The greater part of vegetables are susceptible of putrefaction only, a small number become acid at once, and a still smaller number ever undergo vinous, acetous, and putrefactive fermentation. Fermentation then, in its widest sense, will help us to understand how dry crops may be better manures than green. Let us glance at the principles and products of fermentation.

1st. What vegetable substances are susceptible of the vinous fermentation, and what are its products?

The juices only which contain sugar, or starch, convertible first into gum and then into sugar by the action of ozalized vegetable principles, especially gluten. Pure sugar never ferments. The vinous fermentation must be excited by some substance containing nitrogen. There are three things essential to vinous fermentation, air or oxygen gas, moisture in due proportion, and a temperature never below 50° F., nor above 80° F. The products of this process are gases, ferment or yeast, and vinous liquor. The gases are carbonic acid, and hydrogen. The yeast proceeds from a change in the organization of the gluten and albumen; some late French experimenters think it proceeds from a continued evolution of infusorial plants, hence yeast begets yeast, like sowing crops of seed. However, let us leave speculation. The main facts are as above stated. If, then, we plough in green plants, we put them in a temperature favorable to the commencement of vinous fermentation; we bury them full of sap—the requisite moisture for vinous fermentation;—we cover them, whilst their saccharine principle
is in its perfection. Every thing favors vinous fermentation. The sugar and starch of the plant fermented by its gluten and albumen, are converted into gases and alcohol, the former are lost in air, the last, washes away or is changed to vinegar. All that remains for the farmer is the altered gluten and albumen, which soon putrefy and form geine. All the starch and sugar of the plant are thus lost.

2d. What vegetable substances are susceptible of the acid fermentation, and what are its products?

The substances are, first, sugar, which, in certain cases, becomes acid, without undergoing vinous fermentation; second, gum. The circumstances essential to acid fermentation are air, moisture, and a temperature from 65° to 70° F.; acetic acid is itself the proper ferment of acid fermentation. Vinegar, as is well known, singularly promotes the formation of vinegar in vinous liquors. The products are; carbonic acid, acetic acid or vinegar, and some other acids, especially that called nanceic or zumic acid, which if not lactic, is perhaps only acetic acid, holding in combination, some azotized substance. This acid combines with the alkaline and earthy ingredients of plants and soils, and forms very soluble salts. Green plants, ploughed in, are at once placed in a situation most favorable for undergoing acid fermentation. We suffer a loss of a part of the carbon, and in addition to the sugar and starch, we now lose the gum of the plants. All these are capable of producing geine, and hence in ploughing in green crops, we lose a portion of manure.

3d. What are the vegetable substances susceptible of putrefaction, and what are its products?

With the exception of oils, resins, &c., every organized part of every vegetable may putrefy. The circumstances essential to this process, are air, a temperature not below 45°, and moisture. No perfectly dry plant ever putrefies, nor will a moist one, if air is excluded. I have had a capital example of the last, in a piece of a white birch tree, dug up from a depth of twenty-five feet below the surface in Lowell, this winter. It must have been inhumed there probably before the creation of man, at least at a time "whereof the memory of man runneth not to the contrary," yet this most perishable of all wood is nearly as sound as if cut from the forest last fall. A dried plant has parted with most of its sap, that moisture, essential to the commencement of vinous and acetous fermentation. During the very act of decay, from the moment when its living functions have ceased, new combinations of its elements begin. It has already begun to be destroyed by the very agents
APPENDIX.

[March,

which gave it life. This is the beginning of putrefaction. Let us not be deceived by a name. Putrefaction we always associate with disgusting effluvia. But in the wide sense we have defined it, it includes also the fragrance of new hay. Whenever bodies consist only of oxygen, hydrogen, carbon, and a trace of azote, their putrefaction is fragrant, or inodorous; when, in addition to these, bodies contain large portions of azotized matter, gluten, albumen, or sulphur, and phosphorus, putrefaction evolves abominable odors. To the agriculturist, putrefaction is always a wholesome process, beneficial to his best interests, when promoted and controlled. There is only one case, where this process produces loss. This may be termed destructive putrefaction; it is produced by heaping together green plants, or sometimes by moistening dry vegetable substances. Here oxygen is rapidly absorbed, and finally the mass takes fire, and burns. Up to the moment of inflammation this is putrefaction. New hay, stacked too green, is a familiar example. Volumes of steam are evolved, which proceed partly from the decomposition of the plant; decompositions, and recompositions rapidly ensue; these are the ferment, which keeps up the action till the plants burn. Doubtless, all green plants, ploughed in, undergo to a greater or less extent destructive putrefaction, which succeeds the vinous and acid fermentations, perhaps caused by the very rapidity of these processes. Hence, in addition to the sugar, starch, and gum of the plant, we lose a large portion of its other substances, by turning it in green. The products of this rapid fermentation have been but little studied. Happy the farmer who never witnesses the process. He should never induce it, and may generally prevent its extension, when once begun. It is a dead loss to him; but in all other cases of putrefaction, the products are valuable. These vary according as the process takes place: 1st, in air; 2d, at the surface of the ground; or, 3d, deep in the interior of the earth. The last need not detain us—it produces all the varieties of coal.

1st. In the free air, having access to all parts of a plant, putrefaction produces carbonic acid, nitric acid, and water. But ordinarily, in the air, as oxygen does not find ready access to all parts, a portion of the hydrogen of the plant combines then with the carbon, sulphur, phosphorus and azote of the plant, and we have carburetted, sulphuretted, and phosphuretted hydrogen, and ammonia produced. Now, as these exist but in small quantity in vegetables, the loss of hydrogen will not be very great by drying the plants, and it is possible, that the removal of these, may cause the other elements to enter into more
stable combinations, better fitted to produce geine. In all cases of putrefaction in the open air, oxygen is absorbed, and an equal bulk of carbonic acid given out, while, at the same time, the oxygen and hydrogen of the plant escape as water. The result is, that in the substance left, carbon exists in a greater portion, than in an equal weight of fresh vegetables. In all cases of putrefaction, new products are formed; these again resolve into others; and this action goes on till we have no longer any organic products; we have only binary or inorganic substances left. All our researches into the philosophy of the changes in fermentation, terminate in these binary products, that is, in compounds, consisting of only two elements. During all these various changes, a variety of substances must, of course, be formed. As the elements of living, so the elements of dead plants, are continually changing into new forms. Nature is admirably simple, and never so learned as our books. We ought not to dignify with a new name, every new product of putrefaction, which we may fortunately arrest. However various these products may be, whether products or educts of putrefaction, or of our analytical methods of separating them, all putrefaction at the surface of the earth, ends by forming a brownish, black, powdery mass, which combines with the alkaline, earthy and metallic bases in the plant. This substance has been called "Geine." As I have elsewhere defined it, it is the decomposed organic matter of the soil. It is the product of putrefaction; continually subjected to air and moisture, it is finally wholly dissipated in air, leaving only the inorganic bases of the plant, with which it was once combined. Now, whether we consider this as a simple substance, or composed of several others, called crenic, apocrenic, puteanic, ulmic acids, glairin, apotheme, extract, humus, or mould, agriculture ever has, and probably ever will consider it one and the same thing, requiring always similar treatment to produce it; similar treatment to render it soluble when produced; similar treatment to render it an effectual manure. It is the end of all compost heaps to produce soluble geine, no matter how compound our chemistry may teach this substance to be.

Among the many economical modes of producing geine, the ploughing in of vegetable matter, has held a high rank. Nature teaches us to turn in the dried plant. Dried leaves are her favorite morsels, and the very fact, that Nature always takes the dried plant, from which to prepare the food of growing vegetables, should have taught us long ago, the wisdom of ploughing in dry crops. The careful collecting and husbanding of dried leaves, their superior efficacy in forming
APPENDIX.

compost, bears witness to the facts stated in your letter. That the use of dried leaves for compost, has not led to the turning in of dry crops, has probably arisen from the consideration, that a greater quantity of geine may be produced, by turning in two or three green crops in a season, than by one crop of dry. This needs experimental confirmation. The very act of tillage, on Mr. Keely's plan, by exposing the insoluble geine of one crop, to air, renders it soluble, while, at the same time, two or three green crops must form a greater quantity of salts. If only one crop can be turned in, let it be dry. All our philosophy, and the late experiments of your agricultural friends, confirm this view.

With great respect,

I am very truly, yours,

SAM'L L. DANA.

REV. H. COLMAN,
Agricultural Commissioner.

F.

EXPERIMENT IN FORWARDING SEEDS.

The subjoined experiment rests upon unquestionable authority. No one could be more relied upon for exactness and care, than the eminent man who made it. It is a most striking result. What is applicable to one kind of seeds is doubtless applicable, in a degree, to all seeds; and nothing can more emphatically illustrate the importance of care in the selection of seeds.

H. C.

Experiment, showing the Importance of selecting the first ripe Seeds, communicated to the Trustees of the Agricultural Society, by JAMES FREEMAN, D. D., Sept. 1, 1805.

To ascertain whether the ripening of seeds can be forwarded, by sowing those which are the earliest ripe, I have made experiments, all of which have been successful, on several different sorts. It will be sufficient to mention one only.

In the year 1801, I planted the case knife bean. The pods first
formed, which are commonly those nearest the root, were reserved; and when about the quantity of a peck was fully ripe, they were gathered on the same day. The largest and fairest of seeds were planted the next year, and the first-formed pods reserved as before. The same method has been pursued without any variation, till the present year; by means of which, whilst the bean has not degenerated in its quality, the ripening of the seeds has been forwarded twenty-six days; as will appear from the following table.

<table>
<thead>
<tr>
<th>Planted</th>
<th>Gathered</th>
<th>No. days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1801, May 20,</td>
<td>September 9,</td>
<td>112</td>
</tr>
<tr>
<td>1802, &quot; 11,&quot;</td>
<td>August 21,</td>
<td>102</td>
</tr>
<tr>
<td>1803, &quot; 10,&quot;</td>
<td>&quot; 8,&quot;</td>
<td>90</td>
</tr>
<tr>
<td>1804, &quot; 8,&quot;</td>
<td>&quot; 4,&quot;</td>
<td>88</td>
</tr>
<tr>
<td>1805, &quot; 6,&quot;</td>
<td>July 31,</td>
<td>86</td>
</tr>
</tbody>
</table>

The first column denotes the time of planting the seeds; the second, that of gathering the seeds, which were first ripe; and the third, the number of days which elapsed between the time of planting and the time of gathering.

As in the second and following years, I anticipated the time of planting the seeds, (by which means fourteen days have been gained, in addition to the twenty-six noted above,) to determine what effect later planting would produce, by giving the seeds more advantage from the heat of summer, in the years 1804 and 1805, I put into the ground a quantity of seed, about a week later than that which was first planted. The event which took place, is exhibited in the following table.

<table>
<thead>
<tr>
<th>Planted</th>
<th>Gathered</th>
<th>No. days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1840, May 14,</td>
<td>August 8,</td>
<td>86</td>
</tr>
<tr>
<td>1805, &quot; 13,&quot;</td>
<td>&quot; 6,&quot;</td>
<td>85</td>
</tr>
</tbody>
</table>

As very little time has been gained in the present and in the preceding year, I suppose I have now reached, or nearly reached, the \textit{ne plus ultra}. I delay not, therefore, to communicate to the Trustees
of the Agricultural Society, the result of an experiment, which confirms the important truth, taught in various parts of their useful publications. That, to ensure an early and good crop, the seeds reserved for future sowing should be those, which are the first ripe, and which are, in other respects, the most perfect.

Extracts from a letter of Joseph Cooper, of New Jersey, in 1799.

** "This kind of corn I have continued planting ever since, selecting that designed for seed in the manner I would wish others to try, viz.—When the first ears are ripe enough for seed, gather a sufficient quantity for early corn, or replanting; and at the time you would wish your corn to be ripe generally, gather a sufficient quantity for planting the next year, having particular care to take it from stalks that are large at bottom, of a regular taper, not over tall, the ears set low, and containing the greatest number of good sizeable ears of the best quality; let it dry speedily, and from the corn gathered as last described, plant your main crop, and if any hills should be missing, replant from that first gathered, which will cause the crop to ripen more regularly than is common, which is a great benefit. The above mentioned I have practised many years, and am satisfied it has increased the quantity, and improved the quality of my crops beyond what any person would imagine, who has not tried the experiments."

"For many years past, I have renewed the whole seed of my winter grain, from a single plant which I have observed to be more productive, and of better quality than the rest, which I am satisfied has been of great use, and I am fully of opinion, that all kinds of garden vegetables may be improved by the foregoing methods."

G.

ANALYSIS OF DIFFERENT VARIETIES OF WHEAT.

To show the extraordinary exactness with which experiments have been made in this matter, I subjoin the following tables. The weights given in the first table are apothecaries', and "gros" means drams.
### TABLE I.—From Le Couteur.

An Experiment to ascertain the quantity of Meal, or Flour and Bran, in each of fourteen varieties of wheat under trial.

<table>
<thead>
<tr>
<th>No.</th>
<th>DESCRIPTION OF GRAIN</th>
<th>Half Gill Measure Weighed</th>
<th>Produced in Flour</th>
<th>Produced in Bran</th>
<th>Total in Grinding</th>
<th>Loss in Grinding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>White Danzig—large round, - - - - - -</td>
<td>1</td>
<td>5</td>
<td>22</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Small round, - - - - - - - - - - -</td>
<td>1</td>
<td>4</td>
<td>50</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Reddish round, - - - - - - - - - -</td>
<td>1</td>
<td>4</td>
<td>37</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Fine White—longish, - - - - - - -</td>
<td>1</td>
<td>4</td>
<td>46</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Fine White Seedling—roundish, - -</td>
<td>1</td>
<td>4</td>
<td>30</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Fine White, - - - - - - - - - - -</td>
<td>1</td>
<td>4</td>
<td>52</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>Coarse Yellow—round, - - - - - - -</td>
<td>1</td>
<td>4</td>
<td>50</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>Fine White, - - - - - - - - - - -</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>Plump Whitish—roundish, - - - - -</td>
<td>1</td>
<td>4</td>
<td>38</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>Whitish, - - - - - - - - - - -</td>
<td>1</td>
<td>4</td>
<td>39</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>11</td>
<td>Reddish Yellow, - - - - - - - -</td>
<td>1</td>
<td>4</td>
<td>44</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>12</td>
<td>Yellow—round, - - - - - - - - -</td>
<td>1</td>
<td>4</td>
<td>44</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>13</td>
<td>Liver—elongated, - - - - - - -</td>
<td>1</td>
<td>4</td>
<td>32</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>Reddish Yellow—plump, - - - - -</td>
<td>1</td>
<td>4</td>
<td>23</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>
The straw of wheat is generally reckoned to be about double the weight of grain—an acre producing twenty-four bushels of wheat of ordinary quality, may then be presumed to yield about twenty-six hundred weight of straw. This rule, however, is not certain.

Some exact experiments as to the relative amount of straw to wheat, have given the following results; avoirdupois weight.

No. I. gave 3 lbs. 3 oz. of wheat; 3 lbs. 9 oz. of straw.
" II. " 2 lbs. 12 oz. " ; 3 lbs. 4 oz. "
" III. " 6 oz. more straw than grain.
" IV. " 4 lbs. 4 oz. " ; 3 lbs. 13 oz. of straw.
" V. " 2 lbs. 9 oz. " ; 3 lbs. 15 oz. "
" VI. " the grain 7 oz. more than the straw.

I insert also two other tables, exhibiting the results of other experiments on the values of different wheats. These from the Journals of the English Agricultural Society.

References to Table II.—" Proceeding thus, the whole ground was finished, and then one grain of wheat was dropped into each hole. The rows were thus exactly 6 inches apart, and the grains in the rows were 3 inches from one another. The regularity with which the planting was performed was thus mathematically accurate. The ground was 67 feet in length; and 3 rows of each variety of wheat were planted, except the first and last numbers, of which there were 4 rows. The outer row of each of these, however, was not taken into account, because their roots had a much greater extent of ground for their growth than the others, whose roots touched one another all round. The end plants of each row were also rejected for the same reason. Sixty-six feet in length of ground were thus taken up, and 3 rows of each variety occupied in width 1 ½ foot: the ground occupied by each variety was thus 99 square feet, the 440th part of an acre.

(On page 198, is a tabular account of this experiment.)

The seed from which the first 10 varieties were raised, was carefully selected from specimens of each obtained in the ear. The others were from samples, and here, also, the greatest care was taken that the seed from which each was raised, should be the best and plumpest that could be obtained.

The first four columns need no explanation beyond what is given at the head of each: the fifth shows the number of grains lost from casualties. If the frost had been the only agent in the destruction of so
many of the seeds, this column might have been considered as a very accurate index of the relative hardness of each variety. This, however, is not the case, for the havoc which the birds made must also be taken into account. It was thought at the time, that more injury was sustained, from the latter cause, by those varieties planted, on the 21st, than by any of the others; but this does not appear to have been the case, for, if the great loss sustained by these had been wholly owing to the havoc committed by the birds, it is evident that the varieties marked Nos. 12 and 15 would not have been so slightly injured, while Nos. 11, 13, 14, and 16, suffered so severely. The figures in this column may, therefore, be said to indicate with tolerable accuracy the relative ability of each variety to withstand the effects of a severe and changeable winter, such as that during which the experiment was made.

The number of plants of each variety which came to perfection, is placed opposite the name of each in the sixth column. This was ascertained by pulling each as they respectively ripened, and counting the plants of each before proceeding to the others. In this way, by a simple subtractions, the numbers contained in the fifth column, also, were ascertained.

When all the plants of any variety had been pulled, the number of ears, also, belonging to them was counted, and the results are placed in the seventh column.

By dividing these by 99, the number of square feet which each variety occupied, we obtain the number of ears in each square foot; and this is placed opposite the name of each wheat, in the eighth column.

The average number of ears to each root, ascertained by dividing the number of ears by that of the roots, is placed in the ninth column. This column shows the degree in which each species possesses the important property of spreading and shooting out stems, or, as it is technically termed, of tillering; and it will be seen that they vary in this respect greatly.

After having been pulled and dried, the wheat was carefully rubbed out; and the light and imperfect grains had been separated, the weight of the remainder was taken, and placed opposite each sort, in the tenth column.

The twelfth column contains the number of bushels per acre raised from each variety. The amount per acre allowed at the rate of 64 lbs. to a bushel.

The weight of straw, which is placed in the fourteenth and fifteenth columns, was ascertained after the roots had been cut off, and after it had remained out sufficiently long to dry it perfectly."
### TABLE II.—From John Morton, England, with Remarks.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of Wheat</th>
<th>Produce of 90 Heads of 30 Bushels</th>
<th>Head of 30 Bushels</th>
<th>Length of Spike</th>
<th>Number of Seeds per Spike</th>
<th>Length of Spike as a Line</th>
<th>Weight of 90 Heads</th>
<th>Weight of 90 Spikelets of Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Old Red Lammas</td>
<td>792</td>
<td>391</td>
<td>25</td>
<td>5</td>
<td>19</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Golden Drop</td>
<td>729</td>
<td>339</td>
<td>25</td>
<td>5</td>
<td>18</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Tansos, a Prolific</td>
<td>722</td>
<td>319</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Hunter's</td>
<td>722</td>
<td>318</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Thickset Suffolk</td>
<td>722</td>
<td>317</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Hickey's Prolific</td>
<td>722</td>
<td>317</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>White Thunton</td>
<td>722</td>
<td>317</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>Silver Thunton</td>
<td>722</td>
<td>317</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Scotch White</td>
<td>722</td>
<td>317</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>Tatloverta</td>
<td>722</td>
<td>317</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>Smithers' Hereford White</td>
<td>722</td>
<td>317</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>A. Red Wheat</td>
<td>722</td>
<td>317</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>Egyptian Cone</td>
<td>722</td>
<td>317</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>Red Straw Lammas</td>
<td>722</td>
<td>317</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td>Blue Cone</td>
<td>722</td>
<td>317</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>Red Cone</td>
<td>722</td>
<td>317</td>
<td>24</td>
<td>4.5</td>
<td>17</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>
**TABLE III.—FROM LE COUTEUR'S PRIZE ESSAY.**

**Comparative Statement of the results of different Wheats.**

<table>
<thead>
<tr>
<th>Soil.</th>
<th>Manure.</th>
<th>Quantity of Seed per acre.</th>
<th>Time of Sowing.</th>
<th>Produce per acre.</th>
<th>Produce per acre in 18 lbs. of Flour.</th>
</tr>
</thead>
</table>

"One ear of a superior variety of wheat, sowed grain by grain, and suffered to tiller apart, produced four pounds four ounces of wheat; whereas another of an inferior sort treated in the same manner produced only one pound ten ounces."—*Le Couteur on Wheat*, p. 11.

"The pains I took in making those first selections amply rewarded my labors, as the produce of my crops was increased on an average of about twenty-three to twenty-five bushels an acre to thirty-four, and since I have raised wheat from single ears, or carefully selected sorts, I have increased my crops to between forty and fifty bushels the acre."


"No. 1, produced 3 lbs. 3 oz. from 61 grains, and 3 lbs. 9 oz. weight of straw of a beautiful white color; whereas, No. 14, a red variety, only produced from 59 grains, 1 lb. 10 oz. of wheat, and 2 lbs. 5 oz. of straw.

"No. 8, a downy variety, was still more productive than No. 1, as fifty-five grains produced 4 lbs. 4 oz. of wheat, and 3 lbs. 13 oz. of straw, its average of tillers being 11; the straw of a fine color, and the sample very beautiful, though scarcely so fine, or thin-skinned as No. 1.
This produced nearly three times as much corn (grain) as No. 14, and a third more straw."—Ibid, p. 24.

"From careful observation, it appears that some varieties, if sown the second day, differ in their period of flowering, many days; even ten or twelve intervening."—Ibid, p. 64.

H.

ON USING THE BEST SEED.

"Some people have recommended the sowing of blighted and mildewed wheat, because it will vegetate, though certainly the recommendation, if carried into practice, would be attended with imminent danger to those who practise it. That light or defective wheat will vegetate or produce a plant, we are not disposed to contradict; but that it will vegetate as briskly, or put out a stem of equal strength, and capable of withstanding the severe winter blasts as those produced from sound seed, we must be excused from not believing. Let it only be considered that a plant of young wheat, unless when very early sown, lives three or four months, in a great measure, upon the nourishment which it derives from the parent seed, and that such nourishment can in no view of the subject be so great when the parent is lean and emaciated as when sound, healthy and vigorous. Let it also be remembered, that a plant produced from the best and weightiest seed, must, in every case, under a parity of other circumstances, have a stronger constitution at the outset, which necessarily qualifies it to push on with greater energy when the season of growth arrives. Indeed, the economy of nature would be overturned if any other result followed."—Brown on Rural Affairs, Vol. ii. p. 31.

"An experienced agriculturist asserts with confidence, that he has seen fields partly sown with sound and partly with mildewed wheat, and that the difference was discernible at one glance even in the winter months, during the first stage of their growth."

I give below, a decisive experiment in favor of using perfectly ripened and well-harvested seed wheat, in preference to that which is light or imperfect.

"The late Benjamin Bell, Esq., in October, 1783, sowed a field of twelve acres at Hunthill, in Roxburghshire, with 54 bushels of wheat,
of which 13 bushels were the best that could be procured in the Lon-
don market of crop 1783, 30 bushels were from East Lothian of crop
1783, 6 bushels the best wheat in the London market of crop 1782,
and 6 bushels produced near Edinburgh in that year 1782. It must
be remarked, that 1782 was a season generally unfavorable to raising
wheat in perfection, but that in 1783 the grain was sound and of good
quality. The field on which these parcels of wheat were sown had
been well fallowed, was equally manured with dung, and the whole of
these seeds were sown in the beginning of October, all of them having
been washed in strong brine, and afterwards dried with powdered
quick-lime. The English seed of crop 1783 was sown on one side of
the field; three bushels of the Mid-Lothian seed of crop 1782 were
sown on the next three ridges; to this succeeded the English seed of
crop 1782; then the East-Lothian wheat of crop 1783; and, lastly,
the remaining three bushels of Mid-Lothian seed crop 1782.

"The field being all in good condition, the wheat appeared early
above ground, and the shoots were every where strong, except on
those ridges which were sown with the Mid-Lothian seed of crop
1782, on which the plants were weak and not very numerous; neither
did these spread or tiller like the others; so that during the winter
and spring months, the wheat on these ridges had a weak appearance;
in harvest the straw was thin and short, and the ears were short and
small, the grain likewise being not so large or heavy as on other parts
of the field. On being threshed and measured, the produce of the 12
bushels of seed, crop 1782, both the London and the Mid-Lothian taken
together, was only 66 bushels, or 5½ after one. The produce of the rest
of the field was fully 15 bushels for every bushel of seed. The differ-
ence in value was also considerable, as the produce of the seed from
crop 1782 sold almost a shilling the bushel lower than the other."—

I.

QUANTITY OF SEED TO THE ACRE.

"We have stated it as our opinion, that farmers generally err on the
side of sowing too profusely. The practice, however, has been still
further extended by the recommendation of Mr. Coke, of Norfolk, on
whose estates wheat is now sown at the rate of four bushels to an acre.
The quantity used, should be in a great measure governed by the state and quality of the land upon which it is sown. Soils naturally rich or such as are improved by cultivation and manure, will require much less seed than those in an unfertile state: on the contrary, the lighter and the less cultivated the soil, the greater will be the quantity of seed which it requires. The reason is obvious, plants tiller more in rich and strong than in unfertile soils, and therefore occupy respectively a greater space; they are less liable to be killed on good soils in the winter months; and every plant generally comes to maturity; the straw also becomes more luxuriant and consequently requires a greater circulation of air to preserve it in health and vigor; whereas the plants on light soils will but weakly and partially tiller; this deficiency of stock on the land must be supplied by producing a greater number of plants; and as the straw will not be so liable to rot or mildew on light soils, little danger need be apprehended on such from growing too thick a crop."—*British Husbandry*, p. 147.

These are the opinions of an experienced cultivator. Undoubtedly there may be an excess of seed, but the habits of our farmers are in almost all cases to sow too little seed. An experienced and successful farmer, in Hampden County, says he has found great advantages in sowing a liberal quantity of seed. Formerly, he sowed not more than three pecks or one bushel of rye to an acre, now he sows three bushels to an acre on the intervale land of Connecticut river, and finds an advantage in it.

Mr. Coke was led to adopt the practice of sowing very liberally from accidental circumstances, which I shall give an account of in the words of his steward.

"In this case, at Holkham, Eng., the wheat was drilled, distance not given. The first was on a field of thirty acres. One drill man deposited four bushels to the acre; the other gauged his drill wrong and deposited only three bushels to the acre. The four-bushel-seeding escaped the mildew and was a very fine crop; the three-bushel-seeding was mildewed and was the only thin wheat, and the only mildew worthy of notice on the farms.

The other experiment was in a field of thirty-five acres. Part of the field was drilled with five bushels to the acre, and part with four bushels. Many practical men gave it as their opinion, that the five bushels seeding was the best in the field."—*Blaikie on Mildew quoted in British Husbandry*, p. 146.
"The chief source from which plants derive the materials for their growth is the soil. However various the composition of the soil, it consists essentially of two parts, so far as its solid constituents are concerned. One is a certain quantity of earthy matter, such as siliceous earth, clay, lime, and sometimes magnesia; and the other is formed from the remains of animal and vegetable substances, which, when mixed with the former, constitute common mould. A mixture of this kind moistened by rain affords the proper nourishment of plants. The water, percolating through the mould, dissolves the soluble salts with which it comes in contact, together with the gaseous, extractive and other matters which are formed during the decomposition of the animal and vegetable remains. In this case it is readily absorbed by the roots and conveyed as sap to the leaves, where it undergoes a process of assimilation."

"But though this is the natural process by which plants obtain the greater part of their nourishment, and without which they do not arrive at perfect maturity, they may live, grow, and even increase in weight, when wholly deprived of nutrition from this source. In the experiments of Saussure, sprigs of peppermint were found to vegetate in distilled water; and it is well known that many plants grow when merely suspended in the air. In the hot house of the botanical garden of Edinburgh, for example, there are two plants, species of the fig tree, the Ficus australis and the Ficus elastica, the latter of which has been suspended for ten, and the former for nearly sixteen years, during which time they have continued to send out shoots and leaves."—Tur-ner's Chemistry, p. 565.

"There are some plants that fasten themselves and grow upon the most barren rocks, deriving from the surrounding air and from rains, all the nourishment required by them; of this number are the mosses, the lichens, and the fleshy plants. Their growth is slow; their transpiration almost nothing, and their color remains nearly the same all the year round, so that they constantly absorb water, and carbonic acid; and assimilate their constituent principles."—Chaptal, p. 92.
CHEMICAL PHENOMENA IN GERMINATION AND VEGETATION.

"The conditions necessary to germination are three fold; namely, moisture, a certain temperature, and the presence of oxygen gas. The necessity of moisture to this process, has been proved by extensive observation. It is well known that the concurrence of other conditions cannot enable seeds to germinate, provided they are kept quite dry."

A certain degree of warmth is not less essential than moisture. Germination cannot take place at $32^\circ$; and a strong heat such as that of boiling water, prevents it altogether, by depriving the germ of the vital principle. The most favorable temperature ranges from $60^\circ$ to $80^\circ$; the precise degree varying with the nature of the plant; a circumstance that accounts for the difference in the season of the year at which different seeds begin to germinate.

That the presence of air is necessary to germination, was demonstrated by several philosophers, such as Ray, Boyle, Maschenbroeck, and Boerhaave, before the chemical nature of the atmosphere was discovered; and Scheele soon after the discovery of oxygen, proved that beans do not germinate without exposure to that gas. Achard afterwards demonstrated the same fact, with respect to seeds in general, and his experiments have been fully confirmed by subsequent observers. It has been even shown by Humboldt, that a dilute solution of chlorine, owing to the tendency of that gas to decompose water, and set oxygen at liberty, promotes the germination of seeds. These circumstances account for the fact, that seeds when buried deep in the earth, are unable to germinate.

It is remarkable that the influence of light, which is so favorable to all the subsequent stages of vegetation, is injurious to the process of vegetation. Ingenhouz and Sennebier, have proved that a seed germinates more rapidly in the shade, than in the day-light; and in diffused day-light, quicker than when exposed to the direct solar rays.

From the preceding remarks, it is apparent that when a seed is placed an inch or two under the surface of the ground in the spring, and is loosely covered with earth, it is in a state every way conducive to germination. The ground is warmed by absorbing the solar rays, and is moistened by occasional showers; the earth, at the same time, protects the seed from the light, but by its porosity, gives free access to the air."

Turner's Chemistry, p. 562.
ON DRAINING AND SUBSOIL PLOUGHING.

The statements, which I give below, are from an examination had before a large committee of the British Parliament, relating to draining and subsoil ploughing. I at first intended to give only a short abridgment of them; but they are of such remarkable importance, that I have chosen to give them at large. I know they will be read with the greatest interest.

As my report is going through the press, it gives me pleasure to say, that Messrs. Ellis & Bosson, in North Market Street, Boston, with a commendable and patriotic enterprise, have imported one of Smith's subsoil ploughs, of which I gave an account and an engraving in my First Report of the Agriculture of Massachusetts. Its construction is altogether peculiar; but with sufficient power, there is no doubt it will prove effectual. It is an expensive article to be imported; but it is probable, especially as they are not patented, that they will be manufactured here at a reasonable rate. If the system is faithfully carried out, there cannot be a doubt, of its extraordinary and most beneficial effects. It is only due to these gentlemen, to add, likewise, that they have imported a great variety of wheats, other grains, and grass seeds, with samples, also, in the straw, of the finest kinds, and which must prove of eminent utility to our agriculture.

Our distinguished fellow citizen, Mr. Webster, of the United States Senate, likewise, in his recent visit to Europe, took pains to bring home, at considerable personal trouble and expense, large samples of wheat, oats, barley, beans, vetches, and turnips of the best kinds, cultivated in England, which were placed at the agricultural establishment of Messrs. Breck & Co. in N. Market Street, Boston. This is conferring an eminent benefaction upon the country, and essentially adding to the great obligations which his fellow citizens are under, to his intelligence, public spirit, and patriotism.

Statement by T. F. Kennedy, Esq of Dumure, formerly M. P. for the Ayr Burghs, respecting his experience of the System of Draining and Sub-soil Ploughing, recommended by Mr. Smith, of Deanston, in the county of Stirling.

May, 1836.

I have practised Mr. Smith's system of draining and sub-soil ploughing upon my farm, in the county of Ayr, during the last three years,
APPENDIX.

[March]

and the result has fully justified every anticipation of benefit. It is applicable to all soils not rocky which have not an absolutely porous sub-soil, the great object being, that the sub-soil should be rendered artificially porous, and that all rain-water should sink on the spot on which it falls, and that no running of water should take place on the surface.

There was, at the outset, considerable difficulty in having the work executed; it was arduous, and those engaged in the superintendence and labor were adverse, because they did not see the principles of the system, or the advantages which were likely to arise. A little encouragement and a distinct intimation that there must be perseverance, overcame every difficulty. This observation applies to the sub-soil ploughing, while some difficulty attached to the perfect execution of the drains, in having them made of the full depth of 30 inches, and filled neither too much nor too little, and with all due care in all particulars which must be attended to to secure permanence in the effects. I have invariably made the drains twelve feet apart, in order to secure the effect being complete; being much impressed with the folly of spending a considerable sum per acre in the operation, and still failing to obtain what I may term perfection in the system. I have also used broken stones as the material when they could be obtained within such a distance as to prevent the expense of cartage being excessive; in other cases I have used tiles, with a layer of three or four inches of stones or gravel over them. When stones alone were used, the drains have been uniformly thirty inches deep, leaving 16 inches for the operation of the plough and sub-soil plough; where tiles have been used, the depth has been about 24 inches, the same depth for the ploughs being left as in the other cases. A crop of oats has generally been taken after the drains have been executed, and the land has been comparatively dry; but even the visible effect has been very imperfect until the sub-soil plough has been applied. By means of this plough the whole obdurate undercrust of the soil has been broken up, and all water has instantly escaped, and, after six or eight months of the alternations of heat and cold, wet and dry, a most remarkable change has appeared in the condition of the soil; what was before obdurate and retentive has become comparatively mellow and friable, and the longer the time since the operation has been performed, the greater has been the perceptible progressive effect. The operation of the sub-soil plough has produced cracks and crevices and interstices to the depth of 16 inches; through these the rain passes off with rapidity, and these crevices are imme-
diately filled by the air of the atmosphere, and during dry and hot weather these cracks and crevices are multiplied to an indefinite extent, and in clay soils to an extent quite remarkable. Instead of resuming its original tenacity, there seems to be a decided change effected in the character of the component parts of the land to the depth the plough has reached. It is for the skilful farmer to apply manure judiciously according to the state of each field. Drilled green crop has followed a crop of oats, and the land which before was unfit to grow turnips has become fitted for that crop, although, perhaps, a little rough and cloddy during the first year. Next has come a crop of wheat, and in it has been seen the great and remarkable effects of the system, in the condition of the soil and the quantity of produce. Land which was before, in truth, unfit to carry wheat from extreme wetness, has become altogether the reverse, being sown with wheat without ridges and furrows, being perfectly porous; all rain disappearing as it falls, and being carried off by filtration to the many drains, and each drain having little more than a thread of water to carry off. Possibly the land of which I speak might have previously yielded a precarious produce of 20, or at the utmost 24 bushels of wheat per imperial acre, while in its improved state, the actual produce of the crop of 1835 has been 40 bushels thrashed out, a few bushels of which were not very good in quality, owing to what is now to be mentioned. The fault of the crop was, that it was too strong, and there being much rain while it ripened it was laid down. Had this not occurred, the quality of the whole would have been good, and there is no doubt that six or eight bushels more per acre would have been obtained. The facts, therefore, are most satisfactory, because the result in the first wheat crop may truly be said to be twenty bushels of wheat of extra produce, in return for an expense of 10l. 10s per acre, which was the cost of the drainage and the extra expense of sub-soil ploughing. It ought to be stated, that with the turnips, the land was well manured, and subsequently abundantly. After the wheat was carried, and during the winter, the field was ploughed about nine inches deep with the ordinary plough, and remained rough until the month of March, the whole rains of winter, which were excessive, sinking as they fell. Towards the end of March, the field was harrowed, drilled, and sown with beans, without any manure. The crop is promising, and there can be no doubt that the powers of the soil which have now been brought into action, will render it abundant. The soil is so powerful, that it is intended to take a crop of wheat after the beans, without any manure,
but taking care to make the land perfectly clean; and there is little doubt that the wheat crop of 1837 so treated, will be more productive than that of 1835, because it will be less superabundant in straw, and incur less probable injury from being laid down.

My experience, on a moderate scale, leads me to say, that the system is the greatest discovery which has been made in agriculture (because it is applicable to soils hitherto almost intractable and most expensive to cultivate,) provided it be applied only where the altitude justifies the undertaking, by securing a climate suitable to valuable crops. It, in truth, converts almost the worst into the best land, that is, the most powerful in respect of production, because the quality of land to which it is applicable, the heavy clays and retentive sub-soils, will yield heavier crops after such treatment than the lighter loams and many of those varieties of soil which hitherto have been so pleasant to the agriculturist to cultivate.

The reformation which the system effects on lands, which previously were looked on as hopeless, is quite surprising, and no one believes it until it is seen; but again I say, that the whole success depends on the perfect and complete manner in which the operations are executed, as any thing merely being an approximation to the system will end in disappointment. The expense of what is perfect must not be grudged, and as surely as it is liberally given will it be abundantly repaid. I would also say, that the effects of the draining and sub-soil ploughing are dependent on each other; the one is comparatively worthless without the other; the ploughing would be thrown away without the previous draining, and the draining is a poor improvement compared to the combined effect with the sub-soil ploughing.

I may state, that my bailiff and the ploughmen who worked the sub-soil plough, certainly in the outset thought my orders almost foolish, (who nevertheless carried them into effect faithfully,) but now see the effects of the system, and are fully sensible of the extraordinary benefits resulting from it.

The various views of the advantages might be multiplied to any extent, but a concise statement of them seems to be, that the most obdurate and intractable soils assume a friable and mellow character, and at the same time are rendered permanently most productive. A system which is applicable to 10 acres is equally so, in its principle, to 10,000 or 100,000 acres, and consequently the system becomes a most important national consideration. My decided impression is, that capital judiciously applied in the execution of this system may yield a
return varying from 10 to 40 or 50 per cent., according to the various circumstances attending the infinite variety of cases in which the system may be carried into effect. Every thing depends on the mode and perfection of execution, if any one thinks of limiting the expense of complete execution, he may rest assured, that the recompense will be still more restricted, and that it is more judicious to improve one acre well, than to deceive himself by a superficial operation on a more extended surface.

A remarkable effect is, that the harvest is considerably earlier on land so treated than on the same land in its previous state, and it is scarcely necessary to remark, that there will be a constant return for the same seed and labor and manure far greater than when they are applied to land in a naturally wet condition.

Evidence of James Smith, Esq., inventor of the Sub-soil Plough.

Chairman. You live at Deanston?—Yes.
Where is that?—In the western district of Perthshire in Scotland.
Do you occupy a considerable farm in that part of Scotland?—About 200 acres.
Have you improved your farm lately?—I have.
In what way?—Chiefly by thorough draining and sub-soil ploughing.
What was the nature of the soil upon your farm?—It was various; there is some part of it rather light soil, some of it gravelly upon the edge of the river, and some lightish loam, with rather a tenacious bottom, and in other parts a stiff sandy clay.
Is it a stiff sub-soil?—Some part of it very stiff.
And it was all subject very much to wet?—The greater part of it was covered with rushes and bent before being drained.
Will you describe to the Committee your mode of draining?—The principle upon which I drain is to put in drains frequently, so that there may be opportunities for the water to pass off, because I find that in our climate the chief injury arises from the water that falls from the heavens.
Are those drains placed up the furrows or across the land?—They are placed in the same direction that the furrows were before, but I have now no furrows. I lay all my fields down without any furrows.
I object to furrows, because water is allowed to collect in a body, and thereby ruins the soil.

The fact is, that those drains are so frequent, that they answer the purpose of furrows?—Yes; they answer the purpose of furrows.

How far are they apart?—Twenty-one feet, and two feet six inches deep to the bottom.

Do you drain with stones or with tiles?—Chiefly with broken stones, because I have stones upon the land.

You spoke of sub-soil ploughing; you are the inventor of a sub-soil plough?—I am.

Do you use it after draining?—After draining. I first take a grain crop, and then after the separation of that crop from the ground I sub-soil plough.

How far do you fill up the drain with stones?—I put in 12 inches of stones, leaving 18 inches between the upper part of the drain and the surface of the soil, and then I cover them most carefully with very thin sods, overlapping at the joinings, because it is of the first importance to prevent the soil which has been recently removed from running into the drains. There are many drains destroyed by means of the soil getting in at the top.

The water comes in at the side of the drains?—Yes, by fissures in the sub-soil.

Will you describe the operation of the sub-soil plough?—I have got a plate of it here (producing the same.)* The principle upon which I constructed that plough was this, that I saw it was of the greatest importance to break up the sub-soil, especially where it was tenacious. I saw that the common trench plough, when used to break up the sub-soil, at the same time turned over the recently moved sub-soil to mix with the surface soil, which induced a sort of partial sterility for a time. I then bethought me of having a plough that would move the sub-soil, still retaining the active soil upon the surface, and I considered how I should construct it to have the least draught, so that the horses might easily draw it, because I was aware that it would require considerable force. I therefore made the plough as thin as possible in its transverse section, and the share of the plough, which is usually made with a free point not touching upon the lower part of the plough, and I found it was apt in stony land to get knocked out of its place, and therefore I made a mortice in the sock, and inserted the

point of the share in this mortice: then in order to move the sub-soil as much as possible, I placed an oblique spur upon the one side of the plough, which throws up the subsoil after the furrow has been divided and breaks it, but does not throw it further up than the bottom of the furrow of the active soil.

Mr. Hadley. Does not the spur increase the draught?—It does not materially.

How many horses does it require to work that plough?—Generally four horses in ordinary sub-soils, but upon some it has been necessary to use eight horses.

How deep do you plough?—Sixteen inches from the surface.

Mr. Loch. What is the depth of the original furrow?—Six inches; we first go on with the common plough and turn over a furrow of the depth of six or eight inches, and then the sub-soil plough goes and stirs up the bottom without bringing the soil further up than its original position, then when the common plough comes round again, it throws the active soil upon that part which has been sub-soiled.

Then the advantage of stirring up the sub-soil is that the water which falls gets down to the bottom of the second furrow so as to relieve the upper soil from the effects of the rain that falls?—Yes; besides there is a constant operation of the air upon the sub-soil, which converts it into soil.

Mr. Cayley. Is it with a view to draining principally?—With a view first to draining, and then to converting the sub-soil into a fit soil for growing plants.

It makes the soil more permeable?—Yes.

How long have you been doing this?—About twelve years.

In the first instance, if you were to turn up that sub-soil, it would not be a productive soil, and therefore you prepare it by this course for subsequent turning up when it is prepared?—Yes.

When you conceive it to have come into a proper state for vegetation, do you turn it up at once or gradually?—At once.

Do you find that the soil will be very productive the first year after it is turned up?—I find it so.

Do you stir it up with the old soil?—I sub-soil it only once. I then take a green crop, followed by a grain crop; then it lies three years in grass; and then after that, I take a crop of oats; and then after, I turn it up to the depth of sixteen inches.

Then it takes about three or four years to bring the sub-soil to a proper degree of preparation?—It does.
After the sub-soil has been brought into a proper degree of preparation for vegetation, have you ever tried the experiment of bringing in a certain proportion, say a fourth part of the sub-soil after it is prepared, into co-operation with the active soil?—I have, and it answers very well.

Do you consider that the bringing into play the whole of the sub-soil at once is a better thing and more productive than holding in reserve a portion of the sub-soil?—I think it is.

After turning up the sub-soil, how many years have you grown crops upon it?—My mode of cropping is a seven years' shift, and I have now four fields undergoing a second shift.

Have you had the experience of what the condition of the previous active soil becomes, from being in a state of rest for several years?—It is all mixed together.

Then the effect of your system is to produce a new soil instead of the old one?—Yes.

Mr. Denison. According to your plan, supposing you were not to have turned up any of this sub-soil, but merely to have had your sub-soil plough pass through it, and were to go on cultivating without any thing being turned up to the top, instead of producing sterility, would even that produce an improvement of the crop?—It would, and a continued improvement.

After getting upon land that has been sub-soil ploughed, and then ploughing it up again, do you find that the sub-soil continues friable?—I do to the bottom.

With strong tenacious soils you do not find that it is run together again?—No.

Mr. Heathcote. You have no furrows, and you plough 16 inches deep in all parts of the farm?—Yes.

Do you find that the water stands at the bottom of the furrow any length of time before it gets into the drain?—I do not think it does, but I cannot see the bottom of the furrow.

When you turn it up how do you find it?—I find it particularly dry, and sometimes, where the land has been poached in consequence of taking off a green crop, still it is perfectly dry at the bottom of the furrow.

You do not find that the treading of horses has any effect upon it at that depth?—None whatever; the effect of the most thorough poaching does not go beyond six inches, and below that it is found quite dry.
Will this sub-soil ploughing apply to all species of soils?—I have never yet seen any soil that it would not apply to.

The most retentive stiff soil?—Yes; and the deep bog as well.

Mr. Denison. After breaking up the sub-soil, but without turning it up to the top, suppose the farmer was to continue to plough it seven or eight inches, in that case how long do you think the operation on the sub-soil would remain effectual, or how soon do you suppose it would run together again?—I think it would never run together in a solid form, because, when it has been turned up there is a constant circulation of the water and the air, which prevents running together again; and when soil is laid in a dry position and exposed to the atmosphere, it seems to get some sort of attractive quality; if you look at any mould you will find that it is all in little globules, and those are gathered together in large masses, forming larger globules which keep the soil open.

Do you think that the mere operation of allowing water and air to pass among the soil at a considerable depth in the ground would, to a certain degree, produce that effect upon solid clay of converting it partially into soil?—I think it would.

Mr. Loch. What was the nature of that soil which you said was covered with bent before you ploughed it up?—A great part of it I did not think worth more than 5s. an acre.

In consequence of what you have done to it, what is it worth now?—I consider that it is worth 2l. an acre to any farmer.

What was the course of cropping that you adopted in the improvement of land?—At first I was rather undecided with regard to the rotation I should follow, till from observation I formed a judgment what was the best course. The mode of rotation I generally followed was this: I drain always, if possible, in the lay or grass, because by draining in the lay the work is more neatly done; then having completed the drains, I take a crop of oats the next year. Upon the greater part of that farm I have been obliged to plough very shallow furrows for the first crop, because there was not more than three or four inches of soil that I dared turn up; then I took a crop of oats, and upon some of the fields I had not more than from 24 to 30 bushels of oats. After the separation of that first crop from the ground, I applied the sub-soil plough. Then I gave it another ploughing, and had a green crop; potatoes upon some parts, and turnips upon others.

Could you have attempted any of those crops previous to the sub-soil ploughing?—Not to advantage.
How long had it been in grass before you turned it up?—Some of it 15 years.

What is the next crop after the turnips and potatoes?—I then lay down what I have had in potatoes with wheat; I sow wheat in the end of the season, as soon as I can get the potatoes up; what I have had in turnips I grow barley upon in the spring, and I sow grass seeds upon both.

You could not have attempted barely upon that soil before?—Not with any success, and not wheat, because the land was so full of moisture that it honey-combed by frost, and so threw out the plants. There was one field especially, after a very severe winter, and with a frost, there was sometimes a space of 20 or 30 square yards from which every plant or vegetable had been thrown, not a bit of grass remaining upon it.

After the wheat what do you take?—I sow grass and barley.

Do you cut the grass for hay?—Some; the other is pastured from the beginning.

What is the nature of the grass it produces?—Very good, and very heavy crops of hay; I have generally about 300 stone, which is about three tons per acre.

Do you think that any improvement is likely to be so valuable for general purposes as frequent draining and sub-soil ploughing for strong land?—None.

That, you think, is the most important thing for general purposes of farming that you are acquainted with?—Decidedly.

And applicable to more qualities of soil than any thing else?—Applicable, I should say, to all qualities of sub-soil.

And equally applicable to England as to Scotland?—Equally so, and very much wanted. I have a friend who has made an experiment under my directions in Cheshire, upon very stiff land, Mr. Barton; it is the most thorough brick clay I ever saw; an extremely sterile farm in its original state. Mr. Barton has been completely successful; he has thoroughly drained the ground and sub-soil ploughed, and it is now laid down without furrows, and I there saw a large field of this extremely stiff clay with a beautiful seed surface upon it.

Mr. Denison. Do you think that it is applicable to a soil where there is a bad gravelly sub-stratum?—I think so; I think any sub-stratum, if it is exposed to the atmosphere for a sufficient length of time, will become fertile. In the most barren country, if you see where a ditch has been dug, on the soil which has been thrown up you will generally find a richer verdure and strong weeds growing.
White's account of Draining, on Smith's plan.

The main or leading drains are cut 3 feet deep, 15 inches wide at the top, taper to 6 inches at the bottom, and filled up with stone from 15 to 18 inches. The smaller drains, leading into the main, are 2 feet 6 inches deep, 12 inches wide at the top, taper to 3 inches at the bottom, and filled with stone 13 inches, with turf upon the stone. The stone is first placed on edge, about 6 or 7 inches, and the remaining part covered with stone broken to $2\frac{1}{2}$ inches; a section of these drains is given—the drains are parallel to each other. The sub-soil varies much; the price for cutting the whole, breaking the stones, and filling, has invariably been 1d. per yard; some part has worked better than others, and, upon the whole, I think the work cannot be done for less. With regard to the distance between the drains, in this part, the work must be put out according to circumstances, which requires much attention, as great expense might unnecessarily be incurred, or the object fail. When the land is ready for the operation of the sub-soil plough, a man with a pair of horses turns out the first furrow from 10
An account of the application of the Sub-soil Plough to a dry soil at Heckfield, Hants. By Charles Shaw Lefevre, Esq. M. P.

Although the effects of the sub-soil plough in the improvement of wet and tenacious soils are well known, I am not aware that any one has as yet applied this valuable implement to soils of a totally opposite character: I will therefore state the result of an experiment which I have tried upon land in my own occupation.

I have a field of 6 acres, which for many years has been scarcely worth cultivating. It consists of a light sandy soil, from 5 to 7 inches in depth, covering a stratum of hard gravel. This stratum varies in depth from 8 to 12 inches; and below it there is a yellow sand, with a very slight admixture of loam.

There are no springs in the field; but, in wet seasons, on those spots where the surface of the field is uneven, the water is retained in pools until it has evaporated. In other parts of the field the same passes off immediately, without being retained or absorbed by the sub-soil; and, consequently, in dry seasons the crop is invariably parched and burnt up. It occurred to me to apply the sub-soil plough, which had worked such wonders in a clay soil, to a dry burning gravel.

The effect of my experiment will be best explained by a short statement of the produce of the field, for a series of years, up to the present period:

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CROP</th>
<th>PRODUCE PER ACRE</th>
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</thead>
<tbody>
<tr>
<td>1832</td>
<td>Oats</td>
<td>4 sacks</td>
</tr>
<tr>
<td>1833</td>
<td>Turnips</td>
<td>Not quite 2 tons</td>
</tr>
<tr>
<td>1834</td>
<td>Barley</td>
<td>Not quite 4 sacks</td>
</tr>
<tr>
<td>1835</td>
<td>Clover</td>
<td>2 tons on the whole field</td>
</tr>
<tr>
<td>1836</td>
<td>Wheat</td>
<td>3 sacks</td>
</tr>
</tbody>
</table>

In the autumn of 1836 it was ploughed with the sub-soil plough, at a cost of 30s. per acre.

| 1837 | Turnips | 8 tons per acre |
| 1838 | Barley | 10 sacks per acre |
In other respects the land received the same treatment during the whole of this time. There is at present a fine plant of Dutch clover in the ground, which promises to prove an excellent crop.

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Extracts from the Speech of Daniel Webster, of U. S. Senate, at the agricultural meeting in Boston, 13 January, 1840.

Mr. Webster proceeded to state, that one of the things which now attracted much attention among agriculturalists in England, was the subject of tile draining. This most efficient and successful mode of draining is getting into very extensive use. Much of the soil of England, as he had already stated, rested on a clayey and retentive sub-soil. Excessive wetness is prejudicial and destructive to the crops. Marginal drains, or drains on the outside of the fields, do not produce the desired results. These tile drains have effected most important improvements. The tile itself is made of clay, baked like bricks; about one foot in length, four inches in width, three fourths of an inch in thickness, and stands from six to eight inches in height, being hemispherical, or like the half of a cylinder, with its sides elongated. It resembles the Dutch tiles sometimes seen on the roofs of the old houses in Albany and New York. A ditch is sunk twenty-four inches in depth, and these drains are multiplied, over a field, sometimes at a distance of only seven yards apart. The ditch; or drain, being dug, these tiles are laid down, with the hollow side at bottom, on the smooth clay, or any other firm sub-soil, the sides placed near to each other, some little straw thrown over the joints to prevent the admission of dirt, and the whole covered up. This is not so expensive a mode of draining as might be supposed. The ditch, or drain, need only be narrow, and tiles are of much cheaper transportation than stone would be. But the result is so important, as well to justify the expense. It is estimated that this thorough draining adds often twenty per cent. to the production of the wheat crop. A beautiful example came under his observation in Nottinghamshire, not long before he left England. A gentleman was showing him his grounds for next year's crop of wheat. On one side of the lane, where the land had been drained, the wheat was already up, and growing luxuriantly; on the other, where the land was subject to no other disadvantage, than that it had not been drained, it was still too wet to be sowed at all. It may be thought singular enough, but it was doubtless
true, that on stiff clayey lands, thorough draining is as useful in dry, hot summers, as in cold and wet summers; for such land, if a wet winter or spring be suddenly followed by hot and dry weather, is apt to become hard and baked, so that the roots of plants cannot enter it. Thorough draining, by giving an opportunity to the water on the surface to be constantly escaping, corrects this evil. Draining can never be needed to so great an extent in Massachusetts, as in England and Scotland, from the different nature of the soil; but we have yet quantities of low meadow lands, producing wild, harsh, sour grasses, or producing nothing, which, there is little doubt, might be rendered most profitable hay fields, by being well drained. When we understand better the importance of concentrating labor, instead of scattering it; when we shall come to estimate, duly, the superior profit of "a little farm well tilled," over a great farm, half cultivated and half manured, overrun with weeds, and scoured with exhausting crops, we shall then fill our barns, and double the winter feed for our cattle and sheep by the products of these waste meadows.

There was in England, another mode of improvement, most important, instances of which he had seen, and one of which he regarded as the most beautiful agricultural improvement, which had ever come within his observation. He meant irrigation, or the making of what is called water meadows. He had first seen them in Wiltshire, and was much struck with them, not having before understood, from reading or conversation, exactly what they were. But he had afterwards an opportunity of examining a most signal and successful example of this mode of improvement on the estates of the Duke of Portland, in the north of England, on the borders of Sherwood forest. Indeed, it was part of the old forest. Sherwood forest, at least in its present state, is not like the pine forests of Maine, the heavy hard wood forests of the unredeemed lands of New Hampshire and Vermont, or the still heavier timbered lands of the West. It embraces a large extent of country, with various soils, some of them thin and light, with beautiful and venerable oaks, of unknown age, much open ground between them and underneath their wide-spread branches, and this covered with heather, lichens and fern. As a scene to the eye, and to the memory by its long existence and its associations, it is beautiful and interesting. But in many parts, the soil is far enough from being rich. Upon the borders of this forest, are the water meadows of which he was speaking. A little river ran through the forest in this part, at the bottom of a valley, with sides moderately sloping, and of considerable
extent, between the river at the bottom and the common level of the surrounding country above. This little river, before reaching the place, ran through a small town, and gathered, doubtless, some refuse matter in its course. From this river the water was taken, at the upper end of the valley, conducted along the edge, or bank, in a canal or carrier, and from this carrier, at proper times, suffered to flow out, very gently, spreading over, and irrigating the whole surface, trickling and shining when he saw it, (and it was then November,) among the light green of the new-springing grass, and collected below in another canal, from which it was again let out, to flow in like manner over land lying still further down towards the bottom of the valley. Ten years ago, this land, for production, was worth little or nothing. He was told that some of it had been let for no more than a shilling an acre. It has not been manured, and yet is now most extensively productive. It is not flooded; the water does not stand upon it; it flows gently over it, and is applied several times in a year, to each part, say in March, May, July and October. In November, when he saw it, the farmers were taking off the third crop of hay cut this season, and that crop was certainly not less than two tons to the acre. This last crop was mostly used as green food for cattle. When he spoke of the quantity of tons, he meant tons of dried hay. After this crop was off, sheep were to be put on it, to have lambs at Christmas, so as to come into market in March, a time of year when they command a high price. Upon taking off the sheep in March, the land would be watered, the process of watering lasting two or three days, or perhaps eight or ten days, according to circumstances, and repeated after the taking off of each successive crop. Although this water has no doubt considerable sediment in it, yet the general fact shows how important water is to the growth of plants, and how far even it may supply the place of other sources of sustenance. Now we, in Massachusetts, have a more uneven surface, more vallies with sloping sides, by many times more streams, and such a climate that our farms suffer much oftener from drought than farms in England. May we not learn something useful, therefore, from the examples of irrigation in that country.
REDETECTION OF BOG MEADOW.

Rev. H. Colman,

Dear Sir:—At the request of Mr. Brown, I forward you this paper. It is well worth notice. I have rarely seen labor more successfully applied. I saw the field in the month of August, and I have no question of the correctness of the statement.

JOHN W. PROCTOR,

Secretary of the Essex Agricultural Society.

I have myself been at the place two or three times, and witnessed with the highest pleasure this valuable improvement; not so extensive as many in the State, but remarkable for the good judgment, perseverance, and labor, which its execution evinces.

H. C.

"The swamp in which I have been engaged for two years past, is situated in Saugus. Between 5 and 6 acres of it I have wrought upon. The mud or soil varied from two to twelve feet in depth. Two years ago, this land was so thickly covered with briars and bushes, that it was almost impossible for a dog to pass through it. These bushes were moved and burnt on the ground. There were so many stumps and logs that it was not possible to plough; so I commenced cutting the turf or sods into squares, about 15 inches over, and then with forked hoes, made very strong, pulled them up; and at the same time cleared out the stumps and logs, also cleared out all the small roots with the hoes, and replaced the sods the other side up. This part of the work was done in strips of about one rod in width. I commenced a year ago last August. I mowed the bushes and dug one ditch in 1836. The stumps and logs were cleared out without the help of oxen. Some of the stumps had nearly half a cord of wood in them. There were many trees blown down, and the meadow had formed over them. Many of them were sound, and some measured 60 feet in length. The stumps were very numerous. In some places, apparently three tiers, one above the other; and under the bottom one, lay a pine log, that had been on fire. The expense of clearing the land as above described, and of digging the necessary ditches to drain it, and to protect the adjoining land from fire, in burning the bushes, I estimate to have been $504. In the winter I took off the wood and piled it up for coaling. The largest of the roots I collected for my own fire. The small ones were burnt upon the ground. This part of the labor
I estimate at $35. In the spring, as soon as the frost began to come out of the ground, I commenced harrowing the land. The sods being fastened down by the frost, and the harrow passing over the upper side; they mouldered away as fast as the frost would admit; and when the harrow had got to the depth of the sods, they were worked up pretty fine. The frost below facilitated the passing of the teams. This part of the expense I estimated at $12. About the first of May, I began planting the potatoes, without any manure. I cut the seed very fine, and planted them near together. I merely marked the hills with a hoe; then a man followed after with the seed; then another to cover it. I calculated to have the seed one inch from the surface. I used 89 bushels of seed. I should not have seeded so light, had it not been for the uncertainty of obtaining a crop without the use of manure. There was but one man who gave me any encouragement. Many said I should lose my labor. But to their astonishment I harvested 927 bushels of excellent potatoes. The expense of planting, cultivating and harvesting this crop, I estimate at $117. My land is now in a condition that I can plough it when I please. On a small piece, I planted corn, without manure, and it ripened well. I sowed a small piece with wheat, but it did not come to any thing, either in the straw or grain.

The wood procured from the stumps and logs, I made into charcoal.

In 1837, I coaled 1201 bushels, which sold in market for $166 40. Expense of coaling and marketing $40. In 1838, I coaled 4200 bushels, which sold on the hearth for $333 33; but I afterwards ascertained from the purchaser, that it sold in Boston market for $630. The expense of coaling this lot, I estimate at $100. I sold wood to the amount of $50. I estimate the fuel that I used on my own fire to have been worth $50 more. I have on hand 100 cart loads of the bottom of the coal pits, which I value at $75, having some knowledge of its virtue as a manure.

The result may be stated as follows, viz.:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proceeds of coal in 1837</td>
<td>$166 40</td>
</tr>
<tr>
<td>&quot; 1838</td>
<td>333 33</td>
</tr>
<tr>
<td>Value of crop of potatoes, 927 bushels</td>
<td>463 50</td>
</tr>
<tr>
<td>&quot; the remains of the coal pits</td>
<td>75 00</td>
</tr>
<tr>
<td>&quot; wood sold</td>
<td>50 00</td>
</tr>
<tr>
<td>&quot; fuel used</td>
<td>50 00</td>
</tr>
<tr>
<td>Increased value of land, the same being now estimated at $125 an acre</td>
<td>565 00</td>
</tr>
<tr>
<td>Gross amount of receipts</td>
<td>$1702 23</td>
</tr>
</tbody>
</table>
Clearing the land, as stated, . . . . $504 00
Carting roots, . . . . . 35 00
Harrowing, . . . . . 12 00
Planting, hoeing, harvesting, &c., . . 117 00
Coaling and marketing coal, . . . . . 140 00

Estimated balance in my favor, as the result of
the experiment, . . . . . $808 00

My potatoes grew finely, and it was observed by many, that they
never saw a handsomer field. This crop being cut off in most other
places, in this vicinity, induces me to value them at 50 cents a bushel—which I know to be above the usual price in common seasons.

I have about two acres more of similar land, which I intend to
manage in the same way. It requires much hard labor, but it pays
well for it.

Respectfully yours,

TIMOTHY H. BROWN."

Saugus, Dec. 7, 1838.

N.

CHAPTER 206.

N ACT FOR THE ENCOURAGEMENT OF THE CULTURE OF SILK.

SECT. 1. There shall be allowed and paid out of the treasury of
the Commonwealth, for every ten pounds weight of cocoons of silk,
the produce of silk worms raised within this Commonwealth, the sum
of one dollar, and in the same proportion for any larger quantity of
cocoons, to be paid to the owner of such worms, or his legal represen-
tatives.

SECT. 2. There shall be allowed and paid out of the treasury of
the Commonwealth, to every person who shall reel, or cause to be
reeled, and to every person who shall throw, or cause to be thrown,
in this Commonwealth, from cocoons produced from silk worms,
raised in this Commonwealth, a merchantable silk capable of being
manufactured into the various silk fabrics, or to the legal representa-
tives of such person, one dollar for every pound of silk so reeled and
thrown, and fifty cents for every pound of silk reeled without being thrown.

Sect. 3. When satisfactory evidence, by the oath of the party, or otherwise, shall be exhibited to the selectmen of any town in this Commonwealth, that any person, being an inhabitant of such town, is entitled to claim the bounty or bounties, provided for in the first and second sections of this act, they shall give a certificate thereof, in writing under their hands, stating the quantity of cocoons produced, or of silk reeled or thrown conformably to the provisions of said sections, and that such claimant is entitled to the bounty or bounties therein allowed; and when such certificate shall have been filed in the office of the secretary of the Commonwealth, the governor, with advice of the council, is hereby authorized to draw his warrant on the treasurer therefor.

Sect. 4. If any person shall claim a bounty more than once for the same cocoons, or silk so reeled or thrown, or obtain any bounty under this act, through fraud or deception, such person shall forfeit to the use of the Commonwealth, a sum not more than one hundred dollars, in addition to the amount of any bounty he may have received, to be recovered by indictment, in any court proper to try the same.

Sect. 5. This act shall take effect in thirty days from the time of passing the same, and continue in force during the term of seven years from the time of its going into operation; and an Act entitled "An Act to encourage the reeling and throwing of silk," passed the seventh day of April, in the year one thousand eight hundred and thirty-five, be and the same hereby is repealed; but nothing herein contained shall affect the right of any person, entitled to any premium under the said act.

Sect. 6. The provisions of this act shall not apply to bodies politic and corporate. [April 11, 1836.]

O.

MULBERRY. SHARPE'S VARIETY.

As my Report is passing through the press, I have received the subjoined certificates, in reference to the tree mentioned in the text.
APPENDIX.

Windham, April 8th, 1840.

Mr. Colman:

Dear Sir,—The trees that stand in the nursery at E. Sharpe's, are perfectly sound, while every other variety around them are killed nearly, or quite to the ground; they can be examined at any time, also those referred to in the following certificates, by the incredulous.

Very respectfully, yours,

George W. Benson.

Shorham, Vermont, March 23d, 1840.

We have this day critically examined a mulberry tree called Sharpe's new variety; grown from one bud the last season in this place, which has been standing without any shelter or defence whatever. And although it was grafted late in the season, and did not soon commence growing, yet the main branch grew over seven feet, and notwithstanding its late and rapid growth, it has well endured the winter, and appears equally as well adapted to our climate as apple trees.

Miron Pond,  
M. W. H. Wright,  
George Farnum,  
Reuben Cook,

Munson Pond,  
Alanson J. Treadway,  
Asa B. Moses.

Pomfret, Conn. April 4th, 1840.

This certifies, that I engrafted two scions of Sharpe's variety of mulberry, in this town, last spring; both of them endured the winter well, without any defence or shelter, and are perfectly adapted to a northern climate. Their growth has far exceeded any other tree I ever saw in like circumstances.

Benjamin Segur.
C. Haskell's Letters.

The subjoined are extracts from letters received by me from Calvin Haskell, of Harvard, Mass. He has had considerable experience in producing silk in a household way; and the information given by a man so practical, will be duly esteemed.

Letter I.

Mr. Colman,—

"Harvard, March 9, 1840.

Dear Sir,—I commenced about twelve years since, by sowing the seed of the white Italian mulberry. I set the trees, some in hedges and some twelve feet apart, for standard trees. I prefer the hedge to the large trees, on account of the convenience of gathering the leaves. By cutting off the tops, they are kept within reach. I have never lost any by being winter killed. About the year 1829 or '30, I purchased a few trees of the Morus Multicaulis, which were imported from France. I set them out and let them remain through the two first winters, without their being essentially injured, but those that were grown from cuttings were invariably killed. This induced me to take up the old trees in the fall, and re-set them in the spring. I tried various ways to protect them that I left out during winter, by enclosing some in straw, some with the boughs of pine, and by heaping the earth around the bodies and roots of the trees, but all were lost that were exposed to the winter. I, however, left out two of the old trees during the winters of 1833 and '34; they were but little injured, and in 1835 they blossomed and bore fruit, which in appearance resembled the common low blackberry, excepting their being somewhat longer. I watched them with great care, and was enabled to save only 30 of the berries. From them I obtained seed which the next year produced about 500 seedlings. From that time, with the exception of the second year of their growth, I have multiplied them by laying them in in the usual way. The seedlings differ from the parent trees, the leaf being smaller, although in rich ground they approach near the size of the real Morus Multicaulis. They are more rapid in their growth, having in all cases with me, out grown them when set in rows togeth-
er. The leaves, although not so large as the original tree produces, are larger than any other kind I have seen; and I think will produce as much weight per acre as the parent tree. They appear to be much more hardy, some of them have stood out without protection the three past winters without being injured. I would state, however, that the severe frost we had last fall killed the tops of many of the young trees, the bark on the bodies of the trees being started, while the tops were uninjured. The roots were not hurt, and have stood the past winter without further damage. Those trees that have not been taken up the two last years, are nearly large enough to produce seed; and I expect the next generation will be as hardy as our native trees. The two trees that produced the seed were killed in the winter of 1835, one entirely, the other all but the root. The latter started many sprouts, which I have multiplied by laying them in. I am preparing to set one acre this spring, in order to remain. If the tops should be destroyed the first year, I feel confident the roots will not be, and I have not had them hurt after the first year. I have the Canton mulberry, which was grown from seed obtained at Northampton. I have found them quite as tender as the Multicaulis.

I have made selections from the white mulberry, which I think are valuable, and by engrafting on the more ordinary trees, much improvement can be made. I engrafted some last spring with my seedlings, and from the selected white mulberry; both kinds grew well, and have not been injured by the past winter, excepting being somewhat broken by the snow.

I have tried the various kinds, except the Alpine and Broussa, for feeding the worms, and do not perceive any difference in the worms, as it respects their growth, or health. I have but one objection to the Multicaulis, and that is, they do not come forward soon enough to be depended upon in all cases. I think, in order to raise silk to the most profit, we want some kind that has a large leaf, and that is hardy, to commence with, as early as the fore part of June, and take the Multi-caulis for the last crop. I have found that the worms that were fed early in the season, have produced the heaviest cocoons, the first weighed some over 4 lbs. per 1000, while those that wound up as late as the 10th of September were but about one half as heavy. They ought to finish their labor at least as soon as the first of September; they will then generally escape the cold storms, which are essentially injurious to the worms.”
Letter II.

"March 15, 1840.

I intended to state that the severe frost of last fall destroyed some of my young trees down to the roots, the part that appeared to be most affected was the bodies of the trees; the bark was started and discolored. The branches of the trees, however, remained green, and did not appear affected by the frost. I considered the trees as completely killed as though the branches had been as much affected as the bodies. I left standing out in my field about 1500 of the trees, including some of those that were injured and some that were not; they have remained out through the winter, and do not appear to have suffered by it.

By young trees I mean those of one year's growth from layers. The trees that have stood out the two past winters, were not affected at all by the frost, and are now in good order, although they have had no protection whatever.

The reason for thinking them more hardy than the Multicaulis is, that I have lost, I should think, nearly nine tenths of the Multicaulis that were left out during winter, but the seedlings have never been destroyed by it. If the tops should be destroyed, and the roots should not be, I think them valuable for the raising of silk, as the sprouts start early and grow more rapidly than from layers, and we can commence feeding much sooner.

It has been the practice of those who have raised the Multicaulis and other kinds of the mulberry, in this vicinity, to set them in a very rich soil, and to urge the growth as much as possible. Such a course might be profitable where the trees are to be taken up in the fall, but I think the trees much more tender than they would be when set in a poorer soil, and more liable to be winter killed."

Q.

LETTER OF JAMES DEANE, M.D.

Greenfield, April 7, 1840.

Mr. Colman:—

Dear Sir,—For a considerable period, my attention has been directed to the patriotic exertions made to introduce the culture of silk
into this country, but falling in with the prevailing opinions of the day, I have regarded the establishment of this important branch of agricultural pursuit as visionary and impracticable.

To satisfy myself as to the feasibility and profits of the silk culture, I have made such practical experiments in feeding worms and reeling silk, as to leave no doubts upon my mind, regarding these points. Throughout the wonderful mutations which occur in the brief existence of these precious insects, although a perfect novice, my success was complete. There is no secret, no complexity, or mystery in the art, but far otherwise. It involves but few principles, and those of great simplicity. The entire range of fundamental regulations are embraced in a sufficient allowance of space for the insects, and abundance of fodder for their consumption, a constant supply of pure air and unremitting diligence in regard to cleanliness. In our auspicious climate, an intelligent observance of these rules will surely lead to successful results.

You are probably aware, that there are two systems of rearing silk worms, the natural and artificial. The first was adopted by myself and is the one in general use, being the simplest in its details, and therefore the easiest in practice. It is adopted by those who engage in the culture of silk to a limited extent, or as a collateral branch of agriculture. It dispenses with the complicated preparations of a systematic course of rearing, and adapts itself to such ready means as the tenants of the soil possess. By the appropriation of a moderate space of ground for leaves, a crop of ten to fifty pounds of silk may be reeled, without essentially interfering with the farmers' legitimate plans. Through the operations of this system, the European markets are mostly supplied; the feeding season embracing but a brief portion of the year. Silk is, therefore, an integral production of the soil, a surplus commodity, which finds its way every where, and enriches the producer, for every body is the consumer.

The artificial system is conducted on strict scientific principles. Its prevailing features consist in maintaining an artificial temperature at the exact degree best adapted to develop the vital energies of the silk worm; in neutralizing the extremes of humidity and aridity; in incessant feeding by night and by day; and by observing such other regulations as best promote the health of the establishment, abridge its labors, and the while yielding the greatest amount of silk. Of course this plan is only chosen when the business is prosecuted on an extensive scale, for the cost of buildings and fixtures, the laborious service and
degree of skill it demands, are very considerable. The cocoonerries are fitted in a permanent style, with every appliance for pushing its little tenants through their rapid evolutions in the shortest possible period. For not only by accelerating the labors of the silk worm, do we abridge the period of its life at least one-third, but we augment its produce in a corresponding ratio. We positively obtain in twenty-four days a quantity of silk greater in amount and superior in quality than when the process is protracted through forty days; for it seems to be a law, that the nearer this precious insect is kept to a certain point of temperature, and the more assiduously its wants are supplied, the more perfect will be its developments and valuable its products. It unquestionably is so, and it would seem, therefore, that this method alone would be selected. But it must be remembered, that its application is calculated for an exclusive business, which contemplates the culture of immense numbers, and the expectation of corresponding profits. In cutting short the period of feeding we do not thereby diminish the quantity of forage; for, in large establishments, stimulated by the excitement of an elevated temperature, the consumption of leaves is enormous. In the natural system, we bestow upon a brood of silk worms no more than ordinary attention to its wants; we feed them, protect them from their enemies and the vicissitudes of climate, and leave them to that unerring instinct which impels them to construct their silken spheres. When the culture of silk is merely an incidental branch of domestic industry, it is no advantage to abreviate its labor, at the expense of other interests, and where great numbers are not involved, it would be far from repaying the extra cost. The artificial system is a beautiful result of philosophical experiment, and, under all circumstances, the more near we approximate its regulations, without incurring its expenditures, the greater will be our success.

Whether we adopt the natural or artificial methods, it is a precaution of vital consequence, that the larvae be distributed over an area of space corresponding to their rapid growth, taking care that they never be crowded. It matters not how well all other rules are observed, if this be disregarded, they sicken in great numbers, or, at best, spin but a worthless cocoon. To promote in them the highest state of health, free space and pure air, are indispensable. The atmosphere of the building must be kept pure by cleanliness and uninterrupted ventilation. When an abundant supply of leaves are superadded to these requisitions, we never hear in this climate of the loss of silk worms by disease. This is the secret of cultivating silk, every step of which,
from the first existence of the worm to the filature of its precious cocoons, is, with singular fitness, adapted to the comprehension and powers of the young, and to the infirmities of maturer age. The in-gathering of leaves, the management of feeding and the filature, are performances that do not exceed the strength of childhood. In the silk districts of Europe, the insects are reared, and the silk reeled almost exclusively by women and children. In an ethical sense, it is an occupation that elevates the virtues and appeals directly to the attention of philanthropists. It is a study of nature, full of instruction, that neither hardens the heart nor corrupts the conscience, by an overreaching spirit of avarice, and it should therefore be the concern of our patriotism, to cherish and encourage an enterprise, that, while it administers to our happiness, does not debase the heart. Unlike the great staples of rum, sugar, and cotton, which are extorted from unwilling labor by coercion and blood, this pursuit is destined to find welcome and peaceful reception in this region of our country, which is unsurpassed in its genial condition of soil and climate, by any other on the face of the earth. If there be those who doubt the profits of this culture, a multitude of facts might be easily adduced to overthrow their skepticism and dissipate the errors they have imbibed. But there are those who will not be convinced, though one rise from the dead.

I am persuaded, sir, that silk of the finest description can be produced in New England for two dollars and fifty cents a pound, in the first year of planting, and in the infancy of our knowledge. This estimate has been made again and again by intelligent men, and a book might be filled with reports based on actual experience, to confirm its truth. Can it be otherwise? Every variety of mulberry flourishes in our climate; and from the freedom of our atmosphere from too abundant moisture, its warmth, electricity and purity, our country is unsurpassed for the perfection of the silk worm. It is impossible that the culture of silk will not become established on a sure basis; an event, from its enormous magnitude, of momentous concern to a nation which has been drained, in a single year, of twenty-two millions, for this article of pride and comfort alone. With such propitious advantages, with such a consumption, and with the unconquerable energy of the American people, encouraged and protected by our Legislators, it is impossible that success will not crown this delightful pursuit.

If the art of rearing be then so easy of comprehension and practice, it is, nevertheless, exceeded in simplicity by the art of reeling the cocoon. I found that the difficulties of reeling had been exaggerated.
To produce a perfect filament from the material of wool or cotton, requires the perfection of skill and machinery, but we have made to our hands a filament so perfect, that no human ingenuity can ever approach it, and all we have to do consists in laying a number of these filaments together and drawing them out by the reel, and by maintaining a uniform thread, by adding new fibres, as others become exhausted. No one need be dismayed by imaginary difficulties in reeling, for they always vanish before a spirit of determination to overcome them. All who raise silk should reel silk also. It furnishes profitable employment for young women, and by reason of the delicacy of their fingers, their ingenuity and perseverance, they will readily acquire perfection in the beautiful art that should engage their especial attention.

I am, dear sir,

Yours, respectfully,

JAMES DEANE.
DEANE'S SILK REEL.

The furnace $A$.—The boiler $B$.—The filaments first pass the guides $C$, each thread by itself,—they then converge and pass the guide $D$ together. Both divisions are then wound upon each sufficiently to insure firmness, roundness, and smoothness of thread, and they then separate, each one passing its appropriate guide $E$, and is then gathered upon the reel. It is spread upon the reel by a vibrating movement of the rod $F$, having its fulcrum at $a$, the alternating movement being given by a groove in the shaft of the pulley wheel at $b$. This groove receives a pin from the vibrating rod. The skeins are disengaged in the following manner: The two arms of one division of the reel are set inside of the other, and slip through a mortice in the shaft of the reel, and are retained by two keys driven at right angles with the arms. By starting these keys, the arms slip through the mortices, and the tension of the skein is at once relieved.—To lay out the groove, proceed in this wise: At one of the limits of the intended groove stick a pin; then just half round the shaft at the other limit stick another. A straight line from one pin to the other, and back again on the opposite side, is the track for the groove.—The guides should be made of brass or German silver, by drilling a fine hole and sawing a slit to it, all made perfectly smooth. German silver neither rusts nor corrodes.

James Deane.
The following extracts are from the account of his experiment given by Mr. McLean to the American Silk Society. Mr. McLean's experiment was made in Freehold, Monmouth county, New Jersey. Mr. McLean is a clergyman, and a gentleman of great respectability. I had the pleasure of seeing his silk. It was excellent, and universally admired.

"The weight of the silk in the case which accompanies this paper, is TWELVE POUNDS, sixteen ounces to the pound, and is the product of ONE QUARTER of an acre.

The soil on which my trees were grown is a heavy clay—three or four years ago, the land would not have produced 20 bushels of corn to the acre. The two previous seasons, the lot on which my experiment was made had been very moderately manured—the present season it was covered with what might be considered a good coat of marl and barn-yard manure mixed.

The 20th to the 23d of April last, I planted a half acre lot with Morus Multicaulis roots, cuttings, and layers. The roots were of the previous season's growth, taken from trees that did not exceed $2\frac{1}{2}$ feet. The top was cut off within two inches of the root, and the roots were laid horizontally in the row, about ten inches apart. The cuttings were from the tops of these trees, with one bud to each, and were planted six inches apart in the rows. The layers were small trees, six to eighteen inches long, and were laid continuously in the row—the root of one touching the top of another. The rows were $2\frac{1}{2}$ feet apart. The length of the lot, as planted in trees, is 288 feet, and the width 75 feet. I expected to have had roots sufficient to plant half of this lot, or a quarter of an acre—they planted, however, only 26 feet in width, and 288 in length. In making out my quarter of an acre, therefore, I was obliged to include eleven feet and eight inches in width from the layers—so that the dimensions of the lot was 288 feet in length, and 37 feet 8 inches in width.

I regretted that I had not roots for the whole quarter of an acre, as the roots afforded much more leaves than the layers. Owing to close planting and the nature of the soil, the trees produced were small—say
an average of three and a half feet. The present growth on the quar-
ter of an acre does not exceed 5,500, all counted, large and small.

My cocoony is 36 by 16 feet, 2 stories high. I fed almost entirely in
the second story. There are two tiers of shelves three feet wide by
twenty-four feet long—the shelves rise one above another—one foot
apart, seven shelves in each tier. The second story contains 13 glass
windows, with Venitian blinds. My eggs were of my own producing
the previous season. They were saved with great care from my best
cocoon, on muslin, the pieces of muslin rolled up in the fall, or soon
after the eggs were laid, and placed in a common farm bag, and this
was hung to a beam in the cellar. In March the muslins were folded
up and laid one on top of another, in a small tea chest lined with lead,
this was placed in another of the same kind, but a little larger; and
the space between the two was filled with pulverized charcoal. Then
a few thicknesses of old flannel was laid loosely over the top of the
smaller chest, and a loose board laid over the larger. Then the whole
was set in a still larger rough box, with a loose board on the top, and
this was put down in the ice house, so that the ice surrounded the
sides of the box. In the inner tea chest was a thermometer—the box
was examined every week, and the thermometer was not allowed to
rise above 45° Fahrenheit. I am thus particular as to the mode of
preserving eggs, which has succeeded so well with me, because so
much disappointment has been experienced in regard to eggs. Other
modes equally good may doubtless be adopted for retarding the eggs—
the above plan, however, succeeded with me to admiration—the last
hatching, the 27th of August, was as perfect as the first.

July 12th, I hatched some two or three thousand mammoth white.
July 26, five or six thousand sulphur. July 31, two or three thousand
sulphur. August 19th, over 20,000 sulphur—and August 27th, hatch-
ed the last, say 5 to 8,000, sulphur. The mammoth white worms
wound in 24 to 28 days—the sulphur 28 to 33 days. A few lingered to
36 or 40 days.

Green oak bushes were used for the worms to wind in. Last year I
had plasterers' lathes fastened under the shelves, one and a half inches
apart. I found difficulty, however, in getting the worms to ascend
well. This season I used straw at first, tied up in small bundles and
set on the shelves, but this did not answer as well as I had been led to
expect. At length I threw every thing aside and took the oak bushes.
These have succeeded with me better than any other contrivance. They
seem natural to the worms, and I have never seen them mount
any thing so readily as green bushes. The only objection I see to them is, the cocoons cannot be taken from the bushes with quite the same facility with which they may be removed from straw, or some other fixtures. A little more experience, gathered from different sections of the country, will enable us to adopt the most approved plan for winding. Of the mammoth white cocoons, it required an average of 317 to the lb., weighed just as taken from the shelves; of the sulphur it required 390. 288 of the largest white made one lb., and of the largest sulphur 247. The worms were fed on the shelves without hurdles, and the litter was removed from the shelves about every fourth day. Sometimes they went from one moulting to another without having the shelves cleaned. The shelves were cleaned without hurdles, in the following manner. The attendant had a thin half inch board, planed smooth, 18 by 24 inches. After the worms appeared to be through their moulting, fresh leaves were given them, the attendant took up these leaves, the worms adhering, and laid them on the board which she held in her hand, and thus removed them to clean shelves; if all did not attach to the first leaves, others were strewed on, and generally the second time going over all were removed. Many objections may be urged against hurdles. They are expensive. Hurdles to feed 1,000,000 of worms will cost several hundred dollars. This expense is by no means counterbalanced by the labor which they will save, for it admits of doubt whether, after all, there is much labor saved. The worms will not all ascend on the fresh hurdles, and if the policy of throwing away all that do not ascend readily, is adopted, probably one half the worms will be thrown away; if this is not done, leaves must be thrown on after the hurdles are removed, and the worms must be taken off as they are without the hurdles. Another objection is, the difficulty of preventing the worms from winding under the hurdles and around them, among the litter. Besides the plan of feeding without hurdles is much more simple, and on this account to be recommended to the great mass of persons who will feed. My worms were fed as often during the day as they needed it, say five or six times; they were never fed at night. During the whole time of feeding, the weather was very variable, the thermometer ranged from 60° to 90°, with frequent easterly storms of several days continuance; one storm lasted eight days, from August 16th to August 23d inclusive. Several storms were accompanied with severe thunder and lightning. August 13th, a barn was struck with lightning and burnt to the ground, less than one hundred yards from the cocoonery. The worms appear-
ed to experience no injury whatever from the thunder. The damp wet weather undoubtedly retarded them in their operations. At such times they were not so vigorous and active, but every crop was perfectly healthy; few, if any, were lost the whole season by disease. At one time my shelves were more crowded than they should have been, and worms would frequently fall to the floor. These seldom wound after they were returned to the shelves; in this way I may have lost nearly or quite the amount of one lb. of reeled silk.

In order to be prepared for cold wet weather, I fitted up a furnace in my cellar, with flues leading up and around my upper room. I did not use artificial heat, however, more than a few times when the mornings were a little cool.

The whole number of worms fed on my quarter of an acre was about 40,000. The weight of leaves which they consumed was 2,576 lbs. The amount of cocoons produced was 130 lbs., weighed just as taken from the shelves, without sorting or flossing. After they were sorted and flossed, there was 1 lb. of floss and 4 lbs. defective cocoons, leaving 126 lbs. of cocoons. These produced 12 lbs. of merchantable reeled silk, 16 ounces to the lb., and 1 lb. wastage, ends, &c. The silk was reeled on the Piedmontese reel; the water heated in kettles, set in a furnace; one kettle was used as a heater, and the other to reel from.

From the above statement it will be seen, that it required between 19 and 20 lbs. of leaves to make 1 lb. of cocoons. Of these cocoons, without flossing or sorting, it required 10 lbs. and 10 ozs. to make 1 lb. of reeled silk. After they were flossed and sorted, it required 10 lbs. and 5 ozs., or about 214 to 215 lbs. of leaves to make 1 lb. of reeled silk. This shows a greater amount of leaves necessary to make 1 lb. of cocoons, and a greater weight of cocoons necessary to make 1 lb. of reeled silk, than the estimates published in various quarters, and greater than experiments said to have been made actually required. I was often obliged to feed wet leaves owing to the frequent long storms, and the worms appeared to experience no injury whatever from this. Still I did not consider it safe to feed leaves gathered in the storm, and dripping wet; and in our attempts to dry the leaves, some became wilted and were thrown away. The worms also were always abundantly fed, and a partial waste of leaves frequently, no doubt, occurred in this way. These things, together with the loss of perhaps the value of near 1 lb. of reeled silk, by worms falling from the shelves, would vary the result a little, and might show that 190 lbs. of leaves would produce 1 lb. of reeled silk.
I do not doubt, but that under the most favorable circumstances, a few pounds of cocoons might be produced on 10 or 12 lbs. of leaves to the lb. of cocoons. Nor do I doubt that 1 lb. of reeled silk may be produced from 8 lbs. of cocoons, or even less. Much depends on the quality of the cocoons, and more on the time when they are weighed, whether in a fresh and green, or entirely dry state. I could have selected from my lot, even in a fresh state, 8 lbs. of cocoons, which would, beyond all question, have produced 1 lb. of reeled silk—but this would be no test of the profit of the business.

Last year I produced at the rate of 510 lbs. of cocoons to the acre—this year I produced at the rate of 529—and my deliberate opinion is, that more will fall below this standard than will exceed it—and in one case, where a less quantity of leaves will give the above quantity of silk, two cases will occur that will require a greater.

Greatly will it be for the interests of the community, if it shall be found on further experience, that 80 or 100 lbs. of leaves will make 1 lb. of reeled silk, instead of 214 or 215, as required in my experiment; for my quarter of an acre did produce 2,576 lbs. of leaves, and the trees were not stripped remarkably close either—then the amount of reeled silk per acre would be the handsome yield of 104 to 125 lbs!! A result I utterly despair of seeing realized.

The above shews us 48 lbs. of reeled silk, 16 oz. to the lb. as the product of an acre. If this is worth, as I understand it now is, $6 per lb., then the gross proceeds of an acre will be $288. The first year, let it be remembered. Or if it should be worth but $4.50 per lb., which is undoubtedly the safest price at which to rate it, the gross proceeds of an acre will then be $216.

In regard to the cost of production, it is confidently asserted by many, that it can be produced for $2 per lb. Mine cost me much more than this. My experience, however, satisfies me that it can be produced for $2.25 per lb., and I incline to the belief that it may be produced for $2. Produced on a farm in a small way, the cost will be next to nothing—the whole product will be clear gain. Now take the product of an acre as above stated, at $288, and allow this to be made at an expense of $2 per lb., you have a net profit of $192 per acre!! Allow the cost of production to be $2.25, and you still have a net profit of $189. Again—take the product at $216, (allowing the silk to be worth only $4.50 per lb.) and let the cost of production be $2, it gives a net profit of $129 per acre—but allow the cost of production to be $2.25 per lb.—the sum at which I know it can be made
—and it still affords us a net profit of $108. This last, I am persuaded, will be found more nearly to correspond with actual results. If the price of the silk is more than $4.50 per lb., and the cost of production less than $2.25, so much the better for the culturist. But the above results, very nearly, are produced in another way. The amount of help necessary to attend to one acre, or to 160,000 worms, would not exceed the value of two females, 12 weeks each, and one male, the same time—indeed, I do not believe it would require so much help—but admitting it should, the maximum average value of this help would be, here, $3 per week, including boarding—and then, the cost of producing 48 lbs. of silk would be $108. And the value of that silk being, as above stated, $288, the net profit would be $180!! Or the value being only $4.50 per lb., or the gross amount of $216, still the net profit would be $108 per acre—exactly the result before stated—and this, let it be observed, is just $4 more than the result shewn by my experiment of last year. I believe, therefore, I have demonstrated, not by figures and on paper only, but by the actual production of the silk, that every prudent culturist may safely rely on realizing a net profit of at least $108, the first year, or $180 while the price of raw silk continues what it now is. And I ask, is not this sufficient! ought not any reasonable man to be satisfied with this? I wish, indeed, I could have made the profits a little larger, but I could not do it.

Much is said in various quarters respecting the different varieties of mulberry trees as food for the silk worm. By some it is confidently asserted that the Multicaulis is inferior to the broad-leaved Canton, to the Broussa, and to the hundred and one other varieties for which names are invented. Others go still further, and assert that the Multicaulis is inferior to all other species, the paper mulberry alone excepted, which the worm will not eat at all; and that good silk cannot be made from the Multicaulis, that it is the least hardy of all species of the mulberry, (which, however, has never been proved,) and that the quality of the silk will always be in proportion to the hardiness of the tree from which it is made.

Other species of the mulberry may be good, as I have no doubt they are; they may even be better than the Multicaulis for any thing I know to the contrary. One thing I do know, the worms devour the Multicaulis leaves with great avidity—grow well—continue healthy—make good silk, in sufficient quantities to yield a net profit per acre of $108 to $180. This they have done for me two years in succession.
As to the quality of the silk, I do not profess to be a judge. It obtained the gold medal, at the fair of the American Institute in October last, and intelligent judges pronounced it superior.

Now I say other varieties of the mulberry may make more and better silk than the Multicaulis. But has any individual actually produced more and better silk from any other tree, from a quarter of an acre? Until this is done, the public will be slow to believe that so many intelligent men are deceived, and that the Multicaulis is good for nothing.

It is my deliberate conviction, that the Morus Multicaulis will be the prevailing tree for silk in this country, as well because it is peculiarly adapted to the silk worm, as because great expense will be saved in gathering the leaves. The same amount of foliage can be gathered from the Multicaulis, with probably half the expense, that it can be gathered from any other variety of the mulberry.

I entertain now an unwavering conviction that the silk business will triumphantly succeed in our country. That it promises to do more for the comfort of the indigent and dependent portion of our community, especially for indigent females, and to add more to the wealth of the nation than can now be told."

[T.—For Table, see end of the Report.]

U.

MESSRS. CHENEY'S EXPERIMENT.

The Messrs. Cheney have favored the public with an account of their experience in feeding silk worms, after the plan of M. Camille Beauvais. I subjoin it as a highly interesting and valuable document, and showing remarkable results. The cocoonery of Messrs. Cheney, at Burlington, New Jersey, which I had the pleasure of visiting, is on the most approved plan.

I subjoin a comparison of the two results from G. B. Smith, of Baltimore, to whose intelligence, activity and ability, in relation to this important branch of industry, the agricultural public are largely indebted.

"We followed, as near as circumstances would permit, the plan recommended by M. C. Beauvais, an account of which we have published, and succeeded in terminating the crop in twenty-four days; and
we venture to say, that firmer and larger cocoons have not been produced by any silk grower this season. The silk reels admirably, and is strong, lustrous, and of a superior quality.

June 27th, the eggs were taken from the refrigerator, where they had been kept since the first of March, at an average temperature of 40° Fahrenheit. They were placed upon a shelf in the cellar, where the temperature was 60°. On the 29th, at 4 P. M., they were taken to the cocoonery, the temperature at that time being 78°. All worms found upon the cloths, upon their removal from the cellar, (being but a small number) were destroyed before the cloths were placed in the cocoonery. 80,000 worms hatched on the 30th of June, which we reserved for the experiment.

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The worms were what is generally termed the 'six weeks sulphur,' and it will be seen by the above statement that they terminated their labors in twenty-four days. The amount of cocoons was 356 pounds,
and it required 225 to weigh a pound. The amount of leaves fed out was 3,970 pounds, which gives 11 pounds of leaves to a pound of cocoons, and 9 pounds of cocoons being required to produce a pound of silk, it will be seen that by this system of feeding, 99 pounds of leaves only are necessary for one pound of silk.”

“In the natural system, 40,000 worms consumed 2,576 pounds of leaves; in the artificial system, 1,985 lbs. These worms produced 130 pounds of cocoons in the natural system, and 178 lbs. in the artificial. The cocoons weighed at the rate of 300 to the pound in the natural system, and 225 to the pound in the artificial. It required 10 lb. 5 oz. of cocoons produced by the natural system to make a pound of silk; and 9 pounds of those by the artificial. The 40,000 worms fed on the natural system made 12 pounds of raw silk; the same number fed on the artificial system, made 19 1/2 lbs. The natural system required an average of fully one week more time to produce the cocoons than the artificial system occupied.”

V.

MANAGEMENT OF JOSEPH FIELD.

I have the pleasure of subjoining the account given by Mr. Field, of Charlemont, Franklin county, Mass., of his silk culture. His is one of the clerical examples to which I refer in the passage to which this note belongs; and his intelligence and excellence of character entitle his statements to entire respect.

Letter I.

MR. COLMAN:

Sir,—I will, by your suggestion, submit a few hints, as the result of six or seven years experience in the production of silk, in the town of Charlemont, Franklin county, Mass. One who has tested the art of managing the silk worm, only by experimenting upon a thousand or two at a time, has no high claim to be looked to for instruction, where large establishments are in operation. In small parcels none of the principal difficulties present themselves, which are to be encountered by the cultivator who, in one season, rears his hundreds of thousands in a single laboratory. My experience has been within the range of
APPENDIX. [March, 1854]

from 10,000 to 50,000 per annum. To carry on the business to a much larger extent, with equal success, proportional caution and care will be required. In this communication I will consider the evils and hazards to be guarded against; and the process by which the desired end may be insured.

Well made, perfect cocoons are as essential to profit in this branch of industry, as full plump grain in wheat and other bread stuffs, instead of that which is blighted and shrivelled. To accomplish this, nothing is wanted but a vigorous and healthy worm. The art to be mastered and studied, is such a treatment of the worm, commencing at its earliest existence and continuing to the end, as is found to be the surest preservative from feebleness and disease. The difference of skill or assiduity, (making allowance for the difference of temperature in the seasons,) with which this husbandry is managed, will be apparent from the proportion of worms that fail, either wholly or in part, of yielding a perfect and sound product. It can never be safely calculated that a whole brood will go through without loss, under the best regimen that prudence can adopt. But when (there being nothing peculiarly adverse in the season) the labor bestowed ends, as sometimes, in the entire loss of one quarter or more, dying when they ought to be spinning their cocoons, or the scarcely less revolting spectacle of cocoons scarcely begun and there left for want of power to do more, others half finished, and the rest, though somewhat nearer to perfection, barely worth reeling; it may be presumed that the undertaking of the enterprise began without being sufficiently aware of the nature of his task. The rearing of silk worms differs from many other employments, which, in the last result, do not materially suffer by occasional errors or neglects, they being susceptible of remedy in some after stages of the process. The worms that suffer by bad treatment or unfortunate circumstances, at any period of their existence before their work is done, are liable, more or less, to disappoint the hopes of a satisfactory return; and among other considerations not to be overlooked, there is that which relates to atmospheric temperature. Although considerable changes may be endured without proving fatal, yet the loss of time, which is unavoidable so long as the mercury stands much below 70°, is not the worst effect produced by such an occurrence.

By some, the necessity, or even usefulness of an apartment impervious to cold air, as a place for feeding the worms, is disregarded. Experience, however, during the late cold summers, has made it certain to my mind, that he is not prepared to prosecute this business under
the most promising auspices, who has not a dwelling place for these tender objects of his charge, in which he can raise the temperature of the air to the necessary point, when it has fallen below; and thus keep the wheels in motion, or restore at once to vivacity, the torpid animals whose faculties are benumbed and labors suspended by cold. Stove heat is perfectly adequate to this want.

Being prepared with a proper receptacle for the young caterpillar, when it shall break its shell, and vegetation having advanced far enough to furnish the needed nutriment, the little embryos are to be called forth, by exposure to the influence of a summer atmosphere. The process of hatching in the warmth of early June, out of the sun's direct rays, is ordinarily effected within from five to ten days. Then commences the business which may not be intrusted with impunity to truant or slack hands; but for the encouragement of promptness, industry and attention, will find its reward at the end of twenty, thirty or forty days. Tender leaves should be laid for the worms as soon as they appear, and that will be in the morning, for two or three successive days. The product of each day should be kept by itself, if convenient, that there be no unnecessary assemblage of those of different ages. The expenditure of feed is very small during the first days of the worm; but care must be taken to serve them with fresh leaves as often as they need, and to see that none of them lose their chance of thriving by being buried in rubbish, or retarded in growth by being crowded out of their right through the greater strength and activity of their fellows. Chopping the leaves puts them in a good condition for the worm, until its powers and voracity give it an easy mastery of any thing that contains the material of silk fibre.

Through the successive ages of the worm, an eye is constantly to be had to the convenient arrangement of hurdles or shelves on which the worms are placed; the seasonable and judicious distribution of feed; their preservation from unwholesome effluvia, and from suffocation in their own litter; and other useful matters essential to their cleanliness; and such purity of air as health requires, whether in men, beasts or reptiles. As to the kind of platform upon which a discreet cultivator should deposite his little passive animals, to receive their daily sustenance, and go through their successive ages, to the production and maturity of the golden apple, every man's ingenuity will decide. Fresh, pure air, circulating freely about the bed on which the worm reposes, and which he never leaves at his own choice, is always important; and provision should be made accordingly, for ventilation, especially where the atmosphere becomes hot and sultry.
APPENDIX.

In their food, consisting of clean mulberry leaves, not too much withered and shrivelled by drying, two cautions are to be observed, relating to time and quantity. Some contend that they should be served by weight, according to a prescribed rule, varying the quantity from time to time. My practice has been to do by them as I myself like to be done by; that is, to measure out a portion suited to the demands of appetite, studiously avoiding irregularity and unseasonableness in the ministration. They should be fed early and late, not unnecessarily subjecting them to long intervals of fasting. Five meals a day, at least when they are in a mood promptly to dispatch what is set before them, or laid upon them, are not too much. They are not to be urged to gluttony beyond their inclination, and thus obliging them to leave a residuum to be wallowed upon rather than devoured. There are whole days when they do not eat at all, at the periods of moulting, or casting the skin, when they should not be disturbed until they have disencumbered themselves; and their appetite returns. Much depends, unquestionably, on preserving the silk worm, in all its stages, from the deadly influence of sickly, unwholesome air, arising, it may be, from a variety of causes, one of which is likely to be the accumulation of litter on the shelves, if care be not taken to remove it before moisture and decomposition render it pestiferous. Another evil, from permitting litter to grow into a pile, is often the loss of worms buried in their own rubbish, which, if extricated, can never be restored to vigor sufficient to finish their task and produce a crop. Sickness and death may come in consequence of a culpable inattention to cleanliness. The sick should be removed to some sequestered spot, where they may be restored by sweet air and tender nursing, and the dead thrown away. In removing worms to give them a clean bed, unnecessary handling of them should be avoided. While their size will admit of it, they may be removed by branches laid down, on which they readily fasten.

After nearly attaining their size, it will be found necessary to use the fingers, which should be done with gentleness. Rough handling does not comport with their soft texture. Peculiar care to keep them from falling to the floor from the hurdle is important. When they manifest a disposition to spin their cocoons, which some ordinarily do in about thirty days, no time should be lost in freeing them from all the filth and rubbish remaining under them. This being done, preparation must be made for their accommodation, with a convenient and eligible cabin, in which they may accomplish their last labor and house themselves in their silken tissue, until a mysterious metamorphosis shall
enable them to emerge into the light of day, prepared for procreation; and to leave behind them at their death not many days afterwards, the foundation of a progeny, to be the subject and hope of another year's culture.

Various articles are used for a refuge to the worm where it may build its cell. Oak branches answer well; but rye straw, set up at convenient distances among them, in small handfuls tied, is as good and on some accounts better than any other arrangements. Cocoons being perfectly formed and ripe, which is effected in three or four days, are to be gathered and stripped of their floss or loose silk, preparatory to reeling. If there be occasion to delay this operation more than eight or ten days, the chrysalis within the cocoon must be stifled with heat, by being baked in a moderately heated oven, or by the action of steam; and the cocoons spread out in a safe place to dry until wanted for reeling or sale.

The cultivator may now wish to order things the most wisely for the ensuing season. To keep on the ground of experience, I state my own mode of doing the business. The best cocoons for seed, all scientific and practical men will say, is a rational maxim. Shall we therefore take the best part of our crop, cocoons yielding the most to the reeler and set them apart for seed? Instead of this, we reserve for reeling, such as are best for that operation, which will yield their silk the most readily; but those which we call dupions or double cocoons, and which are incapable for the most part of being reeled, we devote to propagation, and find no perceivable inferiority in the product. The silk, after the escape of the butterfly, is used to good profit by being cleansed of its gum by boiling in soap and water, and then spun like flax on the little spinning wheel, yielding an article for hosiery of excellent quality. The eggs deposited on cloth or paper, are preserved during winter from too much frost and the depredations of mice, and will be ready in spring, to be put to their proper use.

Whether the above sketch can be applied to any useful purpose in aiding the silk culture, I leave entirely to you, confiding in your judgment as to the best means of diffusing knowledge among those who look to you for instruction in what pertains to agricultural pursuits

With high esteem, your servant,

Boston, Jan. 24, 1839.

JOSEPH FIELD.
APPENDIX. [March,

Letter II.

Charlemont, April, 1840.

Rev. Mr. Colman,

My Dear Sir:—My last letter enclosed samples of four varieties of mulberry leaves, White, Multicaulis, Canton and Broussa—all produced last season on the same patch of ground; by inspecting which I think one would come to the conclusion, that the more modern fashionable leaves, after all, have little or no pre-eminence to the white, being little larger in size, and, as to compactness and firmness of texture, manifestly inferior. I have formed no judgment, from my own experience, whether there would be economy in substituting other kinds for the Italian white mulberry; for I have not had sufficient opportunity for a test. There is one consideration not to be overlooked. According to the proposed modern plan of silk production, viz., by taking up the trees in the autumn and housing them, and resetting them in the spring, their foliage will be later, and require that the latter rather than the former part of summer be the season for rearing the worm. Now experience has established us in the opinion that the earlier months are incomparably preferable to the later for rearing healthy worms, and, consequently, for producing good cocoons. Trees, which will not endure the winter, must be waited on for their harvest, until those of a more hardy race have matured their crop and given it into the hand of the gatherer. If the importance of early feeding be not a prejudice, every one must see, that trees which stand the winter, must, other things being equal, be entitled to the preference. When acclimation shall remove the objection which lies against the larger leafed species, they may command respect, and even pre-eminence; but, to continue their triumph by acclamation, is not to be expected. If the leaves I forwarded to you are minutely examined, it will be judged, I believe, that the cultivators of the mulberry tree have good encouragement, even if their preferences cling to the Multicaulis, still to regard the white with favor, so much as to allow it generous fare; not to be turned off with a seat at the second or third table; or, still worse, to be denied every indulgence and kindness. A rich soil is alone able to clothe the mulberry with a rich foliage, and, for a liberal allowance of sustenance, even the common sort, so degraded and scorned, of late, will yield a noble and satisfactory return.

Most sincerely yours,

JOSEPH FIELD.
W. 

THE SILK CULTURE IN FRANCE.

Deeming them both interesting and useful, I subjoin some minutes respecting the silk business in France from a high authority—Ure's Dictionary of Manufactures. The product mentioned of Mr. Folzer indicates a high degree of improvement in the management of the worm.

"Eighty pounds French, (88 lbs. Eng.) of cocoons are the average produce from one ounce of Eggs; or 100 from one ounce and a quarter; but Mr. Folzer of Alsace, obtained no less than 165 pounds."

"The silk husbandry, as it may be called, is completed in France within six weeks from the end of April, and thus affords the most rapid of agricultural returns, requiring merely the advance of a little capital for the purchase of the leaf. In buying up cocoons, and in the filature, indeed, capital may often be laid out to great advantage. The most hazardous period in the process of breeding the worms is at the third and fourth moulting; for upon the sixth day of the third age and the seventh day of the fourth, they in general eat nothing at all. On the first day of the fourth age, the worms proceeding from one ounce of eggs will, according to Bonafous, consume upon an average twenty-three pounds and a quarter of mulberry leaves; on the first of the fifth age they will consume forty-two pounds; and on the sixth day of the same age they acquire their maximum voracity, devouring no less than 223 pounds. The space which they occupy on the wicker tables being at their birth only nine feet square, becomes eventually 239 feet. In general the more food they consume, the more silk will they produce."

"A mulberry tree is valued, in Provence, at from 6d. to 10d.; it is planted out of the nursery at four years of age; it is begun to be stripped in the fifth year, and affords an increasing crop of leaves till the twentieth. It yields from 1 cwt. to 30 cwt. of leaves, according to its magnitude and mode of cultivation. One ounce of silk worm eggs is worth in France about 2½ francs, (about 50 cents;) it requires for its due development into cocoons about 15 cwt. of mulberry leaves, which cost upon an average, 3 francs, (about 60 cents) per cwt. in a favorable season. One ounce of eggs is calculated to produce, as I have said, from 80 to 100 pounds of cocoons, of the value of one franc
52 centimes per pound, or 125 francs (25 dollars,) in the whole. About 8 pounds of reeled silk, worth 18 francs, (about $3 60,) is obtained from these 100 pounds of cocoons. "There are three denominations of raw silk, viz.; organzine, trame (shute or tram,) and floss. Organzine serves for the warp of the best silk stuffs, and is considerably twisted; tram is made usually from inferior silk and is very slightly twisted, in order that it may spread more and cover better in the web; floss or bourse consists of the shorter broken silk which is carded and spun like cotton. Organzine and trame may contain from 3 to 30 twin filaments of the worm; the former possesses a double twist, the compound filaments being first twisted in one direction, and the compound thread in the opposite; the latter receives merely a slender single twist. The quality of raw silk depends very much upon the skill and care bestowed upon its filature. The softest and purest water should be used in the cocoon kettle."

Note.—On page 152, some little doubt is suggested whether the acknowledged superiority of silk produced in northern China and Italy, over that produced in southern Asia, be owing to climate or to the better manner of reeling. Since writing this, I have received such information from a gentleman familiar with silks of every description, and long a resident in China, that I have no longer a doubt in the case. The perfection of silk depends essentially upon the reeling; but silk raised in cold latitudes has always more substance and firmness than that which is produced in a hot climate.
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ERRORS AND CORRECTIONS.
Page 163—line 39 from top, for "occasioned the bankruptcies and the distresses, and many of the flagrant crimes," read "occasioned many of the bankruptcies, distresses and flagrant crimes."
Page 168—line 11th—for "XXXII," read "XXVI."
Page 171—line 8th—for "XXXIII," read "XXVII."
Page 172—line 4th from bottom, for "of life," read "of a new life."
Page 233—line 3, for J. V. McLean, read D. V. McLean.
THE SILK WORM.

A Synoptical Table, showing the rapid Rearing according to the method of M. Camille Beauvais, and the process of Ventilation of M. Dartes.

By M. Brunet de Lagrange......Pupil of M. C. Beauvais.

Published by direction of the Minister of Commerce and Agriculture in France.

Translated from the French.

<table>
<thead>
<tr>
<th>Days of Rearing</th>
<th>Age of the Worms</th>
<th>Progressive of the Worms</th>
<th>Observations</th>
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<td>Weight (lbs.)</td>
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<td>Eggs in the Cocoons</td>
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<td>Cocoons</td>
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<td></td>
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<td>Chrysalis</td>
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<td>Moth</td>
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The worms are shown to be preparing to spin their Cocoons by the following signs:—firstly, they become less active, and are often found in the corner of the box; secondly, they stop feeding, and become more transparent, and the color of the cuticle transparent or red. The cocoons are formed in the place described above, and on the back are usually yellowish green, with the chrysalis under a very thin covering of silk.

The number of hours' work does not represent the proportion in the number of hours of age of the worm from its first laying; 100 hours for adults, 100 days for pupae.

The figure in the square brackets are the number of days from the time of first laying the cocoon.

This table may be framed and hung up for use in the Cocoonery. The State of Temperature is altered from Resinum in the French to Fahrenheit.