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FIFTEENTH ANNUAL REPORT

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OF THE

Maine Agricultural Experiment Station

ORONO MAINE

PART II OF THE ANNUAL REPORT OF THE UNIVERSITY OF MAINE

AUGUSTA
KENNEBEC JOURNAL PRINT
1900

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29 Feb. 1896

The Bulletins of this Station will be sent free to any address in Maine. All requests should be sent to

Agricultural Experiment Station,
Orono, Maine.

STATE OF MAINE.

A. W. Harris, Sc. D., President of the University of Maine:

SIR:—I transmit herewith the Fifteenth Annual Report of the Maine Agricultural Experiment Station for the year ending December 31, 1899.

CHARLES D. WOODS,
Director.

ORONO, Maine, December 31, 1899.

MAINE

AGRICULTURAL EXPERIMENT STATION

ORONO, MAINE.

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EDWARD R. MANSFIELD †	*Assistant Chemist*

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* Resigned June 30, 1899. † Appointed July 1, 1899.

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ANNOUNCEMENTS.

THE AIM OF THE STATION.

Every citizen of Maine concerned in Agriculture, has the right to apply to the Station for any assistance that comes within its province. It is the wish of the Trustees and Station Council that the Station be as widely useful as its resources will permit.

In addition to its work of investigation, the Station is prepared to make chemical analyses of fertilizers, feeding stuffs, dairy products and other agricultural materials; to test seeds and creamery glass-ware; to identify grasses, weeds, injurious fungi and insects, etc.; and to give information on agricultural matters of interest and advantage to the citizens of the State.

All work proper to the Experiment Station and of public benefit will be done without charge. Work for the private use of individuals is charged for at the actual cost to the Station. The Station offers to do this work only as a matter of accommodation. Under no condition will the Station undertake analyses, the results of which cannot be published, if they prove of general interest.

INSPECTIONS.

The execution of the laws regulating the sale of commercial fertilizers, concentrated commercial feeding stuffs, and agricultural seeds, and the inspection of chemical glass-ware used by creameries is entrusted to the Director of the Station. The Station officers take pains to obtain for analysis samples of all brands of fertilizers and feeding stuffs coming under the law, but the organized co-operation of farmers is essential for the full and timely protection of their interests. Granges, Farmers Clubs and other organizations can render efficient aid by report-

ing any attempt at evasion of the laws and by sending, early in the season, samples taken from stock *in the market* and drawn in accordance with the Station directions for sampling. In case there should be a number of samples of the same brand sent in, the Station reserves the right to analyze only in part.

STATION PUBLICATIONS.

The Station publishes 10 to 12 bulletins each year covering in detail its expenses, operations, investigations and results. The bulletins are mailed free to all citizens who request them. The annual Report is a reprint of the bulletins of the year and is bound with the Report of the Board of Agriculture and distributed by the Secretary of the Board. This combined report can be obtained by addressing the Secretary of Agriculture, State House, Augusta, Maine.

CORRESPONDENCE.

As far as practicable, letters are answered the day they are received. Letters sent to individual officers are liable to remain unanswered, in case the officer addressed is absent. All communications should, therefore, be addressed to the

Agricultural Experiment Station,
Orono, Maine.

The post office, railroad station, freight, express and telegraph address is Orono, Maine. Visitors to the Station can take the electric cars at Bangor and Old Town.

The telephone call is "Bangor, 27-3."

Directions, forms and labels for taking samples, of fertilizers, feeding stuffs and seeds for analysis can be had on application.

Parcels sent by express should be prepaid, and postage should be enclosed in private letters demanding a reply.

Remittances should be made payable to the undersigned.

CHAS. D. WOODS, *Director*

FEEDING STUFF INSPECTION.

Samples of the feeding stuffs coming under the inspection law were drawn by the inspectors in November, 1898. The results of the chemical analyses follow. A discussion of the results of some of the analyses will be found on pages 18 to 21.

The law is working very satisfactorily indeed. There are practically no goods sold which are not properly guaranteed. That the law is keeping out low grade goods is evidenced by the following from a letter received a few weeks since: "You will please print tags as ordered for x x x x x Mill and send same by freight instead of express. We have discovered that the meal we anticipated shipping into Maine market was not of sufficient quality to meet requirements of your State. We have, therefore, concluded not to ship as anticipated. We will, later in the season, have a very nice grade of meal at x x x x Mill at which time we will place same in Maine market."

FEEDS LOW IN PROTEIN.

Very few farmers can afford to buy feeds low in protein and high in carbohydrates at any price at which they have been or are likely to be offered. The farmer should grow all the coarse feeds that he needs. Oat and similar feeds are very much like corn stalks or oat straw in composition. Some of the feeds have cottonseed or other nitrogenous feeding stuffs added to them so that they carry more protein than straight oat feeds, but these mixtures are always more expensive sources of protein than are the glutens, cottonseed and linseed meals. One hundred pounds of an ordinary oat feed has from eight to eleven pounds protein. At seventy-five cents per hundred the protein costs from seven to nine cents a pound. One hundred pounds of a good gluten meal has from thirty-four to forty per cent of protein. At $1.10 per hundred the protein costs about three cents a pound and it not only costs less than half as much but it is better digested. As a source of protein, it would be as good economy to pay $60.00 a ton for high grade cottonseed meal as to pay $15.00 a ton for the ordinary oat feed.

MANUFACTURERS AND PLACE OF SAMPLING.

Station Number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8278	American Cotton Oil Co	Huntsville, Ala	Pittsfield
8282	American Cotton Oil Co	Huntsville, Ala	Bowdoinham
8338	American Cotton Oil Co	Huntsville, Ala	East Sumner
8279	American Cotton Oil Co	Pine Bluff, Ark	Pittsfield
8280	American Cotton Oil Co	Little Rock, Ark	Dexter
8283	American Cotton Oil Co	Brinkley, Ark	Newport
8281	American Cotton Oil Co	Memphis, Tenn	Belfast
8284	American Cotton Oil Co	Jackson, Tenn	Belfast
8285	American Cotton Oil Co	Jackson, Tenn	Rockland
8337	American Cotton Oil Co	Jackson, Tenn	Dixfield
8339	American Cotton Oil Co	Nashville, Tenn	East Sumner
8380	American Cotton Oil Co	Nashville, Tenn	Monmouth
8389	American Cotton Oil Co	Nashville, Tenn	Auburn
8349	American Cotton Oil Co		Buxton Center
8286	The Southern Cotton Oil Co	Little Rock, Ark	Bath
8289	J. E. Soper & Co		Newport
8381	J. E. Soper & Co		Augusta
8293	R. B. Brown Oil Co		Dexter
8294	R. B. Brown Oil Co		Corinna
8295	S. W. Thaxter & Co	Benham, Texas	Bucksport
8296	S. W. Thaxter & Co	Benham, Texas	Orrington
8297	S. W. Thaxter & Co	Benham, Texas	Thomaston
8287	S. W. Thaxter & Co	Benham, Texas	Winterport
8290	F. W. Brodé & Co	Memphis, Tenn	Brunswick
8291	F. W. Brodé & Co	Memphis, Tenn	Dexter
8292	F. W. Brodé & Co	Memphis, Tenn	Foxcroft
8340	F. W. Brodé & Co	Memphis, Tenn	W. Minot
8341	F. W. Brodé & Co	Memphis, Tenn	Canton
8350	F. W. Brodé & Co	Memphis, Tenn	Buxton Center
8364	F. W. Brodé & Co	Memphis, Tenn	Bridgton
8382	F. W. Brodé & Co	Memphis, Tenn	Monmouth
8390	F. W. Brodé & Co	Memphis, Tenn	Lewiston
8402	F. W. Brodé & Co	Memphis, Tenn	Houlton
8288	I. A. Barstow		Bangor
8391	C. S. O. Co		Farmington
8308	Chas. Pope Glucose Co	Chicago, Ill	Camden
8309	Chas. Pope Glucose Co	Chicago, Ill	Orrington
8310	Chas. Pope Glucose Co	Chicago, Ill	Brunswick
8345	Chas. Pope Glucose Co	Chicago, Ill	South Paris
8353	Chas. Pope Glucose Co	Chicago, Ill	Saco
8367	Chas. Pope Glucose Co	Chicago, Ill	Portland
8395	Chas. Pope Glucose Co	Chicago, Ill	Lewiston
8298	The Glucose Sugar Refining Co.		Thomaston
8299	The Glucose Sugar Refining Co.		Brunswick
8300	The Glucose Sugar Refining Co.		Bucksport
8301	The Glucose Sugar Refining Co.		Bangor
8302	The Glucose Sugar Refining Co.		Belfast
8303	The Glucose Sugar Refining Co.		Winterport

ANALYSES OF SAMPLES.

Name of feed.	Moisture—per cent.	Protein.		Fat.		Station number.
		Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
Prime Cotton Seed Meal	7.55	42.25	43.00	11.48	9.00	8278
Prime Cotton Seed Meal	8.57	46.44	43.00	10.23	9.00	8282
Prime Cotton Seed Meal	8.36	43.94	43.00	9.77	9.00	8338
Prime Cotton Seed Meal	8.10	45.38	43.00	10.43	9.00	8279
Prime Cotton Seed Meal	8.30	45.50	43.00	9.43	9.00	8280
Prime Cotton Seed Meal	6.67	47.13	43.00	12.46	9.00	8283
Prime Cotton Seed Meal	7.98	42.25	43.00	13.32	9.00	8281
Prime Cotton Seed Meal	9.21	47.81	43.00	8.80	9.00	8284
Prime Cotton Seed Meal	8.90	47.00	43.00	10 78	9.00	8285
Prime Cotton Seed Meal	9.73	46.94	43.00	10.33	9.00	8337
Prime Cotton Seed Meal	8.48	46.69	43.00	10.31	9.00	8339
Prime Cotton Seed Meal	7.42	46.75	43.00	11.26	9.00	8380
Prime Cotton Seed Meal	7.71	46.00	43.00	11.47	9.00	8389
Prime Cotton Seed Meal	8.59	45.82	43.00	10.51	9.00	8349
Prime Cotton Seed Meal	8.46	46.82	43.00	9.76	9.00	8286
Cotton Seed Meal	8.40	46.13	43.00	8.78	9.00	8289
Cotton Seed Meal	6.27	44.75	43.00	14.72	9.00	8381
Prime Cotton Seed Meal	9.32	47.88	43.00	8.34	9.00	8293
Prime Cotton Seed Meal	8.20	46.75	43.00	9.97	9.00	8294
Cotton Seed Meal	8.33	48.69	49.25	11.25	15.62	8295
Cotton Seed Meal	8.54	50.06	49.25	10.87	15.62	8296
Cotton Seed Meal	7.70	51.26	49.25	10.33	15.62	8297
Cotton Seed Meal	7.46	51.92	49.25	10.71	15.62	8287
Owl Brand Cotton Seed Meal	8.46	44.50	43.00	11.38	9.00	8290
Owl Brand Cotton Seed Meal	7.84	44.63	43.00	10.63	9.00	8291
Owl Brand Cotton Seed Meal	7.50	45.32	43.00	11.50	9.00	8292
Owl Brand Cotton Seed Meal	8.20	46.38	43.00	9.90	9.00	8340
Owl Brand Cotton Seed Meal	7.24	43.31	43.00	13.13	9.00	8341
Owl Brand Cotton Seed Meal	8.30	43.31	43.00	12.08	9.00	8350
Owl Brand Cotton Seed Meal	7.52	45.13	43.00	12.41	9.00	8364
Owl Brand Cotton Seed Meal	8.09	44.75	43.00	12.49	9.00	8382
Owl Brand Cotton Seed Meal	7.30	44.50	43.00	12.59	9.00	8390
Owl Brand Cotton Seed Meal	9.28	45.00	43.00	12.87	9.00	8402
Sea Island Cotton Seed Meal	10.73	21.82	20.13	5.83	4.57	8288
Sea Island Cotton Seed Meal	10.98	25.06	24.31	7.09	5.00	8391
Cream Gluten Meal	9.79	30.94	37.12	3.38	3.20	8308
Cream Gluten Meal	8.92	33.50	37 12	5.43	3.20	8309
Cream Gluten Meal	9.48	34.88	37.12	2.24	3.20	8310
Cream Gluten Meal	10.04	33.81	37.12	3.49	3.20	8345
Cream Gluten Meal	8.48	35.69	37.12	2.73	3.20	8353
Cream Gluten Meal	9.27	32.56	37.12	4.32	3.20	8367
Cream Gluten Meal	9.35	31.19	37.12	3.13	3.20	8395
Chicago Gluten Meal	10.56	37.13	37.50	2.59	9.00	8298
Chicago Gluten Meal	11.02	39.63	37.50	1.94	9.00	8299
Chicago Gluten Meal	11.15	36.13	36.00	2.49	3.37	8300
Chicago Gluten Meal	10.76	38.82	38.00	2.79	2.00	8301
Chicago Gluten Meal	10.52	38.63	38.00	2.01	2.00	8302
Chicago Gluten Meal	10.23	37.69	37.50	2.13	9.00	8303

MANUFACTURERS—CONTINUED.

Station Number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8304	The Glucose Sugar Refin. Co		Foxcroft
8342	The Glucose Sugar Refin. Co		Minot
8351	The Glucose Sugar Refin. Co		Buxton Center
8365	The Glucose Sugar Refin. Co		Bridgton
8375	The Glucose Sugar Refin. Co		Milltown
8376	The Glucose Sugar Refin. Co		Calais
8383	The Glucose Sugar Refin. Co		Waterville
8392	The Glucose Sugar Refin. Co		Lewiston
8305	National Starch Manf'g Co	Indianapolis, Ind.	Foxcroft
8306	National Starch Manf'g Co	Indianapolis, Ind.	Richmond
8343	National Starch Manf'g Co	Indianapolis, Ind.	Canton
8393	National Starch Manf'g Co	Indianapolis, Ind.	Lewiston
8364	National Starch Manf'g Co	Des Moines, Iowa	Farmington
8384	National Starch Manf'g Co	Des Moines, Iowa	Oakland
8344	National Starch Manf'g Co	Des Moines, Iowa	Dixfield
8307	National Starch Manf'g Co	Des Moines, Iowa	Dexter
8352	National Starch Manf'g Co	Des Moines, Iowa	Springvale
8358	National Starch Manf'g Co		North Yarmouth
8366	National Starch Manf'g Co		Gorham
8311	Arthur R. Hopkins	Bangor	Bangor
8312	American Glucose Co		Dexter
8327	S. W. Thaxter & Co		Bath
8346	The Glucose Sugar Refin. Co		West Paris
8354	The Glucose Sugar Refin. Co		Berwick
8377	The Glucose Sugar Refin. Co		Calais
8386	The Glucose Sugar Refin. Co		Auburn
8328	Douglas & Co		Brunswick
8329	The Cleveland Linseed Oil Co		Rockland
8330	The Cleveland Linseed Oil Co		Belfast
8313	The American Cereal Co		Bucksport
8314	The American Cereal Co		Brunswick
8316	The American Cereal Co		Rockland
8317	The American Cereal Co		Foxcroft
8347	The American Cereal Co		West Paris
8357	The American Cereal Co		Waterboro
8369	The American Cereal Co		Fryeburg
8378	The American Cereal Co		Eastport
8385	The American Cereal Co		Showhegan
8397	The American Cereal Co		Auburn
8403	The American Cereal Co		Houlton
8315	S. A. & J. H. True		Brunswick
8318	The American Cereal Co		Newport
8319	The American Cereal Co		Brunswick
8320	The American Cereal Co		Rockland
8321	The American Cereal Co		Foxcroft
8348	The American Cereal Co		West Paris
8356	The American Cereal Co		Waterboro
8368	The American Cereal Co		South Windham

ANALYSES—CONTINUED.

Name of Feed.	Moisture—per cent.	Protein.		Fat.		Station number.
		Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
Chicago Gluten Meal	10.47	40.63	37.50	1.70	9.00	8304
Chicago Gluten Meal	11.58	36.88	36.00	1.98	3.37	8342
Chicago Gluten Meal	10.98	37.50	37.50	1.89	9.00	8351
Chicago Gluten Meal	11.28	39.69	38.00	1.92	2.00	8365
Chicago Gluten Meal	11.72	37.07	38.00	2.05	2.00	8375
Chicago Gluten Meal	11.37	36.88	37.50	2.20	9.00	8376
Chicago Gluten Meal	10.50	38.44	37.50	1.80	9.00	8383
Chicago Gluten Meal	10.52	37.50	37.50	2.61	9.00	8392
King Gluten Meal	9.44	34.06	32.00	4.28	16.00	8305
King Gluten Meal	6.69	37.32	32.00	5.06	16.00	8306
King Gluten Meal	9.34	34.69	32.00	4.30	16.00	8343
King Gluten Meal	7.91	35.75	32.00	6.87	16.00	8393
King Gluten Meal	7.04	32.44	32.00	15.57	16.00	8394
King Gluten Meal	6.04	33.13	32.00	15.54	16.00	8384
King Gluten Meal	7.87	31.50	34.26	13.24	14.65	8344
King Gluten Meal	6.34	32.82	32.00	15.41	16.00	8307
King Gluten Meal	8.28	32.81	32.00	16.40	16.00	8352
King Gluten Meal	8.20	33.25	32.00	16.30	16.00	8358
King Gluten Meal	7.07	32.06	32.00	15.90	16.00	8366
Imperial Gluten Meal	9.20	20.13	20.00	12.00	11.50	8311
Buffalo Gluten Feed	9.27	28.25	29.00	4.68	3.00	8312
Gluten Feed	10.26	22.63	*	5.93	*	8327
Rockford Diamond Gluten Feed	10.50	25.44	24.20	4.08	3.75	8346
Rockford Diamond Gluten Feed	9.44	25.44	24.20	3.44	3.75	8354
Rockford Diamond Gluten Feed	8.94	24.69	24.20	3.86	3.75	8377
Rockford Diamond Gluten Feed	7.34	25.75	24.20	4.43	3.75	8396
Old Process Oil Meal	9.00	26.63	36.94	6.45	6.58	8328
Cleveland Flax Meal	11.68	39.75	39.00	2.28	1.50	8329
Linseed Oil Meal	10.40	36.81	39.00	2.52	1.50	8330
Victor Corn and Oat Feed	9.52	9.56	9.46	4.31	3.92	8313
Victor Corn and Oat Feed	9.21	8.12	9.46	3.36	3.92	8314
Victor Corn and Oat Feed	9.31	9.94	9.46	4.44	3.92	8316
Victor Corn and Oat Feed	10.67	8.88	9.46	3.84	3.92	8317
Victor Corn and Oat Feed	10.20	9.06	9.46	3.18	3.92	8347
Victor Corn and Oat Feed	10.57	8.88	9.46	2.85	3.92	8357
Victor Corn and Oat Feed	8.90	9.69	9.46	4.92	3.92	8369
Victor Corn and Oat Feed	9.46	9.38	9.46	4.87	3.92	8378
Victor Corn and Oat Feed	8.54	8.75	9.46	3.53	3.92	8385
Victor Corn and Oat Feed	9.15	8.38	9.46	3.31	3.92	8397
Victor Corn and Oat Feed	11.25	9.02	9.46	3.57	3.92	8403
Corn and Oat Feed	9.80	8.38	9.63	3.44	4.23	8315
Quaker Oat Feed	8.94	9.44	12.03	2.57	3.49	8318
Quaker Oat Feed	8.36	10.31	12.03	3.61	3.49	8319
Quaker Oat Feed	8.32	11.13	12.03	3.57	3.49	8320
Quaker Oat Feed	7.48	7.44	12.03	2.98	3.49	8321
Quaker Oat Feed	8.27	10.31	12.03	3.29	3.49	8348
Quaker Oat Feed	9.51	10.38	12.03	2.87	3.49	8356
Quaker Oat Feed	7.95	10.88	12.03	3.79	3.49	8368

* Not guaranteed.

MANUFACTURERS—CONCLUDED.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8399	The American Cereal Company	.....	Lewiston .....
8322	The American Cereal Company	.....	Brunswick .....
8323	The American Cereal Company	.....	Richmond .....
8373	W. H. Haskell & Company	.....	Portland .....
8398	Andrew Cullen & Company	.....	Auburn .....
8400	.....	.....	Auburn .....
8324	The H-O Company	Buffalo	Bowdoinham .....
8372	The H-O Company	Buffalo	Freeport .....
8386	The H-O Company	Buffalo	Bangor .....
8325	The H-O Company	Buffalo	Richmond .....
8371	The H-O Company	Buffalo	Freeport .....
8388	The H-O Company	Buffalo	Bangor .....
8326	The H-O Company	Buffalo	Richmond .....
8370	The H-O Company	Buffalo	Freeport .....
8387	The H-O Company	Buffalo	Bangor .....
8331	E. W. Blatchford & Company	.....	Brunswick .....
8332	The Bowker Fertilizer Co	.....	Belfast .....
8333	The Bowker Fertilizer Co	.....	Brunswick .....
8334	The Bowker Fertilizer Co	.....	Camden .....
8355	The Bowker Fertilizer Co	.....	Buxton Center .....
8374	The Bowker Fertilizer Co	.....	Gorham .....
8335	Bradley Fertilizer Company	.....	Belfast .....
8336	Bradley Fertilizer Company	.....	Belfast .....

ANALYSES—CONCLUDED.

Name of Feed.	Moisture—per cent.	Protein.		Fat.		Station number.
		Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
Quaker Oat Feed	7.77	10.75	12.03	3.97	3.49	8399
American Poultry Food	9.82	14.19	*	5.91	*	8322
Corn, Oat and Barley Feed	9.42	12.75	11.26	5.39	4.15	8323
Haskell's Oat Feed	9.13	11.31	9.62	7.91	7.66	8373
Crescent Oat Feed	7.42	8.63	*	3.72	*	8398
Monarch Oat Feed	8.78	11.19	10.25	8.79	7.47	8400
The H-O Co.'s Poultry Feed	10.26	17.81	16.80	5.43	7.00	8324
The H-O Co.'s Poultry Feed	9.43	18.00	16.80	5.76	7.00	8372
The H-O Co.'s Poultry Feed	9.50	18.31	16.80	5.92	7.00	8386
The H-O Co.'s Stand. Dairy Feed	8.19	20.38	18.75	5.42	7.25	8325
The H-O Co.'s Stand. Dairy Feed	8.30	20.94	18.75	5.39	7.25	8371
The H-O Co.'s Stand. Dairy Feed	8.52	17.06	18.75	4.24	7.25	8388
The H-O Co.'s Horse Feed	9.80	11.94	12.30	3.81	4.90	8326
The H-O Co.'s Horse Feed	10.91	11.81	12.30	4.51	4.90	8370
The H-O Co.'s Horse Feed	9.06	11.69	12.30	4.75	4.90	8387
Blatchford's Calf Meal	8.36	33.44	*	5.23	*	8331
Bowker's Animal Meal	5.64	41.07	30.00	14.05	5.00	8332
Bowker's Animal Meal	5.67	44.31	30.00	12.05	5.00	8333
Bowker's Animal Meal	6.11	44.94	30.00	12.94	5.00	8334
Bowker's Animal Meal	5.62	41.75	30.00	13.40	5.00	8355
Bowker's Animal Meal	6.04	40.50	30.00	12.32	5.06	8374
Bradley's Superior Meat Meal	6.06	43.56	40.00	15.95	15.00	8335
Old Fashioned Beef Scraps	7.93	49.13	40.00	19.60	10.00	8336

* Not guaranteed.

SUMMARY OF ANALYSES.

	Number of analyses.		Protein. Found—per cent.	Protein. Guaranteed—per cent.	Fat. Found—per cent.	Fat. Guaranteed—per cent.
American Cotton Oil Co.'s Prime Cotton Seed Meal.	14	Highest	47.81	.....	13.32	
		Lowest	42.25	43.00	8.80	9.00
		Average	45.71	.....	10.75	
Southern Cotton Oil Co.'s Prime Cotton Seed Meal.	1	.....	46.82	43.00	9.76	9.00
J. E. Soper & Co.'s Cotton Seed Meal.	2	Highest	46.13	.....	14.72	
		Lowest	44.75	43.00	8.78	9.00
		Average	45.44	.....	11.75	
R. B. Brown Oil Co.'s Prime Cotton Seed Meal.	2	Highest	47.88	.....	9.97	
		Lowest	46.75	43.00	8.34	9.00
		Average	47.32	.....	9.16	
S.W. Thaxter & Co.'s Cotton Seed Meal.	4	Highest	51.92	.....	11.25	
		Lowest	48.69	49.25	10.33	15.62
		Average	50.48	.....	10.79	
F. W. Brodé & Co.'s Owl Brand Cotton Seed Meal.	10	Highest	46.38	.....	13.13	
		Lowest	43.31	43.00	9.90	9.00
		Average	44.68	.....	11.90	
Sea Island Cotton Seed Meal.	2	Highest	25.06	.....	7.09	
		Lowest	21.82	*	5.83	*
		Average	23.44	.....	6.46	
Charles Pope Glucose Co.'s Cream Gluten Meal.	7	Highest	35.69	.....	5.43	
		Lowest	30.94	37.12	2.24	3.20
		Average	33.22	.....	3.53	
The Glucose Sugar Refin'g Co.'s. Chicago Gluten Meal.	14	Highest	40.63	38.00	2.79	3.37
		Lowest	36.13	36.00	1.70	2.00
		Average	38.01	.....	2.15	
National Starch M'f'g Co.'s King Gluten Meal.	11	Highest	37.32	.....	16.40	
		Lowest	31.50	32.00	4.28	16.00
		Average	33.62	.....	11.72	
Arthur R. Hopkins's Imperial Gluten Meal.	1	.....	20.13	20.00	12.00	11.50
American Glucose Co.'s Buffalo Gluten Feed.	1	.....	28.25	29.00	4.68	3.00
S. W. Thaxter & Co.'s Gluten Feed.	1	.....	22.63	.....	5.93	.....
The Glucose Sugar Refin'g Co.'s Rockford Diamond Glut.Feed.	4	Highest	25.75	.....	4.43	
		Lowest	24.69	24.20	3.44	3.75
		Average	25.33	.....	3.95	
Douglas & Co.'s. Old Process Oil Meal.	1	.....	26.63	36.94	6.45	6.58
Cleveland Linseed Oil Co.'s Cleveland Flax Meal.	1	.....	39.75	39.00	2.28	1.50
Cleveland Linseed Oil Co.'s Linseed Oil Meal.	1	.....	36.81	39.00	2.52	1.50

* For guarantees see page 11.

SUMMARY OF ANALYSES—CONCLUDED.

	Number of analyses.		Protein.		Fat.	
			Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.
The American Cereal Co.'s Victor Corn and Oat Feed.	11	Highest	9.94	.....	4.92	
		Lowest	8.12	9.46	2.85	3.92
		Average	9.06	....	3.83	
S. A. & J. H. True Co.'s Corn and Oat Feed.	1	... .	8.38	9.63	3.44	4.23
The American Cereal Co.'s Quaker Oat Feed.	9	Highest	11.13	.....	3.97	
		Lowest	7.44	12.03	2.57	3.49
		Average	8.96	....	2.96	
The American Cereal Co.'s American Poultry Food.	1	..... .	14.19	... .	5.91	.....
The American Cereal Co.'s Corn, Oat and Barley Feed.	1	....	12.75	11.26	5.39	4.15
W. H. Haskell & Co.'s Haskell's Oat Feed.	1	....	11.31	9.62	7.91	7.66
Andrew Cullen & Co.'s Crescent Oat Feed.	1	.....	8.63	....	3.72	.....
Monarch Oat Feed.	1	....	11.19	10.25	8.79	7.47
The H-O Co.'s Poultry Feed.	3	Highest	18.31	... .	5.92	
		Lowest	17.81	16.80	5.43	7.00
		Average	18.04	....	5.70	
The H-O Co.'s Standard Dairy Feed.	3	Highest	20.94	.....	5.42	
		Lowest	17.06	18.75	4.24	7.25
		Average	19.46	.....	5.02	
The H-O Co.'s Horse Feed.	3	Highest	11.94	.....	4.75	
		Lowest	11.69	12.30	3.81	4.90
		Average	11.81	. .....	4.36	
E. W. Blatchford's Calf Meal.	1	.....	33.44	.....	5.23	.....
Bowker Fertilizer Co.'s Bowker's Animal Meal.	5	Highest	44.94	.....	14.05	
		Lowest	40.50	30.00	12.05	5.00
		Average	42.51	....	12.95	
Bradley Fertilizer Co.'s Superior Meat Meal.	1	... .	43.56	40.00	15.95	15.00
Bradley Fertilizer Co.'s Old Fashioned Beef Scraps.	1	.....	49.13	40.00	19.60	10.00

J. M. BARTLETT, *Chemist.*

O. W. KNIGHT, } *Assistant*
A. J. PATTEN, } *Chemists.*

COTTON SEED MEAL.

Pure cotton seed meal is made by grinding the seed after the white down, which remains upon the seed as it comes from the gotton gin, and the hard hulls have been removed. Decorticated cotton seed meal thus prepared carries from forty to fifty-three per cent of protein. From the ease with which hulls may be ground with the cotton seed, this class of goods offers peculiar opportunity to dishonest manufacturers and dealers. When the feeding stuff law went into effect in the fall of 1897 the State was filled with inferior goods carrying from twenty-two to thirty per cent of protein. In the spring of 1898 the inspectors reported a few lots of these goods. In November, 1898, only two lots of low grade cotton seed meal were found by the inspectors, and these samples were guaranteed in accordance with their low grade. Occasionally the Station has had sent to it by correspondents samples of suspected meal, but analyses have shown them to be up to guarantee.* Not all dark colored meal is adulterated and not all bright yellow meal is free from adulteration. The following statement made in bulletin 44 apparently represents the status of low grade cotton seed meal at present: "Goods of this type were very abundant in this State in 1897 but there are almost none of them to be found at present. The inspection law has driven them to other states."

As will be seen from the analyses the cotton seed meals agree quite closely with the guaranteed analyses.

GLUTEN MEALS AND FEEDS.

Gluten meals and gluten feeds are by-products left in the manufacture of starch and glucose from Indian corn. Corn consists largely of starch. The waste product from the manufacture of starch or sugar is relatively much richer in oil and protein than corn. Many factories are removing part of the corn oil from the waste, so that some gluten meals carry but little oil. This reduction in fat is an advantage, as feeding corn oil to dairy animals seems to have a tendency to make the butter soft. No by-products used for feeding differ more from each other than do these starch and sugar wastes. All manufacturers

* After this Bulletin was in press one low grade *unguaranteed* sample has been received.

apparently do not recognize that the composition of these offals change greatly, and some of them have based their guarantees upon old analyses.

Cream gluten meal is not up to the guarantee in protein. It is guaranteed to carry thirty-seven per cent, but from the samples drawn the purchaser can not expect more than thirty-three per cent of protein on the average, and one sample ran as low as thirty-one per cent of protein. The attention of the handlers of this feed has been called to these discrepancies between guarantee and analysis and they will probably be corrected on future shipments.

Fourteen samples of Chicago gluten meal were collected by the inspectors. These samples represent both old and new goods. The old goods were guaranteed too high in fat. The present guarantee, thirty-eight per cent protein and two per cent fat, fairly well represents the goods on the market. The protein found in the samples examined, agrees as closely as can be expected with the guarantees. The State agents seem to be anxious that their guarantees shall represent the goods as sold.

King gluten meal as sold in Maine comes from two mills, the output of which differs greatly in composition. The goods made at the Des Moines mill are very close with the guarantee, thirty-two per cent protein and sixteen per cent fat; the goods from the Indianapolis mills are higher in protein than the guarantee and are correspondingly low in fat. The Indianapolis goods carry about thirty-four per cent protein and four per cent of fat. The attention of the dealers has been called to this and the goods will by correctly branded in the near future.

GLUTEN FEEDS.

But little gluten feed is offered in the State. That found agreed in composition with the guarantee. At Bath a small amount of gluten feed was found which did not carry any guarantee.

LINSEED MEAL.

Only three samples of linseed meal were found by the inspectors. Its high cost, relative to cottonseed meal, has apparently crowded it out of the market. The guarantee of Douglass & Company's oil meal was based upon an analysis of a sample sent

to the Station months before by the wholesaler, who writes as follows: "When you analyzed our oil meal we had a large quantity on hand, and we tagged as you directed. It is so high now that very little is sold and we have had a few lots that we have sold and we supposed was of same quality. We have not at present a single sack in our store."

OAT FEEDS.

A number of samples of different oat feeds have been examined. For the most part guarantees are based upon single analyses of the feeds and the goods usually are not quite as good as the sample upon which the guarantee rests. With the exception of the American Cereal Company's Quaker Oat Feed none of these materials are much below and some run above the guarantee.

BLATCHFORD'S CALF MEAL.

This is a manufactured food only one lot of which was found by our inspectors. This was not guaranteed but carried 33.44% protein and 5.23% of fat. In some advertising matter connected with Blatchford's calf meal it is claimed that 12.8 pounds of it has three and one-half pounds of protein, which is about twenty-seven and one-half per cent. A sample of these goods sent by a dealer to the Station in September analyzed as follows:

Water, 7.70%; ash, 5.46%; protein, 25.63%; crude fiber, 5.28%; starch, 18.24%; undetermined carbohydrates, 32.13%; fat, 5.56%. It will be observed that the goods as evidenced by the official sample and this lot sent to the Station are very uneven in composition;—one sample carrying about 26% and the other about 33% of protein. A large part of the ash is common salt.

These goods were sent to an expert on food mixtures and adulterations at the Connecticut Experiment Station who reports as follows: "I have examined Blatchford's calf meal under the microscope and find it contains linseed meal, some product from the wheat kernel, some product from the bean kernel and a little fenugreek. The linseed meal appears to be the chief constituent. The wheat product is bran, middlings or some similar product consisting of starchy matter mixed with more or less of the seed coats. Bean bran was present in considerable amount and more or less of the starchy matter."

In a letter just at hand from Mr. J. W. Barwell, the proprietor of these goods, he says: "Regarding the ingredients, I cannot give you the exact constituents of it, but I may say that it is composed mostly of locust bean meal with leguminous seeds such as lentils, etc., and oleaginous seeds such as flax-seed, fenugreek and annis seed, all cleaned, hulled and ground together and thoroughly well cooked. There is no cheap mill food and no low grade feed enters into this composition. I am prepared to go into any court in the United States and make an affidavit that there is no farmer in the United States that can compound Blatchford's calf meal for less than $3.50 per hundred."

Locust bean meal which Mr. Barwell claims to be the chief constituent of Blatchford's calf meal is practically not used in this country as a cattle feed. The average of ten English and German analyses show it to carry:—water, 14.96%; ash, 2.53%; protein, 5.86%; crude fiber, 6.39%; nitrogen-free extract, 68.98%; fat, 1.28%.

It is evident from the chemical analysis that locust bean meal cannot be the chief constituent of Blatchford's calf meal, but that the microscopist is correct that linseed meal is the chief constituent. Locust bean meal has only six per cent of protein and in order to make a mixture carrying from twenty-six to thirty-three per cent of protein, it would be necessary to add large quantities of goods like linseed meal rich in protein. As seen from the analysis Blatchford's calf meal has a feeding value somewhat inferior to old process linseed meal. Whatever it may cost to manufacture, no man who has sufficient intelligence to mix feeds can afford to buy it at anything like the price asked.

CHIEF REQUIREMENTS OF THE LAW.

The points of the law of most interest both to the dealer and consumer are concisely stated below.

Kinds of Feed coming within the Law. The law applies to all feeding stuffs *except* hays and straws; whole seeds and meals of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn; brans and middlings. The principal feeds coming under the provisions of the law are linseed meals, cottonseed meals, pea meals, cocoanut meals, gluten meals, gluten feeds, maize feeds, starch feeds, sugar feeds, dried brewer's grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds,

corn and oat chops, ground beef or fish scraps, mixed feeds, and all other materials of similar nature.

Inspection Tax and Tag. To meet the expenses of inspection, a tax of ten cents per ton must be paid to the Director of the Maine Agricultural Experiment Station. On receipt of the inspection tax, the Director of the Station is required to furnish a tag stating that all charges have been paid. This tag must be affixed to the package before it is offered for sale.

The Brand. Each package of feeding stuff included within the law shall have affixed the inspection tax tag and shall also bear, conspicuously printed, the following statements:

The number of net pounds contained in the package.

The name or trade mark under which it is sold.

The name of the manufacturer or shipper.

The place of manufacture.

The place of business of manufacturer or shipper.

The percentage of crude protein.

The percentage of crude fat.

These statements may be printed directly on the bag, on a tag attached to the package, or on the back of the inspection tax tag furnished by the Director of the Station.

A copy of the statement of brand must be filed with the Director of the Station. The goods must carry the inspection tax tag and the brand before they can be legally offered for sale in the State. It will not answer to affix tags at the time the goods are sold.

FREE ANALYSIS OF FEEDING STUFFS.

The Station officers take pains to obtain for analysis samples of all feeding stuffs coming under the law, but the co-operation of consumers is essential for the full and timely protection of their interests. Whenever any one believes that the law is being evaded in any way, he is requested to notify the Director of the Station.

The Station will promptly analyze, free of charge, samples of feeding stuffs *taken in accordance with directions furnished by the Station,* and report the results to the interested parties. Blanks containing full directions for drawing and forwarding samples will be sent on application.

CHAS. D. WOODS, *Director.*

CARE OF ORCHARDS.

W. M. Munson.

The fact that the apple is spontaneous in many parts of the State, and that orchards will exist and bear a partial crop of fruit though utterly neglected, is responsible for much of the ill-treatment seen on every hand. There is little doubt, however, that a well managed orchard is a most valuable farm property, and one of the surest sources of income. In view of the large number of orchards needing care, throughout the State, attention will, at this time, be given to this point rather than to planting.

RENOVATION.

Repair is not necessarily associated with old age and decay. Apple trees ten or fifteen years old sometimes need repairing quite as much as do old and neglected ones. When the orchard to be treated has been neglected for many years, the first operation, if the land does not need draining, is to prune thoroughly. In this operation, which may be performed at any time from late fall till the middle of May, care should be used that the trees are given an open head. This does not imply that all small side limbs should be removed, leaving a lot of whipstocks, but that such of the larger limbs as are parallel and close together, or those which cross, should be cut out. Half of the difficulty of pruning is done away with if one decides to allow the tree its natural form, rather than to attempt to shape it to some particular model.

Many growers suppose that pruning weakens the tree and shortens its life. There is, however, no reason for this belief, other than the general statement that "pruning is unnatural." But pruning is not unnatural. Man seldom prunes so heavily as does nature in removing superfluous limbs in the growth of young saplings in the forest. Furthermore, nature prunes at

all seasons and in the rudest ways. By this it should not be understood, however, that care is not necessary in the mechanical operation of pruning. On the other hand, it is of the greatest importance that large limbs be removed with care and the wounds painted to prevent the entrance of fungi which will induce decay.

Trees are sometimes broken by heavy loads of fruit or by ice. In such matters, prevention is better than cure, and in training young trees, all crotches should be avoided. If bad crotches should be found to exist in trees ten or more years old, they should be braced by means of an iron bolt. Much damage may be avoided if bolts are used in season.

If the land on which the orchard is located has never been plowed, the surest way of stirring the soil and working in the necessary fertilizer is to fence off a portion of the area to be renovated, and turn in several hogs. The hogs, in rooting for grubs, will stir the soil as completely as would be possible with plow and harrow. The value of this treatment has been fully demonstrated at the farm of Charles S. Pope, Manchester, where most of the orchard work of this Station has been conducted. An orchard some fifty years old, which had not been plowed for more than twenty years, was treated as above noted, ten hogs being placed in the enclosure of about one and one-half acres in extent. The trees in this enclosure assumed a brighter, richer color which was noticeable from the street, half a mile distant. No accurate account of the yield of the trees in this plot as compared with others was kept, but Mr. Pope reports that there was a decided difference both in yield and in quality of the fruit. So satisfactory were the results that each year since the first trial a new area is set apart for similar treatment.

Not infrequently, during winters when the snow remains long on the ground, apple trees will be girdled by mice and rabbits. In such a case, "bridge grafting" is often practiced with satisfactory results; *i. e.* cions are set at frequent intervals about the trunk of the tree, one end being inserted underneath the bark above the wound, the other below. In this way the circulation of sap is maintained and the tree may be saved. The wound should be covered with grafting wax or with fresh cow dung, to exclude the air.

GRAFTING.

In starting a new orchard it is usually advisable to set trees which have been grafted in the nursery, rather than to set chance seedlings with the expectation of top-grafting them. Some varieties, as the Baldwin, do better when "top-worked," but even for such, nursery grown stock of Ben Davis, Northern Spy, Pewaukee or some other hardy, vigorous sort will give more uniform and satisfactory results than will seedlings.

While, in general, it is well to avoid top-grafting, there are few orchards in which some such work is not necessary, and many worthless seedlings, along the roadside and in the pastures, may be converted into valuable sources of income. The most successful grafting is that which disturbs the tree least. The first rule to observe, in grafting large trees is: "Graft many and small limbs." Before commencing to graft, decide carefully at what distance from the body, or from the center of the top, the main limbs should be cut to insure a good top. If a spread of six feet or ten feet from the center is decided upon, graft all of the main branches at that distance. In other words, one must plan for the future top of the tree; simply making the cions grow, being but a part of the operation. If the tree has been properly pruned, most of the more conspicuous branches should be grafted, and to avoid long pole-like limbs some cions should be set on the side branches of all the larger limbs. The practice of grafting a few large stubs low down, is not to be commended; the shock of removing a large portion of the top at one time is a serious one, and there is often injury from sunscald. A good grafter will leave enough small brush in the center of the tree to screen the trunk and larger branches.

Old neglected trees which are to be worked over, may with profit be given a preparatory pruning a year or two before grafting. Unnecessary limbs can be cut out better before grafting than afterwards. The ungrafted limbs must be gradually removed; the removal being made annually to about the extent of the growth of the cions, or a little more.

FERTILIZING.

The profit in fruit growing lies in securing an extra large amount of fruit of superior quality. This end can only be attained by the addition of a supply of plant-food in excess of that demanded for the growth of the trees. How much plant-food should be added is simply a matter of business that must be settled by each individual for his own farm. The actual fertility of the soil depends upon the plant as well as upon the amount and kind of plant-food in the soil; for only when the plant is in a healthy, vigorous condition can the maximum

amount of food be appropriated. In most cases, as much depends upon the physical condition of the soil, as upon its chemical constitution.

In general, a liberal application of ground bone or phosphatic rock and of hardwood ashes will be found the most satisfactory fertilizing material for orchards. Stable manure may also be used with good effect, on soils deficient in organic matter; though for most orchards potash and phosphoric acid are desired, rather than nitrogen.

CULTURE.

Many good orchards are so located that cultivation is out of the question. There is no doubt, however, that where possible,

thorough culture, especially while the orchard is young, is much to be desired. By cultivation, the soil is rendered in better condition for the feeding roots, the plant food is thus rendered more available, and the moisture is better conserved than in any other way. During the first years after planting, hoed crops may be grown between the trees, provided sufficient fertilizers are used. In no case, however, should a grain crop be grown, except as a cover crop to be plowed under in the spring. The accompanying illustrations clearly represent the value of culture. The cut on the opposite page represents an orchard of Fameuse,

Northern Spy and Milding planted, as two-year-old trees, in 1892. The above illustration shows an orchard of similar varieties planted the next year. The first has been given thorough culture and was severely pruned in 1897; the other, separated from the first only by a fence, has been left without treatment, and a crop of hay has been taken off each year. Further remark is unnecessary.

SPRAYING.

Spraying is an easy and practical way of applying insecticides and fungicides. Insecticides act in two ways: (1) By poisoning the insects, when eaten; (2) by closing the breathing pores

of the insects, or acting as an external irritant. Paris green is an example of the first class; kerosene emulsion or pyrethrum of the second. Hellebore, if applied in the dry form, acts in both ways. By spraying the trees with Paris green, some particles of the poison will be lodged upon the young fruit or upon the leaves; then as the insects attempt to enter the fruit, or to eat the foliage, they are destroyed.

Fungicides are of importance solely as preventives. The coating of Bordeaux mixture, or other material, upon the fruit and leaves, kills the germinating spores of the fungi before they penetrate the plant tissue. The time of spraying will naturally vary, depending on the purpose in view and the material used. The subject has been discussed in Bulletin 29.

ORCHARD WORK NOW IN PROGRESS AT THE EXPERIMENT STATION.

The principal orchard work now in progress at the Experiment Station is along the lines of tillage and fertilizers. At the farm of Charles S. Pope, Manchester, a young orchard, set on land which has never been plowed, has been laid off in plats, part of which are treated with concentrated fertilizers, and part with stable manure. Half of the orchard has been placed under cultivation, and the other half is heavily mulched.

Another orchard, on the same farm, has been divided into plats for treatment with different salts of potash, with a view to studying the effect, if any, upon quality of fruit and susceptibility to attack of apple scab.

In Aroostook County, as noted in previous reports, some of the more promising Russian varieties of apples, plums, and cherries are under trial; also some of the hardier American sorts. Such of these as have fruited were discussed in the Annual Report of this Station for 1896.

At present there are growing in the Station nurseries several hundred of the hardier standard apples which will next year be sent to different parts of the State, where encouragement to the fruit growing industry seems necessary. These varieties include Arctic, Shiawassee Beauty, Sutton Beauty, Westfield, etc.

INSPECTION OF FERTILIZERS, 1899.

This bulletin contains the analyses of manufacturers' samples of brands of fertilizers licensed before March 8, 1899.

The analyses which appear here are those made from manufacturer's samples, which are deposited under affidavit that they are reasonably near in composition to the corresponding brands found in the market.

The figures which are given as the percentages of valuable ingredients guaranteed by the manufacturers are the minimum percentages of the guarantee. If, for instance, the guarantee is 2 to 3 per cent. of nitrogen, it is evident that the dealer can not be held to have agreed to furnish more than 2 per cent., and so this percentage is taken as the actual guarantee. The figures under the head of "found" are those showing the actual composition of the samples deposited.

Descriptive List of Manufacturers' Samples, 1899.

Station number.	Manufacturer, place of business and brand.
	HIRAM BLANCHARD, EASTPORT, ME.
2114	Blanchard's Fish, Bone and Potash
2115	Blanchard's Ground Fish Scrap, No. 2
	BOWKER FERTILIZER CO., BOSTON, MASS.
1252	Bowker's Ammoniated Dissolved Bone
1868	Bowker's Bone and Wood Ash Fertilizer
1852	Bowker's Corn Phosphate
1251	Bowker's Farm and Garden Phosphate
1257	Bowker's Fresh Ground Bone
1579	Bowker's High Grade Fertilizer
1248	Bowker's Hill and Drill Phosphate
1872	Bowker's Market Garden Manure
1389	Bowker's Potato and Vegetable Phosphate
1390	Bowker's 6 % Potato Fertilizer
1249	Bowker's Special Fertilizers, Potatoes and Vegetables
1250	Bowker's Square Brand Bone and Potash
1866	Bowker's Staple Phosphate or 3 % Fertilizer
1867	Bowker's Superphosphate with Potash
1247	Bowker's Sure Crop Phosphate
1588	Bowker's 10 % Manure
1871	Gloucester Fish and Potash
1580	Stockbridge Corn and Grain Manure
1870	Stockbridge Pea and Bean Manure
1388	Stockbridge Potato and Vegetable Manure
1381	Stockbridge Seeding Down Manure
1869	Stockbridge Strawberry Manure
1392	Stockbridge Top Dressing Manure
	BRADLEY FERTILIZER CO., BOSTON, MASS.
2113	Bradley's Alkaline Bone with Potash
2112	Bradley's Complete Manure for Potatoes and Vegetables
1282	Bradley's Corn Phosphate
2111	Bradley's Eureka Fertilizer
1882	Bradley's Niagara Phosphate
1269	Bradley's Potato Fertilizer
1267	Bradley' Potato Manure
1265	Bradley's X. L. Phosphate
	CLARK'S COVE FERTILIZER CO., BOSTON, MASS.
1606	Bay State Defiance Phosphate
1217	Bay State Fertilizer
1219	Bay State Fertilizer for Seeding Down
1218	Bay State Fertilizer G. G
1215	King Philip Alkaline Guano for Potatoes
	THE CLEVELAND DRYER CO., BOSTON, MASS.
1607	Cleveland Fertilizer for All Crops
1608	Cleveland Pioneer Fertilizer
1264	Cleveland Potato Phosphate
2109	Cleveland Seeding Down Fertilizer
1263	Cleveland Superphosphate
	E. FRANK COE CO., NEW YORK, N. Y.
1901	E. Frank Coe's Bay State Phosphate
2117	E. Frank Coe's Columbian Special Corn Fertilizer
2118	E. Frank Coe's Columbian Special Potato Fertilizer

Analyses of Manufacturers' Samples, 1899.

Station number.	Nitrogen.				Phosphoric Acid.							Potash.	
	As ammonia or nitrates.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.			
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	%	%	%	%	%	%	%	%	%	%	%	%	%
2114	.51	2.44	2.95	2.50	.....	2.61	1.28	2.61	2.0	3.89	4.5	3.82	4.5
2115	.49	3.64	4.13	4.47	.....	3.39	.89	3.39	3.5	4.43	4.5	1.44	1.0
1252	.....	.....	1.88	1.50	5.32	2.51	2.05	7.83	8.0	9.88	10.0	2.17	2.0
1868	.....	.....	1.99	1.50	.....	.....	2.00	8.86	6.0	10.86	8.0	3.09	2.0
1852	.....	.....	1.88	1.60	.....	.....	2.77	8.59	7.0	11.36	9.0	2.26	2.0
1251	.....	.....	1.86	1.50	5.27	3.01	7.79	8.28	8.0	10.07	10.0	2.21	2.0
1257	.....	.....	3.10	2.25	.....	.....	.....	.....	.....	17.49	18.0	.....	.....
1579	.....	.....	2.76	2.25	7.71	2.37	1.92	10.08	8.0	12.00	10.0	4.68	4.0
1248	.....	.....	2.60	2.25	7.36	1.87	3.08	9.23	9.0	12.31	12.0	2.52	2.0
1872	.....	.....	2.18	2.25	.....	.....	2.33	7.80	6.0	10.13	8.0	10.95	10.0
1389	.....	.....	1.77	1.50	3.83	3.50	5.40	7.33	8.0	12.73	10.0	2.34	2.0
1390	.....	.....	1.01	.75	3.93	3.88	3.86	7.81	7.0	11.67	10.0	6.38	6.0
1249	.....	.....	2.54	2.25	3.79	2.54	4.31	6.33	8.0	10.64	10.0	4.42	4.0
1250	.....	.....	1.70	1.50	.....	6.40	7.19	6.40	6.0	13.59	12.0	2.21	2.0
1866	.....	.....	1.06	.75	.....	.....	3.18	8.68	8.0	11.86	10.0	3.65	3.0
1867	.....	.....	.....	.....	.....	.....	2.82	10.70	10.0	13.52	11.0	3.19	2.0
1247	.....	.....	1.02	.75	4.09	3.75	4.07	7.84	8.0	11.91	10.0	1.16	1.0
1588	.....	.....	1.15	.75	1.30	5.17	3.61	6.47	6.0	10.08	8.0	10.98	10.0
1871	.....	.....	.97	.75	.....	.....	4.86	6.58	6.0	11.44	9.0	1.76	1.0
1580	.....	.....	3.33	3.00	6.78	1.85	1.91	8.63	8.0	10.54	10.0	6.55	6.0
1870	.....	.....	2.51	2.00	.....	.....	3.21	6.89	6.0	10.10	8.0	6.28	6.0
1388	.....	.....	3.43	3.25	3.12	2.11	4.26	5.25	6.0	9.49	7.0	9.76	10.0
1391	.....	.....	2.62	2.50	5.63	1.76	4.70	7.39	6.0	12.09	12.0	10.27	10.0
1869	.....	.....	2.29	2.25	.....	.....	3.30	6.96	6.0	10.26	7.0	4.79	4.0
1392	.....	.....	5.09	5.00	3.52	2.26	3.70	5.78	4.0	9.48	6.0	5.87	6.0
2113	.....	.....	2.61	.....	6.73	4.25	2.18	10.98	11.0	13.16	12.0	3.71	2.4
2112	1.06	2.40	3.46	3.30	5.36	3.32	1.51	8.68	8.0	10.19	9.0	6.91	7.0
1282	.....	.....	2.59	2.05	6.79	3.18	1.42	9.97	9.0	11.39	10.0	1.68	1.5
2111	.11	1.06	1.17	1.03	5.93	2.35	1.55	8.28	8.0	9.83	9.0	2.32	2.0
1882	.....	.....	1.00	.82	.....	.....	1.10	8.56	7.0	9.66	8.0	1.56	1.1
1269	.....	.....	2.11	2.06	8.39	2.28	.93	10.67	9.0	11.60	11.0	3.07	3.2
1267	.....	.....	2.61	2.50	5.17	2.14	2.23	7.31	6.0	9.54	8.0	5.43	5.0
1265	.....	.....	2.70	2.50	7.55	3.58	1.48	11.13	9.0	12.61	11.0	2.27	2.0
1600	.....	.....	1.43	.82	7.46	1.72	1.61	9.18	7.0	10.79	9.0	2.10	1.0
1217	.....	.....	2.72	2.47	8.10	1.57	.96	9.67	9.0	10.63	10.0	2.65	2.0
1219	.....	.....	2.33	1.03	7.18	2.55	1.89	9.73	8.0	11.62	10.0	2.59	2.0
1218	.....	.....	2.36	1.85	7.38	2.34	1.81	9.72	8.5	11.53	10.0	2.62	2.0
1215	.....	.....	1.79	1.23	6.52	1.74	1.05	8.26	6.5	9.31	8.0	3.66	3.0
1607	.....	.....	1.48	1.03	6.71	2.16	2.35	8.87	8.0	11.22	9.0	2.42	2.0
1608	.....	.....	1.63	.82	6.80	2.39	1.83	9.19	7.0	11.02	9.0	2.00	1.0
1264	.....	.....	2.16	2.05	8.83	1.64	.97	10.47	8.0	11.44	10.0	3.21	3.0
2109	.11	1.06	1.17	1.03	5.79	2.89	1.27	8.68	8.0	9.95	9.0	2.20	2.0
1263	.....	.....	2.39	2.05	7.38	2.51	1.92	9.89	9.0	11.81	11.0	2.71	2.0
1961	.30	1.49	1.79	2.00	6.99	2.77	2.66	9.76	9.0	12.42	11.0	1.89	1.8
2117	.28	1.22	1.50	1.23	5.97	2.86	2.67	8.83	8.5	11.50	10.5	2.94	2.5
2118	.25	1.19	1.44	1.20	5.85	2.97	2.60	8.82	8.5	11.42	10.0	2.75	2.5

Descriptive List of Manufacturers' Samples, 1899.

Station number.	Manufacturer, place of business and brand.
2119	E. Frank Coe's Excelsior Potato Fertilizer
1617	E. Frank Coe's Grass and Grain Fertilizer
2116	E. Frank Coe's High Grade Ammoniated Bone Phosphate
1884	E. Frank Coe's High Grade Potato Fertilizer
2120	E. Frank Coe's Prize Brand Grain and Grass Fertilizer
1405	E. Frank Coe's Special Potato Fertilizer
2121	E. Frank Coe's Standard Grade Ammoniated Bone Phosphate
	CROCKER FERTILIZER AND CHEMICAL CO., BUFFALO, N. Y.
1855	Crocker's Ammoniated Corn Phosphate
1853	Crocker's New Rival Ammoniated Superphosphate
1856	Crocker's Potato, Hop and Tobacco Phosphate
1854	Crocker's Superior Fertilizer
	Crocker's Superior Rye and Oats Fertilizer
	CUMBERLAND BONE PHOSPHATE CO., PORTLAND, ME.
1899	Cumberland Bone and Potash
1601	Cumberland Hawkeye Fertilizer
1394	Cumberland Potato Fertilizer
1395	Cumberland Seeding Down Manure
1393	Cumberland Superphosphate
	L. B. DARLING FERTILIZER CO., PAWTUCKET, R. I.
2131	Darling's Animal Anchor Brand
2130	Darling's Animal Fertilizer "G" Brand
2129	Darling's Blood, Bone and Potash
	FRANK S. FARRAR & CO., BANGOR, ME.
1277	Farrar's Potato Manure
1276	Farrar's Superphosphate
	GREAT EASTERN FERTILIZER CO., RUTLAND, VT.
1578	Great Eastern Dissolved Bone
1230	Great Eastern General Fertilizer
1231	Great Eastern Grass and Oats Fertilizer
1233	Great Eastern Northern Corn Special
1232	Great Eastern Potato Manure
	E. L. LEWIS, ATLANTIC, MASS.
2132	Lewis Potato Fertilizer
	LISTER'S AGRICULTURAL CHEMICAL WORKS, NEWARK, N. J.
2105	Lister's Seeding Down Fertilizer
2104	Lister's Special Potato Fertilizer
2103	Lister's Success Fertilizer
2102	Lister's "U. S." Superphosphate
	LOWELL FERTILIZER CO., BOSTON, MASS.
1874	Swift's Lowell Animal Fertilizer
1875	Swift's Lowell Bone Fertilizer
1876	Swift's Lowell Dissolved Bone and Potash
1873	Swift's Lowell Ground Bone
1879	Swift's Lowell Fruit and Vine Fertilizer
1877	Swift's Lowell Potato Phosphate
	NATIONAL FERTILIZER CO., BRIDGEPORT, CONN.
1885	Chittenden's Ammoniated Bone Fertilizer
1886	Chittenden's Complete Root Fertilizer
1887	Chittenden's Market Garden Fertilizer
	SAMUEL G. OTIS, HALLOWELL, ME.
1597	Otis Potato Fertilizer
1880	Otis Seeding Down Fertilizer
1620	Otis Superphosphate
	PACIFIC GUANO CO., BOSTON, MASS.
1605	Pacific Guano Company's Grass and Grain Fertilizer
1604	Pacific Guano Company's Potato Special
1234	Nobsque Guano
1235	Soluble Pacific Guano

Analyses of Manufacturers' Samples, 1899.

Station number.	Nitrogen.				Phosphoric Acid.							Potash.	
	As ammonia or nitrates.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.			
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	%	%	%	%	%	%	%	%	%	%	%	%	%
2119	.65	2.02	2.67	2.50	6.14	1.34	1.27	7.48	8.0	8.75	9.0	9.91	8.0
1617	.....	.....	2.83	.80	7.88	2.96	3.63	10.84	8.5	14.47	10.0	1.21	1.5
2116	.....	....	1.68	1.85	5.97	2.62	2.50	8.95	9.0	11.45	11.0	2.90	2.2
1884	.....	.....	2.50	2.40		.....	1.29	7.71	7.0	9.00	8.0	7.86	6.5
2120	.....	.....	....	.....	12.30	2.57	.47	14.87	10.5	15.34	12.0	.67	2.0
1405	.....	.. .	1.95	1.65	7.43	1.82	4.20	9.25	8.0	13.45	10.0	4.58	4.0
2121	.27	1.26	1.53	1.20	6.32	2.33	2.87	8.65	8.5	11.52	10.0	2.45	2.2
1855	.....	.....	2.92	2.05	.....	.....	.58	12.21	10.0	12.79	11.0	2.43	1.6
1853	.....	.....	2.16	1.23	.....	.....	.62	11.75	10.0	12.37	11.0	3.37	1.6
1856	.....	.....	2.42	2.05	.....	.....	.77	10.68	10.0	11.45	11.0	3.39	3.2
1854	.....	.....	.90	.82	.....	.....	.83	8.86	8.0	9.69	9.0	2.06	2.0
....	.....	.....	.90	.82	.....	.....	.83	8.86	8.0	9.69	9.0	2.06	2.0
1899	.....	... ..	....	.....	6.38	3.36	2.08	9.74	8.0	11.82	10.0	3.15	2.5
1601	.....	.....	1.70	.82	7.45	1.42	1.90	8.87	7.0	10.77	9.0	2.08	1.0
1394	.....	.....	2.12	2.06	7.01	1.88	2.16	8.89	9.0	11.05	11.0	3.97	3.0
1395	.....	.....	1.10	1.03	5.82	1.98	2.11	7.80	8.0	9.91	10.0	2.93	2.0
1393	.....	.....	2.08	2.06	5.96	3.36	1.92	9.30	8.0	11.22	10.0	3.56	2.0
2131	.23	2.32	2.55	1.65	5.73	2.69	.71	8.42	6.0	9.13	7.0	3.16	2.0
2130	.23	2.32	2.55	2.06	5.60	2.58	.62	8.18	6.0	8.80	7.0	4.64	4.0
2129	.96	2.84	3.80	4.12	5.50	3.12	.91	8.62	7.0	9.53	8.0	6.37	7.5
1277	.....	.....	2.33	2.25	3.03	7.19	5.99	10.22	9.0	16.21	12.0	3.32	3.0
1276	.....	.....	2.56	2.50	3.24	8.26	4.25	11.50	9.0	15.75	12.0	1.63	2.0
1578	.....	.....	.....	.....	9.27	5.86	1.36	15.13	14.0	16.49	.....	.....	....
1230	.....	.....	1.10	.83	.69	9.25	2.26	9.94	8.0	12.20	.....	4.72	4.0
1231	.....	.. ...	.....	.....	4.11	6.88	4.08	10.99	11.0	15.07	.....	2.15	2.0
1233	.....	... ..	3.06	2.88	3.84	5.36	.74	9.20	8.0	9.94	.....	3.42	2.0
1232	.....	.....	2.35	2.06	5.14	4.90	.68	10.04	8.0	10.72	.....	5.71	4.0
2132	1.20	2.36	3.56	3.28	3.74	2.40	1.93	6.14	5.0	8.07	6.0	10.43	10.0
2105	.06	.84	.90	.62	7.58	2.64	2.47	10.22	10.0	12.69	11.0	1.06	1.0
2104	.25	1.46	1.71	1.65	5.87	2.52	2.38	8.39	8.0	10.77	9.0	2.94	3.0
2103	.27	1.22	1.49	1.24	7.23	2.33	2.43	9.56	9.5	11.99	11.5	2.06	2.0
2102	.19	1.35	1.54	1.32	5.09	2.34	2.03	7.43	7.0	9.46	8.0	2.39	2.0
1874	.....	.....	2.85	2.46	.....	.....	1.01	10 38	9.0	11.39	10.0	4.10	4.0
1875	.....	.....	2.06	1.64	.....	.....	1.31	8.27	8.0	9.58	9.0	3.56	3.0
1876	.....	.....	1.90	1.64	.....	.....	1.73	9.33	9.0	11.06	10.0	2.45	2.0
1873	.....	.....	2.30	2.40	.. ...	....	.....	.....	5.0	27.72	28.0	.....	.....
1879	.....	.....	3.69	3.28	.....	.....	.96	7.72	7.0	8.68	8.0	6.44	6.0
1877	.....	. ....	2.61	2.46	.....	.....	1.08	9.41	8.0	10.49	9.0	6.96	6.0
1885	.....	.....	2.42	1.60	.....	.....	1.61	9.72	9.0	11.33	10.0	3.69	2.0
1886	.....	.....	3.79	3.30	.....	.....	1.33	9.35	8.0	10.68	10.0	6.31	6.0
1887	.....	.....	3.02	2.40	.....	.....	2.90	7.29	7.0	10.19	9.0	5.83	6.0
1597	.....	.....	2.06	2.00	8.46	1.98	1.24	10.44	9.0	11.68	11.0	4.12	3.0
1880	.....	.....	1.36	1.50	.....	.....	1.61	8.37	8.0	9.98	12.0	2.39	2.0
1620	.....	.....	2.57	2.00	6.44	4.72	1.85	11.16	9.5	13.01	11.0	2.77	2.0
1605	.....	.....	1.82	.82	6.70	2.71	1.68	9.41	7.0	11.09	8.0	2.39	1.1
1604	.....	.....	2.65	2.05	8.88	2.13	1.06	11.01	8.0	12.07	9.0	4.10	3.0
1234	.....	.....	1.23	1.15	6.23	2.68	2.44	8.91	8.0	11.35	9.0	2.25	2.0
1235	.....	.....	2.37	2.25	7.33	2.42	1.85	9.75	8.5	11.60	10.5	2.61	2.0

Descriptive List of Manufacturers' Samples, 1899.

Station number.	Manufacturer, place of business and brand.
	PACKERS' UNION FERTILIZER CO., NEW YORK, N. Y.
1566	Packers' Union Animal Corn Fertilizer
1567	Packers' Union High Grade Potato Manure
2126	Packers' Union Universal Fertilizer
1619	Packers' Union Wheat, Oats and Clover Fertilizer
	PARMENTER & POLSEY FERTILIZER CO., PEABODY, MASS.
2123	Plymouth Rock Brand
2122	"P. and P." Potato Fertilizer
2124	Parmenter & Polsey Special Potato Fertilizer
2125	Star Brand Superphosphate
	EDWIN J. PHILBRICK, AUGUSTA, ME.
1888	Philbrick's Fertilizer
	PORTLAND RENDERING CO., PORTLAND, ME.
1616	Portland Rendering Co.'s Bone Tankage
	THE QUINNIPIAC CO., BOSTON, MASS.
1589	Quinnipiac Climax Phosphate
1590	Quinnipiac Corn Manure
1244	Quinnipiac Phosphate
1245	Quinnipiac Potato Manure
1591	Quinnipiac Potato Phosphate
1246	Quinnipiac Seeding Down Manure
	READ FERTILIZER CO., SYRACUSE, N. Y.
1396	Read's Practical Potato Special
1397	Read's Standard
1587	Read's Sure Catch
1555	Read's Vegetable and Vine
1865	Sampson Fertilizer
	RUSSIA CEMENT CO., GLOUCESTER, MASS.
1410	Essex Complete Manure for Corn, Grain and Grass
1411	Essex Complete Manure for Potatoes, Roots and Vegetables
2106	Essex Corn Fertilizer
2108	Essex Potato Fertilizer
1568	Essex XXX Fish and Potash
1891	Maine State Grange Chemicals
1892	Maine State Grange Potato Manure
2107	Maine State Grange Seeding Down Fertilizer
	SAGADAHOC FERTILIZER CO., BOWDOINHAM, ME.
1864	Dirigo Fertilizer
1863	Merrymeeting Superphosphate
1902	Sagadahoc Bone Meal
2127	Sagadahoc Special Potato Fertilizer
2128	Sagadahoc Superphosphate
1862	Yankee Fertilizer
	STANDARD FERTILIZER CO., BOSTON, MASS.
1414	Standard "A" Brand
1890	Standard Bone and Potash
1223	Standard Fertilizer
1221	Standard Guano
1603	Standard Special for Potatoes
	HENRY F. TUCKER CO., BOSTON, MASS.
1846	Original Bay State Bone Superphosphate
	JOHN WATSON, HOULTON, ME.
2133	Watson's Improved Potato Manure
	WILLIAMS & CLARK FERTILIZER CO., BOSTON, MASS.
1237	Americus Ammoniated Bone Superphosphate
1594	Americus Corn Phosphate
1595	Americus Potato Manure
1236	Royal Bone Phosphate for All Crops
1629	Williams & Clark Potato Phosphate
	A. F. YOUNG & CO., NEW YORK, N. Y.
2110	Young's Excelsior Potato Fertilizer

Analyses of Manufacturers' Samples, 1899.

Station number.	Nitrogen.				Phosphoric Acid.							Potash.	
	As ammonia or nitrates.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.		
	%	%	%	%	%	%	%	%	%	%	%	%	%
1566	.....	.....	2.58	2.47	6.18	1.99	2.33	8.17	8.0	10.50	9.0	1.74	2.0
1567	.....	.....	2.11	2.06	6.50	1.49	1.96	7.99	8.0	9.95	9.0	8.05	6.0
2126	.08	1.02	1.10	.82	6.97	1.73	1.17	8.70	8.0	9.87	9.0	4.92	5.0
1619	.....	.....	.25	.....	.....	.....	1.20	10.92	11.0	12.12	.....	2.39	2.0
2123	.21	2.08	2.29	2.47	3.81	4.21	1.38	8.02	8.0	9.40	9.0	4.19	4.0
2122	.46	1.61	2.07	1.64	3.67	3.70	1.12	7.3	6.0	8.49	7.0	5.63	5 5
2124	1.69	1.29	2.98	3.29	4.21	4.27	1.29	8.48	8.0	9.77	9.0	7.41	7.0
2125	1.01	.79	1.80	1.64	3.80	3.54	1.15	7.34	7.0	8.49	8.0	2.60	2.5
1888	.38	1.65	2.03	2.00	2.00	5.19	1.74	7.19	7.0	8.93	9.0	5.58	5.0
1616	.....	.....	4.27	4.42	.....	7.34	12.06	7.34	.....	19.40	18.6	.....	.....
1589	.....	.....	1.28	1.03	4.61	4.02	2.64	8.63	8.0	11.27	9.0	2.54	2.0
1590	.....	.....	2.22	2.06	9.15	1.24	1.29	10.39	9.0	11.68	10.0	2.27	1.5
1244	.....	.....	2.74	2.47	7.91	1.47	1.11	9.38	9.0	10.49	10.0	2.72	2.0
1245	.....	.....	2.71	2.47	5.85	1.82	2.26	7.67	6.0	9.93	7.0	5.80	5.0
1590	.....	.....	2.15	2.05	8.78	1.64	.90	10.42	8.0	11.32	9.0	3.66	3.0
1246	.....	.....	1.23	.82	6.59	2.87	2.26	9.46	9.0	11.72	10.0	2.26	2.0
1396	.....	.....	1.20	.82	3.39	1.55	.54	4.94	4.0	5.48	5.0	8.35	8.0
1397	.....	.....	1.15	.82	6.50	1.73	.92	8.23	8.0	9.15	9.0	4.33	4.0
1587	.....	.....	.....	.....	7.89	1.63	1.56	9 52	6.0	11.08	7.0	5.06	4.0
1555	.....	.....	1.96	1.65	5.04	1.21	1.55	6.25	6.0	7.80	7.0	7.96	8.0
1865	.....	.....	1.97	1.65	.....	.....	1.51	6.75	6.0	8.26	7.0	4.42	4.0
1410	.....	.....	4.00	3.70	3.02	6.39	2.51	9.41	7.0	11.92	9.5	10.52	9.5
1411	.....	.....	3.96	3.70	2.60	5.54	2.84	8.14	7.0	10.98	9.0	9.18	8.5
2106	.52	1.72	2.24	2.00	5.31	4.03	4.14	9.34	9.0	13.48	11.0	3.33	3.0
2108	.63	1.55	2.18	2.00	5.50	4.18	4.08	9.68	9.0	13.76	11.0	5.57	5.0
1568	.....	.....	2.68	2.10	8.00	2.63	2.56	10.63	9.0	13.19	12.0	2.75	2.25
1891	.82	1.58	2.40	2.50	2.45	5.71	3.89	8.16	8.0	12.05	12.0	4.72	4.0
1892	.....	1.02	1.02	1.50	1.34	7.11	3.67	8.45	9.0	12.12	12.0	12.43	12.0
2107	.....	1.91	1.91	1.50	3.19	4.24	6.36	7.43	7.0	13.79	13.0	5.69	5.5
1864	.....	.....	1.85	2.00	.....	.....	4.82	5.41	3.0	10.23	10.0	5.28	4.0
1863	.....	.....	1.50	1.50	.....	.....	3.78	7.72	5.0	11.50	9.0	2.73	2 0
1902	.....	3.79	3.79	3.00	.....	.....	.....	.....	.....	18.42	20.0	.....	.....
2127	2.15	.67	2.82	2.40	5.90	2.46	.75	8.36	6.0	9.11	10.0	8.11	7.0
2128	1.11	1.16	2.27	2 10	7.11	2.84	1.18	9.95	6.0	11.13	10.0	4.61	4.0
1862	.....	.....	.82	.50	.....	.....	2.12	9.03	3.0	11.15	7.0	2.77	1.5
1414	.....	.....	1.33	.82	4.84	3.08	1.96	7.92	7.0	9.88	9.0	1.71	1.0
1890	.....	.....	.....	.....	6.94	3.03	1.51	9.97	8.0	11.48	10.0	4.10	2.5
1223	.....	.....	2.44	2.00	7.36	2.64	1.96	10.00	8.0	11.96	10.0	2.67	2.0
1221	.....	.....	1.75	1.25	6.59	2.02	1.09	8.61	6.5	9.70	8.5	3.69	3.0
1603	.....	.....	2.43	2.05	8.00	2.98	1.03	10.98	8.0	12.01	9.0	3.78	3.0
1846	.....	.....	2.40	2.06	.....	.....	2.42	9.43	9.0	11.85	11.0	2.69	2.0
2133	.19	2.03	2.22	2.50	3.14	3.85	.84	6.99	6 00	7.83	7.00	6.52	5.00
1237	.....	.....	2.80	2.47	7.85	1.65	.79	9.50	9.0	10.29	10.0	2.63	2.0
1594	.....	.....	2.27	2.06	8.76	.33	2.56	9.09	9.0	11.65	10.0	2.03	1.5
1595	.....	.....	2.07	2.06	9.08	.96	1.24	10.04	8.0	11.28	9.0	3.53	3.0
1236	.....	.....	1.26	1.03	6.20	3.11	2.23	9.30	7.0	11.54	8.0	2.26	2.0
1629	.....	.....	2.71	2.47	.....	.....	2.30	7.86	6.0	10.16	7.0	5.54	5.0
2110	2.22	1.14	3.36	2.88	5.02	.86	.29	5.88	5.5	6.17	.....	12.25	10.0

THE CHIEF PROVISIONS OF THE FERTILIZER LAW APPLYING TO MANUFACTURERS, IMPORTERS AND DEALERS.

The law for the regulation of the sale and analyses of commercial fertilizers makes the following requirements upon manufacturers, importers or dealers who propose to sell or offer for sale commercial fertilizers in the State:

1. *The Brand.* Each package shall bear, conspicuously printed, the following statements:

The number of net pounds contained in each package.
The name or trade mark under which it is sold.
The name of the manufacturer or shipper.
The place of manufacture
The place of business of manufacturer or shipper.
The percentage of nitrogen or its equivalent in ammonia.
The percentage of potash soluble in water.
The percentage of phosphoric acid in available form.
The percentage of total phosphoric acid.

2. *The Certificate.* There shall be filed annually between Nov. 15 and Dec. 15 with the Director of the Station a certificate containing an accurate statement of the brand. This certificate applies to the next succeeding calendar year. (Blanks for this purpose will be furnished on application to the Station.)

3. *Manufacturer's Samples.* There shall be deposited annually, unless excused by the Director under certain conditions, a sample of fertilizer, with an accompanying affidavit that this sample "corresponds within reasonable limits to the fertilizer which it represents."

4. *Analysis fee.* For each brand of fertilizer sold or offered for sale in the state there shall be paid annually to the Director of the Station "an analysis fee as follows: Ten dollars for the phosphoric acid and five dollars each for the nitrogen and potash, contained or said to be contained in the fertilizer."

5. *The license.* Upon receipt of the fee, the certificate and the sample (if required), the Director of the Station "shall issue a certificate of compliance."

[The full text of the law will be sent to those asking for it.]

CHAS. D. WOODS, *Director.*

FEEDING STUFF INSPECTION.

CHAS. D. WOODS.

Samples of the feeding stuffs coming under the inspection law, drawn in November, 1898, were analyzed and the results were published in January, 1899, as bulletin 48 of the Station. The inspectors visited most of the larger dealers again in January. At this time, samples were drawn from goods which had not been previously sampled and the results of the analyses are given in the pages which follow. In addition to the analyses here reported quite a large number of samples sent to the Station by correspondents have been analyzed and the results sent to them. In only one instance have correspondents' samples shown inferior goods and that is discussed below. The results of these analyses are not here reported as they agree substantially with the official samples.

Cotton Seed Meal. During the year about 200 samples of cotton seed meal have been examined, chiefly from the dairy sections of the State including the counties of Hancock, Waldo, Penobscot, Piscataquis and the whole of the State west of the Kennebec. Of these samples, two were low grade, *unguaranteed* goods in Hancock county. Upon writing the dealers calling attention to the violations of the law in selling unbranded goods, they took the necessary steps to conform to the law. Three samples of low grade goods found in Androscoggin and Penobscot counties were from the same wholesale house. The firm claimed that their shipper made a mistake in tagging one of the Androscoggin cotton seed meals and that instead of having tags guaranteeing 43 per cent of protein, the meal should have carried tags guaranteeing 25 per cent. The change of tags were made.

The other Androscoggin and the Penobscot county low grade meal was from the same car. This was one of ten cars bought by the wholesale house. As soon as notified of the inferior quality of the goods the guarantee was changed on the stock in the hands of the retailers and the order for the other cars (not then delivered) was countermanded. The law in this instance not only brought it about that the low grade goods in the State were properly guaranteed, but through its operation a number of cars of low grade cotton seed meal were kept out of the State.

[Continued on page 44.]

MANUFACTURERS AND PLACE OF SAMPLING.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8485	American Cotton Oil Co	Huntsville, Ala	Brownfield
8486	American Cotton Oil Co	Brinkley, Ark	Fryeburg
8487	American Cotton Oil Co	Little Rock, Ark	South Windham
8493	American Cotton Oil Co	Nashville, Tenn	West Falmouth
8505	American Cotton Oil Co	Nashville, Tenn	Lock Mills
8484	American Cotton Oil Co	.....	Camden
8506	American Cotton Oil Co	.....	Dover
8484	The Southern Cotton Oil Co	Memphis, Tenn	Bath
8485	The Southern Cotton Oil Co	Memphis, Tenn	Sebago Lake
8496	The Southern Cotton Oil Co	Memphis, Tenn	Hampden
8497	The Southern Cotton Oil Co	Memphis, Tenn	Bangor
8498	The Southern Cotton Oil Co	Memphis, Tenn	Westbrook
8499	The Southern Cotton Oil Co	Memphis, Tenn	Waldoboro
8500	The Southern Cotton Oil Co	Memphis, Tenn	Brunswick
8625	The Southern Cotton Oil Co	Memphis, Tenn	Phillips
8538	The Southern Cotton Oil Co	Memphis, Tenn	Berwick
8501	The Southern Cotton Oil Co	Newport, Ark	Houlton
8502	The Southern Cotton Oil Co	Newport, Ark	Newport
8503	The Southern Cotton Oil Co	Newport, Ark	Dexter
8504	The Southern Cotton Oil Co	Newport, Ark	Stroudwater
8478	O. Holway & Co	.....	Greene
8617	O. Holway & Co	.....	Readfield
8815	*	.....	Dover
8523	R. B. Brown Oil Co	St. Louis, Mo	Pittsfield
8524	R. B. Brown Oil Co	St. Louis, Mo	Bath
8525	.....	St. Louis, Mo	Dexter
8618	.....	St. Louis, Mo	Norridgewock
8479	Chapin & Co	St. Louis, Mo	Belfast
8509	Chapin & Co	St. Louis, Mo.	Milo
8510	Chapin & Co	St. Louis, Mo	Bangor
8511	Chapin & Co	St. Louis, Mo	Newport
8512	Chapin & Co	St. Louis, Mo	Belfast
8513	Chapin & Co	St. Louis, Mo.	Portland
8514	Chapin & Co	St. Louis, Mo	Orrington
8541	Chapin & Co	St. Louis, Mo.	North Fayette
8488	F. W. Brodé & Co	Memphis, Tenn	Hiram
8489	F. W. Brodé & Co	Memphis, Tenn	Cornish
8490	F. W. Brodé & Co	Memphis, Tenn	Richmond
8491	F. W. Brodé & Co	Memphis, Tenn	Dexter
8492	F. W. Brodé & Co	Memphis, Tenn	Winterport
8507	F. W. Brodé & Co	Memphis, Tenn	Westbrook
8508	F. W. Brodé & Co	Memphis, Tenn	East Poland
8619	F. W. Brodé & Co	Memphis, Tenn	Norridgewock
8645	F. W. Brodé & Co	Memphis, Tenn	Bethel
8650	F. W. Brodé & Co	Memphis, Tenn	Albion
8519	*	.....	Norway
8520	*	.....	Bangor
8521	*	.....	Bucksport

* Brand incomplete. Name of manufacturer and place of business not given.

ANALYSES OF SAMPLES.

Name of Feed.	Protein.		Fat.		Station Number.
	Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
Prime Cotton Seed Meal	43.44	43.00	9.64	9.00	8485
Prime Cotton Seed Meal	40.25	43.00	10.27	9.00	8486
Prime Cotton Seed Meal	45.50	43.00	9.86	9.00	8487
Prime Cotton Seed Meal	45.00	43.00	10.39	9.00	8493
Prime Cotton Seed Meal	45.69	43.00	10.54	9.00	8505
Prime Cotton Seed Meal	46.00	43.00	9.96	9.00	8484
Prime Cotton Seed Meal	45.63	43.00	11.01	9.00	8506
Prime Finely Ground Cotton Seed Meal	41.38	43.00	11.32	9.00	8494
Prime Finely Ground Cotton Seed Meal	42.50	43.00	10.51	9.00	8495
Prime Finely Ground Cotton Seed Meal	43.13	43.00	12.21	9.00	8496
Prime Finely Ground Cotton Seed Meal	44.19	43.00	12.38	9.00	8497
Prime Finely Ground Cotton Seed Meal	42.81	43.00	12.26	9.00	8498
Prime Finely Ground Cotton Seed Meal	42.88	43.00	11.55	9.00	8499
Prime Finely Ground Cotton Seed Meal	42.88	43.00	11.39	9.00	8500
Prime Finely Ground Cotton Seed Meal	46.50	43.00	10.58	9.00	8625
Prime Finely Ground Cotton Seed Meal	44.06	43.00	12.02	9.00	8538
Prime Finely Ground Cotton Seed Meal	45.25	41.00	10.48	9.00	8501
Prime Finely Gronnd Cotton Seed Meal	45.63	41.00	11.46	9.00	8502
Prime Finely Ground Cotton Seed Meal	45.50	41.00	10.63	9.00	8503
Prime Finely Ground Cotton Seed Meal	45.13	41.00	10.62	9.00	8504
Prime Memphis Cotton Seed Meal	24.44	25.50	7.35	5.71	8478
Prime Memphis Cotton Seed Meal	23.94	25.50	6.60	5.71	8617
Prime Memphis Cotton Seed Meal	45.13	43.00	13.49	9.00	8515
Prime Cotton Seed Meal	44.56	43.00	13.61	9.00	8523
Prime Cotton Seed Meal	45.75	43.00	12.83	9.00	8524
Prime Cotton Seed Meal	23.31	43.00	6.57	9.00	8525
Prime Cotton Seed Meal	22.38	43.00	6.77	9.00	8618
Cotton Seed Meal	42.50	43.00	10.06	9.00	8479
Cotton Seed Meal	45.50	43.00	9.25	9.00	8509
Cotton Seed Meal	45.25	43.00	10.10	9.00	8510
Cotton Seed Meal	44.81	43.00	10.44	9.00	8511
Cotton Seed Meal	42.38	43.00	9.37	9.00	8512
Cotton Seed Meal	42.63	43.00	11.02	9.00	8513
Cotton Seed Meal	45.06	43.00	9.54	9.00	8514
Cotton Seed Meal	44.25	43.00	10.23	9.00	8541
Owl Brand Cotton Seed Meal	43.50	43.00	12.89	9.00	8488
Owl Brand Cotton Seed Meal	45.13	43.00	9.38	9.00	8489
Owl Brand Cotton Seed Meal	45.63	43.00	13.40	9.00	8490
Owl Brand Cotton Seed Meal	43.94	43.00	10.98	9.00	8491
Owl Brand Cotton Seed Meal	48.69	43.00	10.31	9.00	8492
Owl Brand Cotton Seed Meal	45.50	43.00	9.96	9.00	8507
Owl Brand Cotton Seed Meal	45.06	43.00	10.15	9.00	8508
Owl Brand Cotton Seed Meal	44.81	43.00	10.73	9.00	8619
Owl Brand Cotton Seed Meal	42.80	43.00	10.19	9.00	8645
Owl Brand Cotton Seed Meal	45.44	43.00	10.34	9.00	8650
"Daisy Brand" Cotton Seed Meal	45.06	43.00	9.42	9.00	8519
"Daisy Brand" Cotton Seed Meal	42.88	43.00	14.08	9.00	8520
"Daisy Brand" Cotton Seed Meal	45.88	43.00	9.86	9.00	8521

MANUFACTURERS—Continued.

Station Number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8522	*		Portland
8643	*		Rumford
8482	D. M. Hawkins & Co	Memphis, Tenn	Bowdoinham
8483	D. M. Hawkins & Co	Memphis, Tenn	Portland
8624	D. M. Hawkins & Co	Memphis, Tenn	Farmington
8516	Hunter Bros		Dexter
8517	Hugh Petit & Co		Mechanic Falls
8526	J. E. Soper & Co		Yarmouth
8527	J. E. Soper & Co		Corinna
8529	J. E. Soper & Co		Mechanic Falls
8528	Dyersburg Oil & Fertilizer Co	Dyersburg, Tenn	Belfast
8536	Dyersburg Oil & Fertilizer Co	Dyersburg, Tenn	South Berwick
8539	Doten Grain Co		Waterboro
8530	*		Steep Falls
8531	*		Dexter
8534	*		Portland
8537	*		Springvale
8518	*		West Peru
8626	*		Wilton
8653	*		Augusta
8623	*		Winthrop
8622	*		Lewiston
8621	*		Livermore Falls
8620	*		North Anson
8532	*		Gorham
8533	*		South Paris
8644	*		Hartford
8481	*		Orland
8542	The Glucose Sugar Refining Co.		Richmond
8548	The Glucose Sugar Refining Co.		Belfast
8554	The Glucose Sugar Refining Co.		Camden
8544	The Glucose Sugar Refining Co.		Hampden
8551	The Glucose Sugar Refining Co.		East Poland
8543	The Glucose Sugar Refining Co.		Portland
8545	The Glucose Sugar Refining Co.		Bucksport
8546	The Glucose Sugar Refining Co.		Orrington
8547	The Glucose Sugar Refining Co.		Winterport
8549	The Glucose Sugar Refining Co.		Bangor
8550	The Glucose Sugar Refining Co.		Pittsfield
8552	The Glucose Sugar Refining Co.		Norway
8553	The Glucose Sugar Refining Co.		Dover
8630	The Glucose Sugar Refining Co.		Lewiston
8555	Charles Pope Glucose Co		Brunswick
8856	Charles Pope Glucose Co		Gorham
8857	Charles Pope Glucose Co		Bath
8858	Charles Pope Glucose Co		Portland
8859	Charles Pope Glucose Co		Wiscasset
8860	Charles Pope Glucose Co		Saco

* Brand incomplete. Name of manufacturer and place of business not given.

ANALYSES—Continued.

Name of Feed.	Protein. Found—per cent.	Protein. Guaranteed—per cent.	Fat. Found—per cent.	Fat. Guaranteed—per cent.	Station Number.
"Daisy Brand" Cotton Seed Meal	45.38	43.00	10.32	9.00	8522
"Daisy Brand" Cotton Seed Meal	45.31	43.00	10.41	9.00	8643
Cotton Seed Meal	44.81	43.00	10.64	9.00	8482
Cotton Seed Meal	43.38	43 00	10.57	9.00	8483
Cotton Seed Meal	42.63	43.00	11.07	9.00	8624
Cotton Seed Meal	45.13	43.00	9.36	9.00	8516
Cotton Seed Meal	48.38	43.00	8.03	10.00	8517
Cotton Seed Meal	43.69	43.00	10.73	9.00	8526
Cotton Seed Meal	44.44	43.00	11.33	9.00	8527
Cotton Seed Meal	41.19	43.00	11.65	9.00	8529
Cotton Seed Meal	45.56	43.00	9.54	9.00	8528
Cotton Seed Meal	43.81	43.00	9.04	9.00	8536
Cotton Seed Meal	43.69	43.00	12.16	9.00	8539
Cotton Seed Meal	46.19	43.00	9.81	9.00	8530
Cotton Seed Meal	46.81	43.00	11.59	9.00	8531
Cotton Seed Meal	44.94	43.00	10.49	9.00	8534
Cotton Seed Meal	43.06	43.00	13.33	9.00	8537
Cotton Seed Meal	46.69	43.00	9.21	9.00	8518
Cotton Seed Meal	46.50	43.00	9.97	9.00	8626
Cotton Seed Meal	44.56	43.00	14.46	9.00	8653
Cotton Seed Meal	44.81	46.12	10.34	9.20	8623
Cotton Seed Meal	43.75	46.12	11.79	9.20	8622
Cotton Seed Meal	44.19	46.12	12.24	9.20	8621
Cotton Seed Meal	42.81	46.12	10.68	9.20	8620
Cotton Seed Meal	43.38	.....	60.69	.....	8532
Cotton Seed Meal	44.31	.....	9.79	.....	8533
Cotton Seed Meal	42.56	.....	10.26	.....	8644
Cotton Seed Meal	26.63	.....	7.56	.....	8481
Chicago Gluten Meal	37.44	38.00	3.27	2.00	8542
Chicago Gluten Meal	36.69	38 00	2.65	2.00	8548
Chicago Gluten Meal	37.19	38.00	3.02	2.00	8554
Chicago Gluten Meal	36.75	38.00	3.07	2.00	8544
Chicago Gluten Meal	38.81	38.00	2.75	2.00	8551
Chicago Gluten Meal	38.31	38.00	3.13	2.00	8543
Chicago Gluten Meal	34.50	38.00	3.61	2.00	8545
Chicago Gluten Meal	35.69	38.00	2.73	2.00	8546
Chicago Gluten Meal	38.06	38.00	3.36	2.00	8547
Chicago Gluten Meal	38.94	38.00	2.27	2.00	8549
Chicago Gluten Meal	37.94	38.00	2.71	2.00	8550
Chicago Gluten Meal	37.44	38.00	3.17	2.00	8552
Chicago Gluten Meal	38.25	38.00	3.27	2.00	8553
Chicago Gluten Meal	37.88	38.00	3.16	2.00	8630
Cream Gluten Meal	32.63	37.12	4.91	3.20	8555
Cream Gluten Meal	35.25	37.12	3.12	3.20	8551
Cream Gluten Meal	34.56	37.12	4.65	3.20	8557
Cream Gluten Meal	33.56	37.12	4.84	3.20	8558
Cream Gluten Meal	32.19	37.12	4.39	3.20	8559
Cream Gluten Meal	30.13	37.12	1.84	3.20	8560

MANUFACTURERS—Continued.

Station Number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8633	Charles Pope Glucose Co		Lewiston
8562	National Starch Manf'g Co	Indianapolis, Ind.	Bowdoinham
8568	National Starch Manf'g Co	Indianapolis, Ind.	Milo
8569	National Starch Manf'g Co	Indianapolis, Ind.	Foxcroft
8563	National Starch Manf'g Co	Des Moines, Ia.	Old Town
8561	National Starch Manf'g Co	Des Moines, Ia.	Sebago Lake
8564	National Starch Manf'g Co	Des Moines, Ia.	Brunswick
8565	National Starch Manf'g Co	Des Moines, Ia.	Dexter
8567	National Starch Manf'g Co	Des Moines, Ia.	Norway
8629	National Starch Manf'g Co	Des Moines, Ia.	Livermore Falls
8566	National Starch Manf'g Co	Des Moines, Ia.	Steep Falls
8627	National Starch Manf'g Co	Des Moines, Ia.	Bingham
8628	National Starch Manf'g Co	Des Moines, Ia.	Winthrop
8570	The Glucose Sugar Refining Co.		South Paris
8571	The Glucose Sugar Refining Co.		West Paris
8572	The Glucose Sugar Refining Co.		Guilford
8573	The Glucose Sugar Refining Co.		Damariscotta
8631	The Glucose Sugar Refining Co.		Farmington
8632	The Glucose Sugar Refining Co.		Readfield Depot
8574	International Milling Co		Brunswick
8575	International Milling Co		Richmond
8634	International Milling Co		Lewiston
8576	The Cleveland Linseed Oil Co.		Brownfield
8648	Mayflower Mills	Fort Wayne, Ind.	Bath
8577	E. W. Blatchford & Co	Chicago, Ill	Brunswick
8587	American Cereal Co		Belfast
8588	American Cereal Co		Bowdoinham
8589	American Cereal Co		Bangor
8590	American Cereal Co.		Bucksport
8591	American Cereal Co		Portland
8592	American Cereal Co		Foxcroft
8593	American Cereal Co		Island Falls
8594	American Cereal Co		Bethel
8595	American Cereal Co		Waldoboro
8636	American Cereal Co		Farmington
8637	American Cereal Co.		Bingham
8596	S. A. & J. H. True Co		Bath
8597	S. A. & J. H. True Co		Portland
8598	Commercial Milling Co		Ashland
8599	David Oliver	Joliet, Ill	Fryeburg
8600	The H-O Co	Buffalo, N. Y	Bowdoinham
8601	The H-O Co	Buffalo, N. Y	South Windham
8602	The H-O Co	Buffalo, N. Y	Portland
8635	The H-O Co	Buffalo, N. Y	Phillips
8639			Winthrop
8603	The H-O Co	Buffalo, N. Y	North Yarmouth
8604	The H-O Co	Buffalo, N. Y	North Yarmouth
8605	The H-O Co	Buffalo, N. Y	North Yarmouth

ANALYSES—Continued.

Name of Feed.	Protein.		Fat.		Station number.
	Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
Cream Gluten Meal	34.31	37.12	3.91	3.20	8633
King Gluten Meal	35.31	32.00	4.07	16.00	8562
King Gluten Meal	34.50	32.00	6.78	16.00	8568
King Gluten Meal	36.25	32.00	6.17	16.00	8569
King Gluten Meal	32.06	32.00	15.90	16.00	8563
King Gluten Meal	32.88	32.00	16.38	16.00	8561
King Gluten Meal	33.88	32.00	16.91	16.00	8564
King Gluten Meal	33.19	32.00	16.46	16.00	8565
King Gluten Meal	33.94	32.00	14.50	16.00	8567
King Gluten Meal	33.75	32.00	16.79	16.00	8629
King Gluten Meal	34.94	34.26	15.71	14.65	8566
King Gluten Meal	32.06	32.00	15.84	9.00	8627
King Gluten Meal	32.38	32.00	12.89	12.00	8628
Buffalo Gluten Feed	27.00	25.50	4.00	4.00	8570
Rockford Diamond Gluten Feed	24.56	24.20	4.54	3.76	8571
Rockford Diamond Gluten Feed	25.25	24.20	4.16	3.76	8572
Rockford Diamond Gluten Feed	21.31	24.20	5.02	3.76	8573
Rockford Diamond Gluten Feed	25.31	24.20	5.03	3.76	8631
Rockford Diamond Gluten Feed	25.25	24.20	4.67	3.76	8632
Sucrene Oil Meal	26.44	24.75	3.33	3.50	8574
Sucrene Oil Meal	23.63	24.75	3.26	3.50	8575
Sucrene Oil Meal	26.44	24.75	3.44	3.50	8634
Cleveland Flax Meal	37.00	39.00	3.03	1.50	8576
Old Process Linseed Meal	25.44	.....	8.92	.....	8648
Blatchford's Calf Meal	24.94	.....	4.41	.....	8577
Victor Corn and Oat Feed	11.25	9.46	4.65	3.92	8587
Victor Corn and Oat Feed	10.69	9.46	4.78	3.92	8588
Victor Corn and Oat Feed	8.63	9.46	3.44	3.92	8589
Victor Corn and Oat Feed	8.75	9.46	3.72	3.92	8590
Victor Corn and Oat Feed	8.56	9.46	3.80	3.92	8591
Victor Corn and Oat Feed	9.13	9.46	3.82	3.92	8592
Victor Corn and Oat Feed	9.63	9.46	4.63	3.92	8593
Victor Corn and Oat Feed	7.81	9.46	3.23	3.92	8594
Victor Corn and Oat Feed	10.38	9.46	5.12	3.92	8595
Victor Corn and Oat Feed	8.56	9.46	3.68	3.92	8636
Victor Corn and Oat Feed	9.69	9.46	3.66	3.92	8637
Corn and Oat Feed	9.13	9.63	3.42	4.23	8596
Corn and Oat Feed	9.19	9.63	3.39	4.23	8597
Ground Corn and Oats	9.44	.....	2.89	.....	8598
Lakeside Corn and Oat Feed	8.44	9.50	3.24	3.75	8599
Dundee Corn and Oat Feed	8.88	8.38	3.30	2.95	8600
Dundee Corn and Oat Feed	9.00	8.38	3.11	2.95	8601
Dundee Corn and Oat Feed	8.19	8.38	2.69	2.95	8602
Dundee Corn and Oat Feed	9.25	8.38	3.67	2.95	8635
Monarch Corn and Oat Feed	12.31	10.25	7.12	7.49	8639
The H-O Co.'s Standard Dairy Feed	16.50	18.75	4.48	7.25	8603
The H-O Co.'s Horse Feed	11.00	12.30	4.42	4.90	8604
The H-O Co.'s Poultry Feed	17.31	16.80	5.62	7.00	8605

MANUFACTURERS—Concluded.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8606	The H-O Co	Buffalo, N. Y.	Bowdoinham
8607	The American Cereal Co		Brunswick
8608	The American Cereal Co		North Yarmouth
8609	The American Cereal Co		Westbrook
8610	The American Cereal Co		Richmond
8611	The American Cereal Co		Bath
8612	The American Cereal Co		Portland
8613	The American Cereal Co		Belfast
8614	The American Cereal Co		Foxcroft
8615	The American Cereal Co		Waldoboro
8616	W. H. Haskell & Co	Toledo, O.	West Falmouth
8638	Andrew Cullen		Madison
8480	Northwestern Fertilizer Co		Portland
8585	Northwestern Fertilizer Co		Winterport
8578	Bradley Fertilizer Co		Bangor
8579	Bradley Fertilizer Co		Portland
8583	Bowker Fertilizer Co	Boston, Mass.	Portland
8580	Bowker Fertilizer Co	Boston, Mass	Bangor
8581	Bowker Fertilizer Co	Boston, Mass	Portland
8582	Bowker Fertilizer Co	Boston, Mass	Waldoboro
8584	B. Randall	East Boston, Mass.	Bowdoinham
8586	American Fertilizer Co		Bowdoinham

[Continued from page 37.]

In March a correspondent in Cumberland county sent a sample of very low grade cotton seed meal to the Station. This was one of two cars brought into the State by a wholesale house. As soon as their attention was called to the matter, the sale of the meal was stopped, that in the hands of the retailer was returned to them and together with the other car was sold into New Hampshire, which State is not protected by a law regulating the sale of feeding stuffs. This lot of meal was one of the poorest examined by the Station, and probably occasioned considerable loss from the shrinkage of milk flow as nearly a carload of it was sold in two towns before its poor quality was known. Much of the meal was fine and of fairly good appearance. The dealers claim that it has a *commercial* value equal to high grade cotton seed meal as fineness and brightness determine that. The meal had an *agricultural* value of less than one-half its guarantee.

In none of the above instances was there any evident intention of fraud. The dealers as soon as notified, and without wait-

ANALYSES—Concluded.

Name of Feed.	Protein.		Fat.		Station number.
	Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
The H-O Co.'s Poultry Feed	17.44	16.80	5.87	7.00	8606
American Cereal Co.'s Poultry Food	13.44	.....	5.79	.....	8607
American Cereal Co.'s Poultry Food	13.69	.....	5.93	.....	8608
Quaker Oat Feed	9.25	12.03	3.99	3.49	8609
Quaker Oat Feed	9.63	12.03	3.08	3.49	8610
Quaker Oat Feed	8.94	12.03	3.46	3.49	8611
Quaker Oat Feed	10.75	12.03	3.77	3.49	8612
Quaker Oat Feed	10.81	12.03	4.00	3.49	8613
Quaker Oat Feed	7.75	12.03	3.04	3.49	8614
Quaker Oat Feed	11.69	12.03	4.30	3.49	8615
Haskell's Oat Feed	9.50	9.62	6.51	7.66	8616
Crescent Oat Feed	7.81	10.90	2.99	3.70	8638
Horse Shoe Brand Ground Beef Cracklings for Poultry	64.63	60.00	19.61	16.00	8480
Horse Shoe Brand Ground Beef Cracklings for Poultry	66.44	60.00	16.95	16.00	8585
Bradley's Superior Meat Meal	52.25	40.00	9.40	15.00	8578
Bradley's Superior Meat Meal	53.94	40.00	9.48	15.00	8579
Bowker's Pure Beef Scraps	51.88	.....	14.89	.....	8583
Bowker's Animal Meal	42.13	30.00	12.45	5.00	8580
Bowker's Animal Meal	46.94	30.00	10.69	5.00	8581
Bowker's Animal Meal	39.69	30.00	11.21	5.00	8582
Pure Beef Scraps	47.44	.....	23.08	.....	8584
American Poultry Meal	38.06	.....	22.44	.....	8586

ing for an official notice from the Secretary of Agriculture, either stopped the sale of the goods, or made a guarantee corresponding to the facts. Although the law did not keep these goods out of the State, it has completely prevented their being knowingly sold.

To avoid this class of goods, dealers and consumers should use only reliable brands of cotton seed meal and should send samples of all goods to the Station for free analysis as offered on the last page of this bulletin.

Gluten Meal. With one exception, Chicago Gluten Meal was well up to guarantee in protein. The manufacturers are not sending the Indianapolis King Gluten into the State at present. The Des Moines King Gluten is well up to guarantee. The Chas. Pope Glucose Co.'s Cream Gluten meal continues to fall below the guarantee. Unless the quality is changed for the better, the consumer cannot count on Cream Gluten Meal to carry more than 33 per cent protein.

SUMMARY OF ANALYSES.

	Number of analyses.		Protein. Found—per cent.	Protein. Guaranteed—per cent.	Fat. Found—per cent.	Fat. Guaranteed—per cent.
American Cotton Oil Co.'s Prime Cotton Seed Meal.	7	Highest	46.00	.....	11.01	
		Lowest	40.25	43.00	9.64	9.00
		Average	44.50	.....	10.24	
Southern Cotton Oil Co.'s Prime Finely Ground Cotton Seed Meal, Memphis, Tenn., Mill.	9	Highest	46.50	.....	12.38	
		Lowest	41.38	43.00	10.51	9.00
		Average	43.37	.....	11.58	
Southern Cotton Oil Co.'s Prime Finely Ground Cotton Seed Meal, Newport, Ark., Mill.	4	Highest	45.63	.....	11.46	
		Lowest	45.13	41.00	10.48	9.00
		Average	45.38	.....	10.80	
O. Holway & Co.'s Prime Memphis Cotton Seed Meal.	2	Highest	24.44	.....	7.35	
		Lowest	23.94	25.50	6.60	5.71
		Average	24.19	.....	6.98	
Manufacturer unknown. Prime Memphis Cotton Seed Meal.	1	.....	45.13	43.00	13.49	9.00
R. B. Brown Oil Co.'s Prime Cotton Seed Meal.	2	Highest	45.75	.....	13.61	
		Lowest	44.56	43.00	12.83	9.00
		Average	45.66	.....	13.22	
Chapin & Co.'s Cotton Seed Meal.	8	Highest	45.50	.....	11.02	
		Lowest	42.38	43.00	9.25	9.00
		Average	44.05	.....	10.00	
F. W. Brodé & Co.'s Owl Brand Cotton Seed Meal.	10	Highest	48.69	.....	13.40	
		Lowest	42.80	43.00	9.38	9.00
		Average	45.06	.....	10.83	
"Daisy Brand" Cotton Seed Meal.	5	Highest	45.88	.....	14.08	
		Lowest	42.88	43.00	9.42	9.00
		Average	44.90	.....	10.82	
D. M. Hawkins & Co.'s Cotton Seed Meal.	3	Highest	44.81	.....	11.07	
		Lowest	42.63	43 00	10.57	9 00
		Average	43.61	.....	10.76	
Hunter Bros.' Cotton Seed Meal.	1	.....	45.13	43.00	9.36	9.00
Hugh Petit & Co.'s Cotton Seed Meal.	1	.....	48.38	43.00	8.03	10.00
J. E. Soper & Co.'s Cotton Seed Meal.	3	Highest	44.44	.....	11.65	
		Lowest	41.19	43.00	10.73	9.00
		Average	43.11	.....	11.27	
Dyersburg Oil & Fertilizer Co.'s Cotton Seed Meal.	2	Highest	45.56	.....	9.54	
		Lowest	43.81	43.00	9.04	9.00
		Average	44.69	.....	9.21	
Doten Grain Co.'s Cotton Seed Meal.	1	.....	43.69	43.00	12.16	9.00
Manufacturers unknown. Cotton Seed Meal.	7	Highest	46.81	.....	14.46	
		Lowest	43.06	43.00	9.21	9.00
		Average	45.54	.....	11.27	
Manufacturers unknown. Cotton Seed Meal.	4	Highest	44.81	.....	12.24	
		Lowest	42.81	46.12	10.34	9.20
		Average	43.89	.....	11.26	

SUMMARY OF ANALYSES—Continued.

	Number of analyses.		Protein.		Fat.	
			Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.
The Glucose Sugar Refin'g Co.'s Chicago Gluten Meal.	14	Highest	38.94	.....	3.61	
		Lowest	34.50	38.00	2.27	2.00
		Average	37.42	.....	3.01	
Charles Pope Glucose Co.'s Cream Gluten Meal.	7	Highest	35.25	.....	4.91	
		Lowest	30.13	37.12	1.84	3.20
		Average	33.23	.....	3.95	
National Starch Manf'g Co.'s King Gluten Meal, Indianapolis, Ind., Mill.	3	Highest	36.25	.....	6.78	
		Lowest	34.50	32.00	5.67	16.00
		Average	35.35	.....	8.35	
National Starch Manf'g Co.'s King Gluten Meal, Des Moines, Iowa, Mill.	8	Highest	34.94	.....	16.91	
		Lowest	32.06	32.00	12.89	16.00
		Average	33.28	.....	15.63	
The Glucose Sugar Refin'g Co.'s Buffalo Gluten Feed.	1	.....	27.00	25.50	4.00	4.00
The Glucose Sugar Refin'g Co.'s Rochford Diamond Gluten Feed.	5	Hihgest	25.31	.....	5.03	
		Lowest	21.31	24.20	4.16	3.76
		Average	24.34	.....	4.69	
International Milling Co.'s Sucrene Oil Meal.	3	Highest	26.44	.....	3.44	
		Lowest	23.63	24.75	3.26	3.50
		Average	25.50	.....	3.34	
The Cleveland Linseed Oil Co.'s Cleveland Flax Meal.	1	.....	37.00	39.00	3.03	1.50
Mayflower Mills Old Process Linseed Meal.	1	.....	25.44	.....	8.92	
E. W. Blatchford & Co.'s Blatchford's Calf Meal.	1	.....	24.94	.....	4.41	
American Cereal Co.'s Victor Corn and Oat Feed.	11	Highest	11.25	.....	5.12	
		Lowest	8.56	9.46	3.23	3.92
		Average	9.37	.....	4.05	
S. A. & J. H. True Co.'s Corn and Oat Feed.	2	Highest	9.19	.....	3.42	
		Lowest	9.13	9.63	3.39	4.23
		Average	9.16	.....	3.41	
Commercial Milling Co.'s Ground Corn and Oats.	1	.....	9.44	.....	2.89	
David Oliver's Lakeside Corn and Oat Feed.	1	.....	8.44	9.50	3.24	3.75
The H-O Co.'s Dundee Corn and Oat Feed.	4	Highest	9.25	.....	3.67	
		Lowest	8.19	8.38	2.69	2.95
		Average	8.83	.....	3.19	
Monarch Corn and Oat Feed.	1	.....	12.31	10.25	7.12	7.49
The H-O Co.'s Standard Dairy Feed.	1	.....	16.50	18.75	4 48	7.25
The H-O Co.'s Horse Feed.	1	.....	11.00	12.30	4.42	4.90
The H-O Co.'s Poultry Feed.	2	Highest	17.44	.....	5.87	
		Lowest	17.31	16.80	5.62	7.00
		Average	17.38	.....	5.75	

SUMMARY OF ANALYSES—Concluded.

	Number of analyses.		Protein.		Fat.	
			Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.
The American Cereal Co.'s Poultry Food.	2	Highest	13.69	.....	5.93	
		Lowest	13.44	.....	5.79	
		Average	13.57	.....	5.86	
The American Cereal Co.'s Quaker Oat Feed.	7	Highest	11.69	.....	4.30	
		Lowest	7.75	12.03	3.04	3.49
		Average	9.83	.....	3.66	
W. H. Haskell & Co.'s Haskell's Oat Feed.	1	.....	9.50	9.62	6.51	7.66
Andrew Cullen's Crescent Oat Feed.	1	.....	7.81	10.90	2.99	3.70
Northwestern Fertilizer Co.'s HorseShoeBrand Ground Beef Crackings for Poultry.	2	Highest	66.44	.....	19.61	
		Lowest	64.63	60.00	16.95	16.00
		Average	65.54	.....	18.28	
Bradley Fertilizer Co.'s Bradley's Superior Meat Meal	2	Highest	53.94	.....	9.48	
		Lowest	52.25	40.00	9.40	15.00
		Average	53.10	.....	9.44	
Bowker Fertilizer Co.'s Bowker's Pure Beef Scraps.	1	.....	51.88	.....	14.89	
Bowker Fertilizer Co.'s Bowker's Animal Meal.	3	Highest	46.94	.....	12.45	
		Lowest	39.69	30 00	10.69	5.00
		Average	42.92	.....	11.45	
B. Randall's Pure Beef Scraps.	1	.....	47.44	.....	23.08	
American Fertilizer Co.'s American Poultry Meal.	1	.....	38.06	.....	22.44	

[Blank for forwarding samples of feeding stuffs for free analysis.]

.....189....

(Do not write here.)

Station No..... Chas. D. Woods, Director
Received..... Agricultural Experiment Station,
Orono, Maine.

SIR: I send you to-day, by mail, a fair sample of a feeding stuff. In addition to the red tax tag each package carried the following statements.

(In case these statements are on a tag, it can be sent instead of a copy of the statement.)

Name of goods .....

Name of Manufacturer .....

Per cent. protein..... Per cent. fat.....

The sample was taken by me in accordance with the directions on the back of this sheet, and fairly represents the stock from which it was drawn.

Signature,.....

Post Office address,.....

Witness:* The above-described sample was taken in my presence.

Signature of Witness,.....

Name of Dealer,.....

Address, ...

* The witness should be the dealer or his representative, a postmaster, or town or city officer.

FREE ANALYSIS OF FEEDING STUFFS.

The Station officers take pains to obtain for analysis samples of all feeding stuffs coming under the law, but the co-operation of consumers is essential for the full and timely protection of their interests. Whenever anyone believes that this law is being evaded in any way, he is requested to notify the Director of the Station.

The Station will promptly analyze samples of feeding stuffs taken in accordance with the following directions and report the results to the interested parties. Dealers and consumers are urged to avail themselves of this offer.

DIRECTIONS FOR SAMPLING.

The sample should fairly represent the feeding stuff and is best obtained as follows:

Open one or more full and unbroken packages, and mix well together the contents of each for a foot in depth, take out three cupfuls from different parts of the mixed portions of each package, pour them one over another upon a paper, intermix thoroughly and fill a tin spice or baking powder box from the mixture. Detach this leaf, fill out the blank on the opposite side, securely wrap the box and blank in paper and send by mail to the

Agricultural Experiment Station,
Orono, Maine.

THE SPRAYING OF PLANTS.

W. M. Munson.

LET US SPRAY.

"It is conservatively estimated that the annual yield of all crops is lessened about 25 per cent. by the attacks of injurious insects and fungous diseases. Experiments have demonstrated that at least 75 per cent. of this loss can be prevented by the use of simple remedies applied by means of a spray pump. Expressed in figures, the annual loss would represent about $500,000,000 in the United States alone. Of this amount, 75 per cent., or $375,000,000 can be saved by spraying."*

The above paragraph represents the facts concerning the importance of spraying, at the present time. Previous reports † have detailed the experiments made along this line at this Station, and equally striking results have been obtained at other stations. Spraying has ceased to be an experiment. The beneficial results obtained at the experiment stations have been fully corroborated in practical field work, and now it is important to know the *how* and the *why* of spraying. In other words, in order that the best results may be obtained, spraying must be done intelligently.

Success in spraying, as in most of the work in life, is largely a matter of detail. Little things, seemingly unimportant, all affect the results obtained. Failure may usually be attributed to lateness of application, carelessness in applying or in preparing the material, or to defective apparatus.

WHY SPRAY?

Spraying is plant insurance. It is, with few exceptions, a *preventive* measure for many of the ills that plants are heir to, and *not* a cure. There are several distinct classes of enemies

* Weed, Spraying for Profit, p. 9.

† Rep. Maine Expt. Sta., 1891, p. 99; 1892, p. 92; 1893, p. 124.

that must be met, each in a different way. These enemies may be grouped first under the two general heads,—insects and fungi.

The insect enemies are naturally divided into distinct classes which must be met in very different ways, and the same is true of the fungi. The first class of insect enemies includes those that, either in the mature form or as larvæ, eat the plant tissue; e. g., the plum curculio, the codling moth, the currant worm, the tent-caterpillar, the potato beetle, etc. These are very readily destroyed by the application of some form of arsenic, as Paris green, to the parts which will be eaten.

Another class of insects, e. g., the plant lice and some of the scale insects, obtain their food by sucking the juices of the plant and, therefore, are not affected by an application of poison. These must be overcome by an external irritant, such as kerosene, or an alkali like caustic soda or strong soap suds, or by some material that will close the breathing pores and thus stop respiration, e. g., pyrethrum or hellebore (in the dry form hellebore acts in both ways.)

Fungi (singular, *fungus*) are simply low forms of plant life which feed upon organic matter, either living or dead. Those which grow on living tissues—*parasitic fungi*—are the ones with which we are specially concerned. It is these which cause many of the blights and rusts, and smuts and scabs and mildews of various plants. Fungi are propagated by means of minute, microscopic bodies, called spores, which are carried from place to place by the wind and by insects, birds and other animals. A spore, falling upon the surface of a leaf, or the growing tip of a branch, if in the presence of moisture and the usual summer temperature, germinates in a manner very similar to that of a seed. If the surface of the leaf or fruit is coated with some material which is destructive to the young fungus, as the spore germinates, all the damage from the parasite is warded off. If, on the other hand, there is even a small spot that is not coated, there is opportunity for the parasite to obtain a foothold. With few exceptions, after the parasite has once attacked the plant, spraying is of little if any avail.

WHEN TO SPRAY.

The time of spraying will depend upon the purpose in view, but in *no case* should spraying be done when the plants are in full bloom. Spraying at this time will often interfere with the fertilization of the flowers, and consequently reduce the crop of fruit, while there is much needless destruction of bees and other insects which work upon the flowers.

In general, spray *early*. "Delays are dangerous." Fruit trees should be sprayed before the buds open, potatoes before disease or insects appear. Subsequent treatment will depend very largely upon the nature of the season; if very wet, it may be necessary to spray every two or three weeks; if relatively dry, three or four treatments may be sufficient.*

HOW TO SPRAY.

Insecticides and fungicides are more effective if applied in a liquid rather than in a dry form, since they adhere to the foliage better. *Sprinkling is not spraying.* The best results are obtained from the use of a fine spray or mist forcibly applied to the foliage; and so far as possible, it should reach the under sides of the leaves. A fine mist is preferable to a coarse spray, as there is much less waste of material and much less danger of injury to the foliage. A single dash of the mist is better than continued soaking, as in the latter case the material gathers in drops and runs off or injures the foliage.

As already stated, spraying for fungi is a preventive measure rather than a cure. If the surface of the leaf is not completely covered on both sides, with the protective coating, there is still danger of attack. The spores of the fungus may fall upon the smallest unprotected spot.

Again, while young insects may be killed by a very small dose of poison, a much larger amount will be required as they grow older. So spraying should be commenced early, that the first meal of a young insect may be his last, and in order to insure this end, the poison must be finely divided and evenly distributed.

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* The Station has prepared specific directions for spraying; (1) Apples and other fruit trees; (2) potatoes. These will be sent free to any address upon application.

THE MATERIALS FOR SPRAYING.

The materials used in spraying are mainly of two general kinds, fungicides used in killing fungi, and insecticides, used in killing insects. The principal fungicides are Bordeaux mixture and sulphide of potassium. The more important insecticides are arsenic, in some form (usually Paris green), kerosene and tobacco.

*Bordeaux Mixture.** This is the fungicide *par excellence* for general use, and its preparation is a matter of considerable importance, The formula in general use at present is known as the "4, 4, 40" formula. In other words the mixture consists of 4 lbs. copper sulphate, 4 lbs. fresh lime and 40 gallons of water. The copper sulphate should be dissolved in three or four gallons of water in a wooden or earthen vessel and the lime (which must be absolutely fresh) should be slaked in a separate vessel, and diluted with water till it is of a milky nature. When ready for use, the two solutions may be mixed in a third vessel, care being taken to stir constantly during the process. In every case, the mixture should be passed through a sieve of number 50 brass wire cloth, or through cheese cloth backed by common window screen wire. This straining is necessary to prevent clogging of the nozzle.

Potassium Sulphide. Potassium sulphide, or "liver of sulphur" is specially valuable as a preventive of gooseberry mildew and for use in the greenhouse. In using this material four ounces of the sulphide are dissolved in ten gallons of water.

Paris Green. This material is the one which is always reliable for the destruction of leaf-eating insects. Many other forms of arsenic have been recommended, but none have proved so generally satisfactory as Paris green.† It is practically insolu-

*More specific directions for the preparation of Bordeaux mixture will be found in the special directions for spraying, already referred to. While the use of freshly prepared Bordeaux is to be preferred, there are "prepared" Bordeaux mixtures that are used by some who doubt their ability to make the mixture. These prepared mixtures may be obtained from most dealers in spraying apparatus. The two brands which have come to the notice of the writer are the "Lenox" made by the Lenox Sprayer Company, Pittsfield, Mass., and the "Lion," made by James A. Blanchard, New York City.

† Among the cheaper substitutes for Paris green are "Green Arsenite," "Paragrene," "Emerald Green," "Arsenite of Soda," "Arsenate of Lead," etc. With the exception of the last named, which is largely used by the Gypsy Moth Commission of Massachusetts, the substitutes are still to be considered as experimental.

ble in water, but as there is usually present a small amount of soluble arsenic, it is always well to add a little fresh lime to the mixture before applying, that injury to the foliage may be averted. Paris green is generally mixed with water in the proportion of 1 pound to 200 gallons. If lime is added, however, a pound to 100 gallons may be used.

Kerosene. Kerosene is the specific for all sucking insects. It kills by contact and, owing to its cheapness and efficiency, will probably remain the most valuable insecticide for this class of insects. The form in which it is usually applied is the soap emulsion,* but there are now several forms of spray pumps which make a mechanical mixture of kerosene and water, thus greatly reducing the labor.

Tobacco. A strong decoction of tobacco ("tobacco tea") is often used with success in destroying the lice upon rose bushes and tender, soft-wooded plants.

WHAT APPARATUS IS NECESSARY?

In order that the best results may be obtained, suitable apparatus is needed. Such apparatus consists of a good force-pump, with one or two lines of discharge hose, nozzles, a barrel or tank for holding the mixture and a wagon for carrying all.

The Pump. The pump should be large enough to supply two lines of discharge pipe, so that one man may pump while two others distribute the spray. The small bucket and knapsack pumps do very well for a limited amount of spraying, but in field work, toys will not answer. All parts of the pump that are subject to wear should be of brass and should be carefully adjusted.

The Hose. Two pieces of one-half inch hose, of sufficient length to give freedom to the operator are needed. About fifteen feet is the length usually preferred.

The Nozzle. The nozzle is one of the most important parts of the spraying apparatus. It should throw a fine mist-like spray, and should be easily cleaned. The one in most common use is, perhaps, the Vermorel. The McGowen is one of the best for tall trees.

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* One-half pound hard soap, 1 gallon boiling water, 2 gallons kerosene. Dissolve the soap in the water, add the kerosene and churn through a force pump for ten minutes. For use, dilute ten to twenty times with water.

The Barrel. A kerosene barrel holding about fifty gallons, or a hogshead holding 100 gallons is the best tank. It can be placed upon the side or stood on end, and a small opening made in which to place the pump and to stir the liquid.

The Wagon. Any low wagon with wide tires is suitable. For convenience in turning, a two-wheeled cart is to be preferred.

WHERE MAY APPARATUS BE OBTAINED?

Pumps and nozzles are made by many reliable firms and may be obtained at comparatively low cost by ordering directly from the manufacturers. With so many good pumps on the market, it is not easy to state which is the best.

Of the prominent manufacturers of spraying apparatus, the following is a partial list: Morrill & Morley, Benton Harbor, Mich.; The Field Force Pump Company, Lockport, N. Y.; The Goulds Mfg. Co., Seneca Falls, N. Y.; The Deming Company, Salem, O. (Chas. J. Jager & Co., No. 174 High St., Boston, New England Agents); The Lenox Sprayer Co., Pittsfield, Mass.; F. E. Myers & Bro., Ashland, Ohio; W. & B. Douglass, Middletown, Conn.; The P. C. Lewis Company, Catskill, N. Y.; William Stahl, Quincy, Ill.; The Aspinwall Mfg. Co., Jackson, Mich. All these firms are reliable and will send catalogues on application.

The manufacturers of apparatus were requested to send to the Experiment Station a list of their agents in Maine. The following names were returned: Kendall & Whitney, Portland; C. M. Conant & Co., Bangor; R. B. Dunning & Co., Bangor; A. L. & E. F. Goss Co., Lewiston; George B. Haskell & Co., Lewiston; O. F. Frost, Monmouth; J. C. Crosby, Cranberry Isle; F. A. Hussey, Topsham; G. A. Perkins, Auburn; F. L. Howe, Fairfield; L. H. Strout, Kent's Hill; G. J. Riney, Gardiner.

FERTILIZER INSPECTION.

CHAS. D. WOODS, Director.
J. M. BARTLETT, Chemist in charge of Fertilizer Analysis.

The law regulating the sale of commercial fertilizers in this State calls for two bulletins each year. The first of these contains the analyses of the samples received from the manufacturer, guaranteed to represent, within reasonable limits, the goods to be placed upon the market later. The second bulletin contains the analyses of the samples collected in the open market by a representative of the Station.

The analyses of the manufacturer's samples for this year were published early in March. The present bulletin contains the analyses of the Station samples and of such of the manufacturer's samples as were received after Bulletin 50 was issued.

The figures which are given as the percentages of valuable ingredients guaranteed by the manufacturers are the minimum percentages of the guarantee. If, for instance, the guarantee is 2 to 3 per cent of nitrogen, it is evident that the dealer cannot be held to have agreed to furnish more than 2 per cent and so this percentage is taken as actual guarantee. The figures under the head of "found" are those showing the actual composition of the samples.

A comparison of the results of the analyses of the samples collected by the Station with the percentages guaranteed by the manufacturers shows, that, while as a rule the fertilizers sold in the State are up to guarantee, in some instances the particular lots of fertilizers sampled are not as good as they should be. The comparisons indicate that many of the manufacturers do not intend to do much more than make good the minimum guarantee and it is not surprising that this results in some of the goods falling below the guarantee in one or more ingredients. As this seems

to be a growing tendency, it has been thought best to make a list of the brands which fall considerably below guarantee. The table which follows gives the names of the goods and the ingredients in which they are deficient. No brand is included in this list unless it falls short by at least one-tenth in one or more of its ingredients. While the number of brands which are considerably below their guarantee in one or more ingredients is quite large, there is little reason for thinking that there is any intention to defraud. It frequently happens that a fertilizer which is below in one ingredient is considerably above in others. While this frees the manufacturer from the suspicion of attempting to defraud, it is nevertheless a serious defect in a fertilizer. It is not enough that a fertilizer contains an equivalent amount of some other kind of plant food. When the purchaser pays for fifty pounds of nitrogen he is not rightly treated if the manufacturer gives him thirty pounds of nitrogen, even though he gives him enough more of potash or phosphoric acid to make a financial equivalent.

One of the claims which fertilizer manufacturers are making for the superiority of their goods over "home mixed fertilizers" is that the former are "manufactured." This should mean, if it means anything, that the goods are more evenly mixed and therefore more uniform. In the tables it will be found that in some instances in which two samples of the same brand have been taken and analyzed, that they differ from each other quite materially. The samples were taken with a great deal of care by experienced men from a large number of packages. It would not seem difficult to make "home mixed fertilizers" which should run as uniform as some of the brands here reported upon.

The goods made by the Provincial Chemical Fertilizer Company differ so greatly in composition from the guarantee that the only conclusion seems to be that the company does not know what it is doing. This is illustrated by comparing the guarantee and the analysis of their Imperial Superphosphate as follows:

	Guaranteed. %	Found. %
Nitrogen	2.51	.86
Available phosphoric acid	9.80	9.12
Total phosphoric acid	12.10	17.00
Potash	1.50	5.01

Notwithstanding the great discrepancies between guarantee and the actual composition of the goods offered, it has not been deemed best to report the case to the Secretary of Agriculture. Correspondence seems to indicate that while the Company has made great mistakes, that there was no intention to defraud. If they sell goods in Maine next year they will take pains to learn their composition before offering them.

A LIST OF FERTILIZERS SOLD IN MAINE IN 1899, THE OFFICIALLY COLLECTED SAMPLES OF WHICH CONTAINED LESS THAN NINE-TENTHS OF THE GUARANTEED AMOUNTS OF ONE OR MORE OF THE FERTILIZING CONSTITUENTS.

Kind of Fertilizer.	Deficient in.
Blanchard's Fish, Bone and Potash	Total phosphoric acid.
Stockbridge Seeding Down Manure	Total phosphoric acid.
Stockbridge Top Dressing Manure	Nitrogen.
Bradley's Eureka Fertilizer	Available phosphoric acid.
Bradley's X. L. Phosphate	Nitrogen.
Great Planet Manure	Nitrogen.
Cleveland Bone and Potash	Potash.
Darling's Animal Fertilizer "G" Brand	Potash.
*Darling's Blood, Bone and Potash	Nitrogen and potash.
Lister's Seeding Down Fertilizer	Potash.
Swift's Lowell Ground Bone	Nitrogen.
Otis Seeding Down Fertilizer	Nitrogen and total phosphoric acid.
Philbrick's Fertilizer	Available phosphoric acid.
Provincial Chemical Fertilizer Co.'s Imperial Superphosphate	Nitrogen.
Provincial Chemical Fertilizer Co's Special Potato Phosphate	Nitrogen.
*Quinnipiac Phosphate	Nitrogen.
Maine State Grange Potato Manure	Nitrogen.
Dirigo Fertilizer	Nitrogen and total phosphoric acid.

* A second sample drawn at another place while not up to the guarantee was better than this one.

LICENSED FERTILIZERS NOT FOUND IN THE STATE.

The following brands were licensed and probably sold in the State, but were not found by the inspector. The analysis of the manufacturers' samples of these goods is here reprinted from Bulletin 50 of this Station.

Descriptive List of Manufacturers' Samples, 1899.

Station number.	Manufacturer, place of business and brand.
	E. L. LEWIS, ATLANTIC, MASS.
2132	Lewis Potato Fertilizer
	RUSSIA CEMENT CO., GLOUCESTER, MASS.
1410	Essex Complete Manure for Corn, Grain and Grass
1411	Essex Complete Manure for Potatoes, Roots and Vegetables
2106	Essex Corn Fertilizer
2107	Maine State Grange Seeding Down Fertilizer
	STANDARD FERTILIZER CO., BOSTON, MASS.
1890	Standard Bone and Potash

Analyses of Manufacturers' Samples, 1899.

Station number.	Nitrogen.				Phosphoric Acid.							Potash.	
	As ammonia, or nitrates.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.		
	%	%	%	%	%	%	%	%	%	%	%	%	%
2132	1.20	2.36	3.56	3.28	3.74	2.40	1.93	6.14	5.0	8.07	6.0	10.43	10.0
1410	.....	.....	4.00	3.70	3.02	6.39	2.51	9.41	7.0	11.92	9.5	10.52	9.5
1411	.....	.....	3.96	3.70	2.60	5.54	2.84	8.14	7.0	10.98	9.0	9.18	8.5
2106	.52	1.72	2.24	2.00	5.31	4.03	4.14	9.34	9.0	13.48	11.0	3.33	3.0
2107	.....	1.91	1.91	1.50	3.19	4.24	6.36	7.43	7.0	13.79	13.0	5.69	5.5
1890	.....	.....	.....	.....	6.94	3.03	1.51	9.97	8.0	11.48	10.0	4.10	2.5

TRADE VALUATIONS.

In 1894 this Station stopped printing trade valuations. Although this was explained at the time, letters are occasionally received in which correspondents ask for trade valuations and our reasons for not publishing them. The reasons briefly stated are as follows:

The chief reason is that *commercial* values are not the same as *agricultural* values. Trade values are determined by market conditions, the agricultural value is measured by the increase of crop. Printing trade valuations increases the tendency, already far too strong, to purchase fertilizers on the *ton* basis without

regard to the content or form of plant food. The agricultural value of a fertilizer depends upon the amount and form of nitrogen, phosphoric acid and potash it contains and the use to which it is to be put. The purchase of a fertilizer is really the purchase of one or more of these ingredients, and the thing of first importance is not the trade value of a ton, but the kinds and pounds of plant food contained in a ton.

In the selection of a fertilizer, the first question to be decided is, what use is to be made of it. Is it nitrogen, phosphoric acid or potash that is needed, or is it any two or all three that must be had? Is the fertilizer to supplement farm manures, to act as a "starter" for the crop or must it furnish all the plant food for the crop?

Having decided just what plant food is needed, it is now time to consult the fertilizer bulletin and see which of the brands there given has an analysis nearest to the required one. In this selection generally only high grade goods (those having high percentages of plant food) should be considered, as high grade goods cannot be made from inferior sources of plant food. Low grade can be made from high grade goods by the use of "fillers," but high grade goods cannot be made from other than high class materials. Freight costs no more on a ton of goods having 500 pounds of plant food than on a ton having only 200 pounds of plant food, nor is the cost of mixing a ton of high grade goods greater than the cost of mixing low grade goods.

The final step is to inquire prices and buy the kind which comes nearest to meeting the needs at the lowest price per ton. The cost, although of great importance, is to be considered *after* the kinds and amounts of plant food needed are decided upon.

That which transcends everything else in the purchase of fertilizers is to know *what* you want and then get it—get it as cheap as you can and still get the kind of plant food needed. No one would think of buying salt for sugar because it can be obtained at a lower price, but the writer has knowledge of the purchase of nitrogen when potash was needed, simply because the trade value of a nitrogenous fertilizer as printed exceeded its selling price. The fertilizer bulletin thus became misleading to the unthinking man, and largely on this account the printing of trade values was discontinued.

Descriptive List of Station Samples, 1899.

Station number.	Manufacturer, place of business, and brand.	Sampled at.
	HIRAM BLANCHARD, EASTPORT, ME.	
2154	Blanchard's Fish, Bone and Potash	Houlton
	BOWKER'S FERTILIZER CO., BOSTON, MASS.	
2155	Bowker's Bone and Wood Ash Fertilizer	Belfast
2156	Bowker's Corn Phosphate	Portland
2157	Bowker's Early Potato Manure	Caribou
2158	Bowker's Farm and Garden Phosphate	Portland
2159	Bowker's Fresh Ground Bone	Portland
2160	Bowker's High Grade Fertilizer	Bangor
2161	Bowker's Hill and Drill Phosphate	Portland
2162	Bowker's Lawn and Garden Dressing	Portland
2163	Bowker's Market Garden Manure	Bangor
2164	Bowker's Potash—Bone	Bangor
2165	Bowker's Potato and Vegetable Manure	Houlton
2166	Bowker's Potato and Vegetable Phosphate	Houlton
2167	Bowker's 6% Potato Fertilizer	Presque Isle
2168	Bowker's Special Fertilizers—Potato and Vegetables	Bangor
2169	Bowker's Square Brand Bone and Potash	Presque Isle
2170	Bowker's Staple Phosphate or 3% Fertilizer	Belfast
2171	Bowker's Superphosphate with Potash	Belfast
2172	Bowker's Sure Crop Phosphate	Portland
2173	Bowker's 10% Manure	Houlton
2174	Gloucester Fish and Potash	Belfast
2175	Stockbridge Corn and Grain Manure	Portland
2176	Stockbridge Pea and Bean Manure	Bangor
2177	Stockbridge Potato and Vegetable Manure	Houlton
2178	Stockbridge Seeding Down Manure	Bangor
2179	Stockbridge Strawberry Manure	Bangor
2180	Stockbridge Top Dressing Manure	Bangor
	BRADLEY FERTILIZER CO., BOSTON, MASS.	
2181	Bradley's Complete Manure for Potatoes and Vegetables	Houlton
2200	Bradley's Complete Manure for Potatoes and Vegetables	Portland
2182	Bradley's Corn Phosphate	Portland
2183	Bradley's English Lawn Fertilizer	Bangor
2184	Bradley's Eureka Fertilizer	Bangor
2185	Bradley's Potato Fertilizer	Portland
2186	Bradley's Potato Manure	Portland
2187	Bradley's X. L. Phosphate	Belfast
2300	Bradley's X. L. Phosphate	Portland
	CLARK'S COVE FERTILIZER CO., BOSTON, MASS.	
2188	Bay State Defiance Phosphate	Portland
2189	Bay State Fertilizer	Bangor
2190	Bay State Fertilizer for Seeding Down	Bangor
2191	Bay State Fertilizer, G. G	Bangor
2192	Great Planet Manure	Houlton
2301	Great Planet Manure	Bangor
2193	King Philip Alkaline Guano for Potatoes	Belfast
2194	Triumph Bone and Potash	Bangor

Analyses of Station Samples, 1899.

Station number.	Nitrogen.				Phosphoric Acid.							Potash.	
	As ammonia or nitrates.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.		
	%	%	%	%	%	%	%	%	%	%	%	%	%
2154	.74	1.97	2.71	2.50	.....	1.86	2.02	1.86	2.00	3.88	4.50	5.33	4.50
2155	1.62	.01	1.63	1.50	.....	7.16	3.83	7.16	6.00	10.99	8.00	2.45	2.00
2156	.84	.73	1.57	1.60	2.87	5.01	2.63	7.88	7.00	10.51	9.00	2.59	2.00
2157	1.90	1.26	3.16	3.00	4.67	2.71	1.86	7.38	7.00	9.24	9.00	8.16	7.00
2158	.68	.98	1.66	1.50	7.07	3.12	1.56	10.19	8.00	11.75	10.00	2.22	2.00
2159	.12	2.51	2.63	2.25	.....	.....	.....	.....	.....	22.67	18.00	.....	.....
2160	1.38	1.11	2.49	2.25	5.69	2.81	2.58	8.50	8.00	11.08	10.00	4.65	4.00
2161	.86	1.47	2.33	2.25	7.42	2.64	1.30	10.06	9.00	11.36	12.00	2.41	2.00
2162	3.83	.....	3.83	3.00	.....	7.12	1.90	7.12	6.00	9.02	8.00	5.14	5.00
2163	.88	1.86	2.74	2.25	4.21	2.04	2.03	6.25	6.00	8.28	8.00	10.69	10.00
2164	.70	.16	.86	.75	2.76	3.11	2.58	5.87	6.00	8.45	8.00	2.26	2.00
2165	1.36	1.02	2.38	2.25	5.45	2.96	2.91	8.41	9.00	11.32	11.00	4.12	4.00
2166	.88	.71	1.59	1.50	5.74	3.51	1.86	9.25	8.00	11.11	10.00	2.35	2.00
2167	.66	.33	.99	.75	5.28	3.08	2.26	8.36	7.00	10.62	10.00	6.37	6.00
2168	1.30	1.29	2.59	2.25	4.99	3.25	2.53	8.24	8.00	10.77	10.00	4.56	4.00
2169	.08	1.99	2.07	1.50	1.53	4.45	6.05	5.98	6.00	12.03	12.00	2.41	2.00
2170	.80	.23	1.03	.75	6.24	3.38	2.03	9.62	8.00	11.65	10.00	3.15	3.00
2171	.....	.....	.....	.....	.75	8.87	3.46	9 62	10.00	13.08	11.00	2.16	2.00
2172	.49	.53	1.02	.75	6.14	3.61	2.44	9.75	8.00	12.19	10.00	2.30	1.00
2173	.58	.39	.97	.75	2.58	4.18	3.15	6.76	6.00	9.91	8.00	10.46	10.00
2174	.63	.25	.88	.75	5.50	4.23	3.57	9.73	6.00	13.30	9.00	1.49	1.00
2175	1.24	1.97	3.21	3.00	6.91	2.28	.85	9.19	8.00	10.04	10.00	7.28	6.00
2176	.78	2.07	2.85	2.00	3.96	2.26	2.03	6.22	6.00	8.25	8.00	9.96	6.00
2177	1.26	2.02	3.28	3.25	4.59	2.23	2.83	6.82	6.00	9.65	7 00	11.99	10.00
2178	.66	2.08	2.74	2.50	4.48	2.27	1.79	6.75	6.00	8.54	12.00	10.60	10.00
2179	1.36	1.30	2.66	2.25	5.61	4.19	3.33	9.80	6.00	13.13	7.00	4.94	4.00
2180	3.48	.75	4.23	5.00	4.99	2.67	1.42	7.66	4.00	9.08	6.00	7.10	6.00
2181	1.09	1.89	2.98	3.30	5.63	2.72	2.23	8.35	8.00	10.58	9.00	6.81	7.00
2299	1.38	1.71	3.09	3.30	4.16	4.32	1.88	8.48	8.00	10.36	9.00	6.32	7.00
2182	.12	2.07	2.19	2.05	6.49	2.99	2.37	9.48	9.00	11.85	10.00	2.19	1.50
2183	4.92	.01	4.93	4.95	4.61	4.45	1.42	6.06	5.00	7.48	6.00	3.20	2.50
2184	.10	1.83	1.93	1.03	3.33	2.15	5.05	5.48	8.00	10.53	9.00	2.16	2.00
2185	.24	2.34	2.58	2.06	5.44	3.58	2.63	9.02	9.00	11.65	11.00	3.57	3.25
2186	.82	1.70	2.52	2.50	6.59	.15	2.92	6.74	6.00	9.66	8.00	5.87	5.00
2187	1.04	1.28	2.32	2.50	6.94	2.91	1.99	9.85	9.00	11.84	11.00	2.35	2.00
2300	.44	1.79	2.23	2.50	5.87	3.76	2.77	9.63	9.00	12.40	11.00	2.40	2.00
2188	.18	.94	1.12	.82	2.42	5.93	3.19	8.35	7.00	11.54	9.00	1.20	1.00
2189	.90	1.72	2.62	2.47	6.75	2.87	2.07	9.62	9.00	11.69	10.00	1.90	2.00
2190	.06	1.07	1.13	1.03	5.92	2.46	1.93	8.38	8.00	10.31	10.00	2.61	2.00
2191	.14	2.13	2.27	1.85	5.81	3.25	2.28	9.06	8.50	11.34	10.00	2.24	2.00
2192	1.18	1.78	2.96	3.30	5.85	1.54	3.19	7.39	8.00	10.58	9.00	7.87	7.00
2301	.74	1.93	2.67	3.30	2.22	5.43	3.09	7.65	8.00	10.74	9.00	6.39	7.00
2193	.10	1.33	1.43	1.23	4.58	3.51	3.46	8.09	6.50	11.55	8.00	3.26	3.00
2194	.....	.....	.....	.....	8.96	1.16	2.28	10.12	10.00	12.40	11.00	2.05	2.00

Descriptive List of Station Samples, 1899.

Station number.	Manufacturer, Place of Business, and Brand.	Sampled at
	CLEVELAND DRYER CO., BOSTON, MASS.	
2195	Cleveland Bone and Potash	Bangor
2195	Cleveland Fertilizer for All Crops	Portland
2196	Cleveland Pioneer Fertilizer	Bangor
2197	Cleveland Potato Phosphate	Portland
2198	Cleveland Seeding Down Fertilizer	Portland
2199	Cleveland Superphosphate	Portland
	E. FRANK COE CO., NEW YORK, N. Y.	
2200	E. Frank Coe's Bay State Phosphate	Belfast
2201	E. Frank Coe's Columbian Special Corn Fertilizer	Bangor
2202	E. Frank Coe's Columbian Special Potato Fertilizer	Portland
2203	E. Frank Coe's Excelsior Potato Fertilizer	Belfast
2204	E. Frank Coe's Grass and Grain Fertilizer	Portland
2205	E. Frank Coe's High Grade Ammoniated Bone Phosphate	Belfast
2206	E. Frank Coe's High Grade Potato Fertilizer	Belfast
2207	E. Frank Coe's New Englander Potato Fertilizer	Bangor
2208	E. Frank Coe's Prize Brand Grain and Grass Fertilizer	Portland
2209	E. Frank Coe's Special Potato Fertilizer	Bangor
2210	E. Frank Coe's Standard Grade Ammoniated Bone Phosphate	Portland
	CROCKER CHEM. & FERT. CO., BUFFALO, N. Y.	
2211	Crocker's Ammoniated Corn Phosphate	Bangor
2213	Crocker's Ammoniated Corn Phosphate	Bangor
2212	Crocker's New Rival Superphosphate	Bangor
2214	Crocker's New Rival Superphosphate	Bangor
2213	Crocker's Potato, Hop and Tobacco Phosphate	Bangor
2215	Crocker's Potato, Hop and Tobacco Phosphate	Bangor
2214	Crocker's Superior Fertilizer	Bangor
2216	Crocker's Superior Fertilizer	Bangor
2215	Crocker's Superior Rye and Oats Fertilizer	Bangor
	CUMBERLAND BONE PHOS. CO., PORTLAND, ME.	
2216	Cumberland Hawkeye Fertilizer	Bangor
2217	Cumberland Potato Fertilizer	Belfast
2218	Cumberland Seeding Down Manure	Bangor
2219	Cumberland Superphosphate	Bangor
	L. B. DARLING FERT. CO., PAWTUCKET, R. I.	
2220	Darling's Animal Anchor Brand	Augusta
2221	Darling's Animal Fertilizer "G" Brand	Augusta
2222	Darling's Blood, Bone and Potash	Houlton
2222	Darling's Blood, Bone and Potash	Augusta
	F. S. FARRAR & CO., BANGOR, ME.	
2223	Farrar's Potato Manure	Bangor
2224	Farrar's Superphosphate	Bangor
	GREAT EASTERN FERTILIZER CO., RUTLAND, VT.	
2225	Great Eastern Dissolved Bone	Portland
2226	Great Eastern Gen. Fertilizer	Portland
2227	Great Eastern Grass and Oats Fertilizer	Portland
2228	Great Eastern Northern Corn Special	Bangor
2229	Great Eastern Potato Manure	Bangor
	LISTER'S AGRICUL. CHEM. WORKS, NEWARK, N. J.	
2230	Lister's Seeding Down Fertilizer	Bangor
2231	Lister's Special Potato Fertilizer	Bangor
2232	Lister's Success Fertilizer	Bangor
2233	Lister's "U. S." Superphosphate	Bangor

Analyses of Station Samples, 1899.

Station number.	Nitrogen.				Phosphoric Acid.							Potash.	
	As ammonia or nitrates.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.		
	%	%	%	%	%	%	%	%	%	%	%	%	%
2198	.....	.....	.....	.....	6.62	3.50	2.63	10.12	8.00	12.75	10.00	2.21	2.50
2195	.14	1.22	1.36	1.03	7.42	.75	1.70	8.17	8.00	9.87	9.00	2.10	2.00
2196	.18	1.08	1.26	.82	3.94	4.58	2.59	8.52	7.00	11.11	9.00	1.33	1.00
2197	1.02	1.24	2.26	2.05	3.24	5.29	2.39	8.53	8.00	10.92	10.00	2.86	3.00
2198	.08	2.00	2.08	1.03	5.61	4.19	1.53	9.80	8.00	11.33	9.00	2.32	2.00
2199	.20	1.94	2.14	2.05	5.26	3.56	2.79	8.82	9.00	11.61	11.00	2.51	2.00
2200	.24	1.61	1.85	2.00	6.86	2.34	2.32	9.20	9.00	11.52	11.00	3.30	1.85
2201	.20	1.30	1.50	1.23	6.86	2.99	2.68	9.85	8.50	12.53	10.50	3.03	2.50
2202	.24	1.09	1.33	1.20	5.68	3.27	2.93	8.95	8.50	11.88	10.00	*2.91	2.50
2203	.62	2.07	2.69	2.50	6.62	1.63	2.22	8.25	8.00	10.47	8.00	*8.09	8.00
2204	.20	.84	1.04	.80	6.62	3.34	1.59	9.96	8.50	11.55	10.00	2.28	1.50
2205	.18	1.96	2.14	1.85	6.86	2.61	2.19	9.47	9.00	11.66	11.00	2.66	2.25
2206	1.20	1.54	2.74	2.40	6.19	2.20	2.17	8.39	7.00	10.56	8.00	*6.35	6.50
2207	.08	.99	1.07	.80	4.75	3.65	3.29	8.40	7.00	11.69	9.00	3.38	3.00
2208	.....	.....	.....	.....	7.18	3.47	2.12	10.65	10.50	12.77	12.00	2.26	2.00
2209	.30	1.64	1.94	1.65	7.34	1.84	3.38	9.18	8.00	12.56	10.00	*4.21	4.00
2210	.22	1.27	1.49	1.20	7.03	2.88	2.42	9.91	8.50	12.33	10.00	2.45	2.25
2211	.10	2.22	2.32	2.05	6.33	3.54	1.47	9.87	10.00	11.34	11.00	1.74	1.62
2313	.04	2.12	2.16	2.05	6.62	3.05	2.17	9.67	10.00	11.84	11.00	1.76	1.62
2212	.10	1.40	1.50	1.23	5.50	4.08	2.33	9.63	10.00	11.96	11.00	1.75	1.62
2314	.04	1.36	1.40	1.23	6.94	2.08	2.64	9.02	10.00	11.66	11.00	1.73	1.62
2213	.08	2.12	2.20	2.05	5.95	3.77	1.84	9.72	10.00	11.56	11.00	3.32	3.24
2315	.42	1.80	2.22	2.05	6.65	3.01	1.63	9.66	10.00	11.29	11.00	3.26	3.24
2214	.04	1.06	1.10	.82	3.94	3.69	1.95	7.63	8.00	9.59	9.00	2.03	2.00
2316	.08	.92	1.00	.82	5.02	3.36	1.79	8.38	8.00	10.17	9.00	2.59	2.00
2215	.08	.92	1.00	.82	5.12	4.07	1.28	9.19	8.00	10.47	9.00	2.81	2.00
2216	.10	1.18	1.28	.82	5.31	3.41	1.93	8.72	7.00	10.65	9.00	1.43	1.00
2217	.87	1.19	2.06	2.06	5.95	3.05	1.16	9.00	9.00	10.16	11.00	2.90	3.00
2218	.06	1.14	1.20	1.03	5.93	2.74	1.80	8.67	8.00	10.47	10.00	2.43	2.00
2219	.89	1.17	2.06	2.06	6.01	2.88	2.12	8.89	8.00	11.01	10.00	2.63	2.00
2220	.16	2.05	2.21	1.65	7.10	2.32	.79	9.42	6.00	10.21	7.00	2.10	2.00
2221	.16	2.23	2.39	2.06	7.23	2.02	.75	9.25	6.00	10.00	7.00	3.51	4.00
2222	1.27	2.32	3.59	4.12	5.17	3.88	.68	9.05	7.00	9.73	8.00	6.72	7.50
2302	.90	2.70	3.60	4.12	5.69	2.88	.74	8.57	7.00	9.31	8.00	7.73	7.50
2223	.....	.....	3.60	2.25	1.50	7.80	6.91	9.30	9.00	16.21	12.00	2.76	3.00
2224	.....	.....	3.46	2.50	1.44	7.86	6.93	9.30	9.00	16.23	12.00	2.70	2.00
2225	.....	.....	.....	.....	11.16	3.60	.36	14.76	14.00	15.12	....	.....	.....
2226	.06	.88	.94	.82	5.92	3.41	1.54	9.33	8.00	10.87	.....	5.11	4.00
2227	.....	.....	.....	.....	7.40	4.21	2.09	11.61	11.00	13.70	.....	1.80	2.00
2228	.16	2.93	3.09	2.88	.77	6.54	3.85	7.31	8.00	11.16	.....	2.64	2.00
2229	.14	2.21	2.35	2.06	1.23	7.04	2.68	8.27	8.00	10.95	.....	4.57	4.00
2230	.14	.80	.94	.62	7.18	3.25	2.19	10.43	10.00	12.62	11.00	1.49	1.92
2231	.22	1.51	1.73	1.65	5.18	2.74	3.00	7.92	8.00	10.92	9.00	3.51	3.00
2232	.24	1.27	1.51	1.24	6.78	2.73	2.54	9.51	9.50	12.05	11.50	2.24	2.00
2233	.20	1.29	1.49	1.32	3.16	3.86	2.74	7.02	7.00	9.76	8.00	2.77	2.00

* Largely sulphate.

Descriptive List of Station Samples, 1899.

Station number.	Manufacturer, place of business, and brand.	Sampled at.
	LOWELL FERTILIZER CO., BOSTON, MASS.	
2234	Swift's Lowell Animal Fertilizer	Bangor
2235	Swift's Lowell Bone Fertilizer	Bangor
2236	Swift's Lowell Dissolved Bone and Potash	Bangor
2237	Swift's Lowell Ground Bone	Bangor
2238	Swift's Lowell Potato Phosphate	Bangor
	NATIONAL FERTILIZER CO., BRIDGEPORT, CONN.	
2239	Chittenden's Ammoniated Bone Fertilizer	Presque Isle
2240	Chittenden's Complete Root Fertilizer	Caribou
2241	Chittenden's Market Garden Fertilizer	Fort Fairfield
	SAMUEL G. OTIS, HALLOWELL, ME.	
2242	Otis Potato Fertilizer	Hallowell
2243	Otis Seeding Down Fertilizer	So. Windham
2244	Otis Superphosphate	So. Windham
	PACIFIC GUANO CO., BOSTON, MASS.	
2245	Pacific Guano Co.'s Dissolved Bone and Potash	Bangor
2246	Pacific Guano Co.'s Grass and Grain Fertilizer	Portland
2247	Pacific Guano Co.'s Potato Special	Belfast
2248	Nobsque Guano	Bangor
2249	Soluble Pacific Guano	Bangor
2303	Soluble Pacific Guano	Portland
	PACKER'S UNION FERT. CO., NEW YORK, N. Y.	
2250	Packer's Union Animal Corn Fertilizer	Portland
2251	Packer's Union High Grade Potato Manure	Blaine
2252	Packer's Union Universal Fertilizer	Blaine
2253	Packer's Union Wheat, Oats and Potato Fertilizer	Blaine
	PARMENTER & POLSEY FER. CO., PEABODY, MASS.	
2254	"A. A." Brand	Presque Isle
2255	Plymouth Rock Brand	Presque Isle
2256	"P. and P." Potato Fertilizer	Presque Isle
2257	Parmenter & Polsey Special Potato Fertilizer	Presque Isle
2258	Star Brand Superphosphates	Presque Isle
	EDWIN J. PHILBRICK, AUGUSTA, ME.	
2259	Philbrick's Fertilizer	Augusta
	PORTLAND RENDERING CO., PORTLAND, ME.	
2260	Portland Rendering Co.'s Bone Tankage	East Deering
	PROVINCIAL CHEM. FERT. CO., L'T'D, ST. JOHN, N. B., CANADA.	
2261	Imperial Superphosphate	Presque Isle
2262	Provincial Chemical Fert. Co.'s Special Potato Phosphate	Presque Isle
	THE QUINNIPIAC CO., BOSTON, MASS.	
2263	Quinnipiac Climax Phosphate	Bangor
2264	Quinnipiac Corn Manure	Portland
2265	Quinnipiac Phosphate	Portland
2304	Quinnipiac Phosphate	Belfast
2266	Quinnipiac Potato Manure	Bangor
2305	Quinnipiac Potato Manure	Portland
2267	Quinnipiac Potato Phosphate	Bangor
2306	Quinnipiac Potato Phosphate	Portland
2268	Quinnipiac Seeding Down Manure	Portland
	READ FERTILIZER CO., NEW YORK, N. Y.	
2269	Read's Potato Manure	Bucksport
2307	Read's Potato Manure	Portland
2270	Read's Practical Potato Special	Bucksport
2271	Read's Standard Superphosphate	Bucksport
2272	Read's Sure Catch Fertilizer	Portland
2273	Read's Vegetable and Vine Fertilizer	Bucksport
2274	Sampson Fertilizer	Bucksport

Analyses of Station Samples, 1899.

Station number.	Nitrogen.				Phosphoric Acid.							Potash.	
	As ammonia or nitrate.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.		
	%	%	%	%	%	%	%	%	%	%	%	%	%
2234	.06	2.56	2.62	2.46	7.66	1.59	1.48	9.25	9.00	10.73	10.00	4.59	4.00
2235	.10	1.66	1.76	1.64	4.23	3.31	2.04	7.54	8.00	9.58	9.00	4.13	3.00
2236	.12	1.84	1.96	1.64	6.01	2.92	2.18	8.83	9.00	11.01	10.00	2.35	2.00
2237	.08	2.00	2.08	2.46	.....	.....	.....	....	5.00	28.94	28.00	.....	.....
2238	.14	2.42	2.56	2.46	5.26	2.54	1.56	7.80	8.00	9.36	9.00	*6.51	6.00
2239	.12	1.92	2.04	1.60	3.40	6.31	2.14	9.71	9.00	11.86	10.00	2.35	2.00
2240	.18	3.34	3.52	3.30	5.42	2.72	3.04	8.14	8.00	11.18	10.00	6.27	6.00
2241	.48	2.08	2.56	2.40	5.63	2.10	2.95	7.73	7.00	10.68	9.00	7.00	6.00
2242	.16	2.17	2.33	2.00	5.14	4.02	2.58	9.16	9.00	11.74	11.00	3.52	3.00
2243	.12	1.14	1.26	1.50	5.34	4.00	1.39	9.34	8.00	10.73	12.00	1.89	2.00
2244	.22	1.90	2.12	2.00	6.22	3.67	2.31	9.89	9.50	12.20	11.00	2.27	2.00
2245	.....	.....	.....	.....	6.14	4.93	2.65	11.07	10.00	13.72	11.00	2.07	2.00
2246	.12	1.12	1.24	.82	4.74	2.70	2.42	7.44	7.00	9.86	8.00	1.83	1.08
2247	.14	1.97	2.11	2.05	6.06	4.34	1.57	10.40	8.00	11.97	9.00	3.25	3.00
2248	.18	1.10	1.28	1.15	5.10	3.79	1.71	8.89	8.00	10.60	9.00	2.49	2.00
2249	.08	2.02	2.10	2.25	6.25	3.24	2.11	9.49	8.50	11.60	10.50	2.17	2.00
2303	.08	2.14	2.22	2.25	3.94	4.66	2.48	8.60	8.50	11.08	10.50	2.66	2.00
2250	.22	2.46	2.68	2.47	3.35	6.18	2.09	9.53	8.00	11.62	9.00	2.23	2.00
2251	.22	2.02	2.24	2.06	1.07	6.98	1.94	8.05	8.00	9.99	9.00	6.20	6.00
2252	.36	.78	1.14	.82	4.63	4.58	3.56	9.21	8.00	12.77	9.00	5.40	5.00
2253	.....	.....	.....	.....	7.10	5.56	2.79	12.66	11.00	15.45	.....	2.48	2.00
2254	3.00	1.21	4.21	4.53	3.56	4.59	1.19	8.15	7.00	9.34	8.00	9.46	8.00
2255	1.38	1.29	2.67	2.47	5.12	4.82	1.62	9.94	8.00	11.56	9.00	5.02	4.00
2256	1.40	.86	2.26	1.64	2.66	4.34	1.33	7.00	6.00	8.33	7.00	7.03	5.50
2257	2.04	1.23	3.27	3.29	4.63	3.94	1.16	8.57	8.00	9.73	9.00	8.30	7.00
2258	.04	1.74	1.78	1.64	3.37	4.43	1.85	7.80	7.00	9.65	8.00	3.26	2.50
2259	1.40	.64	2.04	2.00	2.52	3.72	4.02	6.24	7.00	10.26	9.00	6.72	5.00
2260	.....	.....	4.54	4.42	.....	6.14	10.51	6.14	.....	16.65	18.59	.....	.....
2261	.10	.76	.86	2.51	7.18	1.94	7.88	9.12	9.80	17.00	12.10	5.01	1.50
2262	.16	.76	.92	3.08	7.00	2.50	7.22	9.50	10.11	16.72	12.28	6.43	6.02
2263	.12	1.04	1.16	1.03	4.98	3.88	1.45	8.86	8.00	10.31	9.00	2.64	2.00
2264	.12	2.09	2.21	2.06	5.42	3.86	2.48	9.28	9.00	11.76	10.00	2.39	1.50
2265	1.06	1.34	2.40	2.47	4.00	5.38	1.75	9.38	9.00	11.13	10.00	1.97	2.00
2304	.10	2.00	2.10	2.47	5.63	3.02	1.51	8.65	9.00	10.16	10.00	2.79	2.00
2266	1.70	.66	2.36	2.47	4.88	2.66	.89	7.54	6.00	8.43	7.00	4.55	5.00
2305	.70	1.57	2.27	2.47	4.45	3.97	1.34	8.42	6.00	9.76	7.00	4.65	5.00
2267	1.76	.23	1.99	2.05	2.03	6.61	2.51	8.64	8.00	11.18	9.00	3.02	3.00
2306	.54	1.69	2.23	2.05	3.01	5.51	2.64	8.52	8.00	11.16	9.00	3.00	3.00
2268	.12	1.12	1.24	.82	4.42	5.29	1.61	9.71	9.00	11.32	10.00	2.39	2.00
2269	.12	2.20	2.32	2.47	4.53	3.46	2.68	7.99	7.00	10.67	8.00	10.75	10.00
2307	.94	1.42	2.36	2.47	6.59	2.24	.79	8.83	7.00	9.62	8.00	*10.00	10.00
2270	.04	.99	1.03	.82	2.11	2.31	1.26	4.42	4.00	5.68	5.00	9.13	8.00
2271	.10	1.00	1.10	.82	5.09	3.00	1.16	8.09	8.00	9.25	9.00	4.40	4.00
2272	.....	.....	.....	.....	1.79	4.33	.91	6.12	6.00	7.03	7.00	3.67	4.00
2273	.04	1.71	1.75	1.65	4.43	2.46	.93	6.89	6.00	7.82	7.00	8.96	8.00
2274	.10	1.68	1.78	1.65	4.31	2.31	.91	6.62	6.00	7.53	7.00	4.52	4.00

* Largely sulphate.

Descriptive List of Station Samples, 1899.

Station number.	Manufacturer, Place of Business, and Brand.	Sampled at
	RUSSIA CEMENT CO., GLOUCESTER, MASS.	
2275	Essex Potato Fertilizer	Presque Isle
2276	Essex XXX Fish and Potash	Presque Isle
2277	Maine State Grange Chemicals	Houlton
2278	Maine State Grange Potato Manure	Houlton
	SAGADAHOC FERT. CO., BOWDOINHAM, ME.	
2279	Dirigo Fertilizer	Cumberland
2280	Merrymeeting Superphosphate	Brewer
2281	Sagadahoc Bone Meal	Bowdoinham
2282	Sagadahoc Special Potato Fertilizer	Brewer
2308	Sagadahoc Special Potato Fertilizer	Cumberland
2283	Sagadahoc Superphosphate	Cumberland
2284	Yankee Fertilizer	Brewer
	STANDARD FERTILIZER CO., BOSTON, MASS.	
2285	Standard A Brand	Portland
2297	Standard Bone and Potash	Garland
2286	Standard Fertilizer	Bangor
2287	Standard Guano	Portland
2288	Standard Special for Potatoes	Bangor
2309	Standard Special for Potatoes	Portland
	HENRY F. TUCKER CO., BOSTON, MASS.	
2289	Tucker's Original Bay State Bone Superphosphate	Portland
	JOHN WATSON, HOULTON, ME.	
2136	Watson's Potato Manure	Houlton
	WILLIAMS & CLARK FERT. CO., BOSTON, MASS.	
2290	Americus Ammoniated Bone Superphosphate	Portland
2291	Americus Corn Phosphate	Portland
2310	Americus Corn Phosphate	Bangor
2292	Americus Potato Manure	Bangor
2311	Americus Potato Manure	Portland
2293	Prolific Crop Producer	Belfast
2294	Royal Bone Phosphate for All Crops	Bangor
2295	Williams & Clark's Potato Phosphate	Portland
	A. F. YOUNG AND CO., NEW YORK, N. Y.	
2296	Young's Excelsior Potato Fertilizer	Presque Isle

Analyses of Station Samples, 1899.

Station number.	Nitrogen.				Phosphoric Acid.							Potash.	
	As ammonia or nitrates.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.		
	%	%	%	%	%	%	%	%	%	%	%	%	%
2275	.98	1.02	2.00	2.00	3.83	7.53	3.85	11.36	9.00	15.21	11.00	6.29	5.00
2276	.08	2.46	2.54	2.10	4.59	6.07	5.10	10.66	9.00	15.76	12.00	2.46	2.25
2277	1.64	.89	2.53	2.50	4.86	3.83	4.39	8.69	8.00	13.08	12.00	4.31	4.00
2278	.70	.32	1.02	1.50	3.51	7.33	2.49	10.84	9.00	13.33	12.00	12.47	12.00
2279	.08	1.38	1.46	2.00	1.99	3.30	2.76	5.29	3.00	8.05	10.00	5.53	4.00
2280	.30	1.34	1.64	1.50	3.11	2.95	2.23	6.06	5.00	8.29	9.00	3.14	2.00
2281	.18	4.33	4.51	3.00	.....	.....	.....	.....	.....	18.09	20.00	.....	.....
2282	1.56	.60	2.16	2.40	5.26	3.43	1.03	8.69	6.00	9.72	10.00	*8.67	7.00
2308	1.48	.90	2.38	2.40	5.49	3.01	.84	8.50	6.00	9.34	10.00	*8.65	7.00
2283	1.36	.67	2.03	2.10	5.58	3.28	1.35	8.86	6.00	10.21	10.00	6.12	4.00
2284	.14	.92	1.06	.50	2.36	3.75	1.25	6.11	3.00	7.36	7.00	4.39	1.50
2285	.14	1.06	1.20	.82	3.38	5.22	2.67	8.60	7.00	11.27	9.00	1.18	1.00
2297	.....	.....	.....	.....	6.08	4.17	1.77	10.25	8.00	12.02	10.00	2.39	2.50
2286	.76	1.45	2.21	2.00	6.09	4.00	1.84	10.09	8.00	11.93	10.00	2.22	2.00
2287	.82	.70	1.52	1.25	7.23	2.33	2.58	9.56	6.50	12.14	8.50	3.28	3.00
2288	1.02	.94	1.96	2.05	2.47	5.76	2.51	8.23	8.00	10.74	9.00	3.20	3.00
2309	.56	1.74	2.30	2.05	2.55	6.02	2.63	8.57	8.00	11.20	9.00	2.83	3.00
2289	.12	2.13	2.25	2.06	5.53	3.95	1.56	9.48	9.00	11.04	11.00	2.24	2.00
2136	.16	2.39	2.55	2.50	2.49	3.56	.84	6.05	6.00	6.89	7.00	5.00	5.00
2290	.92	1.42	2.34	2.47	6.27	4.02	2.16	10.29	9.00	12.45	10.00	2.36	2.00
2291	.12	2.23	2.35	2.06	5.15	3.74	2.70	8.89	9.00	11.59	10.00	2.29	1.50
2310	.10	2.13	2.23	2.06	5.01	3.83	3.00	8.84	9.00	11.84	10 00	1.98	1.50
2292	1.02	.99	2.01	2.06	2.55	6.11	2.50	8.66	8.00	11.16	9.00	2.84	3.00
2311	.38	1.78	2.16	2.06	2.44	6.78	2.19	9.22	8.00	11.41	9.00	2.99	3.00
2293	.10	1.12	1.22	.82	6.27	3.15	2.03	9.42	6.00	11.45	7.00	1.51	1.00
2294	.14	1.02	1.16	1.03	5.10	4.10	1.49	9.20	7.00	10.69	8.00	2.30	2.00
2295	1.00	1.48	2.48	2.47	3.54	4.09	1.63	7.63	6.00	9.26	7.00	5.14	5.00
2296	1.86	.88	2.74	2.88	3.68	2.81	.60	6.49	5.50	7.09	.....	10.33	10.00

* Largely sulphate.

Descriptive List of Manufacturers' Samples, 1899.*

Station No.	Manufacturer, place of business, and brand.
	BOWKER FERTILIZER CO., BOSTON, MASS.
2145	Bowker's Early Potato Manure
2146	Bowker's Lawn and Garden Dressing
2147	Bowker's Potash—Bone
2148	Bowker's Potato and Vegetable Manure
	BRADLEY FERTILIZER CO., BOSTON, MASS.
2137	Bradley's English Lawn Fertilizer
	CLARK'S COVE FERTILIZER CO., BOSTON, MASS.
2138	Great Planet Manure
2139	Triumph Bone and Potash
	CLEVELAND DRYER CO., BOSTON, MASS.
2140	Cleveland Bone and Potash
	E. FRANK COE CO., NEW YORK, N. Y.
2141	E. Frank Coe's New Englander Potato Fertilizer
	PARMENTER & POLSEY FERTILIZER CO., PEABODY, MASS.
2142	"A. A." Brand
	PROVINCIAL CHEMICAL FERTILIZER CO., L'TD. ST. JOHN, N. B.
2135	Imperial Superphosphate
2134	Special Potato Phosphate
	READ FERTILIZER CO., SYRACUSE, N. Y.
2143	Read's Potato Manure
	WILLIAMS & CLARK FERTILIZER CO., BOSTON, MASS.
2144	Prolific Crop Producer

Analyses of Manufacturers' Samples, 1899.*

Station number.	Nitrogen.				Phosphoric Acid.							Potash.	
	As ammonia or nitrates.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.			
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	%	%	%	%	%	%	%	%	%	%	%	%	%
2145	1.06	1.94	3.00	3.00	5.14	2.67	1.99	7.81	7.00	9.80	9.00	7.72	7.00
2146	3.64	.17	3.81	3.00	5.02	1.84	1.89	6.86	6.00	8.75	8.00	5.81	5.00
2147	.87	.....	.87	.75	1.83	5.41	2.65	7.24	6.00	9.89	8.00	2.36	2.00
2148	.90	1.35	2.25	2.25	5.69	4.25	1.42	9.84	8.00	11.36	11.00	4.36	4.00
2137	5.60	.....	5.60	4.95	4.83	3.36	.70	8.19	5.00	8.89	6.00	3.63	2.50
2138	1.34	1.96	3.30	3.30	6.65	2.75	.79	9.40	8.00	10.19	8.00	7.08	7.00
2139	.....	.....	.....	.....	7.77	3.60	.97	11.37	10.00	12.34	11.00	2.98	2.00
2140	.....	.....		.....	8.12	4.26	1.16	12.38	8.00	13.54	10.00	3.23	2.50
2141	.20	.95	1.15	.80	7.77	2.98	1.96	10.75	7.00	12.71	9.00	*3.46	3.00
2142	3.38	.81	4.19	4.53	3.38	4.41	.83	7.79	7.00	8.62	8.00	10.69	8.00
2135	....	.....	.68	2.51	7.59	1.57	7.84	9.16	9.87	17.00	12.10	4.91	1.50
2134	.....	.....	.81	3.08	7.81	1.31	7.85	9.13	10.11	16.98	12.28	5.15	6.02
2143	.68	2.71	2.79	2.47	5.66	2.28	1.21	7.94	7.00	9.15	8.00	9.08	10.00
2144	.10	.97	1.07	.82	5.20	3.23	1.38	8.43	6.00	9.81	7.00	1.49	1.00

*These goods were licensed after the March Bulletin was issued.

NUTS AS FOOD.

CHAS. D. WOODS and L. H. MERRILL.

While the use of nuts in this country has already attained considerable proportions, it is believed that a careful study of their food qualities would lead to their largely increased consumption. In view of their high nutritive value and the readiness and cheapness with which they may be produced, it is a matter of some astonishment that they have received so little consideration as a food and that so little attention has been devoted to their culture. This neglect is explained in part by the abundance and cheapness of cereal products, which supply our wants so fully that we have not been forced to seek foods from unusual and less reliable sources. Although, within certain limits, grain production varies from year to year, we have few more certain crops. On the other hand, the production of nuts, like that of the apple and tree fruits in general, is subject to greater fluctuations which are far less under the immediate control of man.

It is impossible to estimate with any degree of accuracy the amount of nuts consumed in this country. The following table, furnished by the statistician of the U. S. Department of Agriculture, shows only our imports. The consumption of home grown nuts must exceed these figures many fold.

IMPORTS OF NUTS INTO THE UNITED STATES.

	Twelve Months Ending June					
	1897.		1898.		1899.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Almonds	9,644,338	$880,263	5,746,362	$659,659	9,957,427	$1,222,587
Cocoanuts	.....	471,387	.....	575,935	.....	625,789
All other nuts	.....	848,511	.....	1,002,344	.....	879,166

The vast range of climatic conditions to be found in this country will enable us to grow nearly all the nuts which we now import. Some progress has already been made along these

lines. Our native nuts should be improved. Nuts are subject to as many and great varietal changes as apples and are doubtless as susceptible of improvement.

THE CHEMICAL COMPOSITION OF NUTS.

It is believed that with the larger supply, the improved quality and the lower prices that would in time follow an increased demand, our American dietaries would make an important gain at a small cost. It is with a view of calling more general attention to this subject that the analyses given on the following pages are presented. Those analyses to which the fuel value is added were made at this Station. The others were compiled from various sources, as indicated in the foot-notes.

Almond. (*Amygdalus communis*).

Of the almonds consumed in the United States, by far the larger part is supplied by France, Italy and Spain. Repeated attempts have been made to grow the almond in this country, but nearly all have resulted in failure. California, however, seems to offer a promising field for this culture, and the crop of that state for 1891 was estimated at 1,000,000 pounds. As the imports for the same year amounted to about 7½ million pounds, valued at nearly $1,000,000 it may be safely predicted that our production will be largely increased.

Below is given the average of the analyses of eleven varieties of California almonds, and also four analyses of European almonds.

COMPOSITION OF THE ALMOND.

	Refuse.	Water.	Protein.	Fat.	Total carbo-hydrates.	Ash.
Edible portion:						
California almonds *a*	.....	4.8	21.0	54.9	17.3	2.0
European almonds *b*	.....	6.0	23.5	53.0	14.4	3.1
As purchased:						
California almonds	*c*64.8	1.7	7.3	19.3	6.2	.7

a. California Experiment Station Report, 1895–96; 1896–97, p. 151.

b. Koenig: Nahrungs-und Genusmittel, I, p. 608.

c. As the proportion of shell to kernel for the dry nut was not given, we have used here the proportion found in nuts purchased in the Maine market.

Brazil Nut. (*Bertholletia excelsa*).

As its name indicates, this nut is a native of Brazil, whence large quantities are exported. In 1897 our imports were valued at $234,972. The nut has not been successfully grown in the United States.

COMPOSITION OF THE BRAZIL NUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fats.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6167	.....	5.3	17.0	66.8	7.0	3.9	3,329
As purchased	6167	49.6	2.7	8.6	33.6	3.5	2.0	1,678

Filbert. (*Corylus*).

The European hazels or filberts which supply our markets are crosses and varieties of two species, *C. avellana* and *C. tubulosa.* The filbert is only sparingly grown in the United States. Our native hazels are smaller than the European nuts, though some varieties have been noted which are well worthy of cultivation.

The filbert finds its chief use as a dessert nut. In some European countries where it is produced in large quantities it is ground to a flour and used for bread. Along the Black Sea shore of Asiatic Turkey the culture of the filbert has attained great importance, the production about Trebizond in 1896 being estimated at 38,518,771 pounds.

COMPOSITION OF THE FILBERT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6170	.....	3 7	15.6	65.3	13.0	2.4	3,432
As purchased	6170	52.1	1.8	7.5	31.3	6.2	1.1	1,644
Edible portion *a*	.....	.....	7.1	17.4	62.6	10.4	2.5	

a. Koenig: Nahr. u. Genusmittel, II, p. 500. The average of two analyses.

Hickory-nut.

The hickory-nut best known to our market is the fruit of the shag-bark hickory, *Hicoria ovata* Britton. Like the other hickories, it is a native of America. It has a wide range, being found from southern Maine, west to Minnesota, and south to Texas and Florida. It is said to reach its best development west of the Alleghanies.

The quality of the nut is exceedingly variable, both as to the flavor of the kernel and the readiness with which the shell can be removed. The better varieties are highly esteemed and by many are considered the best of our American nuts, for delicacy of flavor comparing not unfavorably with the English walnut. The price is as variable as the quality, ranging, at the place and time of harvest, from 20 cents to $3.00 per bushel.

COMPOSITION OF THE HICKORY-NUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6171	.....	3.7	15.4	67.4	11.4	2.1	3,495
As purchased	6171	62.2	1.4	5.8	25.5	4.3	.8	1,321

Pecan. (*Hicoria pecan*).

The pecan is also a native of America, but is far less widely distributed than the species last described (*Hicoria ovata*), being found from Indiana to Iowa on the north to Tennessee and Texas on the south. It thrives best in the rich, moist soils along the river banks. Although some of the largest and best pecans are grown in Louisiana, a large proportion of those placed upon the market are from Texas, where its culture has attained considerable importance.

The flavor of the pecan makes it a desirable nut, but it owes much of its popularity to the thinness of its shell and the consequent ease with which it may be removed. These qualities adapt it especially to dessert purposes. Large quantities of this nut are used by confectioners, the shelled meats in halves selling at 30 to 40 cents per pound.

COMPOSITION OF THE PECAN.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Pecans, polished:								
Edible portion	6174	.....	3.0	11.0	71.2	13.3	1.5	3,633
As purchased.....	6174	53.2	1.4	5.2	33.3	6.2	.7	1,700
Pecans, unpolished:								
Edible portion.....	6173	.....	2.7	9.6	70.5	15.3	1.9	3,566
As purchased.....	6173	46.3	1.5	5.1	37.9	8.2	1.0	1,915

English Walnut. (Juglans regia).

In the United States the walnut has been successfully cultivated in the Central and Southern Atlantic States, in California, and Oregon. In California the culture is especially successful, the product for 1898 being estimated at eight million pounds.

COMPOSITION OF THE WALNUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, det.
California soft shell, J. regia, 4 analyses *a*.								
Edible portion.....	.....	.....	2.5	16.6	63.4	16.1	1.4	
As purchased.....	.....	58.1	1.0	7.0	26.6	6.7	.6	
California bijou, J. regia *a*.								
Edible portion	.....	.....	2.5	18.4	64.4	13.0	1.7	
As purchased.....	.....	73.1	.7	4.9	17.3	3.5	.5	
Italian, J. regia.								
Edible portion	6212	.....	4.0	16.9	68.0	9.0	2.1	3,538
As purchased.....	6212	57.8	1.7	7.1	28.7	3.8	.9	1,493
Juglans regia, 4 analyses *b*.								
Edible portion.....	.....	.....	7.2	15.8	57.4	17.6	2.0	
California native black, J. California *a*.								
Edible portion.....	.....	.....	2.5	24.9	54.7	16.1	1.8	
As purchased.....	.....	74.1	.6	6.4	14.2	4.2	.5	
California grown American black, J. nigra *a*.								
Edible portion.....	.....	.....	2.5	30.3	57.8	7.4	2.0	

a. Calif. Expt. Station, Bulletin 113, p. 12.

b. Koenig. Nahr. u. Genusmittel, II, p. 500.

Although Asiatic in its origin, this is commonly spoken of as the English walnut. Owing to its general excellence it early won its way to popular favor, having been distributed through nearly all Europe, reaching England as early as the middle of the sixteenth century.

Chestnut. (*Castanea dentata*).

The American chestnut has a wide geographical range, being found in nearly every state east of the Mississippi, from southern Maine to the Gulf. It seems to thrive best on high lands, with light and even sandy soils. Both the European and Japanese chestnuts are also cultivated here to some extent; neither of them yield nuts of as good quality as our native stock, though both excel our nut in size.* The price of the native nut varies from $1 to $10 per bushel, according to locality, abundance and excellence of the nut.

In France, where the chestnut is widely grown, the nut has come to play an important part in the dietaries of the poor. The common way of preparing the nuts is to remove the shells and steam them, when they may be eaten either with salt or milk, furnishing a cheap and nutritious food. Thus prepared, the hot nuts are sold in the streets, and form the chief morning dish for a large proportion of the working classes. Large quantities of the nuts are also dried and ground to a flour, which can be kept for some time without deteriorating. This flour, mixed with water and baked in thin sheets, forms a heavy, but sweet and nutritious cake. The use of the chestnut is not confined to the poor, since it is used in many forms by the well-to-do classes who prepare from them many palatable side dishes.

In Italy the use of the chestnut is also very general. The nut is eaten fresh, boiled and roasted, or as a substitute for corn meal in the "polenta," a form of porridge much used by the poorer classes. A common delicacy in the Apennines is "necci," flat cakes of chestnut flour and water, baked between hot, flat stones, with chestnut leaves between the cakes.† In Korea the chestnut is said almost to take the place which the potato occupies with us, being used raw, boiled, roasted, cooked with meat, or dried whole.

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*Nut culture in the United States, U. S. Department of Agriculture, p. 82.

†Knight: Food and Its Functions, p. 199.

The chestnut differs widely from the other common nuts, since it contains much less oil and protein and much more of the carbohydrates, especially starch, which is almost wholly wanting in many nuts. It is thus a far less concentrated and better balanced food than our other nuts. The high prices which prevail in our Maine markets will prevent its very general adoption. A large and steady demand would in time lead to an increased production and ultimately to lower prices.

COMPOSITION OF THE CHESTNUT.

Variety and condition.	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.
Edible portion:							
Numbo, fresh *a*	.....	.....	42.2	6.1	6.6	43.3	1.8
Moon's Seedling, fresh *a*	.....	.....	41.7	6.3	6.4	43.8	1.8
Solebury, fresh *a*	.....	.....	29.2	6.7	8.3	54.0	1.8
Native, fresh *a*	.....	.....	34.4	8.0	10.8	45.1	1.7
Italian, fresh *b*	.....	.....	53.8	6.6	2.0	36.9	.7
Italian, fresh *b*	.....	.....	52.7	4.1	2.0	40.4	.8
Variety unknown, fresh *c*	.....	.....	44.9	7.3	8.0	38.3	1.5
Average, fresh nuts	.....	.....	42.7	6.5	6.3	43.1	1.4
Spanish, dry *a*	.....	.....	6.6	9.0	6.6	75.0	2.8
Paragon, dry *a*	.....	.....	6.5	11.4	9.1	70.1	2.9
Spanish, dry *a*	.....	.....	5.4	10.3	9.1	72.5	2.7
Native, dry *a*	.....	.....	4.8	11.6	15.3	65.7	2.6
Average, dry nuts	.....	.....	5.8	10.6	10.0	70.8	2.8
As purchased:							
Numbo, fresh *a*	.....	11.5	37.3	5.4	5.9	38.3	1.6
Moon's Seedling, fresh *a*	.....	14.3	35.7	5.4	5.5	37.5	1.6
Solebury, fresh *a*	.....	15.3	24.8	5.7	7.0	45.7	1.5
Native, fresh *a*	.....	23.2	26.4	6.2	8.3	34.6	1.3
Italian, fresh *b*	.....	15.4	45.5	5.6	1.7	31.2	.6
Italian, fresh *b*	.....	15.5	44.5	3.5	1.7	34.1	.7
Average, fresh nuts	.....	15.9	35.7	5.3	5.0	36.9	1.2
Spanish, dry *a*	.....	21.5	5.2	7.0	5.2	58.9	2.2
Paragon, dry *a*	.....	23.9	5.0	8.7	6.9	53.3	2.2
Spanish, dry *a*	.....	25.3	4.0	7.7	6.8	54.2	2.0
Native, dry *a*	.....	22.9	3.7	8.9	11.8	50.7	2.0
Average, dry nuts	.....	23.4	4.5	8.1	7.7	54.2	2.1

a Penn. Expt. Station, Bulletin 16, p. 15.
b Calif. Expt. Station, Report 1895-6; 1896-7, p. 153, Bulletin 113, p. 7.
c Mass. State Expt. Station, Report, 1893, p. 354.

Peanut. (*Arachis hypogæa*).

The peanut, although not a nut in the botanical sense, is for convenience here included. It is extensively grown in at least four continents—Asia, Africa, North and South America—and

has been so long and so widely cultivated that some doubt exists with regard to its origin. It is now generally regarded as a native of Brazil, although even in that country it is unknown in its wild form. Prior to 1865 the United States imported large quantities of peanuts from Western Africa. Since that date the home production has enormously increased until at the present time our crop is estimated at 4,000,000 bushels, about one-seventh of the crop of the world. Of this amount Virginia, North Carolina and Tennessee produce by far the larger part. The culture is not as profitable as formerly, since, through injudicious methods of cultivation, the previous yield of 50 or more bushels per acre has fallen to less than one-half that amount, while the cost of cultivation remains practically the same.*

There is but little waste in peanut production. The dried vines are used as hay, while the pods and low grades of the nuts are also fed to stock. Probably three-fourths of the peanuts themselves are retailed in the roasted form. A part of the cheaper grades is used by confectioners. In Europe, and to a much more limited extent in this country, the oil is extracted. This oil, forming from one-third to one-half of the kernel, is clear, sweet and palatable, for many purposes fully equal to the more costly olive oil. Indeed, much that is sold as olive oil is either peanut oil, or contains a large admixture of the same. The high grades are used in Germany as a salad oil; while the lower grades find ready use as lubricants or are employed in soap making. Although the American peanut is larger and more palatable than the African, the latter furnishes a better oil.

As a food for man, the peanut has a high claim upon the popular favor. There seems to be no reason why it should not be considered as a regular article of diet and be placed in some form upon our tables. If the cake remaining after the extraction of peanut oil be ground to a fine powder, it furnishes a flour from which a nutritious bread can be made. Attempts made in Germany to utilize this flour in the preparation of army bread have not been altogether successful, but the matter is worthy of farther trial.

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*Farmers Bulletin, No. 25.

COMPOSITION OF THE PEANUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Total value per pound, determined.
Edible portion:								
Georgia peanut *a*	.....	.....	12.9	26.6	37.6	21.0	1.9	
Spanish peanut *a*	.....	.....	13.2	27.9	35.8	20.7	2.4	
Variety unknown *b*	.....	.....	4.9	29.1	48.8	15.3	1.9	
Variety unknown	6213	.....	6.0	28.1	45.7	17.8	2.4	3,008
Varieties unknown, 8 anal. *c*	.....	.....	6.9	27.7	45.8	17.0	2.6	
Average, 12 analyses	.....	.....	7.7	27.8	44.5	17.6	2.4	
Roasted peanut	6214	.....	1.6	30.5	49.2	16.2	2.5	3,177
As purchased:								
Georgia peanut *a*	.....	27.0	9.4	19.4	27.5	15.3	1.4	
Spanish peanut	...	22.0	10.3	21.8	27.9	16.1	1.9	
Variety unknown *b*	.....	28.8	3.5	20.7	34.7	10.9	1.4	
Variety unknown	6213	28.0	4.3	20.3	32.9	12.8	1.7	2,166
Average 4 analyses	.....	26.4	6.9	20.6	30.7	13.8	1.6	
Roasted peanuts	6214	32.6	1.1	20.6	33.1	10.9	1.7	2,141
Peanut butter *d*	.....	.....	2.1	28.7	46.4	18.8	*f* 4.0	
Peanut butter *e*	.....	.....	2.0	29.9	46.7	15.4	*g* 6.0	

a. Georgia Expt. Station, Bulletin 13, p. 64.
b. North Carolina Expt. Station, Bulletin 90 B, p. 10.
c. Koenig: Nahr. u. Genusmittel, II, p. 500.
d. From the Atlantic Peanut Refinery, Philadelphia.
e. From the Peanolina Company, New Haven.
f. Including salt 3.2 per cent.
g. Including salt 5.0 per cent.

Acorns. (*Quercus*).

The only analysis here given is of the fruit of the common black oak of the desert regions of Arizona (Q. *Emoryi*). The acorns of this species are generally known as "biotes." With this analysis is given that of a sample of acorn meal and a bread prepared from the same. Acorns in the natural state are unfit for human food on account of the large amount of tannin which they contain. The meal and bread here reported were prepared by the Indians of California who by some means succeed in removing the tannin. While the meal was found to contain 6.63 per cent tannin, only a trace was discoverable in the bread. Both meal and bread were sour and sodden when received.

The Indians of the Yosemite Valley make a porridge by stirring up acorn meal with water. This is cooked by dropping in heated stones. The cooked porridge thickens on cooling, when it is sliced and browned before the fire.

COMPOSITION OF ACORNS (QUERCUS EMORYI), ACORN MEAL, AND ACORN BREAD.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Food value per pound, determined.
Acorn, edible portion	6193	.....	4.1	8.1	37.4	48.0	2.4	2,718
Acorn as received ...	6193	35.6	2.6	5.2	24.1	30.9	1.6	1,750
Acorn meal.....	6184	.....	8.7	5.7	18.6	65.0	2.0	2,265
Acorn bread	6185	.....	60.3	2.2	9.9	27.0	.6	2,347

Beechnut. (*Fagus Americana*).

The beech is a common forest tree over the eastern half of the United States. The nuts are sweet and among the best of our wild nuts. They are widely gathered by children; but owing to the fact that the tree is an irregular bearer, the nuts small and prime favorites with the squirrels, only a very limited amount of this nut reaches the market. The prices are as variable as the supply, ranging from 10 to 60 cents per quart.

COMPOSITION OF THE BEECHNUTS.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Fagus Americana:								
Edible portion	6166	.....	4.0	21.9	57.4	13.2	3.5	3,263
As purchased	6166	40.8	2.3	13.0	34.0	7.8	2.1	1,932
Fagus sylvestris *a*....								
Edible portion.....	.....	.....	9.1	21.7	42.4	22.9	3.9	
As purchased	.....	33.0	6.1	14.5	28.4	15.4	2.6	

a. Koenig: Nahr. u. Genusmittel, II, p. 500.

Butternut, Oil-nut, White Walnut. (*Juglans cinerea*).

The butternut is found over a large part of the eastern, middle and northern states, though it is most abundant and reaches its highest development in the Ohio River basin. Usually it is not a forest tree, but occurs most frequently in isolated positions and along fences. It is very prolific, single trees sometimes yielding 15 or 20 bushels.

Although a common nut in this State, it is not often found in the Maine markets. In the West it is more frequently met, the price ranging from 20 cents to $2 per bushel. When green the nuts are sometimes used for pickling. The thick dense shell of the ripened nut, its extreme oiliness with a tendency to become rancid, make this one of the least desirable of our nuts.

COMPOSITION OF THE BUTTERNUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6168	.....	4.5	27.9	61.2	3.4	3.0	3,371
As purchased.....	6168	86.4	.6	3.8	8.3	.5	.4	458

Cocoanut. (*Cocos nucifera*).

Although large quantities of these nuts are annually imported into the United States, the home product is now considerable. During the past 20 years large numbers of trees have been planted in southern Florida, where it is estimated that there are at least 250,000 trees, over ten per cent of which are in bearing. The products of the cocoanut palm are so many and varied and find such ready application, that it may be long before our home production will satisfy the growing demand.

"The small, green and immature nuts are grated fine for medicinal use, and when mixed with the oil of the ripe nut it becomes a healing ointment. The jelly which lines the shell of the more mature nut, furnishes a delicate and nutritious food. The milk in its center, when iced, is a most delicious luxury. Grated cocoanut forms a part of the world renowned East India condiment, curry. Dried, shredded (desiccated) cocoanut is an important article of commerce.

"From the oil a butter is made, of a clear, whitish color, so rich in fat, that of water and foreign substances combined there are but .0068. It is better adapted for cooking than for table use. At present it is chiefly used in hospitals, but it is rapidly finding its way to the tables of the poor, particularly as a substitute for oleomargarine." *

COMPOSITION OF THE COCOANUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6169	.....	14.1	5.7	50.6	27.9	1.7	2,986
As purchased	6169	*a*48.8	7.2	2.9	25.9	14.3	.9	1,529
Without milk, as purchased	6169	*b*37.3	8.9	3.6	31.7	17.5	1.0	1,872
Cocoanut milk, as purchased	.....	.....	92.7	.4	1.5	4.6	.8	97
Shredded cocoanut *c*	.....	.....	4.3	6.5	63.7	24.1	1.4	
Shredded cocoanut *d*	.....	.....	2.8	6.0	51.0	39.0	1.2	
Edible portion *e*	.....	.....	5.8	8.9	67.0	16.5	1.8	
Cocoanut milk *f*	.....	.....	91.5	.5	.1	6.8	1.2	

a Milk and shell. *b* Shell only. *c* Storrs Expt. Station. *d* New Jersey Expt Station. *e* Koenig, Nahr. u. Genusmittel, II, 500. *f* Ibid, I, 495.

The meat of the cocoanut is poor in protein, as compared with most of the nuts here reported, and the milk contains about one-tenth the protein and less than one-half the fat found in the milk of the cow.

The Litchi, Leechee, or Chinese Nut. (*Nephelium litchi*).

This fruit is a native of China. It is not a true nut, although commercially classed as such. The imports to this country are quite small, and the consumption for the most part confined to the Chinese population. As the analysis indicates, it differs widely from true nuts, being very low in protein and fats and correspondingly high in carbohydrates. It finds its way to our markets only in the dried form. When fresh it is said to be one of the finest of Chinese fruits, having a white flesh with the taste of the best grapes.†

* Nut Culture in the United States, p. 98–99.
†Popular Science Monthly, XXVIII, p. 574.

COMPOSITION OF THE LITCHI NUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6172	.....	17.9	2.9	.2	77.5	1.5	1,453
As purchased.....	6172	41.6	10.5	1.7	.1	45.2	.9	849

Pine Nuts. (*Pinus*).

The seeds of three species of pine have been analyzed, *Pinus edulis* Engel., *P. monophylla* Torr. and Frem., and *P. Sabiniana* Doug.

COMPOSITION OF PINE NUTS.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Pignolias, edible portion *a*.....	.....	.....	6.4	33.9	49.4	6.9	3.4	
Pinon, (P. monophylla):								
Edible portion	6211	.....	3.8	6.5	60.7	26.2	2.8	3,377
As purchased.....	6211	41.7	2.2	3.8	35.4	15.3	1.6	1,940
Pinon, (Pinus edulis):								
Edible portion	6177	.....	3.4	14.6	61.9	17.3	2.8	3,364
As purchased.....	6177	40.6	2.0	8.7	36.8	10.2	1.7	1,988
Pinon, (P. sabiniana):								
Edible portion	6192	.....	5.1	28.1	53.7	8.4	4.7	3,161
As purchased.	6192	77.0	1.2	6.5	12.3	1.9	1.1	727

"The several species of pine yielding edible nuts are found on the Pacific Slope of the United States and in Colorado, New Mexico, Arizona and Mexico. The nuts are but little known to a majority of the people of the United States, though they are marketed in large quantities in some of the cities of California.

a From Bulletin 28 of the office of Experiment Station.

Some of them are of good size for dessert or confectionery purposes, and in quality and flavor are so superior that their general introduction will doubtless make them very popular.—Along the borders of Mexico the nuts are called "piñons," and to an increasing extent this name is being accepted as applicable to all pine nuts. The pine nut has a rich, marrowy kernel in a shell that varies in thickness from that of a chestnut to that of a hard-shelled hazel nut." *

Pistachio. (*Pistacia vera*).

This nut, although a native of Syria, has long been cultivated in Southern Europe, where it produces a fruit somewhat larger than that of the parent stock, but of a less desirable flavor. Most of the nuts used in the United States are from European countries bordering upon the Mediterranean. The pistachio was introduced into the Southern States nearly half a century ago and has been somewhat widely though not extensively grown. Small quantities of this nut have been successfully grown in California.

The kernel is greenish in color and has a somewhat mild but pleasing and characteristic flavor, suggestive of almonds. In this country it finds its largest use in the manufacture of confectionery, for which purpose it is valued both for its flavor and color.

COMPOSITION OF THE PISTACHIO.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
First quality, edible portion..	6175	.....	4.2	22.3	54.0	16.3	3.2	3,235
Second quality, edible portion	6176	.....	4.3	22.8	54.9	14.9	3.0	3,262
Average.	.....	.....	4.2	22.6	54.5	15.6	3.1	3,249

* Nut Culture in the United States, p. 92.

DISCUSSION OF RESULTS.

It has been found that the nutritive value of all foods, irrespective of their source or kind, depends upon the presence of one or more of four classes of nutrients. These are called protein (nitrogenous matter), fats, carbohydrates and ash (mineral matter). The gluten of wheat, the lean of meat, the white of an egg and the curd of milk (casein), are all familiar illustrations of protein. These matters differ from other food constituents in that they contain nitrogen. Examples of fats are butter (fat of milk), the fat of meat, the oils of plants and seeds, as olive oil, oil of corn, etc. Carbohydrates consist of starch, sugar and allied substances. They make up the greater portion of such foods as potatoes and corn. Ash is the matter left after burning, and so far as nutrition is concerned, consists chiefly of phosphates and chlorides of lime, potash and soda.

Food has in general two distinct uses in the body: one to build up and repair, the other to supply the energy needed to enable the body to do work, maintain its temperature, etc. The living tissues of the body, with the exception of fatty tissues, are built up entirely from protein and ash. Protein can be used by the body as a source of energy, but the fats and carbohydrates are the chief sources of energy under normal conditions. The body cannot create energy, but is dependent upon the potential energy of its food for the work it does. The food yields up its energy to the body by being burned, just as truly as if it were in a furnace under a boiler.

As above stated, protein can be burned by the body as a source of energy. This, however, is wasteful of protein, as energy is much more economically furnished by fats and carbohydrates. Not only are the fats and carbohydrates burned as a source of energy, but being thus oxidized in the body they partially protect the protein of the food and of the body from being burned.

Since the chief use of protein is to build up and repair the animal body, if it were protected so that none of it were oxidized only a small amount of protein would be needed per day for maintenance of the body. As it is, even with an abundance of fats and carbohydrates in the food, quite considerable amounts of protein are daily oxidized. The amount of protein that is

consumed in the body increases to some extent with the amount of external work done. From observation in the respiration calorimeter in feeding experiments and in dietary studies, Atwater estimates that a man at medium work uses daily about 4½ ounces of protein (.28 pounds or 125 grams).

The energy of the body is derived from the potential energy of its food, which can conveniently be measured by its fuel value. The calorie is the unit and is the amount of heat necessary to raise one kilogram of water 1° of the centigrade scale. This is very nearly the same as the amount of heat required to raise 4 pounds of water 1° Fahrenheit. The fuel value of foods can be very accurately determined by means of an apparatus termed the calorimeter. For example, the fuel value of a pound of shelled almonds, as given in the table on page 87, is 3,030 calories. This means that if a pound of this substance were burned, the heat given off would be capable of warming four times that number or 12,120 pounds of water 1° F.

The protein, fats and carbohydrates of the food are burned in the body and their value for this purpose can be best expressed in calories. A person remaining quiet in a temperature near that of the body would theoretically only use sufficient energy to perform necessary vital processes, such as digestion and assimilation of food, circulation of the blood, etc. If the temperature of the air is much below that of the body, more nutrients would need to be burned in order to keep the body warm, and if at the same time, exercise were taken or work of any kind done, added potential energy of the food would be needed to perform this. Atwater estimates that a man at medium work uses daily about 3,500 calories of potential energy which must be supplied by the food. The .28 of a pound of protein in the daily ration would furnish about 500 calories of energy; the remaining 3,000 calories must be furnished in the food in the form of fats and carbohydrates.

The food for a day's ration for a man at medium work should, therefore, supply about .28 pounds of protein and 3,500 calories of energy, or at the rate of 125 calories for each .01 pound of protein. The above facts and estimates make it easier to understand the nutritive value of different food materials and will help in discussing the place of nuts as food.

In the following table there is given the condensed results of the analyses of nuts given on pages 72 to 84 of this bulletin:

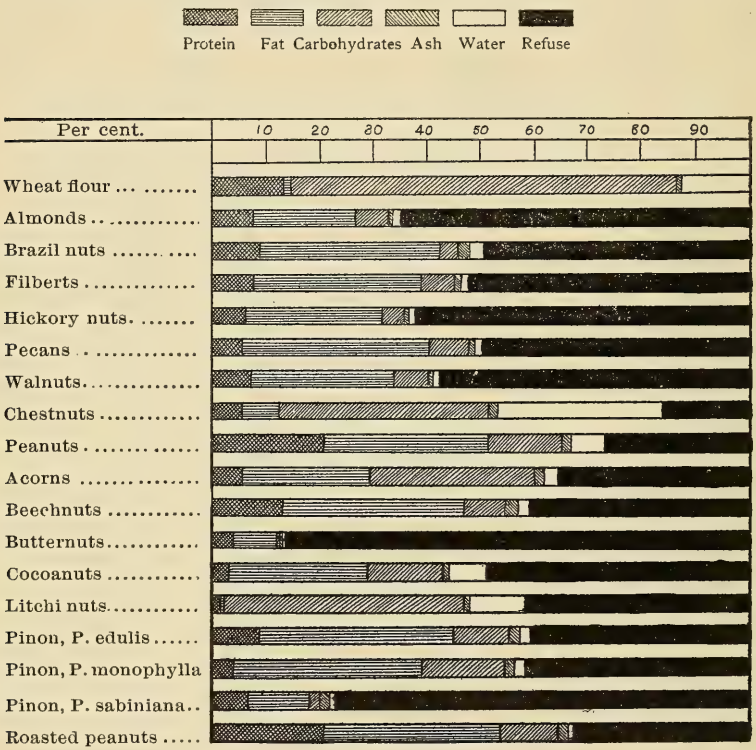
AVERAGE COMPOSITION OF NUTS.

	Number of analyses.	Refuse.	Edible portion.	Edible Portion.					Fuel value per pound.*
				Water	Protein.	Fat.	Carbo-hydrates.	Ash.	
		%	%	%	%	%	%	%	Calories.
Almonds	1	64.8	35.2	1.7	7.3	19.3	6.2	.7	1065
Almonds, kernels	1	.....	100.0	4.8	21.0	54.9	17.3	2.0	3030
Brazil nuts	1	49.6	50.4	2.7	8.6	33.6	3.5	2.0	1545
Filberts	1	52.1	47.9	1.8	7.5	31.3	6.2	1.1	1575
Filberts, kernels	1	.....	100.0	3.7	15.6	65.3	13.0	2.4	3290
Hickory-nuts	1	62.2	37.8	1.4	5.8	25.5	4.3	.8	1265
Pecans	2	49.7	50.3	1.5	5.2	35.6	7.2	.8	1735
Pecans, kernels	2	.....	100.0	2.9	10.3	70.8	14.3	1.7	3445
Walnuts	5	58.0	42.0	1.2	7.0	27.0	6.1	.7	1385
Walnuts, kernels	5	.....	100.0	2.8	16.7	64.4	14.8	1.3	3305
Chestnuts	4	16.1	83.9	31.0	5.7	6.7	39.0	1.5	1115
Acorns	1	35.6	64.4	2.6	5.2	24.1	30.9	1.6	1690
Beechnuts	1	40.8	59.2	2.3	13.0	34.0	7.8	2.1	1820
Butternuts	1	86.4	13.6	.6	3.8	8.3	.5	.4	430
Cocoanuts	1	48.8	51.2	7.2	2.9	25.9	14.3	.9	1415
Cocoanuts, shredded	2	.....	.....	3.5	6.3	57.3	31.6	1.3	3125
Litchi nuts	1	41.6	58.4	10.5	1.7	.1	45.2	.9	875
Pinon, P. edulis	1	40.6	59.4	2.0	8.7	36.8	10.2	1.7	1905
Pinon, P. monophylla	1	41.7	58.3	2.2	3.8	35.4	15.3	1.6	1850
Pinon, P. sabiniana	1	77.0	23.0	1.2	6.5	12.3	1.9	1.1	675
Pistachio, kernels	2	.....	100.0	4.2	22.6	54.5	15.6	3.1	3010
Peanuts, raw	4	26.4	73.6	6.9	20.6	30.7	13.8	1.6	1935
Peanuts, kernels	4	.....	100.0	9.3	27.9	42.0	18.7	2.1	2640
Roasted peanuts	1	32.6	67.4	1.1	20.6	33.1	10.9	1.7	1985
Shelled peanuts	1	.....	100.0	1.6	30.5	49.2	16.2	2.5	2955
Peanut butter	2	.....	.....	2.0	29.3	46.6	17.1	†5.0	2830

*Calculated from analysis. † Including salt, 4.1%.

In the following diagram the composition of the more important of the nuts is shown, compared with the nutrients of a good quality bread flour.

AVERAGE COMPOSITION OF NUTS AS PURCHASED, COMPARED WITH WHEAT FLOUR.



The first six nuts of the table and diagram are common dessert nuts and resemble each other in many respects. As these are found in the market, from 50 to 65 per cent of the unshelled nuts is refuse (shell). Only 35 per cent of the common almond, 40 per cent of the English walnut and about 50 per cent of the filbert, Brazil nut and pecan is edible. All of these six nuts as purchased contain but little water. The protein in the unshelled nuts runs from 5.2 per cent in the pecan, to 8.6 in the Brazil nut, and in the shelled nuts from 10.3 per cent of protein in the pecan, to 21 per cent in the almond. The fats (oils) form the largest part of the edible portion of these nuts varying from 19.3 per cent in unshelled almonds to 35.6 per cent in pecans. The fat

in shelled almonds is 55 per cent and in filbert and walnut meats about 65 per cent and in pecans it makes up 70 per cent of the whole. The carbohydrates, which usually predominate in vegetable foods, occur in only small amounts. A pound of mixed nuts would contain about the following amounts of nutrients and potential energy.

APPROXIMATE COMPOSITION OF ONE POUND OF SIX COMMON NUTS.

	Refuse.	Protein.	Fats.	Carbo-hydrates.	Fuel value.
	Pounds.	Pounds.	Pounds.	Pounds.	Calories.
As purchased	.56	.07	.28	.06	1520
Edible portion	.....	.16	.64	.13	3240

A pound of good wheat flour contains about .13 pounds protein, .013 pounds of fat, and .72 pounds of carbohydrates, and has a fuel value of 1,600 calories. The meat of the nuts contains nearly fifty times as much fat, less than one-fifth as much carbohydrates, and has double the fuel value. A pound of unshelled nuts would furnish about half as much protein and about the same amount of potential energy as a pound of flour. The potential energy of the nuts is largely from the fats and that of the flour from carbohydrates. For each .01 pound of protein, flour has 123 calories of potential energy or in nearly the same proportions as that demanded by Atwater's standard for a man at medium work. The nuts have 202 calories for each .01 pound of protein and would not make a well balanced food when eaten by themselves. This unsuitableness for a food by themselves is also increased by the potential energy being stored in the concentrated form of fat. This is no reason, however, why nuts should not fill an increasingly large place in dietaries. Very few foods supply the needed nutrients in the proper proportion to form a well balanced ration. Foods rich in fuel constituents need to be combined with other foods of relatively high protein content. The low per cent of carbohydrates in nuts would seem to fit them as one of the sources of food for diebetic and other persons who find it needful to avoid foods containing much starch or sugar.

The chestnut differs materially from the six nuts we have just considered. While the protein content of the unshelled nut is not very unlike the ordinary table nut, it contains only one-fourth as much fat and six or seven times as much carbohydrates. Indeed its high starch content explains why chestnuts are so little eaten raw. Boiling or roasting causes the starch granules to swell and burst, rendering the nut of easier mastication and giving the digestive juices better opportunity to act upon the ingested nuts. A pound of unshelled chestnuts contains .057 pounds of protein and has a fuel value of 1,115 calories or 195 calories for each .01 pound of protein. This is a somewhat more nearly balanced food than the other nuts. As it yields itself readily to cookery, the chestnut should have a more prominent place in American dietaries.

Although the peanut is not a nut strictly speaking, it deserves special attention because of its composition. A pound of roasted peanuts in the shell has .206 pounds of protein, and a fuel value of 1,985 calories, and a pound of roasted and shelled peanuts carries .305 pounds of protein with a fuel value of 2,955 calories. Peanut butter is apparently ground peanuts and has practically the same composition as roasted and shelled peanuts. Peanuts have a fuel value of only 96 calories for each .01 pound of protein and hence have a relative excess of protein. This is so unlike other vegetable foods, with the exception of the near relatives of the peanut, as peas and beans, that it is of great importance. A bushel of raw peanuts weighs about 22 pounds and costs from 75 cents to $1.25. The roasted peanuts retail at from 5 to 10 cents a quart. A quart of peanuts contains as much protein as one pound of rump steak although, at usual prices, the later costs three times as much.

In this country nuts will never to any great extent replace the cereal foods, as is the case in some sections of the Old World. Not only would the original cost prevent, but the labor involved in shelling and preparing nuts for the table would prove a serious obstacle to their extended use. It will, however, be interesting to compare the relative cost of the different nutrients as furnished by different nuts and by wheat flour at the prices which fairly represent the cost in Maine cities.

AMOUNTS OF NUTRIENTS FURNISHED FOR 10 CENTS IN NUTS AT ORDINARY PRICES.

Nuts as purchased.	Prices per pound.	Ten Cents will Pay for—					
		Weight of kernel.	Nutrients.				Fuel value calculated.
			Total.	Protein.	Fats.	Carbo-hydrates.	
	Cents.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Calories.
Almonds	15	.23	.21	.05	.12	.04	675
Brazil nuts	12	.42	.38	.07	.28	.03	1370
Filberts	15	.32	.30	.05	.21	.04	1055
Hickory-nuts *a*	9	.42	.40	.07	.28	.05	1405
Pecans	15	.33	.32	.04	.23	.05	1140
Walnuts	15	.28	.27	.05	.18	.04	925
Chestnuts *b*	8.4	1.00	.62	.07	.08	.47	1340
Peanuts *c*	7.3	1.01	.89	.28	.42	.19	2645
Peanuts *d*	14.6	.50	.44	.14	.21	.09	1320
Wheat flour	3.0	.....	2.88	.43	.04	2.41	5450

a At 10 cents per quart, 488 grams.
b At 5 cents per quart, 270 grams.
c At 5 cents per quart, 22 pounds per bushel.
d At 10 cents per quart.

DIGESTIBILITY.

There are no reliable data regarding the digestibility of nuts. The belief in their indigestibility seems to be widespread and perhaps has some basis in fact. It is quite probable that if the nuts were properly prepared and eaten at proper times, much of this prejudice would disappear. Our present practice of munching them at odd hours, or as a dessert, when sufficient food has been taken to meet the requirements of the body, overtaxes the digestive organs and places the nut under a reproach that is at least in part undeserved.

Preparation and Use of Nut Foods.

This subject can be treated here in only a very general way. The first difficulty to be encountered is the removal of the shell. With the peanut this is easily accomplished. With many of our

nuts, however, the shell is so hard and tough as to discourage the use of large quantities. Some varieties are shelled by machine and the kernels are placed upon the market.

Chestnuts and peanuts when properly prepared furnish palatable and nutritious soups. Peanuts and walnuts, if passed through a meat chopper, or otherwise reduced to a fine state of division, make a butter-like paste which may be used in the preparation of sandwiches. A German dish consists of chestnuts baked with raisins. Salads, croquettes and stuffing for roast fowl may be agreeably diversified by the use of nuts. Commercial preparations of "peanut butter" are on the market and are well received. Desiccated cocoanut is an important article of food. With the exception of the peanut, chestnut and almond, most of the nuts are eaten raw. The nuts, particularly the peanut and chestnut afford interesting opportunities for the housewife skilled in adding to the list of "good things." Attention has been called to the fact that nuts form a very concentrated food. They should, therefore, be eaten with coarser foods and, except in the case of the peanut, with those richer in protein.

CEREAL BREAKFAST FOODS.

CHAS. D. WOODS and L. H. MERRILL.

The general use, at the present time, of cereals on the breakfast table is largely due to the improved condition in which these goods are now offered. Twenty years ago uncooked decorticated oats, (sold under the name of oat meal), graham flour, corn meal, and hominy, all of which required long cooking, made up nearly the entire list of breakfast cereals available to the average housekeeper. Today it is possible to purchase at a moderate price cereal foods which have been previously thoroughly cooked, and subsequently dried so that they will keep indefinitely. These are ready for the table without further cooking or, if wanted hot, can be prepared in a few minutes' time. The process of manufacture is hygienic and cleanly and will bear the closest inspection. Starting from the elevator the goods are cleaned, milled, cooked, evaporated, and packed by machinery. It is very gratifying to find that this class of goods is free from adulteration and careless preparation. The processes differ in different factories and many of them are covered by patents. Some goods may be better prepared than others, just as one flour is better than another; but there is no preparation on the market so far as the writers know, but what is better prepared than anything known to the generation which preceded us.

The tables on pages 94 and 95 contain the description of the samples, including name of goods, name of the maker, place of purchase, the price paid, the weight of the package contents, and the cost per pound. The goods were, with one exception, purchased in Bangor the same day. It was found that the prices at different stores were practically the same for the same goods.

The table on page 96 gives the analyses of these foods calculated to dry matter. The determinations were made by the usual methods, and the heats of combustion were determined by means of the Atwater bomb calorimeter. The fuel value is here given per gram.

The table on page 97 gives the results of the table on page 96 calculated to water content at time of the purchase of the materials. Fuel values as here given are calculated per pound instead of per gram as in the preceding table.

CEREAL FOODS.

Laboratory number.	Name.	Manufacturer.
	CORN PREPARATIONS.	
6230	Crown Flakes	Crown Cereal Company
6231	Hecker's Hominy	Hecker, Jones-Jewell Milling Co.
6232	H-O Company's New Process Hominy	The H-O Company
6233	Mazama	Mazama Health Food Company
	UNCOOKED OAT MEALS.	
6234	A Oat Meal	American Cereal Company
6235	C Oat Meal	American Cereal Company
6245	McCann's Finest Oat Meal	John McCann
	COOKED OAT PREPARATIONS.	
6242	Hecker's Oat Meal	
6244	Hornby's H-O Oat Meal	The H-O Company
6236	American Cereal Company's Rolled Oats	American Cereal Company
6237	American Cereal Company's Rolled Oats	American Cereal Company
6338	Buckeye Rolled Oats	American Cereal Company
6239	Buckeye Rolled Oats	American Cereal Company
6241	Echo White Rolled Oats	Steward & Merriam
6243	Hecker's Rolled White Oats	Hecker, Jones-Jewell Milling Co.
6240	Peoria Rolled Oats	Steward & Merriam
6246	Quaker Rolled White Oats	American Cereal Company
6247	Tip Top Rolled Oats	Akron Cereal Company
	WHEAT PREPARATIONS.	
6264	Fruen's Best Wheat Wafers	Fruen Cereal Company
6263	Fruen's Rolled Wheat	Fruen Cereal Company
6254	H-O Company's Breakfast Food	The H-O Company
6256	Old Grist Mill Rolled Wheat	Potter & Wrightington
6258	Pettijohn's Breakfast Food	American Cereal Company
6249	Cream of Wheat	Cream of Wheat Company
6251	Farinose	American Cereal Company
6252	Fould's Wheat Germ Meal	The Fould's Milling Company
6268	Germea	Sperry Flour Company
6250	Hecker's Farina	
6257	Old Plymouth Breakfast Food	Old Plymouth Cereal Company
6259	Pillsbury's Vitos	Pillsbury-Washburn Flour Mills
6260	Ralston Health Club Breakfast Food	Robinson-Danforth Company
6261	Wheatena	Health Food Company
6262	Wheatlet	The Franklin Mills
6265	Shredded Whole Wheat Biscuit	The Cereal Machine Company
	GLUTEN PREPARATIONS.	
6248	Cooked Gluten	Health Food Company
6253	Dr. Johnson's Glutine	Johnson's Educator Food Store
6269	Whole Wheat Gluten	Health Food Company
	MISCELLANEOUS PREPARATIONS.	
6266	Cook's Flaked Rice	American Rice Food & Mf'g Co.
6229	Glen Mills Standard Crushed Barley	Johnson's Educator Food Store
6267	Grape Nuts	Postum Cereal Company
6286	Malt Breakfast Food	The Malted Cereal Company

CEREAL FOODS, WHERE PURCHASED AND COST.

Laboratory number.	Where purchased.	Price paid per package.	Weight contents of package.	Weight contents of package.	Price paid per pound.
		Cents.	Grams.	Lbs.	Cts.
6230	James H. Snow & Co	5	400	.88	5.7
6231	Fred T. Hall & Co	12	1329	2.93	4.1
6232	J. C. Norton & Co.	13 (2 for 25)	1324	2.92	4.5
6233	Fred T. Hall & Co	15	1136	2.28	6.
6234	Staples & Griffin	In bulk	.....	.....	4.
6235	Staples & Griffin	In bulk	.....	.....	4.
6245	Fred T. Hall & Co	55	2331	5.14	10.7
6242	Staples & Griffin	13 (2 for 25c.)	828	1.83	7.1
6244	Fred T. Hall & Co	15	933	2.06	7.3
6236	Staples & Griffin	In bulk	.....	.....	4.
6237	Fred T. Hall & Co	In bulk	.....	.....	4.
6238	James H. Snow & Co	8 lbs. for 25c in bulk	.....	.....	3.1
6239	T. F. Cassidy & Son	10	849	1.87	5.3
6241	J. C. Norton & Co	10	895	1.97	5.1
6243	Staples & Griffin	10	874	1.93	5.2
6240	J. C. Norton & Co	4 cts. per lb., 7 lbs. for 25 cts., in bulk	.....	.....	4.
6246	J. C. Norton & Co	13 (2 for 25c.)	851	1.88	6.9
6247	Staples & Griffin	5	554	1.22	4.1
6264	J. C. Norton & Co	13 (2 for 25c.)	857	1.89	6.9
6263	Staples & Griffin	In bulk	.....	.....	4.
6254	J. C. Norton & Co	10	578	1.27	7.9
6256	Fred T. Hall & Co	15	952	2.10	7.1
6258	J. C. Norton & Co.	13 (2 for 25c.)	841	1.85	7.0
6249	J. C. Norton & Co.	17	853	1.88	9.0
6251	Fred T. Hall & Co	15	936	2.06	7.3
6252	J. C. Norton & Co	13 (2 for 25c.)	830	1.83	4.9
6268	J. C. Norton & Co	15	795	1.75	8.6
6250	J. C. Norton & Co	13 (2 for 25c.)	423	.93	14.0
6257	James H. Snow & Co.	15	853	1.88	8 0
6259	J. C. Norton & Co.	13 (2 for 25c.)	951	2.10	6.2
6260	J. C. Norton & Co	15	857	1.89	8.0
6261	J. C. Norton & Co.	25	992	2.19	11.4
6262	J. C. Norton & Co.	13 (2 for 25c.)	859	1.89	6.9
6265	J. C. Norton & Co	13 (2 for 25c.)	398	.88	14.8
6248	Staples & Griffin	25	416	.92	27.3
6253	Fred T. Hall & Co	25	410	.90	27.7
6269	James H. Snow & Co	55 (5 lbs. bag)	2274	5.01	11.
6266	J. C. Norton & Co	15	387	.85	17.6
6229	Fred T. Hall & Co	15	908	2.00	7.5
6267	J. C. Norton & Co	15	428	.94	15.9
6286	A. A. Gilbert	15	675	1.49	10.1

PERCENTAGE COMPOSITION OF CEREAL FOODS CALCULATED TO WATER-FREE BASIS.

Laboratory number.	Name of Cereal Food.	Protein.	Fat.	Carbo-hydrates.	Ash.	Fuel value per gram.
	CORN PREPARATIONS.	%	%	%	%	Calo.
6230	Crown Flakes	9.23	.98	89.32	.47	4.359
6231	Hecker's Hominy	9.70	.67	89.17	.46	4.287
6232	H-O Company's New Process Hominy	9.09	.59	89.99	.33	4.321
6233	Mazama	9.66	1.10	88.67	.57	4.368
	UNCOOKED OAT MEALS.					
6234	A Oat Meal	18.76	8.27	70.18	2.79	4.789
6235	C Oat Meal	15.47	8.03	74.46	2.04	4.730
6245	McCann's Finest Oat Meal	13.18	10.59	74.27	1.96	4.773
	COOKED OAT PREPARATIONS.					
6242	Hecker's Oat Meal	20.77	8.11	69.01	2.11	4.829
6244	Hornby's H-O Oat Meal	14.75	8.86	74.30	2.09	4.733
6236	American Cereal Company's Rolled Oats	15.04	8.28	74.44	2.24	4.723
6237	American Cereal Company's Rolled Oats	16.39	8.11	73.38	2.12	4.661
6238	Buckeye Rolled Oats (in bulk)	16.08	8.07	73.64	2.21	4.659
6239	Buckeye Rolled Oats (in package)	15.97	8.16	73.72	2.15	4.718
6241	Echo White Rolled Oats	15.94	8.15	73.74	2.17	4.724
6243	Hecker's Rolled White Oats	15.80	8.91	73.24	2.05	4.783
6240	Peoria Rolled Oats	15.56	8.33	73.92	2.19	4.662
6246	Quaker Rolled White Oats	16.11	9.31	72.44	2.14	4.685
6247	Tip Top Rolled Oats	17.75	8.73	71.29	2.23	4.727
	WHEAT PREPARATIONS.					
6264	Fruen's Best Wheat Waters	10.43	2.34	85.08	2.15	4.354
6263	Fruen's Rolled Wheat	10.62	2.26	85.18	1.94	4.307
6254	H-O Company's Breakfast Wheat	11.47	1.78	84.70	2.05	4.406
6256	Old Grist Mill Rolled Wheat	10.97	2.08	85.13	1.82	4.401
6258	Pettijohn's Breakfast Food	13.31	2.05	82.79	1.85	4.401
6249	Cream of Wheat	13.14	1.13	85.31	.42	4.372
6251	Farinose	15.59	3.32	79.50	1.59	4.479
6252	Fould's Wheat Germ Meal	12.24	2.61	83.61	1.54	4.325
6268	Germea	14.61	2.70	81.18	1.51	4.473
6250	Hecker's Farina	11.86	1.06	86.58	.50	4.378
6257	Old Plymouth Breakfast Food	14.75	2.47	81.55	1.23	4.458
6259	Pillsbury's Vitos	13.10	1.70	84.48	.72	4.410
6260	Ralston Health Club Breakfast Food	12.16	1.56	85.36	.92	4.379
6261	Wheatena	16.42	3.79	77.89	1.90	4.541
6262	Wheatlet	15.33	2.17	81.23	1.27	4.436
6265	Shredded Whole Wheat Biscuit	11.92	1.64	84.78	1.66	4.396
	GLUTEN PREPARATIONS.					
6248	Cooked Gluten	16.88	3.86	76.80	2.46	4.555
6253	Dr. Johnson's Glutine	15.31	.99	82.53	1.17	4.455
6269	Whole Wheat Gluten	17.89	5.20	73.85	3.06	4.628
	MISCELLANEOUS PREPARATIONS.					
6266	Cook's Flaked Rice	8.89	.16	90.52	.43	4.295
6229	Glen Mills Standard Crushed Barley	11.14	.96	86.76	1.14	4.326
6267	Grape Nuts	12.34	1.14	84.11	2.41	4.357
6286	Malt Breakfast Food	14.54	2.43	81.53	1.50	

WEIGHTS OF NUTRIENTS, AND FUEL VALUE OF ONE POUND OF CEREAL FOODS AS FOUND IN THE MARKET.

Laboratory number.	Name of Food.	Water.	Protein.	Fat.	Carbo-hydrates.	Ash.	Fuel value per pound.
	CORN PREPARATIONS.	Lb.	Lb.	Lb.	Lb.	Lb.	Calo.
6230	Crown Flakes	.120	.081	.009	.787	.004	1740
6231	Hecker's Hominy	.110	.086	.006	.794	.004	1730
6232	H-O Company's New Process Hominy	.120	.080	.005	.792	.003	1725
6233	Mazama	.107	.086	.010	.792	.005	1770
	UNCOOKED OAT MEALS.						
6234	A Oat Meal	.067	.175	.077	.655	.026	2025
6235	C Oat Meal	.079	.143	.074	.686	.019	1975
6245	McCann's Finest Oat Meal	.051	.125	.101	.705	.019	2055
	COOKED OAT PREPARATIONS.						
6242	Hecker's Oat Meal	.091	.189	.074	.627	.019	1990
6244	Hornby's H-O Oat Meal	.093	.134	.080	.674	.019	1945
6236	American Cereal Company's Rolled Oats	.077	.139	.076	.687	.021	1975
6237	American Cereal Company's Rolled Oats	.069	.153	.076	.683	.020	1970
6238	Buckeye Rolled Oats (in bulk)	.074	.149	.075	.682	.021	1955
6239	Buckeye Rolled Oats (in package)	.080	.147	.075	.678	.020	1970
6241	Echo White Rolled Oats	.082	.146	.075	.677	.020	1965
6243	Hecker's Rolled White Oats	.086	.144	.081	.669	.019	1980
6240	Peoria Rolled Oats	.068	.145	.078	.689	.020	1970
6246	Quaker Rolled White Oats	.081	.148	.086	.666	.020	1955
6247	Tip Top Rolled Oats	.091	.161	.079	.648	.020	1950
	WHEAT PREPARATIONS.						
6264	Fruen's Best Wheat Wafers	.113	.093	.021	.754	.019	1750
6263	Fruen's Rolled Wheat	.106	.095	.020	.761	.017	1745
6254	H-O Company's Breakfast Wheat	.117	.101	.016	.748	.018	1765
6256	Old Grist Mill Rolled Wheat	.112	.096	.019	.756	.016	1775
6258	Pettijohn's Breakfast Food	.107	.119	.018	.739	.017	1780
6249	Cream of Wheat	.106	.118	.010	.763	.004	1775
6251	Farinose	.094	.141	.030	.720	.014	1840
6252	Fould's Wheat Germ Meal	.111	.109	.023	.743	.014	1745
6268	Germea	.115	.129	.024	.719	.013	1795
6250	Hecker Farina	.114	.105	.009	.767	.004	1760
6257	Old Plymouth Breakfast Food	.123	.129	.022	.716	.011	1775
6259	Pillsbury's Vitos	.093	.119	.015	.766	.007	1815
6260	Ralston Health Club Breakfast Food	.121	.107	.014	.751	.008	1745
6261	Wheatena	.086	.150	.035	.712	.017	1885
6262	Wheatlet	.116	.136	.019	.718	.011	1780
6265	Shredded Whole Wheat Biscuit	.188	.106	.015	.756	.015	1780
	GLUTEN PREPARATIONS.						
6218	Cooked Gluten	.089	.154	.035	.699	.022	1880
6253	Dr. Johnson's Glutine	.102	138	.009	.741	.011	1815
6269	Whole Wheat Gluten	.112	.159	.046	.656	.027	1865
	MISCELLANEOUS PREPARATIONS.						
6266	Cook's Flaked Rice	.114	.079	.001	.802	.004	1725
6229	Glen Mills Standard Crushed Barley	.103	.100	.009	.779	.010	1760
6267	Grape Nuts	.053	.117	.011	.797	.023	1870
6286	Malt Breakfast Food	.080	.134	.022	.750	.044	

DISCUSSION.

Corn Preparations.

The first four materials in the table are corn products. They differ comparatively little from corn meal in composition, containing, however, somewhat less fat. The average of 19 samples of granular corn meal as compiled in Bulletin 28 of the Office of Experiment Stations shows that one pound contains .125 pounds of water; .092 pounds of protein; .019 pounds of fat; .754 pounds of carbohydrates and .010 pounds of ash. The only claim that the manufacturers make concerning Crown Flakes, Hecker's Hominy and H-O Company's Hominy is that they are carefully prepared from the best quality of corn and are thoroughly kiln dried, so as to keep well. The low percentage of fat indicates that all of these goods were made from corn from which the germ was more or less removed. The Mazama people make an unwarranted claim on the package. They say, a package "provides, when cooked and ready for the table, 23 pounds of unsurpassed food, sufficient to sustain in health and vigor a family of seven for twenty-four hours." Assuming that the family of seven consists of a man, his wife and five children from two to ten years of age, they would require for their nourishment for one day 1⅓ pounds protein and enough fats and carbohydrates to furnish altogether 17,000 calories. A package of Mazama carries a little more than .2 of a pound of protein and has a fuel value of little less than 4,500 calories.

Uncooked Oat Meals.

The "A" and "C" oatmeals were sold in bulk, being put up in barrels. They differ in composition no more than is to be expected. The "A" oatmeal contains three per cent more protein than the "C." The McCann's oatmeal was put up in a five pound tin can and according to the label was made by John McCann, Drogheda, Ireland. The package carried an analysis by the city analyst of Dublin which differs only slightly from that of the sample here reported. The protein in this meal is considerably less than in American goods. Its high cost is accounted for by the tin package and its being imported goods

It would be difficult to see why anyone should prefer it to American goods.

Cooked Oat Preparations.

Hecker's partly cooked oatmeal (No. 6242) and Hecker's rolled white oats (No. 6243) differ in price and, so far as these two samples are concerned, in composition. The former carries a third more protein than the latter. Very few oatmeals contain so high a percentage of protein as sample No. 6242. Hornby's H-O (No. 6244) carries about the average percentage of protein, although on this package there is an analysis which claims 17.63 per cent instead of 13.40 per cent which the sample examined has. The same analysis calls all of the ash phosphates, ("brain and nerves"), which is of course not strictly in accord with fact. The American Cereal Company put their goods up under at least three names and in four forms. Quaker oats are sold only in package, Buckeye oats in package and barrel, and American Cereal Company's oats in bulk. The only apparent difference in the four kinds is the price. The Buckeye oats in bulk retailed in Bangor at 3 1-8 cents per pound, the American Cereal Company's rolled oats in bulk at 4 cents. The Buckeye oats in package cost in Bangor 5.3 cents, and the Quaker oats 6.9 cents a pound. They are all good quality rolled oats, and there seems to be no reason why one should pay 6.9 cents a pound when apparently just as good goods, made by the same company, sell for less than half that price. All of the rolled oats are good goods from the chemical standpoint, and there are no greater differences in composition than one would expect. The goods of different companies differ no more than different samples from the same companies probably would.

Wheat Preparations.

Judging from the protein content of the different wheat preparations is would appear that they are nearly all made from the soft starch wheats. This is an excellent way to utilize wheat relatively low in gluten, which will, in consequence, not make strong flour. For bread flours no wheats are so good as the hard wheats of high gluten content. For one restricted to a diet of wheat products, the hard wheats are more desirable, but

in a mixed diet there are other sources of protein, and the use of the softer wheats in mushes and the like is to be encouraged.

Fruen's Wheat Wafers at 6.9 cents a pound and Fruen's Rolled Wheat at 4 cents are apparently the same goods, one put up in paper, the other in barrels. The claims that these preparations are "the most natural food for mankind," "the great nerve, brain and muscle food," etc., are exaggerations, but we are so used to overstatement of facts in advertisements that probably no one is deceived by such claims.

The H-O Company's Breakfast Food claims to be made from California wheat, and the analysis, showing 10 per cent protein and 75 per cent of starch, indicates a soft wheat such as is grown in California.

Old Grist Mill Rolled Wheat is also made "from the finest California white wheat." Pettijohn's Breakfast Food "is made from selected Pacific coast wheat." The sample analyzed carries 2 per cent more protein than most of the above mentioned brands.

Cream of Wheat claims to be "composed almost entirely of pure gluten, is one of the healthiest and most nutritious foods known." It claims also to be "made from the very choicest of selected hard spring wheat and being almost pure gluten, is highly recommended for the use of diabetic persons." The claim that Cream of Wheat is "almost pure gluten" is false and should be criminal. As a food for people in health, Cream of Wheat is all right. Diabetic persons should avoid starch and sugar, and this preparation contains 75 per cent of these carbohydrates.

Farinose, "a pure preparation from Ohio's best amber wheat," is the richest in protein of any of the samples examined and in this respect more nearly resembles the oatmeals.

Fould's Wheat Germ Meal "is made from the glutinous portion of choice wheat." If this statement means (and it is evident that it was intended to convey this meaning) that in its manufacture the starchy part of the wheat is excluded, it is not true. Although made by a patented process, the resulting preparation chemically resembles ordinary white wheat preparations in starch and in protein content.

Germea is "prepared from the choicest California white wheat" by the Sperry Flour Company of San Francisco. The

sample examined differs from the average of California wheat products by containing a higher percentage of protein.

Hecker's Farina, judging from appearance and composition, is a finely ground white wheat flour. The only drawback to the goods for the purposes mentioned on the wrapper is the high cost, 14 cents a pound.

The statement that "Old Plymouth Breakfast Food is made from carefully selected *glutinous* wheat" accords fairly well with its analysis which shows it to contain more protein than the most of the other wheat preparations examined. That it "is the most economical of all cereal foods" is not so evident. It costs at retail at the rate of 8 cents per pound, and equally good wheat preparations are sold in bulk at one-half the price.

Pillsbury's Vitos is the "choicest product of carefully selected Northwestern hard spring wheat." The analysis on the package calls for 16.64 per cent of protein, and the sample examined carries only 11.9 per cent. The first analysis corresponds with a hard wheat, while the sample reported bears evidence of having been made from a soft winter wheat. The claimed analysis shows 6.68 per cent of water; the sample examined carried 9.30 per cent.

Ralston Breakfast Food, "a perfect food made from selected wheat rich in gluten," is also apparently made from a soft winter wheat. The sample examined carries 10.70 per cent of protein, and hence could not have been made from a "wheat rich in gluten." It is a well made preparation, but its cost of 8 cents a pound is too high.

The Health Food Company's Wheatena contains the highest percentage of protein of any of the wheat preparations examined by the Station. While some of the claims made by the company for Wheatena are not fully borne out, they do call attention to the fact that it can be used, "in all cases and conditions and by all beings, *except such as suffer from the disease known as diabetes.*" Its high cost, 11.4 cents per pound, prevents its use as an economical cereal food.

"Wheatlet," made from choice selected wheat "especially rich in the nitrogenous elements," is a well prepared food of good composition, carrying a higher per cent of protein (13.6%) than most of the wheat preparations.

There is probably no other cereal food on the market so widely and extensively advertised as Shredded Wheat Biscuit. For the most part its advertising matter is free from exaggerated statements. Its chemical composition is that of good quality winter wheat. It is the highest in price of any of the wheat preparations, costing nearly 15 cents a pound. From this fact it should not have a place upon the table of those who are trying to live economically.

The average composition of the different classes of corn, oat and wheat preparations is compared with milk and a good quality of bread flour in the following table.

WEIGHT OF NUTRIENTS AND FUEL VALUE OF ONE POUND OF THE MORE IMPORTANT CLASSES OF CEREAL FOODS AS FOUND IN THE MARKET COMPARED WITH MILK AND FLOUR.

Classes of Foods.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value per pound.
	Pound.	Pound.	Pound.	Pound.	Pound.	Calories.
Milk	.865	.035	.042	.051	.007	337
Flour	.128	.131	.013	.723	.005	1645
Corn foods	.114	.084	.007	.791	.004	1740
Oat meals	.060	.148	.084	.682	.021	2018
Rolled oats	.081	.150	.078	.671	.020	1965
Wheat meals	.108	.124	.020	.737	.010	1790
Rolled wheats	.111	.101	.019	.752	.017	1765

Miscellaneous Preparations.

Cook's Flaked Rice is "manufactured from the best Carolina head rice." It has practically the same composition as raw rice, but is cooked ready for use. Rice is much lower in protein content than wheat or oats, and more nearly resembles Indian corn in composition. Best Carolina head rice retails for 10 cents a pound. The price asked for the cooked flaked rice in packages makes its cost about 15 cents per pound.

Glen Mills Crushed Barley has about the same composition as bolted barley meal. Its cost, 7½ cents a pound, is about that of the wheat preparations in packages.

Malt Breakfast Food is prepared "from the best barley malt and the choicest wheat." It contains as much protein as the best of the wheat foods. The analysis here reported agrees as closely as would be expected with that on the package.

Grape Nuts, manufactured by the Postum Cereal Company, is "made by special treatment of entire wheat and barley." These goods have nearly the same proximate composition as the wheat foods. Part of the starch has been changed into dextrin and grape sugar. The claims of the makers are preposterous. Grape Nuts "are a condensed food." "Four heaping teaspoons of Grape Nuts are sufficient for the average meal." "The system will absorb a greater amount of nourishment from 1 pound of Grape Nuts than from ten pounds of meat, wheat, oats, or bread." A man at moderate work needs per day about .28 pounds of protein and sufficient fats and carbohydrates in addition to make the potential energy of the day's food 3,500 calories. Four heaping teaspoonfuls of Grape Nuts weigh about 1 ounce. The protein and energy needed for one meal (⅓ of 1 day) and that furnished by 4 heaping teaspoonfuls of Grape Nuts are compared in the following table:

	Protein —lbs.	Fuel value —calories.
Needed for ⅓ day by man at moderate work..	.090	1,175
Furnished by four heaping teaspoonfuls, (1 oz.) of Grape Nuts.....	.007	117

It would require .77 pounds of Grape Nuts (¾ of a package) to furnish ⅓ of the protein needed for one day for a man at moderate work; the energy needed would be afforded by .63 pounds.

The nutrients of beef are more completely digested and absorbed than those of vegetable foods. There is no reason for thinking that Grape Nuts would be more completely digested than rolled oats, wheat flour or wheat bread. About 85 per cent of the protein and of fuel value of vegetable foods are digested and rendered available to the body. In the following table there are compared the pounds of protein and fuel values of one pound of Grape Nuts with "ten pounds of meat, wheat, oats or bread."

POUNDS OF PROTEIN AND FUEL VALUE OF ONE POUND OF GRAPE NUTS COMPARED WITH 10 POUNDS OF BEEF, ROLLED WHEAT, WHEAT FLOUR, ROLLED OATS AND BREAD.

	Protein —lbs.	Fuel value —calories.
1 pound of Grape Nuts	.12	1,870
10 pounds round steak, including bone	1.90	8,950
10 pounds beef rump, including bone	1.29	14,050
10 pounds rolled wheat	1.01	17,650
10 pounds bread flour	1.31	16,450
10 pounds rolled oats	1.50	19,650
10 pounds white bread	.80	12,200

While there is no question that Grape Nuts is a good cereal food, it is difficult to understand why the manufacturers should make claims so absurd and contrary to fact.

Gluten Preparations.

It was the intention to confine this study to the breakfast cereals, but as local physicians were prescribing certain so-called gluten foods for diebetic patients, the three in most common use were analyzed. Gluten preparations, containing as high as 70 per cent of protein, were on the market five years ago, and there are now preparations carrying from 30 to 50 per cent of gluten which can be used with reasonable safety by persons suffering from diabetes. As is seen from the table, the Health Food Company's Cooked Gluten, Dr. Johnson's Glutine, and the Health Food Company's Whole Wheat Gluten carry only a little more protein and a little less carbohydrates than ordinary flour. Samples of flour made from the hard spring wheat of the Northwest not infrequently carry more protein that the sample of Dr. Johnson's Glutine and nearly as much as the two other samples here reported upon. Too much can hardly be said in condemnation of the foisting, by false statements in advertising, such materials upon diabetic patients, imposing upon physicians as well as the public. As articles of food for healthy persons, or for the undernourished, those so-called glutens are excellent, and whole wheat gluten at 11 cents a pound is no more expensive than some breakfast cereals. The two others each cost at retail

about 27 cents a pound. The analyses of these materials compared with ordinary bread flour bought by the Station in the open market are given, calculated on dry matter, in the table which follows:

COMPOSITION OF WATER-FREE-MATERIAL OF ORDINARY BREAD FLOUR AND THREE GLUTEN MATERIALS.

	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value.
	%	%	%	%	Calories.
Bread Flour	15.02	1.50	82.91	.57	–
Cooked Gluten*	16.88	3.86	76.80	2.46	4555
Whole Wheat Gluten*	17.89	5.20	73.85	3.06	4628
Dr. Johnson's Glutine	15.31	.99	82.53	1.17	4455

* Made by the Health Food Company.

PECUNIARY ECONOMY.

While the composition of foods would seem to be a matter of prime importance, to the average consumer the cost is a matter of equal importance. An intelligent selection can be made only by considering both factors. In the following table there is shown the amount of the various constituents that can be purchased for 10 cents at the prices mentioned, milk at 5 cents per quart and flour at 3 cents per pound being added for comparison.

A study of the table shows that protein is furnished more cheaply by oat preparations than by those of corn or wheat. The oats also supply fat 10 times as cheaply as the corn products, and 5 times as cheaply as the wheat foods. The carbohydrates are supplied most economically by the corn preparations, oats ranking second. In fuel value, oats again rank first.

If wheat flour be included in the comparison, it will be found to be the cheapest source of protein and carbohydrates. With the exception of one sample of rolled oats, it also leads in fuel value.

AMOUNTS OF NUTRIENTS FURNISHED FOR TEN CENTS IN CEREAL FOODS AT ORDINARY PRICES, COMPARED WITH MILK AND FLOUR.

Name of Food.	Prices per pound.	Ten Cents will Pay for—					
		Total food materials.	Nutrients.				Fuel value.
			Total.	Protein.	Fats.	Carbo-hydrates.	
	Cts.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Calo.
Milk	2.5	4.00	.51	.14	.17	.20	1350
Flour	3.0	3.33	2.88	.43	.04	2.41	5471
Crown Flakes	5.7	1.75	1.54	.14	.02	1.38	3047
Hecker's Hominy	4.1	2.44	2.16	.21	.01	1.94	4221
H-Company's New Process Hominy	4.5	2.22	1.95	.18	.01	1.76	3832
Mazama	6.0	1.67	1.48	.14	.02	1.32	2956
A Oat Meal	4.0	2.50	2.27	.44	.19	1.64	5065
C Oat Meal	4.0	2.50	2.26	.36	.19	1.71	4940
McCann's Finest Oat Meal	10.7	.93	.86	.12	.09	.65	1910
Hecker's Oat Meal	7.1	1.41	1.25	.27	.10	.88	2807
Hornby's H-O Oat Meal	7.3	1.37	1.21	.18	.11	.92	2667
Rolled Oats, American Cereal Company's	4.0	2.50	2.26	.35	.19	1.72	4935
Rolled Oats, American Cereal Company's	4.0	2.50	2.28	.38	.19	1.71	4920
Buckeye Rolled Oats (in bulk)	3.1	3.23	2.92	.48	.24	2.20	6318
Buckeye Rolled Oats (in package)	5.3	1.89	1.70	.28	.14	1.28	3720
Echo White Rolled Oats	5.1	1.96	1.77	.29	.15	1.33	3855
Hecker's Rolled White Oats	5.2	1.92	1.72	.28	.16	1.28	3805
Peoria Rolled Oats	4.0	2.50	2.27	.36	.19	1.72	4928
Quaker Rolled White Oats	6.9	1.45	1.30	.21	.12	.97	2832
Tip Top Rolled Oats	4.1	2.44	2.16	.39	.19	1.58	4753
Fruen's Best Wheat Wafers	6.9	1.45	1.25	.13	.03	1.09	2539
Fruen's Rolled Wheat	4.0	2.50	2.19	.24	.05	1.90	4365
H-O Company's Breakfast Wheat	7.9	1.27	1.10	.13	.02	.95	2243
Old Grist Mill Rolled Wheat	7.1	1.41	1.23	.14	.03	1.06	2501
Pettijohn's Breakfast Food	7.0	1.43	1.26	.17	.03	1.06	2548
Cream of Wheat	9.0	1.11	.99	.13	.01	.85	1968
Farinose	7.3	1.37	1.22	.19	.04	.99	2522
Fould's Wheat Germ Meal	4.9	2.04	1.79	.22	.05	1.52	3558
Germea	8.6	1.16	1.01	.15	.03	.83	2083
Hecker's Farina	14.0	.71	.62	.07	.01	.54	1249
Old Plymouth Breakfast Food	8.0	1.25	1.08	.16	.03	.89	2219
Pillsbury's Vitos	6.2	1.61	1.44	.19	.02	1.23	2919
Ralston Health Club Breakfast Food	8.0	1.25	1.09	.13	.02	.94	2183
Wheatena	11.4	.88	.79	.13	.03	.63	1656
Wheatlet	6.9	1.45	1.27	.20	.03	1.04	2580
Shredded Whole Wheat Biscuit	14.8	.68	.59	.07	.01	.51	1210
Cooked Gluten	27.3	.37	.33	.06	.01	.26	696
Dr. Johnson's Glutine	27.7	.36	.32	.05	.00	.27	653
Whole Wheat Gluten	11.0	.91	.78	.14	.04	.60	1696
Cook's Flaked Rice	17.6	.57	.50	.04	.00	.46	984
Glen Mills Standard Crushed Barley	7.5	1.33	1.18	.13	.01	1.04	2342
Grape Nuts	15.9	.63	.58	.07	.01	.50	1179
Malt Breakfast Food	10.1	.99	.89	.13	.02	.74	

APPLE INSECTS OF MAINE.

F. L. Harvey and W. M. Munson.

Specific directions for spraying the apple for insect and fungous pests have been prepared by one of the writers and will be sent, free of cost, on application to the Agricultural Experiment Station, Orono, Maine. The indiscriminate killing of insects should, however, be guarded against, as all are not injurious. Many are parasites upon the injurious species, or at some period devour their eggs or young.

These beneficial insects should be recognized when seen, and should be protected and encouraged. Attention is particularly called to the ichneumon, syrphus and tachina flies, and to the lady birds and ground beetles, illustrated in plate I. The ichneumon flies have four wings and are related to the wasps and bees. There are numerous minute forms which prey upon the eggs and larvæ of injurious insects, and larger forms that deposit their eggs upon the caterpillars. Syrphus and tachina flies are two-winged insects, the former of which, in the larval stage, devour plant lice, and the latter are parasitic upon the larvæ of other species. The lady birds and ground beetles are carnivorous, feeding upon both larvæ and perfect forms of other insects.

In the following pages only the more important insects injurious to the apple are discussed, and methods of treatment suggested.

EXPLANATION OF TERMS.

An insect with a complete life history passes through four stages; viz., egg, larva, chrysalis or pupa, and imago or mature insect. The egg hatches into the larva—i. e. caterpillar, worm, grub, or maggot, as the case may be; the larva, after a time, changes to the pupa or chrysalis, which is the inactive or resting state, and may be naked or enclosed in a cocoon; the pupa, after a longer or shorter period, develops into the imago or perfect insect.

A. Insects Affecting The Trunk and Branches.

THE ROUND-HEADED APPLE TREE BORER. *Saperda candida,* Fabr.

The round-headed borer was first recorded in 1824 by Thomas Say, but was doubtless a native of America, widely distributed at that time, though unnoticed. While it prefers the apple, it also affects the native crab apple, sugar pear, thorn bush, pear, quince, and roundwood.

Description.

Eggs.—Minute, yellowish white.

Larva.—When full grown about one inch long; footless, yellowish white. Head small, chestnut brown, polished, hornlike; jaws two, black; the second joint large and broad, the next two narrow. Rings of the body (segments), from the fourth to the tenth inclusive, armed on the upper side with two fleshy warts.

Pupa.—Lighter colored than the larva and with transverse rows of minute spines on the back.

Perfect Insect.—A beetle, about three-fourths of an inch long, with two broad white stripes extending from the head to the ends of the wing cases; cinnamon brown above; hoary white below; legs, antennæ and face whitish.

Life History.

The eggs, according to Mr. Chas. Pope, who has gathered hundreds of them, are laid in a short slit, made by the beetle with the ovipositor, in the smooth bark. Sometimes the eggs are laid in the bottom of the slit next to the wood, but generally in an opening made in one side of the slit, half way through the bark. Several eggs, sometimes ten or a dozen, are laid on the same tree, being distributed around the trunk usually within six inches of the ground, but occasionally higher and sometimes at the base of the limbs. They are deposited from June to September, in Maine. The egg soon hatches and the young larva gnaws its way into the inner bark and sap wood. When winter comes the young borer works its way, in the wood, below the surface of the soil. In the spring it ascends and passes the second summer in the sap wood. It spends the second winter below the surface of the soil, as it did the first. The third summer it ascends and bores deep channels in the wood in every direction and finally bores upward and outward, nearly to the bark, lines the cavity with borings and transforms to the pupa. The third

spring it emerges, deposits its eggs, and the cycle of life is complete.

Vulnerable Points and Remedies.

The eggs are laid in the bark, in plain view, and can be readily detected and taken out. The young larvæ are readily located by the flow of sap from the wound they make, and by the chippings they push out of the mouth of the borings.

The perfect insect may be prevented from depositing eggs by the application of repellants to the trunk of the tree, e. g., tarred paper, or a mound of earth. Soft soap, or whitewash, applied to the trunk of the tree in June and July, is said to prevent the beetle from laying her eggs on the trees thus protected. The trees should be examined twice each year, in May and September, and the young larvæ removed. Should any escape, and penetrate deeply into the wood, they may be destroyed by probing with a sharp wire.

THE FLAT-HEADED APPLE TREE BORER. *Chrysobothris femorata,* Fabr.

This insect, a native of America, is common in Maine. Besides the apple, it is known to attack the pear, plum and peach, also the oak, box-elder, hickories and maples. The injury attributed to the round-headed borer is often due to it.

Description.

Eggs.—Pale yellow, varied, with one end flattened, irregularly ribbed.

Larva.—Soft, flesh-like, pale yellow; head small, deeply set; jaws black; third segment twice as broad as any of the posterior ones, and bearing on its upper surface a large, oval, callous-like projection, covered with numerous raised brown points.

Pupa.—Lighter colored than the larva and with transverse rows of minute spines on the back and a few at the extremity of the body.

Perfect Insect.—A beetle, variable in size but usually about one-half inch long, oblong-flattish in shape, of a dark, dull greenish color with a coppery reflection; under side and legs brilliant copper color; feet green. On each wing case are two irregularly oblong spots of deeper copper color than the remainder of the wing, dividing the wing cases into three nearly equal portions. The upper surface appears as though sprinkled with an ash-colored powder.

Life History.

The beetle makes its appearance in June or July in our latitude. It loves the light and may frequently be seen about the

orchard on the trees. It is very active and hard to catch, quickly taking wing. It lays, probably, about one hundred eggs.

The female fastens her eggs, singly or in groups, to loose flakes of bark, or in the crevices, by means of a glutinous substance. The eggs soon hatch and the young larvæ gnaw through the bark and live on the sap wood, making flat channels next to the bark, sometimes girdling the trees. As they get older they bore upward into the solid wood and, when ready to change to the chrysalis, gnaw to the bark and nearly through it. They then change to the chrysalis, and in about three weeks the beetles come forth. The larvæ attack the trunk and larger branches and remain in the tree but one year.

Vulnerable Points and Remedies.

Same as for the round-headed borer.

THE OYSTER-SHELL BARK LOUSE. *Mytilaspis pomorum*, Bouché.

The oyster-shell bark louse is a native of Europe and was introduced into this country, on nursery stock, about a hundred years ago. It is widely distributed, and is exceedingly common in Maine. The twigs of apple trees are often literally covered with the scales, causing great injury. Besides doing great damage to apple trees, this scale is found on the pear, plum, cultivated and wild currant, roundwood, dog wood, and several other shrubs and trees.

Description.

Eggs.—White, changing to yellowish or reddish with age, oblong, about .01 inch long; from 20 to 100 under each scale.

Young females.—Wingless, white and about .01 inch in length, move about quickly, appearing on the branches as small white specks which finally attach themselves, by their beaks, to the new shoots, where the scale is perfected.

Scale of female.—Wingless, about .08 of an inch long, narrow, widened at the posterior end, curved and shaped somewhat like an oyster shell. Brown or grayish, closely resembling the bark in color. Most frequently placed with the small end toward the tip of the twig.

Scale of male.—Much smaller than the female, wedge shaped and straight; usually placed on the leaves and rarely seen. The male insect undergoes a complete metamorphosis, and in the perfect form is provided with two wings.

Life History.

The eggs hatch late in May or early in June. If the weather is cold, the lice remain under the scale until warm weather, when they may be seen running about the twigs for a location to attach themselves. The most of these fix themselves around the bases of the side shoots of the twigs, by means of their tiny slender beaks, and live upon the sap of the tree. They gradually undergo changes. Before the close of the season the louse secretes the scale under which it lives and perfects itself. By the middle of August the female becomes a bag of eggs, which are deposited in a mass under the scale, the body of the louse shriveling, as the eggs are laid, until it is a mere speck at the small end of the scale. These eggs remain under the scale, if not destroyed, until the following spring and then hatch, completing the life history.

How this pest is spread from tree to tree is not well made out, but it is supposed that birds carry them on their feet and that large insects may transport them or that the wind may blow the young about. They are probably introduced into young orchards on the nursery stock and multiply.

Remedies.

During the winter examine the twigs and scrape off the scales, after which, wash with a strong solution of caustic soda or washing powder, applied with a stiff brush. In June, while the lice are still active, spray with an alkaline solution, or better, with kerosene emulsion.

There are several natural enemies which help to keep the insect in check. One of the most important of these is a species of mite, which preys upon the louse as well as upon its eggs. This mite is so small as to be seen only with a microscope.

Another important aid in controlling this pest is the twice-stabbed lady-bird. Both larva and perfect beetle devour large numbers of the lice. The mature form of this insect is readily recognized by its polished black wing-cases with a blood-red spot on each.

THE PEAR-BLIGHT BEETLE, OR SHOT-BORER. *Xyleborus pyri,* Peck=*X. dispar,* Fabr.

This is a native species that attacks hemlock, beech, oak, and cedar, and has transferred its depredations to apple trees in Maine. We have received from several localities specimens of apple limbs that were literally honeycombed with small channels that extended through the laburnum and heart wood to the center. The young larvæ bore into the wood, making deep channels which in small twigs interfere with the circulation of the sap, and the twigs wither, giving the appearance of blight, hence the name pear-blight beetle. The work of this beetle should not, however, be confounded with the pear-blight proper, which is caused by bacteria. The exit holes through the bark were .06 of an inch in diameter and nearly circular, looking like small shot holes. The wood was green, showing that the insect attacks the growing tree. Living wood does not appear to be essential to the life and comfort of this species, for after a period of several weeks we found in a limb that had been in a dry place in a box, young larvæ, full grown larvæ, pupæ, and perfect beetles.

Description.

So far as we know, the eggs have not been described. They must be very small and are said to be laid at the bases of the buds. We have never seen them.

When the larvæ are full grown they transform to pupæ in the burrows, and finally emerge as small beetles about one-tenth of an inch long and of a dark brown or nearly black color, with the antennæ and legs of a rusty red. The thorax is short, very convex, rounded and roughened. The wing covers are marked by longitudinal rows of punctures. The hind part of the body slopes abruptly. The beetles leave their burrows in July and deposit eggs before August.

Remedies.

As the beetles work wholly under the bark they cannot be reached by insecticides. The only way is to watch the trees during the latter part of June and July and, if blighted twigs or diseased limbs are noticed, examine the branches for small pin holes; if found, the presence of this or some related species may be suspected. The diseased limb should at once be cut far enough below the injury to include all the burrows, and burned,

to prevent the beetles emerging and attacking new trees. As these beetles live in forest trees, orchards near timber are more liable to become infested.

THE WOOLLY LOUSE OF THE APPLE. *Schizoneura lanigera*, Hausm.

Two forms of this insect are recognized by entomologists. One, known as the apple-root plant-louse, attacks the roots, producing wart-like excrescences or swellings. The other form, known as the woolly louse of the apple, is the one found in Maine. It feeds upon the sap of the trunk and branches. The two are regarded as the same species, living under different conditions. The above ground form occurs most abundantly, in this country, in New England. Entomologists differ in their opinions regarding its nativity; some accredit it to America; most are inclined to think it originated in Europe, where it is much more destructive than in this country.

This insect, in the root form, was noticed in this country as early as 1848, when thousands of trees were found so badly infested that they had to be destroyed. Since then the insect has been reported as doing more or less damage in every section of the country. The pest is distributed upon nursery stock, and the importance of carefully examining nursery stock before setting is strongly urged.

Description and Life History.

The eggs, which are very minute, are laid in the crevices of the bark at or near the surface of the ground.

The young when first hatched appear like specks of mold, being covered with fine white down. As they get older, the cottony covering becomes more distinct, apparently issuing from the pores of the skin of the abdomen and attaining considerable length. The young have beaks longer than the body and, when grown, this organ is fully two-thirds the length of the body. By means of the beak, they attach themselves to the roots or branches, and when abundant, draw heavily upon the vitality of the tree, or may even kill it.

When full grown the females are about one-tenth of an inch long, oval; head and feet black; legs and antennæ dusky; abdomen yellowish; body covered with white mealy powder; a tuft of long, easily detached down upon the hinder part. Under each patch of down is usually found a female and her young. During the summer the females are wingless

and the young are produced alive. Toward the fall the broods contain both winged females and winged males, which have not much down on them and are plump and nearly black. The fore wings are about twice as long as the narrow hind ones. These winged females fly about to other trees and lay eggs, establishing new colonies. During the early part of the season this form of the insect is found in clusters about the base of the trunk, upon suckers or twigs springing from the trunk, but in autumn they commonly attack the axils of the leaves and sometimes cover the whole under surface of the limbs and trunk, making the tree look as though whitewashed.

Remedies.

In early spring wash the tree with a strong solution of soft-soap or washing powder. Later in the season spray with kerosene emulsion.

B. Insects Affecting the Foliage.

THE BUD MOTH. *Tmetocera ocellana,* Schlieff.

This is probably one of the worst pests to apple orchards in Maine. It works in the unfolding flower and leaf buds of orchard trees, often doing great damage to the crop, besides attacking nursery stock and young trees. It seems to be on the increase in Maine and did much damage in the season of 1899. It is an European insect but is now widely distributed in the northern U. S. and Canada. Besides the apple, it feeds upon the pear, plum, cherry, quince and peach trees, and in Maine has been bred from blackberry plants.

Description.

Eggs.—Disc-shaped, transparent, flattened, usually oval or sometimes circular in outline. The center of the disc elevated, the outer flat rim attached to the leaf.

Larva.—When first hatched, greenish, with head and first thoracic segment black. It molts four times before hibernating. The half-grown caterpillar, which appears on the buds in spring, is about one-sixth of an inch long, brown, with a black head, thorax, shield and legs. When full fed, about the last of June, it changes to the pupa stage within a tube of dead leaves.

Pupa.—Light brown, about a quarter of an inch long. On the back of each abdominal segment are two transverse rows of teeth directed backward.

Perfect Insect.—A moth with three-fifths inch spread of wings. It may be known by the ash-gray color of the fore wings, which are banded across the middle with a cream white band.

Life History.

The half-grown, brown, hibernating caterpillars usually emerge from winter quarters about the time the buds begin to expand, their first appearance depending on the advance of the season, and ranging over two or three weeks. When they are out early, they gnaw into the buds. If the buds are open they crawl inside. They attack both flower and leaf buds, fastening the parts together with silken threads, forming a nest, within which they feed upon the enclosed tender flower or leaf parts. They do not confine their depredations to a single leaf or flower in the bud, but increase the injury done by sampling nearly all. They sometimes bore down the stems a few inches, killing the terminal shoots. The bud attacked turns brown, making the nest conspicuous. The caterpillars feed mostly at night for six or seven weeks and molt three times. When full grown the caterpillar forms a tube out of leaves, which it lines with thin, closely woven silk, and within it soon changes to the pupa. In about ten days the pupa works its way nearly out of the tube by the hooks on its back. The skin splits open and the moth appears. The moths are on the wing during the latter part of June and the first of July. They fly mostly at night, resting on the trees during the day time, when they are easily detected by the white bands on the wings. They live two or three weeks, during which time they mate and the eggs are laid. The eggs, which resemble small fish scales, are laid singly or in clusters, mostly at night, on the under side of the leaves. The eggs hatch in seven to ten days. The young larvæ feed upon the epidermis of the leaf, forming a silken tube for protection. After the fourth molt, which occurs the last of August or the first of September, or before the leaves fall, they leave the silken tubes and form a silken winter home (*hibernaculum*) on the smaller twigs near the buds, in which they spend the winter. The appearance of the hibernating larva in the spring completes the cycle of life.

Remedies.

Pull off and crush the withered clusters of leaves containing the caterpillars and chrysalids early in spring.

Spray with Paris green or with Bordeaux mixture and Paris green, as soon as the buds begin to swell in the spring.

THE OBLIQUE-BANDED LEAF ROLLER. *Cacœcia rosana,* Harris.

This is a native species, reported from several localities in the United States, and one of several species responsible for the destruction of the buds and foliage of apple trees. We have bred it from the leaves of the apple, currant and strawberry in Maine. It also feeds upon the plum, pear, peach, cherry, rose, and a great variety of other trees and shrubs.

Description.

Eggs.—So far as we know, the eggs have not been described.

Larva.—Length .8 of an inch; livid green when young, becoming yellowish green, reddish or brownish with age. Head oval, top of first segment yellow or brown; usually a darker green stripe along the back. The posterior half of the segments wrinkled transversely, and bearing a few minute tubercles from which single hairs arise. When mature the larva spins a silk lining to the leaf in which it lives and changes to a chrysalis of a dark brown color from which emerges the moth.

Perfect Insect.—A short, broad, flat, bell shaped moth, with about one inch spread of wing. The wings pale, reddish brown, crossed with wavy, pale brown lines and with three oblique darker brown bands, one of which covers the base of the wings, another the middle and the third a triangular spot on the front margin near tne tip.

Life History.

As soon as the leaves start, the caterpillars begin to coil up and fasten together the young leaves which they feed upon, and in which they find shelter. They attack the buds, leaves and also the young fruit, gnawing its surface or eating deep holes into it. They are full grown the last of June or early in July, when each lines its leaf house with silk, and changes to the chrysalis, from which the moth emerges the last of July. There is a second brood in August. We know nothing of its egg laying habits, or how or where it spends the winter.

Remedies.

The same remedies may be used for this insect as for the bud moth.

THE LESSER APPLE LEAF FOLDER. *Teras minuta,* Robr.

This is another of the small moths that do damage to the buds and leaves of the terminal shoots of the apple tree. It is particularly bad in Maine. It is said to be specially bad in nursery stock, and young orchards, but large trees also suffer. This is a well known cranberry insect and may get into orchards from the bogs.

Description.

Eggs.—The eggs, so far as we know, have not been described.

Larva.—A small, greenish yellow, active caterpillar, with a pale brown head. When disturbed it seeks the more secluded parts of its burrow, or if too much molested, wriggles out and drops to the ground.

Chrysalis.—Within the folded leaf, the larva spins a silken web and changes to a brown chrysalis, three-tenths of an inch long. There is a characteristic knob-like projection from the head end of the chrysalis.

Perfect Insect.—A small moth, with one-half inch spread of wing. There are three broods and the insect is dimorphic, the moths of the third brood being very different in color. These dimorphic forms were thought to be different species until carefully bred and studied. The moths of the first two broods have the head, thorax and fore wings a bright orange color; the hind wings, body and legs are whitish with a silken lustre. The moths of the third brood have the fore wings of a uniform ash-gray, or slate color with reddish luster by oblique light; hind wings light colored and semi-transparent.

Life History.

The gray-colored moths of the third brood hibernate in some sheltered place during the winter. In the early spring they come forth and deposit their eggs on the buds or unfolding leaves. The eggs hatch in a few days and the larvæ crawl between the unfolding leaves and begin feeding upon them, often fastening one or more leaves together by a silken web and living within them. They live upon the epidermis and pulp, but sometimes gnaw holes in the leaves, and sometimes forsake the nest, to feed on adjacent exposed leaves. When mature they spin a silken lining to the leaf and change to the chrysalis, where they remain about a week, and early in May the orange-colored moths of the first brood come forth. The larvæ of the second brood appear the last of May or early in June, and the moths the last of June or in July. The moths of the third brood appear in August, and hibernate, completing the round of life.

Vulnerable Points and Remedies.

The young larvæ of all the broods are exposed when they first hatch and before their leaf shelter is made. The same remedies apply to this insect as to the bud moth.

THE FOREST TENT CATERPILLAR. *Clisiocampa disstria,* Hübner.

There are two tent caterpillars in the eastern United States; the apple tree tent caterpillar, *Clisiocampa Americana,* and the forest tent caterpillar, which was called by Prof. Harris *Clisiocampa sylvatica,* but in recent literature is known as *Clisiocampa disstria.* Both species are common in Maine but are often confounded. Though similar in their life history, they are readily separated by differences in the egg clusters, caterpillars and moths.

Distinguishing Characteristics.—Egg clusters of this species, the same diameter throughout, docked off squarely at the ends; caterpillars with a row of spots along the back; oblique lines on the wings dark colored; web inconspicuous, closely attached to the limbs or trunk and easily overlooked. Insect restless, wandering from tree to tree. Occurs in orchards but, being a general feeder, is more commonly found on forest or shade trees, from which habit it receives its common name.

Description.

Eggs.—The egg clusters, composed of about 300 to 400 eggs, are attached to the terminal twigs of the food plant. They are of the same diameter throughout and cut off squarely at the ends. The eggs are creamy white, rounded at the base, enlarging upwards, narrowing again at the top and terminated by a circular rim on the border and a sunken spot in the center. They are held to the twig and to each other by a brown varnish, which also covers the egg clusters, protecting them from the weather and probably from their enemies.

Larva.—The eggs hatch in the early spring, usually about the time the buds are bursting. The time, however, varies with the exposure of the egg clusters to the sun, and also with the season. In Maine they are hatched the last of April or early in May. Sometimes, during continued warm weather, the eggs hatch before the leaves start, and cold weather comes on afterwards. The young larvæ are very hardy, however, and are not often killed. We have kept them alive in breeding cages for three weeks without food. They will eat the varnish on egg clusters. As soon as hatched they spin a web wherever they go, possibly to enable

them to retrace their steps. Soon the branches are lined with these silken patns along which they travel in search of food. They shed their skin (molt) four times, changing color and markings in the first three. They are full fed in about six weeks, though the growth may be hastened or retarded by the weather or food supply. At this time they may be seen wandering about for a suitable place to spin their cocoons.

Cocoon.—The larva spins a whitish-yellow cocoon, resembling that of the apple tree tent caterpillar, and by preference folds it in a leaf, but often attaches it to loose bark or about fences, houses or other places of concealment. Inside of the cocoon the caterpillar changes, in two or three days, to the chrysalis. In two or three weeks the moths emerge.

Perfect Insect.—A brownish yellow moth, expanding an inch and a half or more. The fore wings marked by two oblique brown lines, the space between them usually darker than the rest of the wing. The moths eat nothing. After they have mated and laid their eggs, they die, completing the life history.

Remedies.

(a) Collect the egg clusters in winter when the trees are bare.

(b) While young the caterpillars can be destroyed by spraying with Paris green, but when half grown the amount of poison they get in feeding will not kill them.

(c) After the third molt, they collect in bunches, on the trunks and branches, and can be reached by hand or by spraying. A solution of one pound of washing powder in four or five gallons of water, applied to the bunches by means of a swab attached to a long pole, has proved effectual.

(d) After the caterpillars begin to collect in bunches, or even before, spread a sheet of canvas under the tree. Climb the tree and with a padded mallet suddenly jar the branches on which they rest, and they will fall on the canvas and can be swept up and destroyed. This method is applicable to both orchard and shade trees, and would recommend itself to town authorities, as by the employment of a few men for a few days in June, in Maine, the shade trees could be protected.

(e) Put bands of cotton, or of tarred paper bearing a ring of a mixture of equal parts of sulphur and lard, around the trees, or use any other practical method to prevent them from ascending the trees. In our own experience a band of paper covered with the lard and sulphur mixture has proved an absolutely effectual barrier.

(f) The moths are night fliers and are attracted by electric lights and many are probably destroyed this way. The cater-

pillars, cocoons and moths should be destroyed by hand whenever possible.

(g) The city of Rochester, N. Y., has successfully enlisted the services of the school children in protecting the city shade trees. Pride in one's city adornment could be thus stimulated in pupils, and by collecting the egg clusters, caterpillars, cocoons and moths, a valuable and practical lesson in nature study would be learned. It would pay town authorities to offer a small bounty, if need be, to stimulate the collecting. All specimens collected should be burned.

Remarks.

For a fuller consideration of this insect and illustrations of all the stages in its life history, the reader is referred to Maine Experiment Station Report, 1888, p. 164; 1889, p. 188; 1890, p. 138, and 1897, p. 173; or to the Maine Agricultural Reports of the corresponding years.

THE APPLE TREE TENT CATERPILLAR. *Clisiocampa Americana*, Harris.

This insect is a native of North America and occurs wherever apples are grown. It has given more or less trouble to apple growers since the early settlement of the country. While it prefers wild cherry, and selects the apple as second choice, it feeds upon plum, peach, rose, and other members of the rose family; also upon the oak, poplar, willow, birch, witch hazel, beech, etc.

Description and Life History.

Eggs.—Dull gray; the upper end circular with a dark spot in the center. They are laid in clusters round the twigs and covered with varnish to protect them from the weather. There are from fifty to two hundred and fifty in a bunch.

Larva.—When first hatched they are dull black and sparsely covered with gray hairs. They appear about the time the leaves start, but if ahead of them, may feed for a time upon the varnish covering the eggs. They molt about six times. The larvæ soon begin to spin a web which increases in size by additional layers of silk as the worms grow, until it is sometimes ten inches or more across. The worms remain in the tent at night, during stormy weather and when not feeding, unless the weather is warm, in which case they may often be seen upon the outside, literally covering the web. They march in military order twice a day from the nest to feed, once in the morning and once in the afternoon.

They pave their roads with silk and follow along them to the leaves. When mature, each worm will consume two leaves a day and an average of five hundred leaves would be required for a colony. There are often several webs in a tree. The effects are to rapidly defoliate the tree and draw heavily upon its vitality to produce new leaves. The caterpillars require about six weeks to mature and are then about an inch and three-fourths long. The worms have a "white line along the back, then a yellow line dotted with black, then a black stripe marked with blue and yellow dots, then a wavy yellow line dotted with black, then a blue stripe dotted with yellow, then a broken white line; head black, under side of body black, the body covered with yellowish or whitish hairs." When mature the larvæ leave the tree and wander about in search of a place to spin their cocoons. They prefer the loose bark of trees, or the under side of fence caps, and will enter sheds and porches and climb the sides of houses and transform under the edge of clapboards, window caps and eaves. When the orchard is near they become a nuisance by entering the house.

Cocoon.—Oblong oval, light yellow, formed of a loosely woven, outer covering and a dense, tough, inner coat. The larva enclosed becomes a brown chrysalis and in about three weeks the moth appears.

Perfect Insect.—A moth of a pale, dull, reddish or reddish-brown color. The fore wings crossed by two oblique, parallel, dirty-white lines. The female is larger than the male. The male has feathery antennæ. The moth has no mouth and takes no food and lives only a few days. Its office is to lay the eggs.

Remedies.

Most of the remedies suggested for the forest tent caterpillar are equally valuable in controlling this insect. As this species does not migrate, the jarring and the protective bands are useless.

THE FALL WEB WORM. *Hyphantria cunea,* Drury.

The fall web worm is a native insect which has from time to time done great damage to forest and fruit trees. It is a general feeder, having been observed to feed upon over one hundred different species of trees, shrubs and herbs. It makes a web which is sometimes very conspicuous, attaining dimensions of several feet. The web can readily be told from that of the apple tree tent caterpillar.

We found this insect abundant in western Maine on July 5 when the webs were already quite conspicuous. In "Forest Insects," issued from the U. S. Department of Agriculture, Dr. Packard, on page 244, says: "The name fall web worm is most

expressive for New England and other northern states where the insect is single brooded, appearing there during August and September, while in more southern regions it is double brooded." Though we have not traced this insect through its life history in Maine, and cannot positively say that there are two broods, yet the fact that the webs were conspicuous and the larvæ fully three-fourths of an inch long early in July, would indicate two broods in western Maine.

Description.

Egg.—About one-sixth inch long, bright golden yellow, globular, ornamented with numerous regular pits, which, according to Packard, give it, under the magnifying lens, the appearance of a beautiful golden thimble.

Larva.—Pale yellow when young, with two rows of black marks along the body, a black head and sparse hairs. Full grown larva usually pale yellowish or greenish with a broad, dark stripe along the back and a yellowish stripe along the side, covered with whitish hairs that spring from black and orange yellow warts. The caterpillars are somewhat variable as to depth of color and marking, even on the same tree. The fall brood is generally darker colored than the spring brood.

Cocoon.—Thin, almost transparent, composed of a slight web of silk intermixed with a few hairs from the caterpillar, or sometimes mixed with sand when the cocoon is spun in the soil.

Pupa.—Length .6 inch, breadth in the middle, .23 inch; dark brown, smooth, polished, faintly punctuate, and bulged a little all around in the middle.

Perfect Insect.—A moth which varies greatly in size and color. These color varieties have received different names by entomologists, but are now reduced to *H. cunea,* Drury. The most common form is white or slightly fulvous with white wings, but the wings show variations from pure white to those profusely dotted with black and brown. Front thighs tawny yellow, sometimes marked with a large black spot; feet blackish; expanse of wings one and one-fourth to one and two-thirds inches. Male moth usually smaller with the antennæ doubly feathered beneath. The antennæ of the female possesses two rows of minute teeth.

Life History.

The female deposits her eggs in clusters, laid in regular rows or smaller irregular patches, on either side of the leaves, usually near the end of a branch. Each female lays on an average about five hundred eggs. Those for the first brood are deposited by the last of May or during June, and the time required for them to hatch depends upon the weather. Under favorable circumstances they mature in about ten days, or those of the second

brood in eight days. As soon as the caterpillars hatch they spin a small silken web which soon becomes conspicuous. Under this they feed together, upon the upper surface of the leaves. As they grow, other leaves and branches are included until the web reaches considerable size and contains dead leaves and the molt skins of the larvæ. If their food supply gives out, they quit the web and drop to the ground and crawl directly toward other trees with almost unerring instinct, or, when disturbed, let themselves down by a thread and by this regain the tree when the danger is past.

When full grown they are nearly two inches long and leave the web and wander about for suitable places to spin their cocoons. They select crevices in bark, the angles of tree boxes, rubbish about the base of trees, and other similar situations, while the fall brood prefer to bury themselves in the earth if possible, but adapt them elves to circumstances. They soon spin their cocoons. The pupæ contained in these hatch into the second brood of moths about the first of August, and the moths lay eggs which hatch into caterpillars that feed, mature, and spin their cocoons during August and September. The insects invariably spend the winter in the chrysalis state in the cocoon, and the following spring the moths emerge and lay their eggs, thus completing the life history.

Remedies.

Spray with Paris green before the insect makes much headway. If there are but few webs on the tree, cut off the branches and burn. Another effective remedy is a strong alkali, whale oil soap, or washing powder solution applied with a swab.

There are several predaceous insects which attack the larvæ, the most important being the spined soldier bug, *Podisus spinosus* (Dallas).

THE LIME TREE WINTER MOTH. *Hybernia tillaria,* Harris.

This is a native species often associated with the fall canker worm, which it resembles very much in its life history. It seems to remain and do damage when the fall canker worm has disappeared.

Description.

Eggs.—Pale yellow, oval and marked with a network of raised lines. They can be distinguished from the eggs of the canker-worm by their color and form. (See Report Maine Experiment Station, 1888, p. 167, Fig. 20).

Larva.—When full grown, about an inch and a quarter long; head dull red with a V-shaped mark on the front; yellow above and marked with many longitudinal black lines; the under side paler. Like the larva of the canker worm, it is a span or inch-worm, but it is larger than the caterpillar of that species.

Female Moth.—Wingless, spider-like, yellowish white; sides marked with black dots. Each ring of the body, excepting the last, which has only one, bears two black dots. Head black in front; antennæ thread-like. Ovipositor jointed and retractile; legs ringed with black. The larger size, the spotted back, and the black rings on the legs readily distinguish this from the wingless females of the fall and spring canker worms.

Male Moth.—Expanse of fore wings an inch and a half; color rusty buff, sprinkled with brownish dots and with two transverse, brown, wavy, lines, the inner most distinct. Between the bands and near the anterior edge is usually a brownish dot; hind wings paler; body color of fore wings; antennæ feathered. Like most of the moths of the inch worms, the wings are very delicate. The moths of the canker worm are on the wing at the same time, but they are smaller and are thus readily distinguished.

Life History.

The eggs, which are laid in situations similar to those of the canker worm, hatch early in the spring and the young larvæ feed upon the foliage of the apple tree, basswood, elm, hickory, etc., and when full grown, about the middle of June, they usually let themselves down by a silken thread, enter the ground about five or six inches and form a little oblong cell, within which they change to the chrysalis state. In October or November (sometimes not until the following spring), the moths appear. The wingless females climb the trees or other objects where they meet the winged males, pair and soon deposit the eggs in clusters, usually upon the branches of the trees they have infested, completing the life history.

Remedies.

The life history of this species is so nearly like that of the canker-worm that the remedies suggested for that insect are applicable to this. It has never done as much damage as the canker worm, but it is capable of doing much injury to the foliage of apple trees.

THE APPLE LEAF BUCCULATRIX. *Bucculatrix Pomifoliella*, Clemmens.

This moth was described by Clemmens in 1860. It is known to be widely distributed, having been reported from Texas, Missouri, Massachusetts, New York, and now from several localities in Maine. It has done considerable damage to the foliage of apple trees especially in New York.

Description.

Eggs.—So far as we know, the eggs of this species have never been described. They must be quite small as the cocoons of this diminutive moth have been mistaken for insect eggs. They are said to be laid upon the leaves.

Larva.—About one-half inch long when mature, cylindrical, tapering at both ends. Joints of the body rounded and prominent, color dark yellowish, with a greenish tinge and reddish shades on the anterior segments. Body armed with short black hairs which are more numerous on the back of the first segment. Head small, brown and ellipsoidal. The larvæ are active and when disturbed suspend themselves by a silken thread.

Cocoons.—Dirty white, slender, about one-fourth inch long, ribbed longitudinally by about six prominent ridges, oblong, tapering at both ends, flattened on the side to which it is attached. Usually fastened to the twigs and branches in groups.

Chrysalis.—Dark brown, rough, punctured on the back, about one-tenth of an inch long. When ready to transform, the chrysalis works itself partly out of the cocoon and the moth comes forth.

Perfect Insect.—A small moth that has only about one-fourth inch expanse of wings. Fore wings whitish, tinged with pale yellow and dusty brown. On the middle of the inner margin is a conspicuous oval brown spot; a wide streak of the same color on the opposite margin extending nearly to the end of the wing, where it tapers and points to a small circular brown spot near the tip.

Life History.

This insect spends the winter in the pupa state in the cocoon, usually attached to the twigs and branches of the host plant. There is reason to believe that the larvæ, when full grown, sometimes desert the host plant and form their cocoons on other plants close by. We have seen cocoons on the side of a building in Maine. About the time the leaves unfold, the moths come forth and lay their eggs upon the tender foliage. The larvæ are full grown in July. The specimens sent us in July were in the

larval form and went into the chrysalis state in August and emerged the following spring, a fact which would indicate only one brood in Maine. Prof. Riley believed that there are two or three broods in the latitude of St. Louis, Mo. In the latitude of New York, Prof. Lintner states that there are two broods, one in July and one in September.

In September or October the cocoons in which the pupæ spend the winter are formed. The larvæ feed externally upon the foliage, at least the leaves we have received had the upper epidermis and pulp eaten away in patches, the veins and lower epidermis intact.

Remedies.

(a) Jar the trees when the larvæ are full grown and they will suspend themselves by threads and can be swept down by a broom and killed by hot water or crushed.

(b) Apply kerosene emulsion with a spraying pump in winter, to the branches that bear the cocoons. The same application might be made for the first brood when the foliage is on.

(c) If in small numbers, the cocoons may be removed during the winter months by hand.

(d) Spray with Paris green, as for other leaf eating insects. This small moth is preyed upon by several parasites that attack the larvæ and hold the pest in check, and some of the cocoons probably suffer somewhat from inclemency of the weather. Possibly birds may eat them, but we find no record of observations.

THE WHITE-MARKED TUSSOCK MOTH. *Orgyia* (*Notolophus*) *leucostigma,* Sm. & Abb.

During the past ten years specimens of the above insect, in the egg, larval and wingless female stages of its life history, have been received at the Experiment Station from various parts of the State. It is a native species and is apparently widely distributed, having attracted considerable attention as an apple insect.

Description.

Eggs.—Three or four hundred in a mass, attached to the empty grayish cocoon previously occupied by the female moth. Egg mass convex, smooth, grayish-white; composed of several layers of eggs, with a frothy, gelatinous material between them.

Larva.—When mature, over one inch long; bright yellow; head, and two small protuberances on the back carrot-red; back ornamented with four cream-colored brush-like tufts; two long black plumes near the head and one near the posterior end of the body; sides clothed with yellow hairs; brown or black stripe on the back, and a dusky stripe on each side.

Cocoon.—Gray; spun on the inside of a leaf. Texture loose and the silk interwoven with numerous hairs from the caterpillar. Chrysalis, enclosed in the cocoon, oval, brown or sometimes whitish below, covered with whitish hairs or down.

Perfect Insect (female).—Wingless or wings mere rudiments; light gray, oblong-oval; body distended with eggs; legs long.

Perfect Insect (male).—Winged, expands an inch and a quarter; fore wings crossed by wavy bands of darker shade; a small black spot on the outer edge of the wing toward the tip; beyond it an oblique blackish stripe, near the outer hind angle a minute white crescent; body gray, with a small black tuft near the band of the abdomen; antennæ feathered.

Life History.

During the winter months there will occasionally be found in the orchard, dead leaves attached to the branches of the trees. Upon examination these will usually be found to contain an empty, gray cocoon with a mass of eggs attached to it, as described above. These eggs hatch, in Maine, about the first of June, or earlier farther south. The young larvæ at once begin to devour the leaves of the tree. When disturbed they lower themselves by means of a silken thread which they climb when danger is past. The beautiful caterpillars described above feed about two months and then spin their cocoons. The moths soon emerge and the wingless females, being little more than animated masses of eggs are sluggish. The males, having wings, are able to fly, and they meet the females while resting upon the empty cocoon to which the mass of eggs is finally attached. If there is only one brood, the eggs do not hatch until the following spring; if two broods, the eggs soon hatch, producing the second brood of caterpillars which complete their growth late in the season and enter the chrysalis state. The moths soon emerge, mate, and the female lays the eggs on the cocoon, completing the life history.

Remedies.

Collect and destroy the eggs and cocoons during the winter. Spray with Paris green, or with Paris green and Bordeaux

mixture. Usually no special treatment is required for this insect if the trees are thoroughly protected from the tent caterpillar.

THE FALL CANKER WORM. *Anisopteryx pometaria,* Harris.

This insect has been very bad at times in Maine, doing much damage to fruit and shade trees. Parasites and other enemies soon control it, however, so that it does not usually do damage in the same locality more than two successive seasons.

Description.

Eggs.—Grayish, flattened above, with a central puncture and a brown circle near the border. Each female lays 100 or 200 eggs in rows arranged in clusters on the twigs or branches, or on fences and buildings, usually in exposed situations.

Larva.—Pale olive green when young, but varying in color, when grown, from greenish yellow to dark brown. Dorsal band broad, brownish; lateral lines three, white, the middle one paler; broad brown bands below the lateral lines, and below that a broad white band. Under side, flesh-colored; head brown.

These caterpillars belong to the group of inch or measuring worms, because they alternately loop and extend the body in moving. When at rest they sometimes assume an erect position, and can hardly be told from twigs. When full grown they are about one inch long. When mature they crawl down the trunk or let themselves to the ground by a silken thread, and burrow to a depth of from two to six inches. They make a tough cocoon of buff colored silk interwoven with earth, and in twenty-four hours turn into the chrysalis.

Chrysalis.—Light greyish brown; about half an inch long. The male slender, and provided with wing cases; the female larger, and without wing cases.

Perfect Insect (male).—A moth provided with wings, the fore wings brownish gray, glossy, crossed by two whitish irregular bands, the outer one enlarging into a pale spot at the apex. Hind wings grayish brown with a white band crossing them, and in the center a faint blackish dot.

Perfect Insect (female).—Wingless; uniform shining ash color above, gray beneath; length three to four-tenths of an inch. Sluggish of movement and spider-like in appearance.

Life History.

The eggs hatch about the time the buds on the apple trees expand. The young worms feed upon the tender leaves, seeking shelter within the expanding flowers or buds when the weather is wet and cold. They eat holes in the leaves while young, but

when older devour the whole pulp of the leaf, leaving only the veins and midrib. They feed for about four weeks, and when numerous so injure the foliage as to give the trees the appearance of having been scorched with fire. They have done great damage to the foliage of trees along highways. While letting themselves down to the ground they are often swept off by carriages and carried long distances.

The larvæ enter the ground, spin cocoons and are changed immediately into the chrysalis state, from which, during the fall, winter and following spring, they emerge in the perfect form, completing the life history.

Remedies.

Since the females are wingless, they may be trapped and destroyed by placing bands of tarred paper about the trunks of the trees and smearing these with printer's ink, tar mixed with oil, or refuse molasses. As these materials soon dry, however, they must be frequently renewed, or the insects will be able to cross. Tin or lead troughs, containing crude petroleum, are also used with some success. The most effective treatment, however, is to spray with Paris green, just as soon as the insects appear. Delay in applying the poison is often fatal to success.

There are numerous natural enemies, including a small mite, which destroys the eggs; a species of Microgaster,—a small four-winged fly,—parasitic upon the larvæ; and a species of tachina fly, also parasitic upon the larvæ.

THE APPLE TREE APHIS. *Aphis mali,* Fabr.

This insect was originally from Europe, but is now a pest in apple orchards throughout the northern United States and Canada, often causing serious losses in young orchards and nurseries.

Description.

Eggs.—Minute, oval, light yellow or greenish when first laid, gradually changing to shining black.

Young Insects (male).—Head, thorax and antennæ black; neck usually green; abdomen short, thick, oval, bright green; sides with row of black spots; nectaries and tail-like appendages black; wings transparent with dark brown veins.

Perfect Insect (female).—Length of wingless form less than one-tenth inch; body oval, pale yellowish green, often striped with deeper green; eyes and tail appendages black; honey tubes green. The winged female resembles the male in color.

Life History.

The eggs are deposited in the autumn in the cracks of the bark of twigs and at the bases of the buds. The eggs hatch when the buds begin to expand and the lice locate themselves on the young buds and leaves by means of their beaks and feed upon the juices. The spring brood is composed of females and is about ten days reaching maturity. Each louse gives birth to living young, producing about two a day for two or three weeks, and then dies. These young become mothers in about ten days. This process is continued through the season, there being many generations, mostly wingless females, without the appearance of males. Winged females are sometimes produced which, migrating to other trees, spread the pest. Late in the season males and females are produced in the same brood and, after mating, eggs are laid to perpetuate the species, thus completing the life history.

Remedies.

Wash the trees during winter or early spring with a strong solution of soft soap, or of washing powder, to destroy the eggs. Later in the season, if the aphids become numerous, spray with kerosene emulsion or with a strong decoction of tobacco, made by pouring 1 gallon of boiling water over a pound of tobacco stems or leaves.

There are many natural enemies of the aphis which should be encouraged. Among these are seven or eight species of lady-birds, and the larvæ of syrphus flies and of chrysopa or lace winged flies.

THE RED-HUMPED APPLE TREE CATERPILLAR. *Œdemasia concinna,* S. & A.

This species is native to the United States and has been reported from several localities in Maine as doing considerable damage to the foliage of apple trees. It is said to be widely distributed in this country, but is not an abundant species. It

prefers the apple, but is known to feed upon the plum, cherry, rose, thorn, and pear,—plants belonging to the rose family.

Description.

Eggs.—The eggs, so far as we know, have not been described.

Larva.—When full grown, the larvæ are often an inch and a quarter long. They may be known by the coral-red head and a hump of the same color on the fourth ring or segment from the head. The body is striped lengthwise with narrow yellow, white and black lines. There are two rows of black spines along the back, and rows of shorter black spines on the sides. Each spine bears a fine hair. The spines on the coral red hump are more prominent than the others. The hinder end of the caterpillar tapers and is usually elevated when the insect is at rest. When handled, a fluid with a strong acid smell is emitted. This is so offensive that the insects are never eaten by birds.

Perfect Insect.—A moth which measures from an inch to an inch and a quarter across the wings. The fore wings are dark brown on the inner, and grayish on the outer margin. There are several longitudinal streaks along the margin, also a dot near the middle and a spot near the angle, all dark brown. The body is light brown, and the thorax of a darker shade.

Life History.

The moths are on the wing late in June or in July. The female deposits her eggs on the under side of a leaf, in a cluster, usually during July. They soon hatch into small caterpillars. These caterpillars, while young, feed upon the tender tissues of the under side of the leaf, leaving the upper surface unbroken, but when large they devour greedily the whole leaf, excepting the midrib. They reach maturity during August and September. There is but one brood in the northern states. In the broods further south, the caterpillars feed in bunches and when not feeding remain close together. When mature they descend to the ground and hide under leaves or rubbish, or sometimes burrow a little into the ground and slowly change to the chrysalis state, where they remain until the following spring, when the moths appear, completing the life history.

Remedies.

As these caterpillars go in flocks, and when not feeding remain close together, they may easily be destroyed by cutting off the branch on which they appear and burning it. They may also be destroyed by jarring the limb, and, when they fall to the ground,

trampling them under foot. Spraying with Paris green is also effective, but poison should be used with caution on bearing trees. It is said that ichmeumons are parasitic upon them and hold them in check.

THE CECROPIA EMPEROR MOTH. *Platysamia cecropia,* Linn.

This is a native species and the largest moth found in the United States. It is widely spread and a general feeder. It is a well known apple insect, and, though not abundant, attracts attention on account of its large size and voracious appetite. It has been reported in its various stages from every part of Maine.

Description.

Eggs.—Nearly one-tenth of an inch long, almost round, dull creamy white, with a reddish streak near the middle.

Larva.—When first hatched, black with shining black knobs on the body from which arise black hairs. It molts several times in coming to maturity. When full grown it is from three to four inches long and pale green. There are coral red warts on the third and fourth segments, yellow warts on the back of the other segments, except those on the second and terminal, which are blue like the smaller tubercles on the side.

Cocoons.—About three inches long, pod-shaped, rusty grey or brown and firmly attached to one side of a twig. Composed of two layers of silk, an outer loose, papery, fibrous one and a densely woven inner one which contains the brown chrysalis.

Perfect Insect.—A moth with from five to seven inches spread of wing. Both the front and hind legs are rich brown. About the middle of each wing is a kidney-shaped white spot shaded with red and margined with black. Near the tips of the fore wings is an eye-like spot containing a bluish white crescent.

Life History.

The moth lays from two to three hundred eggs, usually in pairs, firmly fastened to the under side of the leaves of the host plant. The eggs hatch in a week to ten days, the young larvæ first feeding on the empty egg-shells. They have a ravenous appetite, grow rapidly, and consume a large amount of food. When nearly mature, a few on a young apple tree may in short time strip it of leaves. The larvæ, when full grown in the fall, spin their cocoons, attaching them to the twigs of shrubs or trees on which they feed. Their great size makes them conspicuous objects after the leaves fall. The following spring, in May or

June, the moths appear and soon mate, completing the life history.

Remedies.

The larvæ and cocoons are not abundant, and are so conspicuous that hand picking is the most satisfactory treatment.

C. Insects Affecting The Fruit.

THE CODLING MOTH. *Carpocapsa pomonella,* Linn.

The codling moth is probably native to southeastern Europe, the native home of the apple. It was introduced into the United States probably in apples or pears, early in the history of the country, but it was not noticed until 1849, its work previously having been referred to the plum curculio.

It is found in most of the apple growing countries of the world and is widely distributed in Maine, being one of the worst apple insects. The larvæ, particularly of the second brood, are often in apples when marketed, and crawl out and go into the pupa stage when the apples are stored or exposed for sale. It is not uncommon to see the moths in the spring in apple outhouse cellars, or on the windows of stores and houses.

While the codling moth is more particularly an apple insect, it feeds also upon pears, wild haws, crab apples and quinces, of the pome fruits, and upon plums, apricots and cherries of the stone fruits. Specimens have been reared from the fruit of a species of screw bean and from the seed buds of roses.

Description.

Egg.—A thin scale, slightly smaller than the head of a pin; whitish, often with a yellowish tinge, semi-transparent, looking like a minute drop of milk on the skin of the fruit.

Larva.—Whitish, flesh-colored or pink; one-sixteenth of an inch long when hatched; three-fourths of an inch long when full grown; three pairs of true legs and five pairs of false legs; head, first thoracic and anal segments brown; body armed with a few short hairs arising from more or less distinct black spots.

Cocoon and pupa.—When mature the larva spins, in a day, a thin tough silken cocoon, the inner layer thin and white, the outer layer mixed with pieces of the bark or substance on which the cocoon rests. Within the cocoon, or later, the larva changes to the brown pupa.

Moth.—Spread of wing about three-fourths of an inch. Front wing crossed by numerous gray and brown lines, which are often wavy, the hind angle marked by a large, dark brown spot streaked with bronze or gold. The hind wing light greyish-brown with a darker margin. The males have a pencil of long black hairs in a furrow on the upper surface of the hind wing, and on the under side of the front wing an elongate, narrow, black spot.

Life History.

The eggs are laid on the surface of the fruit, on its stem, or on the adjacent leaves. Between the middle of May and the middle of June, a week or two after the blossoms have fallen and the fruit is from a half-inch to an inch in diameter, the young larvæ craw about on the surface of the fruit. The most of them find their way into the blossom end, where they remain feeding for several days, and finally bore to the core of the fruit. They are full grown in about three weeks, when they make their exit channel to the surface. After feeding a few days near the surface, they emerge and usually spin cocoons under the loose bark of the trunk of the tree. Those designed for the first brood change soon to the pupa and the moths emerge in about two weeks, to lay eggs for the second brood. Those that go into the cocoon in August, and later, remain in the larval state in the cocoon during the winter and emerge as moths the following spring. In Maine only part of the first brood transform to moths the same season. When the moths appear, whether the same season or the following spring, the life history is complete.

Remedies.

As soon as the blossoms fall, spray the trees with Paris green, or with Paris green and Bordeaux mixture. The fallen fruit should be gathered and destroyed. Hogs or sheep may be kept in the orchard for the purpose. Owing to the protection afforded by the apple, the larvæ are particularly free from natural enemies. There are, however, two species of ichneumon flies which are occasionally found as parasites.

THE PLUM CURCULIO. *Conotrachelus nenuphar,* Herbst.

The plum curculio is a native of this country and originally fed upon the wild plums, which it still infests. Both males and females puncture the fruit to feed on it, but only the latter make

the crescent-shaped cuts. This insect is known to infest the plum, peach, nectarine, apricot, cherry, apple and pear. From ten to twenty-five per cent of the early apples examined in July, showed the characteristic cut.

After the first of August but few cuts, made by this insect, were found and we are led to believe that they prefer the earlier varieties, and that the apples punctured do not mature. A large per cent of the larvæ which hatched did not reach maturity. We, however, succeeded in transforming enough to identify the species. It would seem that the plum curculio does not flourish well in the apple and attacks it in the absence of its favorite fruit. The decline in the cultivation of plums, due to the ravages of this pest, and the black knot, will account for its attacking apples.

Description.

Egg.—Oblong, oval, pearly white. Visible to the naked eye, and can be found readily by examining the crescent-shaped cut made by the female.

Larva.—When young, tiny, soft, footless; head distinct, horny. When full grown it is usually of a glossy yellowish white, but varies in color with the food; head light brown or yellowish. Along each side is a light line, below which is a row of black bristles and above it a less distinct one, and toward the hind extremity a few pale hairs; length about two-fifths of an inch. The larva is so transparent, the internal organs are plainly seen through the skin, imparting a reddish color to the central parts of the body.

Perfect Insect.—A beetle, belonging to the family of insects known as weevils or snout beetles. It is blackish or greyish, rough, with a black shining hump on each wing case near the middle, behind which is a dull ochre-yellow band marked with whitish about the middle; each thigh has two small teeth on the under side; snout short. Length of insect about one-fifth of an inch.

Life History.

The beetles hibernate in secluded spots during the winter and appear on the wing about the time the plum trees blossom. As soon as the young fruit forms, the eggs are deposited. The female, when about to lay an egg, makes a minute incision with her jaws and then, inserting the snout, enlarges the hole sufficiently to hold the egg, turns around, deposits the egg, thrusts it to the bottom of the hole with the snout, then cuts a crescent-shaped incision around one side of the opening.

Only one egg is laid in a place, though on the apple, several punctures may occur on the same fruit. Each beetle lays from fifty to one hundred eggs and deposits from five to ten a day. The time of depositing eggs by early and late beetles probably occupies about two months. The first apples examined, July first, were badly punctured and no new cuts were found after the twentieth of the month. The eggs hatch in a few days and the larva is full grown in from three to five weeks. The infested apples or plums usually drop to the ground before the larva is grown and when mature it leaves the fruit, enters the ground four to six inches, forms an oval cavity, changes to the chrysalis, and in from three to six weeks the perfect insect is formed and makes its way to the surface, completing the life history. There seems to be some reason for believing that a few remain in the ground all winter. The specimens we transformed appeared in September, about four weeks from the time the larva was mature. We are inclined to believe that those apples in which the egg hatches and the larva grows, drop early. Abortive cuts shrivel and deface the fruit and check its growth, but it may mature.

Remedies.

Spraying with Paris green early in the season and after the blossoms fall is sometimes practiced. On a few trees in the garden, the jarring method employed for plum trees may sometimes be used to advantage. There are many insects which devour the curculio larva as it escapes from the fruit. Foremost among these are two or three species of common ground beetles. The larva of the soldier beetle is also a useful destroying agent, often entering the fruit while still on the tree, in search of its prey.

THE APPLE MAGGOT. *Trypeta* (*Rhagoletis*) *pomonella,* Walsh.

This is a native species which originally fed upon thorn plums, and probably wild crab apples, and has transferred its depredations to cultivated apples. It first attracted attention nearly fifty years ago, and as early as 1867 was doing great damage in New York, Massachusetts, Connecticut and Vermont. Since that time it has spread and increased until it is now widely distributed and regarded as one of the worst pests of the apple.

It is particularly bad in Maine, attacking nearly all varieties of apples, both fall and winter, though most destructive to the early sweet varieties. It is known as the railroad worm in Maine.

Description.

Eggs.—Length .032 to .036 inch; breadth .008 to .009 inch; light yellow when taken from the fruit; fusiform and about four times as long as wide; pedicellate at the end. The larva is placed in the egg with the head away from the pedicel and the end containing the head is inserted into the apple.

Larva.—Length .28 to .32 inch; breadth .07 to .08 inch. When full grown usually yellowish white. When younger, and sometimes when full grown, tinged with greenish; footless; the body composed of fourteen segments. Ninth, tenth and eleventh segments widest, narrowing rapidly toward the head, which is small, pointed and emarginate. From the broadest segment the body slopes slowly backward to the last segment, which maintains its size one-third of its length and then abruptly slopes to one-half its thickness. The lower and posterior half is nearly vertical behind, giving the larva a docked appearance.

Pupa.—Length .17 to .21 inch; breadth .08 to .1 inch; pale yellowish brown. When the maggot assumes the pupa state it does not shed the larval skin, but contracts, assuming an oval form. The pupa is a little more than twice as long as wide, and barrel-shaped. The ends slope about equally, and the head end is very pointed. Otherwise the resemblance between the pupa and larva is apparent. There is quite a variation in the size of pupæ. Some are much longer and thicker than others and may be of females, as the female flies are much larger than the males.

Perfect Insect.—A two-winged fly somewhat smaller than the house fly. Readily recognized by its general black color; yellowish head and legs; dark feet; greenish prominent eyes; white spot on the back and upper part of the thorax; three white bands across the abdomen of the male, four on the female, and four black bands across the wings, resembling the outlines of a turkey.

Life History.

In early seasons, under favorable conditions, the flies in Maine begin to emerge about July first, and earlier in the states farther south. They continue to emerge all summer and are on the wing in abundance until the middle or last of September, and occasionally in October. Early frosts check them. The flies lived three weeks in confinement and will probably live longer in nature. They begin to deposit their eggs in the early fruit by July first, or earlier, and egg laying continues while the flies are on the wing. The earlier races of flies affect the earlier

varieties, and the later races, the fall and winter fruit. Each female is capable of laying between three and four hundred eggs, and possibly more, which are inserted from time to time, one in a place, by means of a sharp ovipositor through the skin of the apple. The eggs being successively developed in the ovary of the female, after the manner of the eggs of the barnyard fowl, the season of egg laying extends over considerable time. The eggs are vertically inserted into the pulp of the apple, with the end opposite the pedicel, which contains the head of the maggot, pointing toward the core. The eggs are deposited in all parts of the apple, usually upon the cheeks, sparingly near the calyx and stem ends, and more abundantly upon the pale or shaded side of the fruit. The time required to deposit the eggs is about one-half minute. By means of the sharp ovipositor a characteristic puncture is made through the skin of the apple. These punctures can be detected by careful observation with the naked eye, but a pocket lens is necessary to see them well. They appear as brownish specks, and have not been before distinguished from the brownish, rusty spots common on apples. Under the glass they appear as circular or oblong openings, surrounded by a brownish border, somewhat shrunken by the shriveling of the tissue beneath. They may be numerous on the same apple.

The eggs hatch in four or five days, under favorable conditions, and the minute larvæ begin at once to work in the pulp of the apple. They have no true opposable jaws, but the head is provided with two black curved hooks, situated above the mouth, with which they rasp the pulp of the fruit rapidly by means of a vertical movement of the head. They live upon the juice of the particles of apple thus detached, which is sucked into the mouth. The pulp is rejected and turns brown. They can burrow their length in soft fruit in less than a minute. The channels made by the young larvæ, while the fruit is still growing, are largely healed and neither they nor the minute white larvæ are likely to be detected by the naked eye, or by the casual observer. As the larvæ grow, and the fruit matures, the enlarged channels do not heal, but turn brown and the presence of the maggots is then readily detected. These channels meander through the whole fruit, even the core. They often cross each other, enlarge as the larvæ grow, and in the last

stages of Trypeta work, run together, producing large cavities. Finally they involve the whole fruit, rendering it a worthless mass of disgusting corruption, held together by the skin.

In the early stages of Trypeta work there is no external evidence that the fruit is infested, excepting the punctures made for the insertion of the eggs. In advanced Trypeta work, brownish trails, where the larvæ have come to the surface, can be seen through the skin. Apples marketed with no suspicion of their being infested are frequently found hopelessly involved, honeycombed and worthless. Apples apparently sound when gathered may, by the presence of eggs or young larvæ, afterwards become worthless. The newly hatched larvæ are a little shorter than the egg and can not readily be detected in the white pulp of the apple without a pocket lens. They attain their growth, under favorable circumstances, in four or five weeks, but their development may be arrested by cold, by insufficient food, hardness of the fruit, etc., for a great length of time. They ordinarily remain in the fruit but a short time after they mature, and often leave it and go into the pupa state while there is still an abundance of nourishment and the fruit is still occupied by younger larvæ of various ages. If the fruit is kept cold, the larvæ, though full grown, remain longer, or may even change to the pupa state, within it. We have never seen the exit holes in hanging fruit and believe the maggots do not drop, but go into the ground from the fallen fruit. Their presence causes the fruit to mature earlier. Fruit picked from the trees may contain larvæ, and often stored or marketed fruit is alive with maggots.

The exit openings are characteristic, irregular holes, about one-twelfth inch in diameter, surrounded by a brownish border. They look as though the maggots had gnawed a hole for the head, and then forced the body through, leaving a lacerated border. They may occur anywhere on the apple but are more frequently found where the brown larval trails show through the skin. They begin to appear in the early apples about the first of August and may be found until frost, in windfalls, and in the stored fruit as long as the larvæ remain.

It would seem that the development of the larvæ is so nicely timed that they are not mature until the fruit is ripe. Their

development is slower in late and in hard fruits. A dozen maggots may infest the same apple, though a single one is enough to render it worthless. The maggots have been found in numerous varieties, early and late; sweet, acid, and sub-acid, extending from early in July through August, September, October, November, December, January and February. The larvæ usually leave the apples and go into the ground an inch or less and soon change to the pupa state. The pupæ are occasionally found within the fruit in windfalls and quite frequently in stored fruit. Sometimes the larvæ change on the surface of the ground, under decaying fruit. On grass ground they probably change in the debris about grass roots.

Remedies.

The Trypeta is an unusually hard insect to destroy, since the eggs are laid under the skin of apples; the larvæ spend their time within the fruit; the pupæ are safely concealed in the ground, within the shrunken skins of the larvæ; thus in all forms it is immune from the attacks of parasites. The flies do not seem to be attracted by sweetened poisonous substances and cannot be trapped. The eggs are so safely lodged underneath the skin of the apple as to be beyond the reach of poison applied by spraying, hence there is no hope in that direction. The only chance left is to destroy the larvæ and pupæ. This can best be done by destroying the fruit within which they are contained. The larvæ are found abundantly in windfalls and in decayed fruit from the cellars, and the pupæ in bins and barrels where fruit has been stored. Destroying the windfalls, and all refuse fruit, and burning the rubbish from places where fruit is stored are, then, the only reasonable and practicable methods of treatment now recognized.

DESCRIPTION OF PLATES.

PLATE I. Beneficial Insects. See p. 107.

Fig 1.—*Pimpla inquisitor,* an ichneumon parasite of the tussock moth caterpillar. *a,* parasitized caterpillar; *b,* egg of parasite; *c,* same in situ; *d,* parasite larvæ issuing; *e,* parasite cocoons—all slightly enlarged, except *b* and *c,* which are much enlarged. (After Howard. Farmer's Bulletin 99, U. S. Dept. Agr.)

Figs. 2 and 3.—Ichneumons, parasitic upon apple tree tent caterpillar.

Fig. 4.—Ichneumon parasitic upon flat-headed apple tree borer.

Fig. 5.—The 15-spotted lady bird, destructive to plant lice. *a,* larva; *b,* chrysalis; *d, e, f, g,* various forms of the perfect insect.

Fig. 6.—The twice-stabbed lady bird, destructive to the oyster-shell bark louse.

Fig. 7.—Tachina fly, parasitic on apple tree tent caterpillar.

PLATE II.

Fig. 1.—Round-headed borer (*Saperda candida*). See page 108. *a,* larva; *b,* pupa; *c,* beetle.

Fig. 2.—Flat-headed borer (*Chrysobothris femorata*). See page 109. *a,* larva; *b,* pupa; *c,* head of larva, under side; *d,* beetle.

Fig. 3.—Woolly louse. (*Schizoneura lanigera*). See page 113. *a,* excrescence upon the root; *b,* the lice at work; *c,* a louse much magnified.

Fig. 4—Pear-blight beetle or shot-borer (*Xyleborus pyri*). See page 112.

Fig. 5.—Work of the pear-blight beetle.

(Figs 4 and 5 after Howard).

PLATE III.

Fig. 1.—Oyster-shell bark louse (*Mytilaspis pomorum*). See page 110. *a,* egg; *b,* female louse; *c, d, e, f,* stages in the life history; *g,* under side of female scale,—all much magnified.

Fig. 2.—Oyster-shell bark louse. Scales in place upon the bark.

Fig. 3.—Lesser apple leaf folder, (*Teras minuta*). See page 117. *a,* larva; *b,* pupa; *c,* moth; *d,* case made on apple leaf. (After Smith).

Figs 4 and 5.—Oblique-banded leaf roller (*Cacœcia rosana*). See page 116.

Fig. 6.—Bud moth (*Tmetocera ocellana*). See page 114. (Cornell Expt. Sta., Bulletin 50).

PLATE IV.

Fig 1.—Forest tent caterpillar (*Clisiocampa disstria*). See page 118. *a,* egg clusters; *b,* moth; *c* and *d,* eggs; *e,* caterpillar.

Fig. 2.—Apple tree tent caterpillar (*Clisiocampa Americana*). See page 120. *a* and *b,* larvæ; *c,* egg cluster; *d,* pupa; *e,* male moth; *f,* female moth.

PLATE V.

Fig. 1.—Fall web worm (*Hyphantria cunea*). See page 121. Moths and cocoons—natural size. (After Howard. Farmer's Bulletin 99, U. S. Dept. Agr.)

Fig. 2.—Fall web worm. *a,* light form of full-grown larva; *b,* dark form of same; *c,* pupa; *d,* spotted form of moth (compare fig. 1), all slightly enlarged. (After Howard. Farmer's Bulletin 99, U. S. Dept. Agr.)

PLATE VI.

Fig. 1.—Lime tree winter moth (*Hybernia tillaria*). See page 123. *a,* larvæ at work; *b,* female moth; *c,* male moth.

Fig. 2.—Apple leaf bucculatrix (*Bucculatrix Pomifoliella*). See page 125. *a,* cocoons, natural size; *b,* same, enlarged; *c,* moth, enlarged.

Fig. 3.—Apple tree aphis (*Aphis mali*). See page 129. *a,* female; *b,* male; *c,* male, natural size.

Fig. 4.—Fall canker worm (*Anisopteryx pometaria*). See page 128. *a,* male moth; *b,* female moth; *d,* egg cluster.

Fig. 5.—Fall canker worm,—eggs and larva. *a* and *b,* egg, enlarged; *c,* segment of larva enlarged; *e,* egg cluster; *f,* full grown larva.

PLATE VII.

Fig. 1.—White-marked tussock moth (*Orgyia leucostigma*). See page 126. *a,* larva; *b,* female pupa; *c,* male pupa; *d, e,* male moth; *f,* female moth; *g,* same, ovipositing; *h,* egg mass; *i,* male cocoons; *k,* female cocoons, with moths carrying eggs—all slightly enlarged. (After Howard. Farmer's Bulletin 99, U. S. Dept. Agr.)

Fig. 2.—Codling moth (*Carpocapsa pomonella*). See page 133. *a,* fruit showing work of larva; *b,* point of entrance; *c,* larva, full grown; *d,* pupa; *f, g,* moth; *h,* head of larva; *i,* cocoon. (After Riley).

Fig. 3.—Plum curculio (*Conotrachelus nenuphar*). See page 134. *a,* larva; *b,* chrysalis; *c,* beetle; *d,* beetle and its work—all except *d,* enlarged.

PLATE VIII.

Fig. 1.—Apple maggot (*Trypeta pomonella*). See page 136. Mature fly (female), much enlarged.

Fig. 2.—Apple maggot. Larva much enlarged.—The short line above shows the natural size.

Fig. 3.—Apple maggot. An infested fruit.

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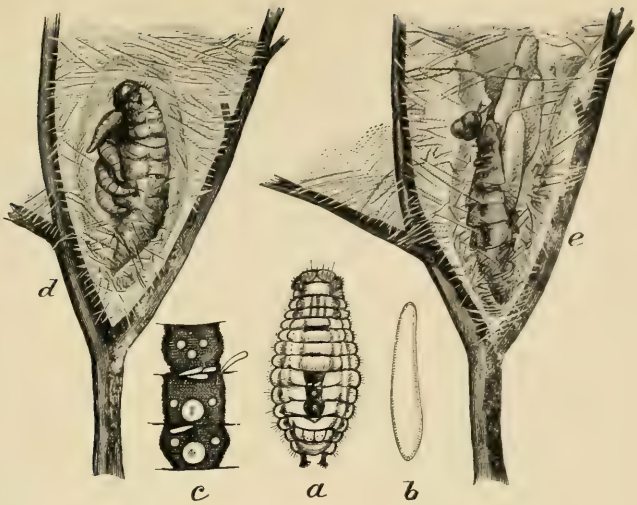
PLATE I.



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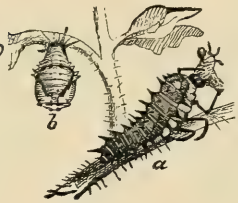

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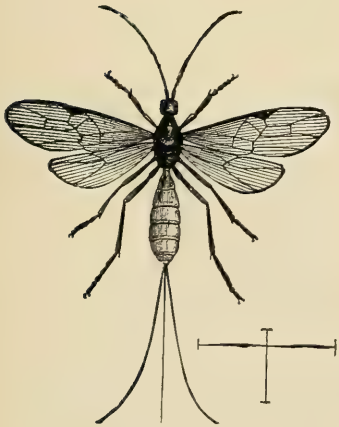

FIG. 4.

FIG. 6.

FIG. 7.

PLATE II.

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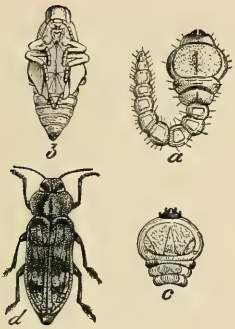

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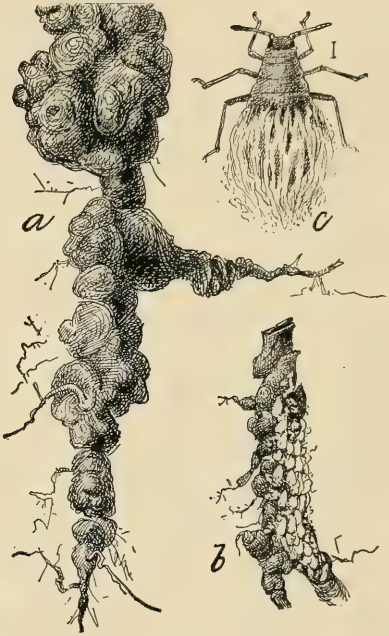

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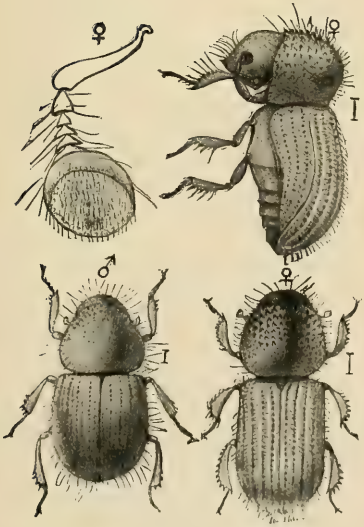

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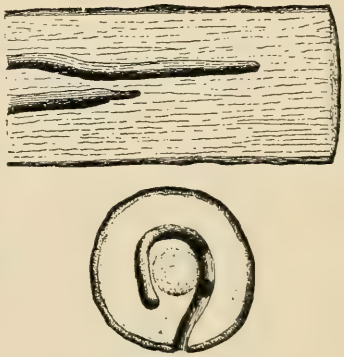

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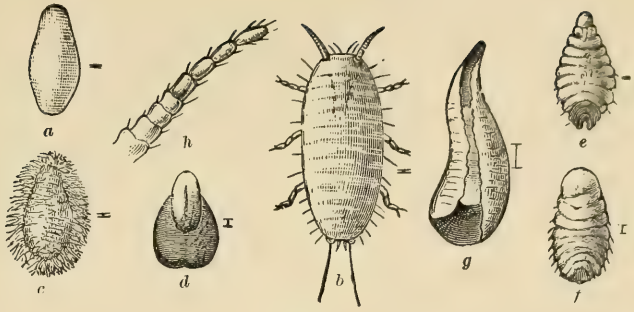

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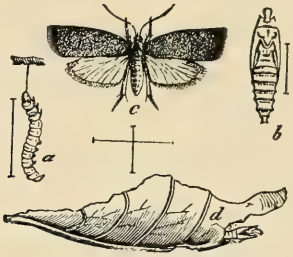

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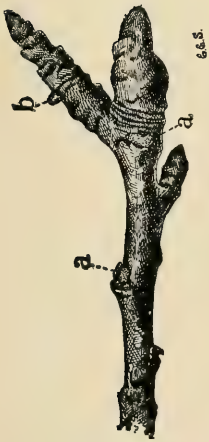
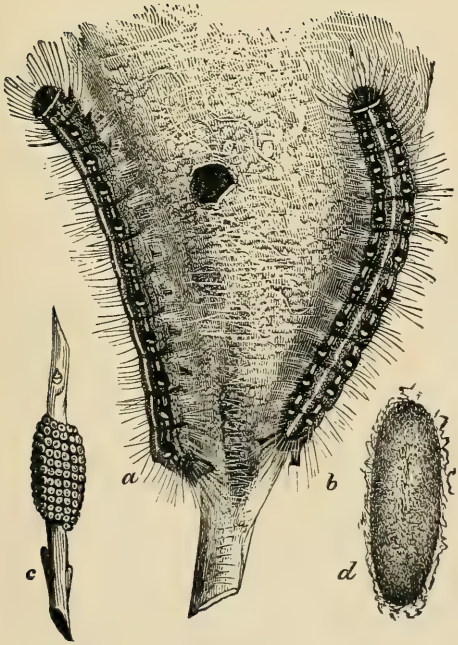


FIG. 6.

FIG. 5.

PLATE IV.

FIG. 1.



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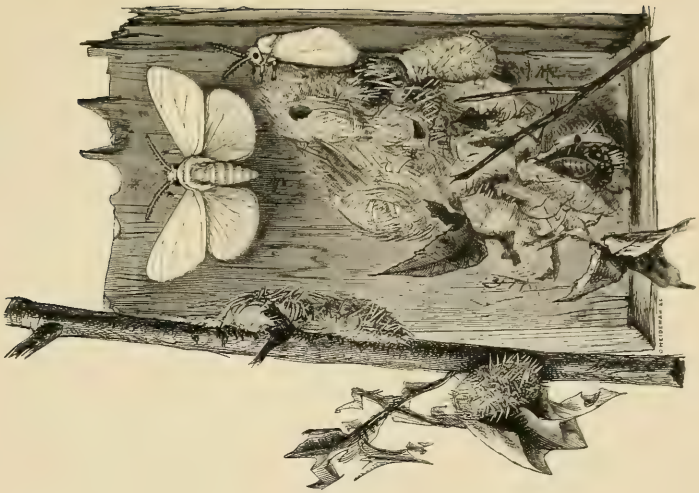

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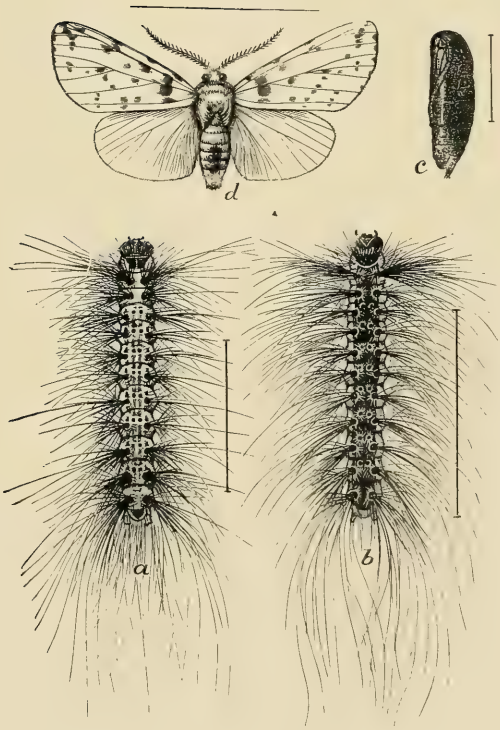
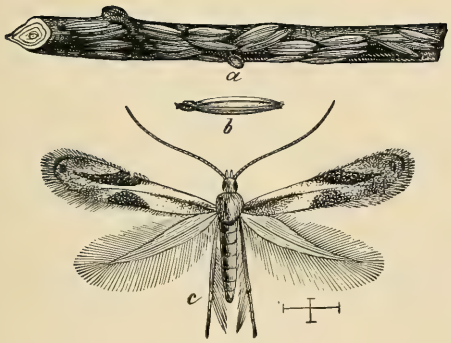


FIG. 2.

PLATE VI.

FIG. 1.



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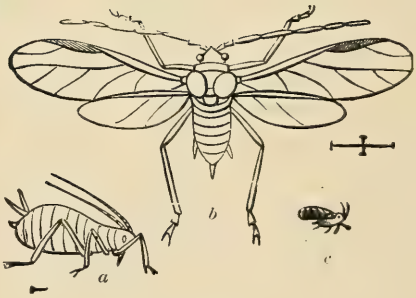

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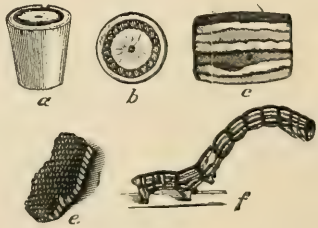

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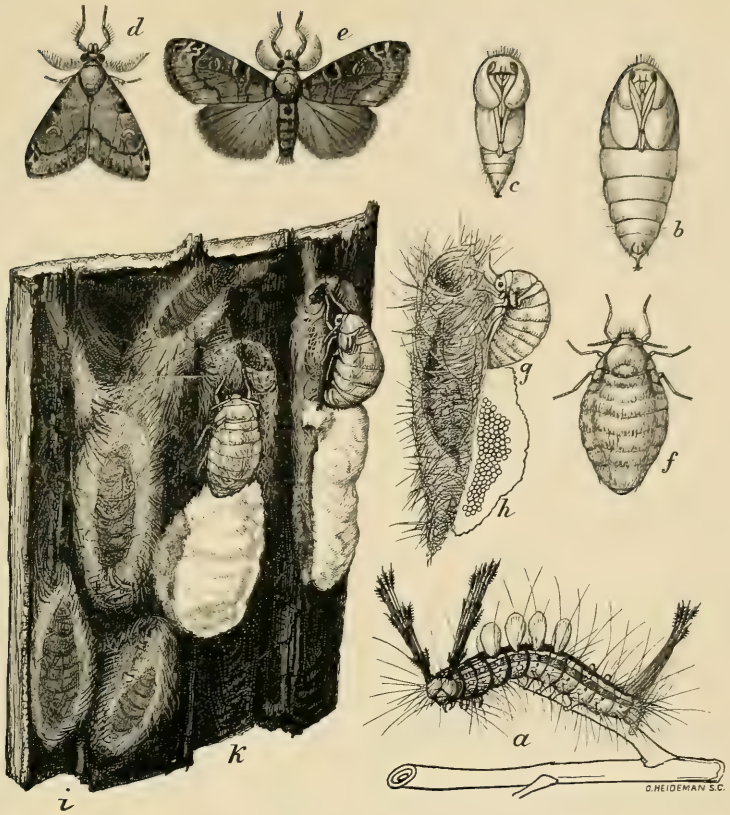

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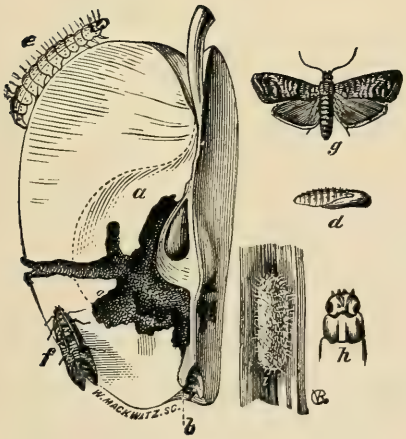

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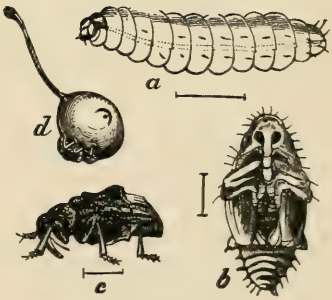

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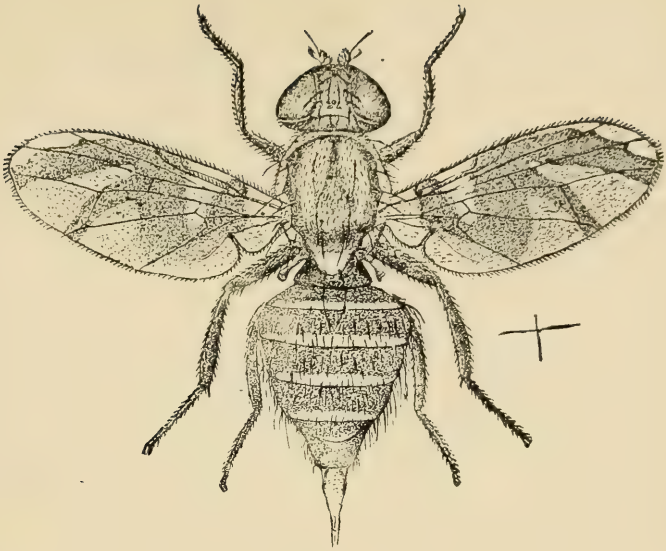
PLATE VIII.



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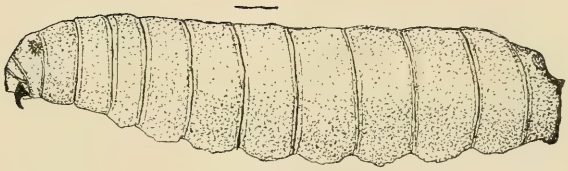

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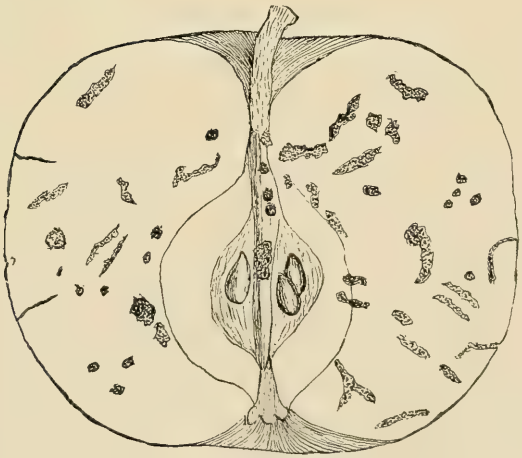

FIG. 3.

EXPERIMENTS WITH POTATOES.

CHAS. D. WOODS AND J. M. BARTLETT.

An investigation was planned for the purpose of determining the effect of spraying potato vines with Bordeaux mixture on the starch content of the tubers. As starch accumulates most rapidly when the plant is maturing, it seemed reasonable to assume that if spraying prevented blight and prolonged the life of the plant to its natural period of growth, the tubers would be of better quality with a larger proportion of starch than those from immature plants. Aroostook county being the great potato county of the State, where large starch factories are located, arrangements were made in the fall of 1898, with growers in that section to supply us with potatoes from sprayed and unsprayed fields.

The samples were selected by the growers and only merchantable potatoes were taken for analysis. About the time that we were preparing to begin the analyses, Dr. Wiley, Chief Chemist of the U. S. Department of Agriculture, visited the State to study the starch factories of Aroostook. He kindly offered to have the analyses of the potatoes made in his laboratory, and the samples were accordingly forwarded to Washington. The Department laboratory was being entirely rebuilt at that time and this occasioned so much delay in the analyses that the results were not received until the growing season was well begun and it was, therefore, deemed best to defer the publication until the present time.

The description of the samples and the results of the analyses as found by the Chemical Division of the U. S. Department of Agriculture follow:

DESCRIPTION OF POTATO SAMPLES.

No. 3036, Beauty of Hebron. Grown by C. H. Richardson, Fort Fairfield; sample was taken from a field of eight acres which had been in pasture since being cleared until 1896. In 1896 it bore a heavy crop of potatoes without any rust; in 1897, it was again planted to pota-

toes with a light yield and an early rust. The yield in 1896 was about 100 barrels per acre and in 1897 about 50 barrels. The soil is light red loam and, like most land in that vicinity, is on a shell-like lime rock ledge. The field was plowed in the fall of 1897, and harrowed three times in the spring with a spring toothed harrow. It was planted with a planter and hoed with a horse hoe. The field had received no manure until in 1896 and that year, and in 1897 and in 1898 it received about 500 pounds of complete fertilizer per acre. In 1898, the crop was planted May 19 and harvested between September 1 and 20.

The crop was sprayed twice with Bordeaux mixture, July 30 and August 9, but it was too late to save the plants from the blight. The yield was about fifty barrels of merchantable potatoes and fifteen barrels of small ones, per acre.

No. 3037, *Beauty of Hebron.* These potatoes were taken from a field adjoining that from which No. 3036 were taken. The field was plowed for the first time in the fall of 1897 and the crop was grown on the sod without the addition of any fertilizing materials.

Nos. 3038 *and* 3039, *White Elephant and* 3040 *and* 3041, *Delaware.* These samples were from T. B. Bradford, Golden Ridge, Sherman, Maine. The land had a slope to the north; had been in grass until October, 1897, when it was plowed. The soil was dark soil, inclined to be wet, and was not underdrained. The sub-soil was gravelly. It received about ten two-horse loads of barn manure, broadcast, over the field and about 500 pounds of fertilizer per acre; the fertilizer was applied in the drill. The field was planted June 1 and harvested September 28. The whole field was sprayed three times with Bordeaux mixture by the use of an Aspinwall Sprayer; in addition to this, sample No. 3038 was sprayed more with a knapsack sprayer. At the time that had been sprayed five times, the others were killed by rust. There were forty-five barrels of merchantable potatoes and seventy-five barrels of small potatoes per acre. All of the potatoes rotted very badly, and the decay began before any of the leaves were killed.

Nos. 3044 *and* 3045, *White Elephant.* These samples were received without the name of the sender. Three thousand forty-four was not sprayed and 3045 was sprayed with Bordeaux mixture.

Nos. 3046 *and* 3047, *White Elephant.* These were grown by R. S. Hoyt of Fort Fairfield. The field has a slope to the northeast and was in pasture previous to 1896. In 1897, a crop of potatoes was grown with the addition of 300 pounds of fertilizer. The yield was about sixty barrels. The field was plowed again in October, 1897, harrowed May 20, 1898, planted May 24 and harvested September 21. Four hundred pounds of complete fertilizer were used, applied in the drill. The part from which No. 3046 was taken, was sprayed twice, and 3047 was not sprayed. The yield was sixty-five barrels of merchantable potatoes and twenty-five barrels of small potatoes per acre.

Nos. 3050 *and* 3051, *White Elephant.* Grown by Powers Bros. of Caribou. The field bore potatoes in 1895; was seeded to oats in 1896 and grew a crop of red clover in 1897. The soil is a medium light clay loam with a gravelly sub-soil. The field was plowed in October, 1897,

and harrowed in the spring. Four hundred pounds commercial fertilizer was applied in the drill, and the piece was planted May 15-19 and harvested September 20-25. The field was sprayed three times but finally succumbed to the blight. The yield was sixty barrels of merchantable potatoes and thirteen barrels of small ones per acre. Number 3051 was from an unsprayed portion of the field.

Nos. 3052 *and* 3053, *Delawares.* The name of the sender and the culture is not known, except that 3052 was sprayed with Bordeaux mixture and 3053 was unsprayed.

Nos. 3054 *and* 3055, *Carmen.* These were from the same person as 3052 and 3053. No. 3054 was sprayed with Bordeaux mixture and 3055 was unsprayed.

ANALYSIS OF POTATOES GROWN IN 1898, THE RESULTS CALCULATED TO WATER CONTENT AT TIME OF SAMPLING.*

Variety.	Laboratory No.	Water.	Starch.	Fiber.	Protein nitrogen X 6.25.	Ash.	Total.	Specific gravity.
		%	%	%	%	%	%	
Hebron	3036	79.72	16.94	0.90	2.12	0.76	100.44	1.0604
Hebron	3037	78.13	18.59	0.72	2.06	0.78	100.28	1.0795
White Elephant	3038	76.81	19.96	0.84	2.19	0.99	100.79	1.0867
White Elephant	3039	76.92	20.38	0.90	2.31	0.87	101.38	1.0742
White Elephant	3044	78.74	15.96	0.64	2.25	0.92	98.51	1.0803
White Elephant	3045	75.21	19.31	0.61	2.12	0.83	98.02	1.1058
White Elephant	3046	75.88	18.81	0.56	2.25	0.96	98.46	1.0921
White Elephant	3047	77.44	18.12	0.63	2.06	0.88	99.13	1.0906
White Elephant	3050	75.56	18.14	0.56	1.81	1.04	97.11	1.1129
White Elephant	3051	78.13	18.62	0.63	1.75	0.98	100.11	1.0881
Delaware	3040	76.02	19.20	0.61	2.06	1.01	98.90	1.0852
Delaware	3041	76.93	18.63	0.61	2.19	0.94	99.30	1.0904
Delaware	3052	75.72	18.63	0.55	2.31	0.95	98.16	1.0745
Delaware	3053	77.64	16.26	0.61	2.56	0.91	97.98	1.1120
Carmen	3054	76.87	18.03	0.66	2.06	0.90	98.52	1.0967
Carmen	3055	76.57	17.07	0.59	2.38	0.76	97.37	1.0804

*The analyses were made by the Chemical Division of the U. S. Department of Agriculture.

As these results are not given in the usual form of food analyses, they are presented in that form on both the fresh and water free basis in the tables which follow. As the fat was not determined, it is included with the carbohydrates. It will be

seen that the starch as determined, as given in the table on page 147, exceeds in several instances, the combined carbohydrates and fat, as given on page 149. These discrepancies are due to the fact that the analytical methods have in several cases given too high results, carrying the total above 100 per cent, while in the second table, the carbohydrates and fat are calculated by difference. The average of 136 analyses, as compiled in Bulletin 28 of the Office of Experiment Stations of the United States Department of Agriculture, is added for comparison:

ANALYSES OF POTATOES.

RESULTS CALCULATED TO WATER-FREE BASIS.

Variety.	Laboratory number.	Ash.	Protein.	Fiber.	Carbohydrates and fat.
		%	%	%	%
Hebron	3036	3.75	10.45	4.44	81.36
Hebron	3037	3.57	9.42	3.29	83.72
Average	.....	3.66	9.94	3.86	82.54
White Elephant	3038	4.27	9.44	3.62	82.67
White Elephant	3039	3.77	10.01	3.90	82.32
White Elephant	3044	4.33	10.58	3.01	82.08
White Elephant	3045	3.35	8.55	2.46	85.64
White Elephant	3046	3.98	9.33	2.32	84.37
White Elephant	3047	3.90	9.13	2.79	84.18
White Elephant	3050	4.26	7.41	2.29	86.04
White Elephant	3051	4.48	8.00	2.88	84.64
Average	.....	4.04	9.06	2.91	83.99
Delaware	3040	4.21	8.59	2.54	84.66
Delaware	3041	4.07	9.49	2.65	83.79
Delaware	3052	3.91	9.51	2.27	84.31
Delaware	3053	4.07	11.45	2.73	81.75
Average	.....	4.06	9.76	2.55	83.63
Carmen	3054	3.89	8.91	2.85	84.35
Carmen	3055	3.24	10.16	2.52	84.08
Average	.....	3.57	9.53	2.69	84.21
Average of 136 samples*	.....	4.61	10.14	1.84	83.41

* Bulletin 28 of the Office of Experiment Stations.

ANALYSES OF POTATOES.

RESULTS CALCULATED TO WATER CONTENT AT TIME OF SAMPLING.

Variety.	Laboratory No.	Water.	Ash.	Protein.	Fiber.	Carbohydrates and fat.
		%	%	%	%	%
Hebron	3036	79.72	.76	2.12	.90	16.50
Hebron	3037	78.13	.78	2.06	.72	18.31
Average	.....	78.92	.77	2.09	.81	17.41
White Elephant	3038	76.81	.99	2.19	.84	19.17
White Elephant	3039	76.92	.87	2.31	.90	19.00
White Elephant	3044	78.74	.92	2.25	.64	17.45
White Elephant	3045	75.21	83	2.12	.61	21.23
White Elephant	3046	75.88	.96	2.25	.56	20.35
White Elephant	3047	77.44	.88	2.06	.63	18.99
White Elephant	3050	75.56	1.04	1.81	.56	21.03
White Elephant	3051	78.13	.98	1.75	.63	18.51
Average	.....	76.84	.93	2.09	.67	19.47
Delaware	3040	76.02	1.01	2.06	.61	20.30
Delaware	3041	76.93	.94	2.19	.61	19.33
Delaware	3052	75.72	.95	2.31	.55	20.47
Delaware	3053	77.64	.91	2.56	.61	18.28
Average	.....	76.58	.95	2.28	.60	19.59
Carmen	3054	76.87	.90	2.06	.66	19.51
Carmen	3055	76.57	.76	2.38	.59	19.70
Average	.....	76.72	.83	2.22	.63	19.60
Average of 136 analyses*	.....	78.30	1.00	2.20	.40	18.10

* Bulletin 28 of the Office of Experiment Stations.

ANALYSES OF THE ASH OF POTATOES.

In four samples large quantities of the ash were obtained for analysis. These analyses were also made by the Chemical Division of the United States Department of Agriculture. The results follow:

PERCENTAGES OF IMPURITIES (CARBON, SAND AND SILICA) AND PURE ASH IN THE CRUDE ASH.

Sample number.	Impurities.	Pure Ash.
	%	%
3045	9.36	90.64
3047	12.32	87.68
3050	5.14	94.86
3051	7.04	92.96

ANALYSIS OF PURE ASH OF POTATOES.

Sample number.	Potash, K_2O.	Soda, Na_2O.	Lime, CaO.	Magnesia, MgO.	Phosphoric acid, P_2O_5.	Sulphuric acid, SO_3.
	%	%	%	%	%	%
3045	55.13	1.70	1.01	3.85	15.78	6.92
3047	56.16	1.62	1.38	3.93	14.50	5.98
3050	56.43	1.70	1.29	3.76	15.00	6.38
3051	57.30	2.15	1.05	3.57	13.33	5.56

RELATION BETWEEN STARCH CONTENT AND SPECIFIC GRAVITY.

The specific gravity of starch is 1.65, water being taken as one. From this it would seem to follow that the richer a potato is in starch, the higher will be its specific gravity. From this assumption, a German agricultural calendar* has for years published a table giving the starch content of potatoes corresponding to various specific gravities. Assuming this method to be reliable, one of the best experiment stations in the United States has made an otherwise valuable investigation of little account. In Wiley's Principles and Practice of Agricultural Analysis, the unreliability of this method for scientific purposes is pointed out. The figures obtained in the analyses here reported, show in a striking manner the unreliability of the specific gravity method of determining starch in potatoes. In only one instance, (No. 3045) is there a practical agreement between the starch deter-

* Mentzel und v. Lengerke's Landw. Huelfs und Schreib-Kalender.

mined chemically and that found by the specific gravity method. Number 3036 has the lowest specific gravity of any of the samples examined, and 3053 has the next to the highest. Number 3036 carries 16.94 per cent while 3053 has only 16.26 per cent. As found by specific gravity, 3036 would have only ten per cent of starch and 3053 would have over twenty per cent. In the table which follows the samples are arranged according to their specific gravities.

TABLE SHOWING ABSENCE OF RELATION BETWEEN SPECIFIC GRAVITY AND STARCH CONTENT OF POTATOES.

Sample number.	Specific gravity.	Starch by specific gravity.	Starch directly determined.
		%	%
3036	1.0604	10.1	16.94
3039	1.0742	12.7	20.38
3052	1.0745	12.9	18.63
3037	1.0795	13.8	18.59
3044	1.0803	13.9	15.96
3055	1.0804	13.9	17.07
3040	1.0852	15.0	19.20
3038	1.0867	15.3	19.96
3051	1.0881	15.6	18.62
3041	1.0904	16.1	18.63
3047	1.0906	16.2	18.12
3046	1.0921	16.4	18.81
3054	1.0967	17.5	18.03
3045	1.1058	19.4	19.31
3053	1.1120	20.7	16.26
3050	1.1129	20.9	18.14

EFFECT OF SPRAYING UPON THE STARCH CONTENT OF POTATOES.

As before stated, this investigation was begun with the express purpose of studying the effect of spraying upon the starch content of the potatoes. Owing to the fact that in most instances the spraying was begun so late that none of the potatoes here sampled completely escaped the attack of the blight, it was thought that very little, if any, difference would be found

between the starch content of potatoes whose vines were sprayed with Bordeaux mixture and those unsprayed. Theoretically, anything which prolongs the growing season ought to increase the amount of starch which will be stored up in the potato; hence, if vines sprayed with Bordeaux mixture live longer than those not treated, not only should the yield of potatoes be larger, but the percentage of starch should be higher.

PERCENTAGES OF STARCH IN SPRAYED AND UNSPRAYED POTATOES.

Variety of potatoes.	Sprayed.		Unsprayed.	
	Sample No.	Starch.	Sample No.	Starch.
		%		%
White Elephant	3038	19.96	.....	.....
	3039	20.38	.....	.....
	3045	19.31	3044	15.96
	3046	18.81	3047	18.12
	3050	18.14	3051	18.62
Average	.....	19.32	.....	17.52
Delaware	3040	19.20	3041	18.63
	3052	18.63	3053	16.26
Average	.....	18.92	.....	17.45
Carmen No. 1	3054	18.03	3055	17.07
Average of all	.....	19.06	.....	17.43

In the case of the Hebron potatoes, the unsprayed had a larger starch content than the sprayed. From the description of the samples, it will be noted that the field from which the sprayed potatoes were taken had been planted to this crop for three years, while the unsprayed was on sod, and that the growing time of the plants was not prolonged by the spraying. In the other instances, spraying seemed to increase the percentage of starch in the tubers. The four samples of White Elephant potatoes which had been sprayed, contained 19.3 per cent of starch, while the three samples of the same variety unsprayed had on the average only 17.5 per cent. The two samples of sprayed Delawares had 18.9 per cent and the unsprayed 17.4 per cent of starch, and the one sample of sprayed Carmen had 18.0 per cent against 17.1 per cent for the unsprayed. So far

as these cases go, they seem to indicate that spraying with Bordeaux mixture not only prolonged the life of the vines, but that sprayed potatoes contained higher percentages of starch than unsprayed.

The results of a single experiment at Kalmaes Agricultural College, Norway, gave results indicating a very beneficial influence from Bordeaux mixture, both in yield and in starch content of the potatoes grown. The condensed results were as follows:*

	Yield per acre.	Starch content.
	Lbs.	%
Potatoes not treated with Bordeaux mixture	1,426	13.9
Potatoes treated once with Bordeaux mixture	2,116	14.3
Potatoes treated twice with Bordeaux mixture	2,858	16.3

THE STARCH CONTENT OF AROOSTOOK GROWN POTATOES COMPARED WITH THAT OF POTATOES GROWN ELSEWHERE.

The sixteen samples here reported upon were found to carry an average of 18.29 per cent of starch. The percentages ranged from 15.96 to 20.38 per cent. Two of the samples carried about 16 per cent, two about 17, two about 19 and two about 20 per cent. The other samples had about 18 per cent. The eight sprayed samples had an average of 19.06 per cent and the unsprayed had an average of 17.43 per cent of starch. It is probable that the crop of 1898 did not average much above that of the unsprayed samples here reported upon.

In 1890, the Utah Experiment Station† made sixteen analyses of potatoes in which the starch ran abnormally high. In 1894 and 1895, the same station made about seventy-five analyses in which the starch content varied from a minimum of 10.17 per cent to a maximum of 22.49, with an average of about 17 per cent.

The analyses of something over 200 samples of potatoes by the West Virginia Experiment Station‡ show a range in starch from 13.46 per cent to 21.43 per cent. Only four of the samples

* Experiment Station Record, Vol. 8, p. 122.

† Report of Utah Experiment Station for 1896, pp. 21 to 25.

‡ Report of West Virginia Experiment Station, 1896, pp. 50-57.

contained twenty per cent or above of starch and fourteen had less than fifteen per cent. The greater number of the samples carried between 15.50 and 17.50 per cent. The average was 16.50 per cent.

In fifteen samples of Norwegian grown potatoes,* the starch ranged from 12.3 to 20.3 per cent with an average of 14.91 per cent. In still another lot of Norwegian potatoes† consisting of 122 samples, 20 samples contained less than 13.19 per cent of starch, 22 samples contained less than 14.15 per cent, 38 samples contained less than 15.06 per cent of starch and 42 samples had over 17 per cent. The highest percentage found was 20.59 per cent.

The average of 20 samples examined by the Halle (Germany) Experiment Station was 19.77 per cent of starch with a range from 17.72 to 22.78 per cent.

From the above comparisons it is evident that the potatoes which were sprayed were full higher in starch than most others which have been examined. If the per cent and a half more of starch found in the sprayed than in the unsprayed potatoes was due to the treatment of the vines, and no other explanation suggests itself, this alone is a strong argument in favor of spraying.

FERTILIZING MATERIALS REMOVED BY A CROP OF POTATOES.

Ash analyses of four samples of the potatoes are given on page 150. These results, calculated to the fresh potato, are given in the table which follows:

FERTILIZING CONSTITUENTS OF POTATOES CALCULATED TO WATER CONTENT OF FRESH POTATOES.

Variety.	Laboratory number.	Nitrogen.	Phosphoric acid.	Potash.	Lime.
		%	%	%	%
White Elephant	3045	.34	.12	.41	.01
White Elephant	3047	.33	.11	.43	.01
White Elephant	3050	.29	.15	.56	.01
White Elephant	3051	.28	.12	.52	.01
Average		.31	.13	.48	.01

* Experiment Station Record, Vol. 6, p. 410.
† Experiment Station Record, Vol. 5, p. 1017.

In the Year Book of the United States Department of Agriculture for 1896, are given figures which agree very closely with the above. These are compiled results and from the close agreement it would seem to indicate that the composition of potatoes, so far as nitrogen, phosphoric acid and potash are concerned, is fairly uniform.

Assuming these figures to fairly represent potatoes as grown in Maine, a crop of 200 bushels, weighing six tons, would remove thirty-seven pounds of nitrogen, sixteen pounds of phosphoric acid and fifty-eight pounds of potash.

If the amounts and proportions of fertilizing elements removed by a crop could be taken as a guide in preparing a field for that crop, the problem of supplying the proper amount and kind of plant food to the soil would be much simplified. To manure a field for a crop of potatoes, nitrogen, phosphoric acid and potash would have to be added in about the proportions given above and in sufficient quantity to supply the vines and tubers the land was expected to yield. A formula made up on this basis would be very materially different from any mixed fertilizer on the market and would contain the fertilizing elements in about the following proportions: Nitrogen, 5 parts; phosphoric acid, 2 parts; and potash, 8 parts. Twenty-six different brands of so-called potato fertilizers were sold in the State in 1899. The table which follows show how these goods were made up:

COMPOSITION OF SO-CALLED POTATO FERTILIZERS SOLD IN MAINE IN 1899.

	Nitrogen.	Available phosphoric acid.	Potash.
	%	%	%
12 brands	1.5—2.5	8—9	2—3.25
6 brands	2—2.5	6—9	4—6
8 brands	2.5—3.5	5.5—8	7—10

The first twelve brands mentioned cannot properly be called potato or special fertilizers as their composition is practically the same as all general purpose goods. The formulas of the last eight, approximate more nearly to the popular idea of what a

potato manure should be, but even these carry much more phosphoric acid in proportion to the nitrogen and potash they contain than is found in the plants or in farmyard manure.

It is possible that in using commercial fertilizers, more phosphoric acid is applied than is needed in many cases, yet there is not much evidence at hand in the form of accurate experimental data to prove this assertion. Many experiments have been made both in this country and Europe in growing potatoes with commercial fertilizers and chemicals, but very few experimenters have made a study of the relative proportions of the fertilizing elements that can be most profitably used.

L. Hecke* in his quite extensive experiments with chemicals on the potato plant found that it needed, throughout its entire period of growth, liberal supplies of all fertilizing elements. The demand for nitrogen was especially strong in the first half, and for potash in the last half of the season. The application of potash had a marked influence on the production of tubers and starch. Phosphoric acid had less effect, probably because the soil was quite rich in phosphates.

Experiments are reported by the New York Experiment Station,† in which the primary object was to determine the profitable amount of fertilizer to apply. Two formulas were used, one of which carried approximately nitrogen 4%, phosphoric acid 8.2%, potash 10%; the other, nitrogen 6.5%, phosphoric acid 4.8%, potash 10%. The quantities applied were the same for each formula, being 500, 1,000, 1,500 and 2,000 pounds per acre. One thousand pounds per acre of either kind yielded the largest profit, but the one carrying the most phosphoric acid gave the largest yields in every case; the greatest difference occurring when but 500 pounds were used, and least when 2,000 pounds were applied per acre. As the mixture high in phosphoric acid cost several dollars per ton less, on account of containing less nitrogen, it was more profitable than the other.

Experiments were made at the Kentucky Experiment Station‡ on a limestone soil quite rich in phosphoric acid, in growing potatoes with chemicals. The best yield was obtained when the three elements, nitrogen, phosphoric acid, and potash were used.

* Jour. Landw. 43 (1895) p. 285.
† Bulletin 137, 1897.
‡ Bulletin 55.

Much better crops were obtained when phosphoric acid and potash were used than when potash was used alone or with nitrogen only. The chemicals were added in the proportion of nitrogen 25.6 pounds, phosphoric acid 57 pounds and potash 80 pounds per acre, or if mixed, the composition would be nitrogen 5.5%, phosphoric acid 12.4%, potash 17%.

The Connecticut Experiment Station* made experiments to compare the effect of muriate with that of sulphate of potash on the starch content and yield of tubers. The potatoes were grown on very poor soil which was dressed with 400 pounds nitrate soda, 615 pounds acid phosphate and 120 pounds of muriate or sulphate of potash. The yield was increased from 43 to 228 bushels of salable tubers per acre. Doubling the potash, applying 240 pounds per acre, increased the yield only twelve bushels per acre over what was produced when 120 pounds were applied. Muriate produced a somewhat greater yield than sulphate, but the tubers contained slightly more water and less starch than when sulphate was used.

The evidence in regard to the relative effect of sulphate and muriate of potash on potatoes is somewhat conflicting. Most of the experiments made in this country and Europe show that sulphate produces better tubers with less water and a slightly higher starch content, but the difference is slight. Some German experimenters, Pfeiffer† and others, have recently published results of experiments showing that pure muriate has no injurious effect on the tubers, but impurities, noticeably chloride of magnesia, are influential in depressing the proportion of starch.

An analysis of the ash of the potato shows it to be exceedingly rich in potash, and the fact has led many to believe that a potato manure should contain a large amount of this element, but when we consider the small amount of ash a potato contains, we find the amount removed by an ordinary crop (58 pounds) is not greater than is taken up by any other farm crops. Two tons of mixed hay would take away sixty-three pounds, while two tons of red clover would take eighty-eight pounds of potash.

In preparing a field for any crop it is more essential to consider the special needs of the soil, to render it fertile, than the special

* Report 1895, p. 124.
† Die Land. Vers. Stat. Bd. 49, p. 49.

needs of the crop to be grown upon it. While it is true that some plants take up more of some one element than others, the difference is insignificant when compared with the difference in soils. The soils of Maine are extremely variable in character and composition and it is therefore impracticable to make a fertilizer formula for potatoes or any other crop that would be applicable in all cases. Each farmer who uses commercial fertilizers extensively should experiment with unmixed goods enough to determine to what elements his soil most readily and profitably responds. Some marl or limestone soils are quite rich in phosphoric acid and consequently a fertilizer containing a small amount of that element and relatively large amounts of nitrogen and potash would give best results, while some of our granite soils and clay loams are quite rich in potash and respond best to a fertilizer containing relatively large amount of phosphoric acid.

A study of the experimental data indicates that the potato plant thrives best in a rich soil which is abundantly supplied with all fertilizing elements. In the early stages of its growth, when the vines are forming, the demand for nitrogen is particularly large, and for this reason a potato fertilizer should contain quite a part of its nitrogen in a soluble, immediately available form. Later in the season, when the tubers are forming, large amounts of phosphoric acid and potash are required, also a bountiful supply of water to take up the plant food, etc., and transmit it through the vines.

ACKNOWLEDGMENTS.

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Set Economic Seeds, Seed Potatoes—United States Department of Agriculture.

Apple Cions—Jules Lagace, Van Buren.

Kerowater Spraying Apparatus—Gould's Manufacturing Co., Seneca Falls, N. Y.

Copper Electric Sprayer—A. L. & E. F. Goss, Lewiston.

Spray Pump—Deming Co., Salem, Ohio.

Spray Pump—Morrell & Morley, Benton Harbor, Mich.

Paragrene—F. L. Lavenburg, New York City.

Green Arsenite, Green Arsenoid, Pink Arsenoid—Adler Color and Chemical Works, N. Y.

Prepared Bordeaux Mixture and Bordeaux Paint—Lennox Spraying Co., Pittsfield, Mass.

Special Laurel Green—Nichols Chemical Company, N. Y.

Sulphate, Muriate and Carbonate of Potash, and Kainit—German Kali Works, New York City.

Guano and Bone—Bowker Fertilizing Co., Boston, Mass.

Low Farm Wagon—Electric Wheel Co., Quincy, Ill.

Reliable Nest Box—M. L. Newell, Denver, Colo.

Calf Dehorner—Bullock Manufacturing Co., Flint, Mich.

Scythes—Nolin Manufacturing Co., Skowhegan.

Ground Oyster Shells—Poultry and Farm Supply Co., Boston.

The following newspapers and other publications are kindly donated to the Station by the publishers:

Agricultural Epitomist, Indianapolis, Ind.

Agricultural Gazette, Sidney, New South Wales.

American Cultivator, Boston, Mass.

American Fertilizer, Philadelphia, Pa.

American Florist, Chicago, Ill.

American Gardening, New York City.

American Grange Bulletin, Cincinnati, O.

American Grocer, New York City.
American Miller, Chicago, Ill.
Baltimore Weekly Sun, Baltimore, Md.
Bangor Weekly Commercial, Bangor, Me.
Breeders' Journal, Himrods, N. Y.
Canadian Horticulturist, Grimsby, Ont.
Chronique Agricole, Lausanne, Switzerland.
Country Gentleman, Albany, N. Y.
Dairy World, Chicago, Ill.
Detroit Free Press, Detroit, Mich.
Elgin Dairy Report, Elgin, Ill.
Farm, Furnace and Factory, Roanoke, Va.
Farmer's Advocate, Burlington, Vt.
Farmer's Advocate, London, Ont.
Farmer's Guide, Huntington, Ind.
Farmer's Home, Dayton, O.
Farm Home, Springfield, Ill.
Farmers' Tribune, Des Moines, Iowa.
Farm and Home, Chicago, Ill.
Farm Journal, Philadelphia, Pa.
Farm-Poultry, Boston, Mass.
Farmer's Magazine, Springfield, Ill.
Farmer's Review, Chicago, Ill.
Farmer's Voice, Chicago, Ill.
Farming, Dayton, O.
Florists Exchange, New York City.
Forester, Princeton, N. J.
Fruit, Dunkirk, N. Y.
Green's Fruit Grower, Rochester, N. Y.
Hoard's Dairyman, Ft. Atkinson, Wis.
Holstein Friesian Register, Brattleboro, Vt.
Homestead, Des Moines, Iowa.
Horticultural Visitor, Kinmundy, Ill.
Jersey Bulletin, Indianapolis, Ind.
Journal of the Royal Agricultural Society, London, England.
Louisiana Planter, New Orleans, La.
Lewiston Weekly Journal, Lewiston, Maine.
Maine Farmer, Augusta, Me.
Mark Lane's Express, London, England.
Market Basket, Philadelphia, Pa.

Market Garden, Minneapolis, Minn.
Massachusetts Ploughman, Boston, Mass.
Michigan Fruit Grower, Grand Rapids, Mich.
Mirror & Farmer, Manchester, N. H.
Montana Fruit Grower, Missoula, Mont.
National Farmer and Stock Grower, National Stock Yards, Ill.
National Rural and Family Magazine, Chicago, Ill.
New England Farmer, Boston, Mass.
New England Florist, Boston, Mass.
New England Homestead, Springfield, Mass.
New York Farmer, Port Jervis, N. Y.
New York Produce Review, New York City.
North American Horticulturist, Monroe, Mich.
Northern Leader, Fort Fairfield, Me.
Northwestern Miller, Minneapolis, Minn.
Ohio Farmer, Cleveland, Ohio.
Oregon Agriculturist, Portland, Oregon.
Pacific Bee, Sacramento, Cal.
Pacific Coast Dairyman, Tacoma, Wash.
Park and Cemetery, Chicago, Ill.
Practical Farmer, Philadelphia, Pa.
Public Ledger, Philadelphia, Pa.
Ruralist, Gluckheim, Md.
Rural Californian, Los Angeles, Cal.
Rural New Yorker, New York City.
Rural Topics, Morgan City, La.
Southern Farm Magazine, Baltimore, Md.
Southern Farmer, New Orleans, La.
Southern Planter, Richmond, Va.
Southwest, Springfield, Mo.
Southwestern Farmer, Wichita, Kans.
Strawberry Specialist, Kittrell, N. C.
Sugar Beet, Philadelphia, Pa.
Turf, Farm and Home, Waterville, Me.
Vick's Magazine, Rochester, N. Y.
Weekly Union, Manchester, N. H.
Western Agriculturist, Chicago, Ill.
Western Creamery, San Francisco, Cal.
Western Fruit Grower, St. Joseph, Mo.
The World, Vancouver, B. C.

METEOROLOGICAL OBSERVATIONS.

The instruments used at this Station are the same as those used in preceding years, and include: Wet and dry bulb thermometers; maximum and minimum thermometers; thermograph; rain-gauge; self-recording anemometer; vane and barometer. The observations at Orono now form an almost unbroken record of thirty-one years.

The noticeable features of the year at this point were the warm month of December, which was 7.33 degrees warmer than the average; and the small rainfall of April, August, and November. In August the only rain which fell was in the form of light showers, the precipitation in each case being less than one-hundredth of an inch. The total rainfall for the year was 10.66 inches below the average for thirty-one years.

For the first nine months of the year, observations were made at 7 A. M., 2 P. M., and 9 P. M. Since October 1 the morning and evening observations have been discontinued. Latitude 44°, 54′, 2″ N. Longitude 68°, 40′, 11″ W. Elevation above the sea, 150 feet.

METEOROLOGICAL SUMMARY FOR 1899.

Observations Made at the Maine Experiment Station.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean.	Total.
Highest barometer	30.58	30.28	30.60	30.16	30.13	30.15	30.11	30.18	30.32	30.36	30.31	30.37	30.30	.....
Lowest barometer	29.05	29.03	28.68	29.28	29.44	29.48	29.44	29.60	29.39	29.52	29.40	29.03	29.28	.....
Mean barometer	29.86	29.75	29.77	29.83	29.84	29.78	29.75	29.84	29.88	30.04	29.80	29.84	29.83	.....
Highest temperature	49°	52°	51°	84°	80°	87°	91°	93°	88°	76°	58°	57°	.....	.....
Lowest temperature	—21°	—16°	—3°	18°	26°	37°	41°	40°	23°	22°	8°	—9°	.....	.....
Mean temperature	15°.95	16°.52	26°.47	43°.32	52°.27	62°.05	68°.40	66°.48	56°.59	49°.97	33°.99	28°.04	43°.34	.....
Mean temperature for 31 years	15°.98	19°.24	27°.56	40°.26	52°.38	61°.98	66°.97	65°.05	57°.02	45°.81	34°.21	20°.71	42°.26	.....
Total precipitation in inches	2.75	2.27	4.76	.66	4.12	4.10	4.49	trace.	3.20	2.92	2.01	3.01	.....	34.29
Mean precipitation for 31 years	4.22	4.05	4.19	2.85	3.46	3.61	3.36	3.64	3.37	4.00	4.44	3.76	.....	44.95
No. of days with precip. of .01 in. or more	5	7	11	2	9	13	10	.....	5	7	6	9	.....	84
Snow fall in inches	10	13.5	28	0.5	.....	.....	.....	.....	.....	.....	7.5	6.5	.....	66.0
Average snow fall for 31 years	23.1	21.8	17.1	6.0	.....	.....	.....	.....	.....	1.0	7.8	16.9	.....	93.7
Number of clear days	13	12	8	19	17	14	11	18	12	12	10	10	.....	156
Number of fair days	12	7	8	10	5	10	9	4	6	4	4	4	.....	83
Number of cloudy days	6	9	15	1	9	6	11	9	12	15	16	17	.....	126
Total movement of wind in miles	6898	6744	8241	5391	6832	5547	5321	4352	5500	5021	4857	5489	.....	.....

REPORT OF THE TREASURER.

Maine Agricultural Experiment Station in account with the United States appropriation, 1898-9.

DR.

To receipts from the Treasurer of the United States as per appropriation for the fiscal year ending June 30, 1899, as per act of Congress approved March 2, 1887		$15,000 00

CR.

By salaries:		
(a) Director and administration officers	$2,194 26	
(b) Scientific staff	4,493 48	
(c) Assistants to scientific staff	1,215 13	
(d) Special and temporary services	51 96	
Total		$7,954 83
Labor:		
(a) Monthly employees	$450 00	
(b) Daily employees	1,319 66	
Total		1,769 66
Publications:		
For envelopes for bulletins and reports		229 93
Postage and stationery		357 61
Freight and express		154 62
Heat, light and water		829 67
Chemical supplies:		
(a) Chemicals	$197 06	
(b) Other supplies	201 18	
Total		398 24
Seeds, plants and sundry supplies:		
(a) Agricultural	$57 17	
(b) Horticultural	260 43	
(c) Botanical	10 00	
(e) Miscellaneous	83 50	
Total		411 10
Fertilizers		$71 45
Feeding stuffs		486 82
Library		279 83
Tools, implements, and machinery		544 42
Furniture and fixtures		242 09
Scientific apparatus		42 93

Live stock:		
(e) Poultry	$154 00	
(f) Sundries	143 55	
Total		$297 55
Traveling expenses:		
(a) In supervision of Station work	$118 77	
(b) In attending various meetings	60 48	
Total		179 25
Buildings and repairs:		
(a) New buildings		750 00
Total		$15,000 00

ISAIAH K. STETSON, *Treasurer.*

I, the undersigned, duly appointed Auditor of the Corporation, do hereby certify that I have examined the books of the Maine Agricultural Experiment Station for the fiscal year ending June 30, 1899; that I have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000.00, and the corresponding disbursements, $15,000.00; for all of which proper vouchers are on file and have been examined by me and found correct.

And I further certify that the expenditures have been solely for the purposes set forth in the act of Congress approved March 2, 1887.

A. W. HARRIS, *Auditor.*

Maine Agricultural Experiment Station in account with Fertilizer Inspection for the year ending December 31, 1899.

DR.

To receipts for licenses		$2,805 00

CR.

By balance from account of 1898	$20 04	
Collection and analyses of samples	1,831 27	
Executive and office expenses	700 00	
Balance to account of 1900	253 69	$2,805 00

Maine Agricultural Experiment Station in account with Feed Inspection for the year ending December 31, 1899.

DR.

To receipts for inspection tags, 1899	$2,112 19	
Balance to account of 1899	786 07	$2,898 26

CR.

By balance carried from 1898 account	$1,014 01	
Collection and analyses of samples	773 48	
Tags	410 77	
Executive and office expenses	700 00	2,898 26

Maine Agricultural Experiment Station in account with Creamery Inspection for the year ending December 31, 1899.

DR.

To fees for calibrating glassware	$53 34

CR.

By expense calibrating glassware	$53 34

Maine Agricultural Experiment Station in account with "General Account" for the year ending June 30, 1899.

DR.

To balance from 1897-8	$798 54	
Sales of produce, etc	2,425 58	$3,224 12

CR.

By labor	$292 54	
Freight and express	32 10	
Seeds, plants, and sundry supplies	75 23	
Feeding stuffs	61 57	
Library	10 90	
Tools, implements and machinery	30 79	
Furniture and fixtures	8 10	
Scientific apparatus	43 13	
Live stock	114 25	
Traveling expenses	25 28	
Contingent (chiefly insurance)	424 01	
Buildings and repairs	800 93	
Balance to 1899-1900 account	1,305 29	3,224 12

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