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Thirty-eighth Annual Report

OF

The Connecticut Agricultural Experiment Station

Being the annual report for the year ended October 31

1914

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CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

OFFICERS AND STAFF.

SEPTEMBER 30, 1914.

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Plant Breeding.
H. K. HAYES, M.S., *Plant Breeder.*
C. D. HUBBELL, *Assistant.*

Vegetable Growing.
HOWARD F. HUBER, B.S.

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REPORT OF THE BOARD OF CONTROL.

OF

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

To His Excellency, Simeon E. Baldwin, Governor of Connecticut:

As required by Statute, the Board of Control of The Connecticut Agricultural Experiment Station herewith submits a report of its operations for the year ending November 1, 1914.

There have been few changes in the Station staff. Miss M. H. Jagger, seed analyst in the botanical laboratory, resigned in May, 1914, and at the same time Mr. George Graham was appointed botanical laboratory assistant.

Mr. A. E. Moss, Assistant Forester, by arrangement between the Connecticut Agricultural College and this Station, has undertaken the management of the College woodland and will give instruction in forestry in that institution during the second semester.

A department of vegetable growing has been added to the Station organization and on July 1, 1914, Mr. Howard F. Huber, a graduate of the New Jersey Agricultural College, was engaged to do the work of this department, the object of which is to study the various problems of the vegetable growers and engage in experimental work on their behalf.

The following summary shows the scope of the Station work, without presenting a complete catalogue of its activities:

BOTANICAL DEPARTMENT.

Cases of violent illness and death, following the eating of chestnuts from trees infected with chestnut bark disease, occurred last year in the state. Certain physicians and others attributed these effects to a poison developed by the disease. A careful study by the botanist revealed no evidence of any direct connection between the blight fungus and the illness. Small quantities of the pure blight fungus were eaten by the botanist, without any resulting

discomfort, and white rats fed largely on infected chestnuts and various preparations containing the fungus developed no symptoms of poison.

Spraying and variety tests with melons, begun in 1908, and selection tests, begun in 1911, are continued.

Experiments are in progress with peach trees, to test the comparative efficiency of various sprays to control leaf curl, scab and brown rot of peaches, to determine the nature, manner of spreading and possible means of control of "yellows," to note the effects of various fertilizer elements on the growth, yield, longevity and relation to winter injury and yellows.

Experiments with potatoes are designed to determine the distribution of powdery potato scab in the state and methods of control, to determine the effect of spraying with Bordeaux mixture in wet and dry summers and the effect of level culture versus ridging.

These may serve as illustrations of the kind of work done by this department. The botanist and his assistant are frequently called upon to visit farms for the purpose of advising and directing efforts to suppress some fungous trouble.

Two hundred and ninety-three specimens of fungi have been received, with requests for information about them, and 581 letters of advice and instruction have been written. Nine addresses have been made on botanical matters at gatherings of farmers.

Chemical Department.

The examination of fertilizers, feeds, food products and drugs and other work required of the Station by statute have involved the analyses of 799 samples of fertilizers and waste products having fertilizing value, 237 samples of feeds, 1889 samples of foods and drugs, and testing and marking 490 pieces of Babcock glassware.

Two hundred and forty-seven melons have been tested for sugar, 32 samples of farm crops analyzed, and partial analyses made of several hundred samples of maize kernel.

In connection with work for the Dairy and Food Commissioner members of the staff have appeared 20 times in court, to furnish expert evidence.

The chief chemist has served as a member of the Food Standards Committee of the U. S. Department of Agriculture.

A number of studies of technical chemical matters have been

completed: for example, The Carbohydrates of the Soy Bean, The Detection of Chrysophanic Acid in Medicinal Preparations, The Relative Value of Casein and Sanatogen in Maintenance and Growth, etc.

The chemical department is being called upon frequently by the police to identify habit-forming drugs found in possession of those who trade in them illicitly. This has been done without charge and necessary testimony given in court.

Twenty-two addresses before various organizations have been made during the year by the chief chemist and 886 letters and manuscript reports have been written.

Entomological Department.

The work of inspection required by statute has involved the careful examination of 60 nurseries and of 1,477 packages of imported stock containing more than a million and a half plants. In 54 of the 303 separate shipments insects and fungi, some of them dangerous, were found.

Four hundred and sixty-three apiaries have been inspected, 156 of which were found to harbor foul-brood.

The gypsy moth infestation at Wallingford seems to have been entirely wiped out by the work of this department. The same is true of the infestation found earlier in Stonington. But the pest has apparently been blown over into this state from Rhode Island, where it is well established, and has been found within the year in 10 towns on our eastern border.

The problem of checking this invasion is a very serious one and requires a much larger state appropriation than has yet been made. The work done in Wallingford and Stonington has shown what can be accomplished by prompt and intelligent action.

Experimental work has been done on the control of the cabbage maggot and of the white pine weevil. The outbreak of the army worm gave a chance for further study of this pest.

Four hundred and thirty-nine insects were received for identification and advice. 75 orchards and gardens were examined, 60 circular letters, 313 reports of inspection to the Federal Horticultural Board and 2,861 letters were sent out from the entomologist's office. 18 lectures and addresses were also delivered at gatherings of farmers.

Forestry Department.

In the spring of the present year 170,000 seedlings of forest trees were sold at cost from the Mt. Carmel farm, for forest planting in this state. This work will soon be discontinued, as it is now possible to buy stock at reasonable rates from private concerns.

The Station forest plantations have only required fire protection and some interplanting.

Experiments in combating the pine weevil, in co-operation with the entomological department, have been carried out with encouraging results.

Fourteen examinations of forest land have been made, at the request of their owners, and advice has been given as to their management.

About 80 acres have been added to the state forest at Portland and 16,500 trees have been planted. The weeviled tops from the older plantations have been cut and placed in cases for breeding the parasite, as has been successfully done at Rainbow.

In the Simsbury state forest 10,000 trees have been planted. A fire caused by a locomotive burned over 15 to 20 acres, which had been planted in 1912.

In the Union forest the only work done has been the cutting out of weeviled pine tops.

Three hundred acres were added to the six hundred acres previously bought for the Cornwall forest and a survey and map are being prepared.

From January to July 503 forest fires burned over about 10,000 acres, involving a money loss of $45,000.00. That the loss was not very much larger is due to the fire-warden service, which under the direction of the forester is increasingly efficient.

The forest survey of the state has been very actively continued during the year and is nearly completed.

The forester has delivered nine addresses at farmers' meetings and has sent out 1,598 letters, besides circular letters to fire-wardens, selectmen, etc.

Plant Breeding Department.

The studies of inheritance with maize and tobacco have been continued. This work increases in value with the number of successive seasons in which it is carried on.

In co-operation with the Storrs Station, a corn survey of the state is being made. The object is to find what varieties of husking and ensilage corn are now most promising, to test them at both Storrs and New Haven, to select two or three which promise best and finally get some one or more farmers interested to grow this improved seed under adequate direction, so that farmers may buy at home seed corn of tested merit and yielding capacity.

A preliminary test of 35 varieties and 8 first generation crosses has been made this year at Storrs and at New Haven.

Eighteen varieties of soy bean have been grown, to study their adaptation to Connecticut conditions of climate, and the work with selections of melons, rye and alfalfa is continued.

Two hundred and fifty-seven letters have been written by the plant breeder and four addresses made at farmers' gatherings.

Protein Research Department.

This work is supported by the Adams Fund and also by grants from the Carnegie Institution. Inaugurated by Prof. S. W. Johnson, it has been directed from the start (in 1890) by a single individual, Dr. T. B. Osborne.

After years of study of the proximate and structural composition and of the physical and chemical properties of a large number of vegetable proteins, it became possible for the first time to study with a good chance of fruitful result the relative nutritive value of the individual proteins and the results already obtained are throwing a new light on the problems of animal feeding and introducing new aims and new methods into experiments on this subject.

In this study Dr. L. B. Mendel, professor of physiological chemistry in Yale University, is collaborating.

The year's results are set forth in 10 papers, published in various scientific journals, being too extensive and too technical for the pages of our annual report.

The Station has made educational exhibits of these various departments of its work at the agricultural fairs held at Salisbury, Norfolk, Brooklyn and Berlin, where members of the staff were present to explain exhibits and answer questions.

A field meeting was held at the Mt. Carmel Farm in August, with an attendance of 250 people.

This experimental field of 20 acres contains an old but reclaimed orchard and a small experimental apple and peach orchard now in its fourth year and offers space, rather insufficient, for various experiments of the botanist, entomologist, plant breeder and vegetable grower.

The Station correspondence has involved the sending of 11,360 letters and manuscript reports. (Administration office, 5,137, and from the departments; botanical 581, chemical 886, entomological 2,861, forestry 1,598, plant breeding 277).

Members of the staff have also made 73 addresses at granges, farm institutes and other agricultural gatherings, and have published in scientific journals 14 papers relating to their work, besides the Station reports and bulletins and frequent contributions to magazines and agricultural papers.

The following publications have been issued:

The annual report of 441 printed pages, 17 plates and 2 maps, in an edition of 10,000 copies, and three bulletins aggregating 115 printed pages, with 55 figures in the text. It was impossible to adequately present a statement of the year's work in the 475 pages allowed by statute. The botanist's report, therefore, had to be omitted and will form part of the next report.

All or which is respectfully submitted.

GEORGE A. HOPSON, *Secretary.*

NEW HAVEN, CONN., November 1, 1914.

REPORT OF THE TREASURER, 1914.

RECEIPTS.

Balance on hand, October 1, 1913 (analysis Fees)		$769.59
State Appropriation, Agriculture	$17,500.00	
State Appropriation, Food	2,500.00	
State Appropriation, Insect Pest	4,000.00	
State Appropriation, Gypsy Moth	4,000.00	
United States Appropriation, Hatch	7,500.00	
United States Appropriation, Adams	7,500.00	
Analysis Fees	9,900.00	
Sale of Station Produce	49.48	
Miscellaneous Receipts	9.37	
From the Lockwood Income (including sale of seedlings and Mt. Carmel farm produce).	7,691.94	
Total		60,650.79
		$61,420.38

DISBURSEMENTS.

E. H. Jenkins, director, salary	$2,800.00
E. H. Jenkins, treasurer, "	400.00
G. A. Hopson, salary	29.94
V. E. Cole, "	850.00
L. M. Brautlecht, "	750.00
J. P. Street, "	2,500.00
T. B. Osborne, "	2,400.00
E. M. Bailey, "	1,779.17
C. B. Morison, "	1,200.00
C. E. Shepard, "	1,000.00
G. L. Davis, "	1,000.00
W. E. Britton, "	2,383.33
G. P. Clinton, "	2,491.67
E. M. Stoddard, "	1,183.33
W. O. Filley, "	2,000.00
A. E. Moss, "	1,300.00
H. K. Hayes, "	1,775.00
Edna L. Ferry, "	1,290.00
H. F. Huber, "	232.50
H. Lange, "	925.00
V. L. Churchill, "	825.00
Wm. Veitch, "	697.92
E. L. Avery, "	480.00
E. B. Whittlesey, "	624.00
M. H. Jagger	310.00
C. D. Hubbell	728.00
H. Kiley	728.00

Wm. Pokrob	$728.00	
Geo. Graham	728.00	
Frank Sheldon	322.00	
Wm. Sperry	120.00	
Labor	2,571.45	
Publications	1,071.70	
Postage	216.12	
Stationery	369.03	
Telephone and Telegraph	162.93	
Freight and Express	352.23	
Gas, Kerosene and Electricity	888.87	
Coal	1,417.60	
Water	160.60	
Chemicals and Laboratory Supplies	1,511.26	
Agricultural and Horticultural Supplies	119.94	
Miscellaneous Supplies	749.92	
Fertilizers	600.43	
Feeding Stuffs	387.98	
Library and Periodicals	624.73	
Tools and Machinery	416.49	
Furniture and Fixtures	357.57	
Scientific Apparatus	34.74	
Traveling by the Board	225.98	
Traveling by the Staff	1,662.78	
Traveling in connection with Adams Fund Investigations	81.17	
Fertilizer and Food Sampling (included in traveling by the Staff)		
Insurance	253.26	
Insect Pest Appropriation to State Entomologist	4,000.00	
Contingent	299.48	
Lockwood Expenses	400.00	
Gypsy Moth Appropriation to State Entomologist	4,000.00	
New Buildings	1,665.25	
Betterments	250.09	
Repairs	1,050.91	
Total Disbursements		$60,483.37
Balance on hand, Oct. 1, 1914 (Analysis Fees)		937.01
		$61,420.38

NEW HAVEN, CONN., Oct. 31, 1914.

THIS CERTIFIES that we have examined the accounts of E. H. Jenkins, Treasurer of The Connecticut Agricultural Experiment Station, for the fiscal year ending Sept. 30, 1914, have compared the same with the vouchers therefor and found them correct.

WILLIAM P. BAILEY,
JAMES P. TOBIN,
Auditors of Public Accounts.

CORRECTIONS.

Page 202, line 12; read *call* for *all*.

Page 222, line 6 from bottom; read 42.46 instead of 52.46.

Page 227, first line, first paragraph; read *collected* instead of *collector*.

Page 227, line 6 from bottom: insert *be* after *must*.

The first line on page 235 should be transferred to page 234, first line.

PART I.

REPORT OF THE BOTANIST FOR 1913.

G. P. Clinton.

I. NOTES ON PLANT DISEASES OF CONNECTICUT.

A. DISEASES PREVALENT IN 1913.

Weather Conditions. Because of its mild weather, the winter of 1912–1913 on the whole produced very little injury to trees and shrubs in this state. January was a record month for warmth. The first part of February, however, was colder, but the change did not come so suddenly or severely as to cause injury to the buds. Very little snow fell during the winter, but there was considerable rain, much of which soaked into the ground. Because of this warm weather, the spring blossoms opened earlier than usual, and their profusion on fruit trees in general was unusual.

The spring, like the winter, was rather wet, and this with frosts in May finally set back the vegetation so that in the end not much was gained by the early start. These late frosts came about the tenth of May, when the peach bloom was mostly past, but the apples were largely in bloom. However, the latter were seriously hurt only in restricted districts, where conditions were unusually favorable for such injury. The same thing was true regarding strawberries, which, while injured considerably in certain fields, in others did not suffer much, and the crop on the whole was very satisfactory. Potatoes, tomatoes, and a few tender plants set out early, were injured somewhat, especially in the northern part of the state. Injury to the leaves of shade trees will be mentioned later.

June, while rather cool during its first half, was, like most of July, unusually dry, so that short-rooted crops suffered considerably, though the abundant supply of rain during the winter and early spring kept the deep-rooted perennial crops from suffering

as much, except in the case of early peaches and some of the bush berries. What threatened to become a severe drought was checked by timely rains about the middle of July, and from then on the rains were so distributed that crops as a whole did not suffer much further injury from lack of moisture.

The early fall was quite favorable for plant growth, as the rains were sufficient, but not so abundant as to injure fruit, especially peaches, by causing rot. October, however, proved a very wet month, as ten inches of rain fell, which broke the record for that month in this vicinity. The fall was also rather warm. While light frosts occurred about September first, and again on October 21st to 23d, causing damage only to very tender plants in certain localities, it was not until the very last two days of October that general killing frosts occurred in the region of New Haven. This gave an unusually long fall, similar to that of the year before, or even better, since the early frosts did comparatively little injury.

Because of the warm winter, the early spring, and the late, warm fall, the year 1913 was unusual as regards its average temperature, and is said to have been the warmest since the weather bureau of New Haven was started in 1872. Because of the abundance of rain through the winter and spring and the unusual amount in October, it was also an average year as regards moisture. The only unfavorable conditions, therefore, as regards plant growth, were the somewhat cool, wet spring, with late May frosts, and the drought of June and early July.

Ornamental Plants. There were comparatively few complaints of diseases of ornamental plants during the year, and so far as we can judge from these and our own observations, the following include the more conspicuous troubles. The wet spring was favorable for the development of root rots, apparently chiefly Rhizoctonia, on sweet peas; and one amateur grower reported failure to find any successful method of combating this trouble. Rust of hollyhock was also apparently more common than usual. Leaf spot, *Phyllosticta Labruscæ* Thuem, of Boston Ivy, *Ampelopsis tricuspidata* (Plate I a), was likewise unusually injurious on certain vines where it had gained a foothold the previous year. Mildew of rose was injurious, but not so much so as the leaf spot, which, together with the early summer drought, caused an unusual defoliation of the more susceptible varieties.

Shade and Forest Trees. The May frosts already mentioned caused considerable injury to the leaves of shade and forest trees such as oaks, maples, etc., in certain localities. Many of the trees were just beginning to leaf out when the frosts occurred, and where other conditions were adverse the leaves on these trees were either severely injured or killed outright. In some places only the leaves on the lower part of the tree were killed, the frost line evidently not extending high enough to injure those higher up.

While we did not make a special study of the chestnut blight the past year, from what we saw and learned from others, it seems to us that it was fully as conspicuous as the previous year, so there was no very evident let-up in its development, of which there had been some previous indications. Government investigators have recently reported the discovery of this disease in China, where, however, it does comparatively little injury. Their contention that it is an imported, and not a native disease, is strengthened by this discovery.

Aside from the blight injury, some chestnut and oak trees in various parts of the state have died from drought and winter injuries received in previous unfavorable seasons. On the whole, however, the weather conditions of 1913 were not especially unfavorable to trees in a healthy condition, with the following exceptions. Pine seedlings, especially white pine, suffered from drought, dying in patches in the beds where the moisture was insufficient to supply the immediate demands. Likewise, the drought was responsible for an unusual amount of leaf scorch of maples and some other trees on dry hillsides. The injury to these trees in parts of Connecticut and Massachusetts was the worst the writer has ever seen. With the exception of these and the anthracnose of sycamore, there were no very serious shade tree troubles. The leaf spot of horse chestnut was conspicuous by its absence.

Market Garden and General Farm Crops. The leaf spot of alfalfa was quite conspicuous, and together with the early drought caused considerable defoliation before the first cutting of this crop. Asparagus rust was prominent in certain fields. The Septoria (Plate III a) and the Cercospora leaf spots of celery, ordinarily classed by growers as "rust," also caused considerable injury, especially in low or irrigated fields. Overhead irrigation, which is being taken up by market gardeners, may have as one of its drawbacks a liability to produce fungous troubles.

Where sprayed, cucumbers and muskmelons had an unusually long season, whereas unsprayed plants died in August, chiefly from downy mildew blight. Potatoes, so far as we could learn, did not suffer at all from the late blight, and very little from the early blight, though tip burn was common as a result of the drought.

One of the most conspicuous injuries of the year was the so-called "blast" of onion. Apparently all fields produced a poor crop, while most of those in Orange gave from less than half a crop to none at all. While we did not investigate this trouble at its beginning, an examination of the dead fields led us to conclude that the injury was not caused by a fungus, as some growers seemed to believe. In years past we have seen the onion blossoms killed by the same Botrytis fungus that causes the stem rot, but we were unable to find this or any other suspicious fungus on the dead blossoms this year. Furthermore, the weather conditions had not been favorable for the development of a fungous disease, in fact, the blast seems to have been due largely to the drought that occurred at this time and caused considerable damage to crops in general. Possibly the injury was aggravated by the thrips, which was more or less destructive this season.

Two diseases of tomatoes were unusually prevalent during the year. The first of these was the mosaic disease, the same as that occurring on tobacco, known as "calico." This trouble was more common than we have ever seen it, but just how much damage it caused is hard to tell. Whether or not the May frosts, which injured the early tomatoes, were responsible for it, we do not know. The point rot, another and more serious trouble of tomatoes, was generally prevalent. Judging from recent investigations and our own limited observations, we believe that this is a true bacterial disease. It may be that the wet spring favored its start, as it did the fire blight of fruit trees, and there also seems to be some ground for believing that the later drought was favorable for its development. Spraying did little good on our Station grounds, though the treatment was not begun until the middle of July.

Concerning the Phoma rot of turnips, reported by us last year for the first time in this country, new light on its spread by means of manure was shown by Mr. Durgy of Danbury, who writes as follows: "The past year I sowed my turnips on new sod ground that is, most of them, and used artificial fertilizer, without any barnyard manure, and had a splendid crop, very smooth, nice

size, and found no rot. But in my vegetable garden, where I had peas and string beans, I sowed some of the same seed, but used the manure from the stock that we had fed with those Rutabaga turnips that were like the sample I sent you, and I have just finished looking them over, and find the same trouble I had last year, namely, the rot, but not so bad as they were then. I am convinced that they were infected from the manure that I used on my vegetable garden."

Fruits and Berries. Fire blight of apple, pear and quince was unusually prominent in early July, killing the young branches. The cold, wet weather at blossom time was quite favorable for the development of this bacterial trouble. Scab of apple, also, got a good start on account of these weather conditions, and became very conspicuous on the susceptible varieties before the end of the season. Frost injury of apples developed some curious freaks which will be described later in this report. Bitter rot of apple is a trouble we do not find doing much injury in this state, but this year it developed on some of the stored apples, though not as commonly as black rot.

The brown rot of peach did comparatively little harm. The scab also seemed less conspicuous than usual. On the other hand, leaf curl, due to the cold, wet spring, was as prominent as it has been for some years. An unusual infection of the fruit by this fungus is described later. Yellows was not conspicuous, in fact, some affected trees showed little further advance of the trouble, and peach trees as a whole had fine green foliage and made good growth. Black knot of cherry and plum, and rust of quince, were common troubles.

Orange rust was very common on blackberries, as was leaf anthracnose on currants, especially certain varieties. The leaf blotch, aided by the common leaf spot and drought, caused considerable injury to strawberry plants about harvest time. Glen Mary was a variety badly infected in some fields. The leaf blotch (Plate VII a) can be told from the leaf spot by its purplish spots lacking the whitish center of the latter. The fungus causing this trouble is *Marsonia Potentillæ* var. *Fragariæ* Sacc., which seems to be the same as *Ascochyta colorata* Pk.

A careful search failed to reveal the source of infection of the black currants at Meriden by the white pine rust, mentioned in our last report. No rust could be found on any white pines in this

district, and the currants did not become infected again this year. Neither native white pines, less than a mile distant, nor several white pine plantations within a few miles, showed any indications of this rust.

B. DISEASES OR HOSTS NOT PREVIOUSLY REPORTED.

APPLE, *Pyrus Malus.*

Fasciation. Plate I b. The peculiar flattening of young apple twigs, as shown in the illustration, known technically as fasciation, was called to the writer's attention in June by Mr. R. S. Chisolm of Litchfield. The young twigs were greatly flattened, and divided into two, recurved, flattened tips. The leaves were scattered in an irregular way over the surface, and at the branch tips were reduced to a rudimentary fringe. In one instance the injury consisted merely in a slight flattening of the otherwise normal, straight stem.

Fasciation is not an uncommon phenomenon in plant life, and is usually caused by pressure on the very young tissues. According to Sorauer (Handb. Pflanzenkr. **1**:334) fasciation similar to that described here may be caused by a binding of the enveloping leaf scales, thereby producing a temporary lateral pressure on the nascent tissues within, or by injury to the growing point itself. The direct cause in this case we believe to have been the frosts in May. Either the enveloping leaf scales were injured so that their easy dehiscence at the proper time was prevented, thus furnishing unusual pressure on the enclosed growing tissues, or the injury was directly to the embryonic leaf axis, inciting the subsequent abnormal development.

Frost Bands. Plate I c. The frosts of early May, besides producing the trouble just mentioned, also caused considerable russeting of apples, and in some cases peculiar variations of this known as frost bands. This latter injury usually consists of severe russeting of the skin in bands extending around the fruit about midway between the stem and blossom ends. The illustration shows a case of these banded apples sent to the Station by Mr. C. E. Lyman of Middlefield, in which one had developed a second band at right angles to the first. This injury starts when the fruit is very young, and is extended through a much wider area by the subsequent development of the slightly injured tissues. Besides russeting and banding, such frost injuries, when severe, often misshape and crack the fruit.

Just why the injury should partake of the nature of a general russeting in some cases and of a distinct banding in others is not very clear to the writer, unless there was in some way a greater exposure of the affected tissues in the latter case. Possibly the correct explanation is that given by Powell (Garden and Forest **8**:417), who says: "This belt is due to any injury of the epidermis of the fruit in its young stage, and is caused by the freezing of the dew collected on these spaces." Whether this dew settled in a band around the fruit or was generally scattered over the surface might settle the character of the injury. While we have not reported these banded apples before, Dr. Britton informs us that he has previously observed them in this state. Stewart (N. Y. Agr. Exp. Stat. Rept. **1895**:544) gives a description and illustration of this trouble on apple and also on pear, which he calls "belted" fruit. Welden (Monthly Bull. Cal. St. Com. Hort. **2**:717) has also recently noted and figured this trouble. He says: "The presence of the characteristic bands as illustrated is a sure indication of frost injury."

Syncarpy. Plate II. In September we received a number of apples from Mr. E. Hill of South Norwalk that were found on a tree growing on Pilot Island. These apples show various stages of twin and triple fruit. In the example illustrated (c) the two apples were of nearly normal size, but partly joined together from the stem end to the center, while one of them showed a third small, closely-attached apple starting from its stem end. Most of the apples produced merely a small secondary apple starting out of the stem end and attached by its base. We have seen another case (b) where a small apple came directly out of the side of the larger apple. We also have a photograph of a group of apples (a) sent to the Station in 1911, where four distinct apples were all joined to the same stem, and one of these bore an imperfect apple at its blossom end.

Stewart, in Bulletin 328, of the Geneva Station, page 313, gives references to literature on this subject, and describes various double and triple apples. He makes the following quotation from the "Country Gentleman": "Recent notes on Siamism in apples, said by some authorities never or rarely to occur, have brought in a number of specimens, the latest being two pairs from Mr. George Beaumont of New Haven County, Conn., who says the tree pro-

duces a lot of these monstrosities annually, this year half a bushel of them." Young, of the Washington Experiment Station, in a recent article (Popular Science Monthly **84**:162–5) also gives descriptions and illustrations of double apples.

As regards the nature of syncarpy, Sorauer (Handb. Pflanzenkr. **1**:375) says: "In the case of the apple the sprouting power sometimes exhibits itself only as a single fibrovascular bundle in the fruit. There is formed on the side a swelling, which may increase to a small side-fruit. If this side-fruit produces a real bud, we have two incipient fruits standing obliquely one above the other. In this case, it is much like the double-fruiting which occurs by the union of two separate lateral blossom buds."

Mr. Hill says, in speaking of the Pilot Island tree, that one apple of this kind was found on it last year. While undoubtedly some trees show a tendency to produce these abnormal fruits year after year, we believe that some special irritation or injury to the particular blossom when very young is the direct cause, and that this year was peculiarly adapted to produce such phenomena, since we also found cases of double peaches in the Barnes orchard at Yalesville. This leads us to the conclusion that here, as in the two monstrosities previously described, the late spring frosts were in some way the inciting factor.

Water Core. Although this is a trouble which we have not reported before, it is not uncommon on certain varieties, such as Pound Sweet, King, etc., in this state, and has long been known to occur here. The past season was one in which it was said to be more prevalent than usual. This was probably due to the very wet weather of October, and possibly to the rapid growth of the fruit after the June-July drought. The appearance of water core is familiar to all through the hard, translucent, watery tissues, usually commencing near the core of the apple and extending outward in more or less irregular spots to the surface, so that in extreme cases the trouble can be detected from the outside by the semi-translucence of the skin. In the worst cases the core cavity is said to become filled with liquid, and the core is provided on the inside with irregular hair-like growth. Such apples may split open at the blossom end and offer entrance for decay organisms.

Water core is purely a physiological disease, as has recently been shown by O'Gara (Phytopath. **3**:121–8. 1913.), who has made a special study of it in the extreme West, where the trouble is apparently much worse than here. He finds that physical conditions which check the transpiration from the trees when the roots are furnishing an abundant supply of moisture are the determining causes of the trouble. Such are high humidity of the air when abundance of moisture is being taken from the soil; excessive precipitation, especially just before maturity of the fruit; pruning of branches or frost injury to the leaves in the fall, reducing the transpiration surface; high cultivation, retaining an excessive amount of water in the soil; excessive vegetative growth where the percentage of fruit is small; also rapid conversion of starch into sugar, producing cell turgor. The water core spots are usually sweeter than the other tissues, having more sugar and less acid. O'Gara also found that water core, except in extreme cases, could be cured largely by picking the fruit before the trouble was too far advanced and storing it in a place with a cool, but not too cold, even temperature.

BLUE GRASS, KENTUCKY, *Poa pratensis.*

Rust, *Puccinia poarum Niels.* The II stage of this rust was found in the writer's yard on blue grass leaves, forming numerous small, dusty, orange-yellow pustules. The III stage is rarely found. The I stage occurs in Europe on species of Tussilago. A microscopic examination of the II, or uredo-stage shows the club-shaped paraphyses as a conspicuous feature. The rust causes no noticeable injury in lawns here, as it is usually found on uncut grass in protected spots.

BRUSSELS SPROUTS, *Brassica oleracea.*

Club Root, *Plasmodiophora Brassicae* Wor. This slime mold disease was sent to us on the above host last August from the Eccoci farm at Bridgewater. Previously we had listed club root only on cabbage and turnip. While this trouble is not rare in this state, it probably does not cause as much injury as in some of the trucking states further south, at least, we have rarely received specimens or complaints of it. There is no doubt that other cruciferous hosts than those reported here are occasionally attacked in Connecticut. We recently heard the statement made that in certain fields on the Sound near Granniss Corners, New Haven, where oyster shells are abundant and the high tides occasionally cover the land, this dis-

ease is not troublesome, while other fields near by not so flooded could not be used to advantage for cruciferous crops because of it. Liming of any kind is known to lessen this trouble in the land, but whether salt water has any influence we do not know. Rotation of crops also helps to prevent it from becoming serious. Some claim however, that when once land becomes badly infected, a long time is required for it to disappear, even if not planted to susceptible crops in the meantime.

CELERY, *Apium graveolens.*

HEART ROT, *Bacillus carotovorus* Jones. Plate III b. Twice during the past season our attention was called to bacterial heart rots of celery in the field. In the early winter there was also considerable complaint of a general bacterial rot of the banked celery. In the first instance the rot was on young plants which has been grown in rows in the field for transplanting later. When seen by us in early July so many plants were severely injured or killed outright that the stand was very poor. These infected plants were on the farm of Mr. Burton of East Haven, whose land is a reclaimed swamp, consisting of very deep, black humus subject to great variations in moisture. The celery had been thoroughly watered during the season by the Skinner sprinkling system. The trouble was confined to the Golden Self-Blanching variety, which is very tender, and on account of this disease cannot now be grown there to advantage.

The injured plants could be detected by their yellowed appearance, and in advanced stages by the ease with which they could be pulled from the ground. The trouble showed in very young plants, which were often killed outright, as well as in those which had reached a fair size. The rot did not at first appear on the outside of the stalk, but when cut open, a reddish discoloration of the tissues could be seen at the heart. The germs evidently gained entrance at the base of the lowest leaves, possibly through the leaf scars, or some very slight insect injury. In time, a distinct internal cavity, formed by the collapse of the rotted tissue, was evident.

In the second case called to our attention, the trouble was seen in October in a large, coarse variety of celery, about the time it was first banked for bleaching. This occurred in a small celery field belonging to Mr. Jacobs near Granniss Corners, New Haven.

When the still green, but somewhat wilted plants, were pulled up, often no indication of the trouble showed on the outside of the stalks, yet when these were cut open the injury (see illustration) was very conspicuous as a large decayed cavity in the heart of the stalk extending down into the upper part of the root. In advanced cases the plants rotted off below the ground and were very easily pulled up. Fortunately this trouble, while conspicuous, was not very abundant in this field, and occurred only in those rows where some poorly growing lettuce had been plowed under earlier in the season. The rotting tissues of the lettuce no doubt furnished a start for the decay of the celery, which was further favored by the warm, very moist weather of October.

Apparently no one in this country has yet described a bacterial decay of celery caused by a definitely named organism. Both Harrison and Jones (see discussion under Salsify, page 25 of this report), however, produced a rot of celery with pure cultures of *Bacillus carotovorus*, though neither investigator was studying this as a cause of celery rot. Since this species seems to be a common agent of soft decay of various vegetables, we have little doubt that it was the agent responsible in the cases under investigation. While cultures were obtained, special studies of these have not yet been made.

Halsted (N. J. Exp. Stat. Spec. Bull. Q:10–12. 1892.) has described an unnamed bacterial disease of celery leaves and stalks, chiefly on Golden Plume, from New Jersey, which he was able to reproduce on the leaves. He also says that "the germs, when introduced into the core of a plant, cause this tender portion to decay with greater rapidity than when placed in the leaf tissue." He further states that: "The same trucker has lost a large percentage of his carrots from bacterial decay, and this suggests a possible connection between the two. * * * That this disease is serious may be judged from the fact that a large grower has lost his whole last crop, the heart of each plant melting away to a worthless mass of rottenness." From Halsted's general description it would appear that he had to do with the same disease that we have under consideration.

Selby (Ohio Agr. Exp. Stat. Bull. 241:385) also described a bacterial heart rot of celery apparently identical with ours, as follows: "The inner parts rot very suddenly, and emit a penetrating odor, and the market value of the affected celery is destroyed. The de-

cayed parts are teeming with motile bacteria, to which this form of decay has been attributed. The heart rot prevails in very hot, steaming weather, but preventive measures are about all that can be recommended. It is suggested that when the boards are first put up to the celery under such conditions as accompany the heart rot, they should be left apart at the top, and only closed up to the usual point after an interval of several days. This secures better ventilation, and often prevents the disease."

In Italy there has been described by Dr. Brizi (Centr. für Bakter. 3^2:575–9. 1897.) a bacterial disease of the stalks and leaves of celery which, while it seemed to start as external yellowish, and finally reddish, cankers at the base of the leaf stalk, is perhaps only a variation of this same trouble. He found that the leaf invasion was internal, from the bacteria in the cankers at the base through the fibrovascular bundles out into the leaf tissues, instead of by direct external infection. The organism causing the disease is described as a new species, *Bacterium Apii*, which was later named by Migula *Bacillus Apii* (Brizi) Migula.

CORN, *Zea Mays.*

Corn Molds, *Cephalothecium roseum* Cda., etc. Plate IV b. According to newspaper accounts, corn in certain parts of the state suffered from mold at harvest time. We had no opportunity to investigate these cases, but an examination of the corn grown on the Station farm at Mount Carmel showed a little trouble of this sort. The mold developed only on immature or imperfectly cured corn that was husked late in the fall. The kernels, where they came in contact with each other, were covered with a conspicuous superficial white mycelial growth which often had a pinkish cast. Some of the kernels had an olive-black growth which also entered into the tissues of the kernels and cob. The trouble evidently was caused by two or more fungi, the most conspicuous of which was the pink mold named above. Species of Cladosporium and Penicillium have also been found at times on corn.

CURRANT, *Ribes rubrum.*

Anthracnose, *Pseudopeziza Ribis* (Lib.) Kleb. (*Glœosporium Ribis.*) Plate IV a. While currants are not grown extensively in this state, there are several plantations of from one to several acres.

One of the largest and most recent of these is that on the farm of the American Optical Company at Union. Visiting this farm last summer, the writer found a number of different varieties growing and some of them were being considerably injured by anthracnose. This is the most common and injurious fungous foe of the currant in Connecticut, and this year it was unusually common. Previously we had found it only on the foliage, where it produced numerous, small, purplish or reddish-brown spots, which, if abundant, caused premature defoliation. At this plantation not only were the blades and petioles of the leaves copiously spotted, causing defoliation of the lower part of the plant by the middle of July, but the fruit also was abundantly infected.

Stewart (N. Y. Agr. Exp. Stat. Bull. 199) and others have previously recorded this fungus on the fruit. While on the berries at Union it was usually less conspicuous than on the leaves, being entirely absent on some varieties, on others it was so abundant that it did considerable harm. The Wilder was one of the worst infected. This trouble is quite distinct from the bitter rot of the berries described in our Report for 1907, as shown by the photographs given there and in this report. The anthracnose appears on the fruit as more or less numerous, small, circular, dark specks about the size of a pinhead, which are in strong contrast to the light green of the young fruit. The fruiting bodies also occur on the pedicels of the fruit, and, according to Stewart, on the new wood, the latter offering a means for carrying it over the winter.

The parasitic stage of this anthracnose fungus belongs to the genus of imperfect fungi known as Glœosporium. Klebahn (Zeitschr. Pflanzenkr. **16**:65–83) in 1906 showed that its mature stage is a Pseudopeziza, and that this appears in spring on the old infected leaves that last through the winter. This stage serves as one of the sources of infection of the new leaves in spring. Burning the leaves after all have fallen, especially in a badly diseased plantation, is helpful in limiting the disease. This, coupled with spraying, should usually prevent the fungus from causing any serious injury. Bordeaux mixture is the best fungicide to use, and the spraying should start as soon as the leaves begin to unfold. Two or more treatments at intervals of about two weeks, should be given, the number depending upon the severity of the trouble the previous year. It may be necessary, when the disease is especially difficult to control, to continue the treatments after harvesting the fruit.

DAISY, SHASTA, *Chrysanthemum Leucanthemum hybridum.*

LEAF SPOT, *Septoria Leucanthemi* Sacc. and Speg. In the fall of the past year the writer found in a local nursery a fungus causing spotting of the leaves of the Shasta daisy. The conspicuous reddish-brown spots were angular or roundish, about one-quarter to one-half inch in diameter, frequently running together into larger irregular areas, the dead tissues being in sharp contrast to the surrounding healthy parts. Under conditions favorable to it the disease is capable of causing serious injury to the foliage. We have previously reported a somewhat similar trouble on the leaves of the cultivated chrysanthemum, *C. sinense.* The latter trouble we have ascribed to *Cylindrosporium Chrysanthemi* E. & D. Some years before Ellis and Dearness named this species, Saccardo and Spegazzini described on *C. Leucanthemum*, of which the Shasta daisy is a hybrid form, the fungus *Septoria Leucanthemi.* Both these fungi have spores very similar, though those of the latter are described as larger. Their generic position is somewhat doubtful, since in the *Cylindrosporium* there are indications of a perithecial body, and in our specimens on Shasta daisy the perithecia are not as distinct as is usual in a Septoria.

Since our fungus on the Shasta daisy has practically the same host, and its spores agree best with those of the Septoria, we have placed it under *Septoria Leucanthemi*, but we believe that the fungus described under *Cylindrosporium Chrysanthemi*, if not identical, is a very closely related species. The spores on the Shasta daisy are elongated, linear, straight, or more or less conspicuously curved, rather abundantly septate, with guttulate contents. They vary from 65-130μ x 3-5 μ, but are usually 75-110 μ x 3-4 μ, and taper from near the center in either direction, chiefly toward the free end, where they are about 1 μ in diameter. Several other smaller-spored species of Septoria have been described on both of these hosts.

EUONYMUS, CLIMBING, *Euonymus radicans.*

CROWN GALL, *Bacterium tumefaciens* Sm. & Towns. This bacterial gall was sent to us the past fall on specimens of the above host from a local nursery. It had been previously collected there on a related host, Japanese bittersweet, as well as on several other hosts. The climbing Euonymus seems to be a new host for this disease in this country.

JUNIPER, CHINESE, *Juniperus chinensis.*

RUST, *Gymnosporangium Haræanum* Syd. In our Report for 1911–12, page 350, we mentioned finding on imported specimens of juniper from Japan the rust *Gymnosporangium japonicum* Syd. These specimens showed the rust not only on the large woody stems, but also in certain plants on the young green stems at the base of the appressed leaves, and more rarely directly on the awl-shaped leaves. We did not consider this latter form as specifically distinct from the form on the large stems, since Shirai (Zeitschr. Pflanzenkr. **10**:1–5. 1900.), in his description of the life history of the fungus, states that it occurs on both stems and leaves. A microscopic examination of the leaf form, however, showed some difference in the spores, as indicated by our remark that "those on the leaves are as a rule smaller than those on the stem." The spores of this leaf form are chiefly 35–45μ, while those on the stem are chiefly 45–65μ, according to our recent measurements.

Long (Journ. Agr. Research **1**:353–6. 1914.), who received specimens of this leaf form from our collection, has recently published it as a new species under the name *Gymnosporangium chinensis.* He gives characters that distinguish it from *G. japonicum*, chief of which is the size of the spores. While Long describes this as a new species, he notes its very close relationship to *G. Haræanum* Syd. H. & P. Sydow (Ann. Myc. **10**:405. 1912.) describe this species on the same host as our fungus, and from material sent by Hara from Japan. Long, however, comparing our leaf form with that described by the Sydows, says: "*G. chinensis* and *G. Haræanum* are so closely related that the writer would not publish the former as a new species until he had examined the type material of the latter. After a careful examination, however, the conclusion was reached that the two were distinct, as they differ in certain fundamental microscopic characters. These differences are shown in the description given of each species. The most marked difference between these two species is the position of the germ pores in the colorless, thin-walled teliospores. In *G. chinensis* they are plainly apical in the upper cell, while in *G.*

Haræanum they are just as certainly situated only at the septum in both cells."

We have again carefully examined our specimens of the leaf form, and while we find it difficult to determine the position of the germ pores on many of the cells of the thinner-walled spores, in almost all cases where we could see them they occurred at the septum rather than apically, as Long states. Even Long in his specific description says: "Pores one or two in each cell, near septum, or usually only one in upper cell, and apical." Sydow's specific description of *G. Haræanum* agrees very well with our specimen, and the host and general locality are the same. We see no real reason for considering Long's species as distinct. This conclusion is further strengthened by a recent article by Ito (Tokio Bot. Mag. **27**:220–3. N. 1913.) in which he calls attention to the two species, *G. japonicum* and *G. Haræanum*, on the same host, which he states that Shirai confused as one. He says: "This author [Shirai] reports that the sori of this Gymnosporangium [*G. japonicum*] occur not only on the stem and branches of *Juniperus chinensis*, as the original diagnosis of Sydow states, but also on the leaves. This statement by Shirai has been cited in several works," among which is mentioned our article already referred to.

Ito also states that Miyabe and Yamada have for some time considered these two forms distinct. He further made infection experiments, and found that *G. japonicum* had for its aecial stage *Rœstelia Photiniæ* P. Henn. on *Photinia villosa*, but failed to infect *Pyrus sinensis* and several related hosts. Hara (Tokio Bot. Mag. **27**, no. 319. 1913.) recently showed, however, that *G. Haræanum* has for its aecial stage *Rœstelia Koreœnsis* on pear leaves. According to Ito, Miyabe and Yamada had already proved that *G. asiaticum* Miyabe, which Ito gives as a synonym of *G. Haræanum*, has its aecial stage on leaves of *Pyrus sinensis*, *Cydonia vulgaris*, and *C. japonica*. He concludes that there are therefore two species on this juniper, namely *Gymnosporangium japonicum* and *G. Haræanum*. Why he does not use the older name, *G. asiaticum*, for the latter species, is not clear, since he cites its publication by Miyabe (Tokio Bot. Mag. **17**:34.) in 1903. Sydow (Just. Bot. Jahresb. **32**:166) also gives it questioningly as a synonym of *G. japonicum*.

JUNIPER, *Juniperus communis.*

Rust, *Gymnosporangium clavariæforme* (Jacq.) DC. Plate IV c. This rust, while occurring on our native junipers, has not been reported before on cultivated forms. While inspecting nursery stock imported in March from James Fils, Ussy, France, by the C. R. Burr Nursery Company, Durham, Ct., Mr. Walden, in a lot of one thousand *Juniperus communis* var. *hibernica*, ran across 78 specimens that were infected with this rust, and had developed the gelatinous fruiting sori in transit. The fungus causes slight swellings on the stem, and on these the sori show as flat, tongue-shaped, light-orange colored bodies from 4 to 10 mm. in length. Various species of Crataegus, Amelanchier, Pyrus, etc., form the alternate hosts for the aecial stage of this fungus, but as yet little injury to cultivated hosts has been reported in this country.

LAUREL, MOUNTAIN, *Kalmia latifolia.*

Leaf Blight, *Cercospora Kalmiæ* E. & E. This fungus forms on the leaves dark brown spots with prominent purplish borders. The fruiting threads are grouped as inconspicuous pustules on the upper surface. We have not found the disease as yet doing any conspicuous injury. It can usually be distinguished from the more common Leaf Spot on the same host, as the latter forms smaller spots with a lighter center.

LIMA BEANS, *Phaseolus lunatus.*

Arsenical Burn. Early in July of the past summer we were called to determine the cause of the sudden injury to pole Lima beans on the farm of one of our large market gardeners. The plants were still young, most of them having developed only the first pair of leaves above the cotyledons, and on these were irregular, light-yellow, injured areas which more or less covered their surface. Reddish spots also showed on the stems of some of them. In most cases the terminal bud escaped injury, though a few of the plants were killed outright.

We found that the trouble, instead of being some destructive blight, as believed by the grower, was due to arsenical burn from Paris green in bran which had been placed around the plants for cutworms a short time before. Some of the poisoned bran had fallen on the foliage, as shown by its presence there at this time,

and in general it had been placed too close to the stems, with the consequent serious result already mentioned. We have previously noted Paris green burn on potato foliage, when it was used in dust form to kill potato beetles. The foliage of some plants is much more susceptible than that of others, and the Lima bean seems to be in the former class.

MAPLE, HARD, *Acer saccharum.*

Oil Injury. During the past year we had called to our attention, first by Mr. Bartlett of Stamford, and later by Mr. Tyler of Meriden, both tree specialists, cases where the bark on the trunks of hard maples was killed to such an extent that the trees that were not already dead were sure to die eventually. It is often difficult to tell the cause of these bark injuries on city street trees, since escaping gas in the soil, sun scorch, winter injury, etc., produce very similar troubles. However, the above cases were directly traceable to the use of certain oils in treating the trees to kill the scurfy bark scale.

At Meriden, the trees had been scrubbed the year previous in most cases with pure kerosene oil, while those at Stamford had been sprayed with certain standard miscible oils. Mr. Bartlett informed us that he had found it very dangerous to use these miscible oils for winter spraying on hard maples, though soft maples do not seem to be injured. Stone (Reprint Mass. Agr. Exp. Stat. Rept. **1912**:47) speaks of similar injury to various trees. Following the injury, certain fungi are apt to appear on the dead or dying bark, and the superficial observer may mistake these for the cause of the injury.

PALM, KENTIA, *? Howea Belmoreana.*

Anthracnose, *Glomerella cingulata* (Ston.) Sp. & v. S. Mr. Walden, in examining some imported Kentia palms at a local florist's, found a disease that frequently caused the leaves to die, especially at their tips. Its fruiting stage showed in places on the foliage as numerous, small, black, circular bodies, bearing abundant conidial spores similar to those of the bitter rot of apple and the privet anthracnose fungus mentioned later in this report.

Shear (Bur. Pl. Ind. Bull. 252:14, 36.) reports this fungus under the above name on a Kentia palm belonging to the genus Hedyscepe, and the writer saw in Illinois some years ago a similar fungus in the Gloeosporium stage on undetermined species of Kentia palm. The fungus at times apparently does considerable injury, especially when it attacks the plants at the base, causing the death of the parts above. Apparently this fungus has been reported under other species of Gloeosporium, as shown by the following statement of Trelease (Rept. Mo. Bot. Gard. **9**:159. 1898.): "In October, 1897, Mr. W. J. Hesser, a large importer and grower of palms, sent to the Garden leaves of Kentia and Phœnix affected by unrecognized fungi. The latter were referred to Professor P. A. Saccardo, who reports that the one on young specimens of Kentia is *Glœosporium Allescheri* Bres., which, however, may be considered a palmicolous form of *G. sphærelloides* Sacc." Other Gloeosporiums have been reported on different palmaceous hosts, but whether they are distinct from this is uncertain.

PARSNIP, *Pastinaca sativa.*

Soft Rot, *Bacillus carotovorus* Jones. We have seen in American literature no reference to a bacterial rot of parsnip occurring in nature. Jones (Vt. Agr. Exp. Stat. Rept. **13**:309. 1901.), however, gives the results of successful inoculation of parsnips with the above bacterial species obtained originally from a soft rot of carrots. His description of the soft rot of carrot agrees with a soft rot of stored parsnips which was called to our attention in 1910, at a local market garden. A more detailed account of this soft rot is given in this report, page 25, under Salsify, as it was observed on stored roots of the latter at the same place.

PEACH, *Prunus Persica.*

Leaf Curl, *Exoascus deformans* (Berk.) Fckl. Plate V a. We have mentioned previously in this paper that leaf curl of peach was unusually abundant on the leaves and young twigs this year. In the Barnes orchards at Yalesville, however, we found this fungus for the first time on the fruit. The trouble in its young stage was so obscure that we thought it might be frost or spray injury, but a microscopical examination of the in-

fected tissues revealed this fungus in fruiting condition. In July the trouble showed as conspicuous blotches, sometimes covering half the surface of the fruit. These were whitish, but often had more or less of a purplish color, as seen on the curled leaves. The blotches were slightly elevated, with a more or less irregular, smoothish surface, usually indented at the edges. In time these areas became more or less cracked, thus opening the way for subsequent decay. This injury is sometimes very conspicuous on the larger fruits, causing deformity and stunting of those badly affected.

While we have never before seen the fruit affected by this disease, Duggar, in his book on Fungous Diseases of Plants writes: "The idea generally prevails that the leaf curl occurs only upon the leaves and young branches, but the flowers and young fruit are likewise subject to attack." Pierce (U. S. Dept. Agr. Div. Veg. Path. Bull. 20:13) also says: "It is known to cause considerable losses of the fruit in some sections." No doubt this loss comes chiefly from the dropping of the young fruit. We have seen no statement, however, of its appearance on the half-grown and mature fruit, such as occurred in the Yalesville orchard. The trouble even here was not so common as to become very noticeable.

PINE, NORTHERN SCRUB, *Pinus Banksiana.*

Pine-Sweetfern Rust, *Peridermium Comptoniæ* (Arth.) Ort. & Adams. We have previously reported six species of pine that have been infected with the above named rust in the State forest at Rainbow. Last May *Pinus Banksiana* was also found infected. We have used the spores from most of these hosts, including the last, to successfully infect the sweet fern with the II stage of this rust.

Arthur and Kern (Science **38**:311. 1913. Mycol. **6**:131. 1914.) have recently shown that *Peridermium pyriforme* Peck, under which name we have previously reported this rust, is an entirely different species whose telial stage apparently occurs on *Comandra umbellata.* (See also article by Orton and Adams in Phytopath. **4**:23. 1914.)

POPLAR, WHITE, *Populus alba.*

Crown Gall, *Bacterium tumefaciens* Sm. & Towns. These

galls were found the past summer on exposed roots near the trunk of a white poplar in the writer's yard. This makes ten different hosts upon which crown gall has now been reported in this state. They are as follows: Apple, bitter sweet (Japanese), blackberry, Euonymus (climbing), peach, plum, poplar (white), raspberry, rose, wistaria (Chinese). There are, no doubt, other hosts beside these here. On none of them have we had complaint of serious injury except on blackberry, raspberry and rose.

There is some question as to just how injurious the disease is here, even when the galls are abundant. In some regions, however, crown gall is considered very harmful. It is always safest to reject any plants showing the galls. Generally, nursery and greenhouse men cut off only the infected parts of the roots. Our nursery inspectors now condemn stock found infected with galls, though where plants are inspected only in the field it is impossible to detect galls on the roots.

POTATO, *Solanum tuberosum.*

Black Leg, *Bacillus phytophthorus* Appel. Last June in the potato field of Mr. John S. Buck at Wethersfield we noticed occasional plants grown from Maine seed that showed this disease, while the part of the field planted with selected home-grown tubers did not show it. The plants attacked by black leg are smaller, stiffer, and have yellowish, often curled, leaves. The stem near and under the ground reveals a very characteristic black rot, starting from the seed tuber, which is destroyed by a wet rot. Badly infected plants are easily pulled from the ground. The new tubers usually show no decay, but under very moist conditions, or with much humus in the soil, we have found them decaying badly, as they are said to do in Canada and Europe.

In our Reports for 1903, page 350, and for 1904, page 324, we described and illustrated a bacterial disease of potato which in the latter report was referred questioningly to *Bacillus Solanacearum.* This we now believe to be what is commonly called black leg, which at that time had not been reported in this country. Specimens of our earliest collections and those from Wethersfield were sent to Morse of Maine, who has made a special study of this disease, and he confirms our opinion as follows: "I am pretty well satisfied in my own mind that all the specimens you sent are

from plants attacked by black leg. This being the case, they represent the first authentic report of the disease in the United States, as these collections antedate Jones' observations in Vermont by two or three years. However, I am convinced that it existed in Maine for quite a number of years before it was reported. It was not found earlier simply because no one was working upon plant diseases in the state who had special training along that line."

Several investigators in Germany, Ireland, France and Canada have described bacterial diseases of the stem and tubers of potatoes said to be caused by different bacterial organisms, but which are possibly merely this same disease. We accept here the conclusions of Jones and his pupils, who found the American disease to be the same as that described by Appel in Germany. As yet black leg in Connecticut is not a serious trouble. Morse believes that germs are carried on the tubers, and he found that the selection of perfectly sound tubers and their treatment with formalin, as for scab, will largely prevent black leg in the field.

PRIVET, *Ligustrum vulgare.*

ANTHRACNOSE, *Glomerella cingulata* (Ston.) Sp. & v. S. In September there was sent to this Station by the Elm City Nursery Company of Westville injured twigs of privet imported the previous spring from France. Microscopical examination showed that the asco-stage of the above-named fungus was present on some of the branches. In our 1909–10 Report, page 733, we mentioned receiving this fungus from the same nursery, where it was found that time also on imported French nursery stock, but only in its conidial stage, *Glœosporium cingulatum* Atk. The spores of both the conidial and asco-stages are very similar.

An inspection of this privet plantation in October showed that quite a number of the branches had been killed. These were not completely invaded by the fungus, but were killed by its girdling the stem for an inch or two and then forming the fruiting pustules as small black outbreaks on the reddish-brown dead area. The girdled areas may occur at the base of the stem near the ground, at its juncture with a branch, or at some distance above. When the stem is completely girdled the leaves above soon wither and die, and later the stem also gradually succumbs. It seems to the

writer that while this may develop into a serious trouble on the privet, especially on the French variety, the weakening of the imported plants through transplanting, and their subjection to the June-July drought may have been largely responsible for its unusual development. However, it is a disease which needs watching to determine how serious it may become.

RED TOP, *Agrostis alba.*

SCLEROTIUM DISEASE, *Sclerotium rhizodes* Auersw. This disease of meadow grasses has been fully described rather recently by Stout (Wis. Agr. Exp. Stat. Research Bull. 18:207–61. 1911.) who found it affecting a variety of grasses, but most frequently on *Calamagrostis canadensis.* The writer, upon the suggestion by Stout that this fungus occurred in Connecticut, succeeded in finding it on Red Top in a wet meadow at Wethersfield, last June, and we have no doubt that it occurs elsewhere in the state on this and other grasses. Curiously enough, Red Top is one of the hosts that Stout found apparently immune in Wisconsin. The fungus sometimes causes serious injury to meadows, but where observed by us, while conspicuous, was not a very serious pest.

The infected plants become noticeable by the dying of the infected leaves, which roll up near their tips, the narrowed whitened tissue being in sharp contrast with the healthy green part below. The injured culms do not attain their normal height, and in early summer their dead tips give the impression of having been nipped by frost. The leaves when closely inspected usually show a slight growth of the whitish mycelium, but more conspicuous are the more or less numerous, small, oval, purple-black sclerotia, which are one-fifth of an inch or less in diameter, and loosely attached to the surface of the leaves. So far as known, these sterile sclerotia are the only fruiting stage of the fungus.

RHODODENDRON, *Rhododendron* sps.

Leaf Scorch, Plate V b. From time to time there have been sent to this Station leaves of Rhododendron, usually *R. maximum,* which were injured in spots, or more frequently at the margins, so that the tissues had died prematurely. Usually no fungus showed on these dead areas, or, if so, it was not of a parasitic nature. Such troubles have apparently resulted from winter injury

of the old leaves, or from sun scorch to both old and new ones.

One of the worst cases seen was called to our attention in New Haven last July. In this instance, as frequently in others where this trouble has occurred, the shrubs had recently been transplanted. They were in a rather dry place, with no special shade or mulch to protect them or the soil from rapid loss of water, consequently, following the rather severe June-July drought, they suddenly showed early in July many reddish-brown dead leaf margins, as in the illustration. Where the house north of which they were planted provided partial shade, the plants developed very little of the trouble. Such shrubs need some shade protection to do their best, and cultivation or mulching of the ground to conserve the moisture is also a helpful precaution.

ROSE, *Rosa* sps.

Mechanical Spotting by *Pilobolus crystallinus* (Wigg.) Tode. Plate VI a. A peculiar, though slight, injury to the foliage and blossoms of roses and other greenhouse plants was called to our attention the past fall by Mr. John Coombs, a Hartford florist, who wrote: "I am sending you by same mail as this a box containing some rose leaves covered with small black spots. Can you tell me what the trouble is? It appears only on two benches in a six bench house, the two benches which have been recently mulched with fresh cow manure. The other four benches have not been mulched, and do not show any trace of the trouble except on the side of the bench next to one that has been mulched. The roses are healthy and in good growth. The trouble is new to me, but seems in some way to be connected with the manure used in mulching. It has been suggested that they are fly specks, but there are very few flies in the house, and they are scattered all over the house. Let me hear from you as soon as possible if you can give any explanation of the trouble."

An examination of the small black spots on the leaves showed that they were merely the spore heads of the fungus *Pilobolus crystallinus*, which develops on fresh manure. These spore heads, when ripe, are shot off into the air and stick to the objects on which they alight. This fungus in time is replaced by other fungi in the manure, and the spore heads cease to be shot off. Such was soon the case here, and as no objection was raised by the purchasers of the roses, the trouble did not prove so serious as Mr. Coombs feared it might when it was first observed by him.

SALSIFY, *Trapogon porrifolius*.

Soft Rot, *Bacillus carotovorus* Jones. Plate VI b. In December there was called to our attention at the market garden of A. N. Farnham, Westville, a soft rot of salsify. The roots had been placed in pits ordinarily used for hot beds, and covered over to protect them from frost. As more or less of the green tops adhered, and the weather of late fall had been unusually warm and moist, these conditions and storage with poor ventilation had favored decay. In a number of cases this decay extended down from the crown into the interior of the roots for a considerable distance. The interior tissues only were seriously affected, while the harder outside tissues formed a firm coating to this central decay. The bacteria, however, invaded the fibrovascular bundles, as shown by their blackening, in advance of the soft inner rot, which was also a darker color than the healthy tissues. The inner lamellæ of the cells attacked by the bacteria dissolved in time, so that the cells were easily pressed apart. This same rot was also found on stored salsify roots at the Station grounds, and apparently was not an uncommon trouble this year.

We have found no description of a soft rot of salsify occurring in nature, except a short note by Halsted (N. J. Agr. Exp. Stat. Rept. **1894**:354) in which he said: "Bacteriosis is not uncommon in the crown of the salsify plant, where it causes a decay that may extend down and destroy the root." Jones, however (Vt. Agr. Exp. Stat. Rept. **13**:310. 1901.), was able to produce a decay in salsify roots by inoculation with his *Bacillus carotovorus*. He writes concerning this inoculated salsify: "Two roots of this plant decayed when inoculated in the crown, and did so less rapidly than did carrot or turnip. The decay advanced faster in the fibrovascular ring than in the adjacent parenchyma." This germ seems from these investigations of Jones, and also those of Harrison* and later those of Harding and Morse (N. Y. Agr. Exp.

* Harrison (Ontario Agr. Coll. & Exp. Farm Bull. 137:1-32. 1904.) described a new bacterial rot on cauliflower and white turnip whose organism (*Bacillus oleracea* n. sp.) he isolated and used to produce rot in a variety of plants. Later Harding and Morse showed this to be the same species as that previously described by Jones.

Stat. Tech. Bull. 11:251–87. 1909.) to be the cause of soft rot in a number of different vegetables.

In the present report we have already mentioned rot of celery and parsnip, which we believe to be caused by *Bacillus carotovorus*. We have previously reported undetermined soft rots of cabbage (Rept. **1903**:311) and onion (*Ibid*: 334), which apparently are caused by this same organism. In the 1903 Report, page 327, mention is also made of a rootstock rot of Iris found in a local nursery, which proved the same as that originally described by van Hall (Zeitschr. Pflanzenkr. **13**:129–44) from Germany. He found several bacteria associated with this rot, of which the chief was a species which he called *Bacillus omnivorus*. Harding and Morse received cultures of this species from van Hall, and found it to be the same as Jones' *Bacillus carotovorus*.

In our 1903 report, page 312, we gave the following description of a bacterial rot of carrots raised from seed, which we have not since seen: "While visiting a seed farm in the vicinity of Milford in 1902, there was observed a rather serious trouble of this host due to bacteria. The infected plants showed a wet rot, confined chiefly to the outer layers of the stem. These had a greenish-black color, were watery, and easily mashed out of place with handling. To a less extent the leaves showed blackened spots, and the inflorescence was somewhat infected. An examination of these injured parts showed plenty of bacteria, which were no doubt the cause of the trouble, though no experimental or cultural work was undertaken with them. So far the writer has seen no description by others of this trouble on carrots."

It was from a root rot of carrots that Jones originally obtained his cultures of *Bacillus carotovorus*. No one has especially investigated this trouble in the field, but this note of ours suggests that perhaps here was a case where slightly diseased roots had been used to grow seed plants, and as these became mature, the bacteria from the roots, by following through the bundles, finally invaded the soft parts of the stem and leaves and produced the decay. Brizi, in his description of a bacterial rot of celery (see present report, page 12) mentions an invasion of the leaf tissue from a basal stem rot in this manner.

While cultures of bacteria have been isolated by us from most of these vegetable rots, neither a special study of these nor inoculation tests have as yet been carried on, so that our general conclusions as to the identity of the particular organism involved are based largely on our observations and the statements of those investigators already quoted. Perhaps later we may be able to present cultural and inoculation data.

As regards the prevention of these troubles, we suggest the following precautions. First, for seed crops use no roots showing any signs of the rot. Second, avoid heavy manuring, and especially do not feed these decaying roots to animals and then use the manure on land where any such root crops are to be grown. Third, in storing try to protect the roots against excessive moisture by proper ventilation, and avoid, if possible, any overheating.

TOBACCO, *Nicotiana Tabacum*.

Phyllodiniation or *String Leaves*. Plate VII b. In the past few years we have several times received abnormal tobacco plants from places both in Connecticut and Massachusetts in which the chief abnormality was the excessive narrowing of the leaves, as shown in Plate VII b. Such plants are usually quite short, because of the imperfect development of the internodes, and the leaves, besides being narrowed in varying degrees, are often more or less irregularly scalloped and crinkled. Frequently such leaves show the peculiar mottling characteristic of calicoed plants, and for this reason some writers consider this appearance as an extreme condition of the mosaic disease. However, while we have seen this association, we do not believe that this deformity necessarily depends upon a calicoed condition of the plant for its development. We have never found such plants in our experimentally calicoed plots, no matter how early or severely the plants were calicoed. Furthermore, we have seen cases where such plants did not have the characteristic mosaic mottling, and we were unable to produce the disease by using their juice on young sound plants.

This trouble, while it has not received particular attention from investigators in this country, has been mentioned by a number of writers. The earliest reference we have found is given in the Annual Report of the U. S. Department of Agriculture for 1874, page 58, which reads as follows: "A second cause [of abnormality] is too much wet weather after the plant starts to grow, causing it to 'French' as we term it. The leaf thickens, grows very narrow, dagger-shaped, frequently not broader than a case knife, and often as

many as fifty leaves on a plant, all of them spread out on the ground." Frenching was later described by J. B. Killebrew (Tenth Census U. S. **3**:262) in 1880, in an article on the culture and curing of tobacco in the United States. He says:

"Frenching, derived from the French *friser* (to curl), occurs almost exclusively upon cold, stiff uplands having a close and stiff subsoil. During a wet season it is very prevalent upon clayey lands, and sometimes found upon sandy soils in small basins during excessively rainy weather. This disease renders the plant worthless when it has progressed to any considerable extent. The effects are first seen in the buds of the plant, which become of a yellow color. The leaves afterward become thick and fleshy, having a semi-transparent or honey-colored appearance, and often curl around the edges downward, sometimes growing in long, narrow strips with ragged outlines. When cured, the leaves are dull and lifeless in color and very brittle. No remedy for the disease has been found. It is sometimes arrested by close plowing, or by giving the plants a vigorous pull so as to break the tap root, but the only preventive measure is to avoid planting on a soil not properly underdrained, either naturally or artificially."

Woods (Bur. Pl. Ind. Bull. 18) in 1902 figured a calicoed plant showing these leaf abnormalities, produced by cutting back the stem, but he considered this merely an extreme symptom of calico. Jenkins (Conn. Agr. Exp. Stat. Bull. 180:56. 1914.) very recently, under "String Leaves or Shoe Strings" gave the following description: "Very narrow deformed leaves, sometimes leaving little beside the midrib, are frequently associated with calico."

This disease has also been reported from a number of foreign countries. Peters (Reprint Mitteil. Kais. Biol. Anst. Land. Forstw.: 64. 1912.) gives a short description of it under the term *schmalblättrigkeit*, and lists it from Russia, Dalmatia, France and Java. Delacroix (Reprint Ann. de l'Inst. Nat. Agron.:21–2. 1906.) gives examples of it under the name *polyphyllie*. Both speak of it in connection with the mosaic-disease of tobacco. Jensen (Med. van Het Proefstat. voor Vorstenl. Tabak No. 5:68–9. 1913.) figures and describes this same trouble from Java under the name *tjakar*. He found that affected young plants would outgrow it if transplanted into more favorable soil conditions, though the new soil might vary greatly as to richness. If we remember correctly, this trouble has also been reported recently from West Africa, where it developed under certain unfavorable mechanical conditions of the soil.

The cause or causes of these abnormal plants are not fully known. The writer believes they are connected with imperfect nutrition due generally to unfavorable soil or root conditions. Under unfavorable soil conditions we would mention excessive amount of fertilizer in the soil immediately around the deformed plant. We have known of some cases where this over-fertilization seemed to be the most reasonable explanation, and Koning (Zeitschr. Pflanzenkr. **9**:76. 1899.) gives a description and illustration of malformation of tobacco leaves through excessive use of certain chemicals, especially potash compounds, which seem to throw light on this subject. The improper aeration of the roots, too much moisture in the soil, or a poor mechanical condition, also seem to be factors in producing the trouble.

WHEAT, *Triticum vulgare.*

Orange Leaf Rust, *Puccinia Triticina* Erikss. While this rust is very common wherever wheat is grown, it has not been reported before by the Station, since in recent years very little wheat has been raised in this state. Attempts have lately been made to revive wheat culture somewhat, and in examining some of these fields the writer has found this rust several times. Its summer stage, II, forms small, dusty, orange outbreaks, covering the leaves, especially the upper surface, more or less thickly. Its less conspicuous mature stage, III, is more permanently embedded in the leaves and of a darker color.

Loose Smut, *Ustilago Tritici* (Pers.) Jens. This is another common fungus of wheat, not previously reported. It changes the spikelets into dusty, olive-black masses, which dissipate in time, leaving behind only the naked rachis. In regions where wheat is grown extensively it sometimes becomes a serious pest.

II. SO-CALLED CHESTNUT BLIGHT POISONING.

Publicity of Alleged Poisoning.

During the latter half of October and the whole of November there appeared in the newspapers of this state and elsewhere numerous accounts of the illness and death of persons whose sickness was popularly supposed to be in some way connected with the eating of chestnuts affected by blight, this fungus being generally held as a poisonous agent causing the trouble. These accounts, while numerous, really related to comparatively few cases of sickness.

There had also been frequent mention in the newspapers during September and October of the illness and death of persons from eating mushrooms. Concerning these cases there was no question that the illness had a direct connection with the eating of certain poisonous mushrooms. Poisonous species of the genus Amanita were unusually common last fall, and there is a growing disposition on the part of our foreign population, especially Italians, to gather miscellaneous mushrooms for food, according to customs established in their native countries. Such persons are unacquainted with our native species and unfamiliar with the poisonous nature of many of the Amanitas, consequently each year there are a number of cases of illness and death recorded. Last year these cases were unusually frequent, as shown by newspaper accounts.

During the last few years chestnut blight has been a frequent subject of discussion in the newspapers. Because of this publicity, and the great damage wrought by the blight in our forests, there are few people who have not heard of this disease, while many of them are more or less familiar with its work. Such a destructive disease often leads the partially informed to suppose that the fungus causing it is equally poisonous to men or animals if taken internally. This belief, together with the fact that there had been unusual trouble from eating poisonous mushrooms, easily opened the way for the supposition that the blight was responsible for any sudden illness following the eating of chestnuts.

A newspaper notice of the death of two children in Bristol in October, in which a doctor was credited with the statement that their death probably resulted from eating chestnuts from blighted trees, proved the forerunner of similar reports from different parts

of the state, and these were widely copied and commented upon by the newspapers. We quote the following to illustrate:

"October 22. It did not become generally known until to-day that the death of —— ——, six years old, who died Sunday, was probably caused by his eating chestnuts which had been taken from a tree affected with blight. * * * His brother is now in a serious condition, and likely to die. Six other deaths from chestnut eating occurred in Connecticut last week." That all doctors did not agree as to the cause of the trouble is shown by the following statement: "Hartford physicians are divided in their opinion regarding the danger to life and health from the chestnut blight, which has affected many trees in Connecticut and other states, and which is said to have been responsible for at least three deaths. Some believe that the nut itself is affected by the blight, and becomes a deadly poison to the eater, while others scoff at the theory, and say that the deaths reported to have come from chestnuts were probably from other causes."

These newspaper accounts finally ran from the possible into the very improbable, as indicated by the following: "Nov. 4. Local physicians have several times been called upon to treat a number of people for a peculiar malady which seems to attack the nerves of the face, arms and legs, and is accompanied by a sort of rash or eruption. In every instance the patients have eaten grey squirrels. * * * Several hunters report finding grey squirrels lying dead in the woods. There is a possibility that they may be affected by some malady, or they may have become poisoned by the chestnut blight." "Nov. 25. Ptomaine poisoning due to eating a grey squirrel which in turn had eaten chestnuts from trees affected with blight, is the cause assigned by the attending physicians for the death of —— —— this morning. He was seized with convulsions Monday night, and these continued until death. It is believed to be the first known case of the kind."

There seems to be no reason whatever for connecting the death of the squirrels with the chestnut blight. Certainly there is no proof of any such connection. It is quite reasonable to believe, however, that the reported cases of illness may have had some relation to the eating of squirrels, as they may have resulted from ptomaine poisoning, especially since the fall was unusually warm, and squirrel meat would quickly spoil. There is also a bare possibility that some poisonous thing eaten by the squirrels may have

killed them or seriously affected them, thus making them unwholesome as food. Indirect, though not very convincing, evidence along this line is shown in the following statement by Chesnut in bulletin on Principal Poisonous Plants (U. S. Dept. Agr., Div. Bot. Bull. 20) concerning our common mountain laurel. "Horses and even goats have died from eating the leaves, and in May, 1895, a monkey was killed at the National Zoological Park at Washington, D. C., by eating a few flowers and leaves offered to it by a visitor. Deer and grouse are said to be immune, and it is claimed that their flesh, especially that of the ruffed grouse, is poisonous when they have fed upon it. It is stated that chickens have been poisoned by eating the vomited matter from poisoned animals."

The newspaper publicity of so-called chestnut blight poisoning naturally caused many persons to become suspicious about eating chestnuts of any kind. Various inquiries about the poisonous nature of the blight were sent to the Station, and the writer undertook to investigate the subject, since he had already made extensive studies of the blight fungus itself.

NATURE OF THE TROUBLE.

Persons Affected. So far as we could learn from newspaper and other information, there were from five to eight deaths in this state attributed directly or indirectly to eating blighted chestnuts, and perhaps twice that number of persons who were made more or less seriously ill. Of those who died, three were children, six or under six years of age. One was a woman of about thirty years, of whom the papers stated that "although she had not been well of late, it was not thought that her previous condition caused her death." One was a young man of about thirty years, whose death was attributed to eating grey squirrel, with the further statement that he also had not been in good health previously. Concerning the other two or three persons who died no very definite information was obtained.

Dr. T. C. Merrill of Washington, D. C., in a recent article (Journ. Amer. Med. Asso. **62**:289–90. 1914.) gives data concerning twenty-one persons said to have been made ill by eating chestnuts last fall, and of these eighteen are credited to Connecticut. Of these eighteen there were four who died, one three years, two six years, and one thirty-two years old, and these are undoubtedly included among those already mentioned by us. Since out of the five to eight deaths three were children and two were persons not in good health, it can readily be seen that acute indigestion from eating chestnuts might account for their death without the assumption of poisoning. In order to gain a little more light on the nature and cause of their illness, we wrote for information to some of the persons concerned. Answers were received from several, including the father and the physician in charge of the children whose death was first attributed directly to the blight fungus. These letters, while they show some possible connection between the eating of chestnuts and the subsequent illness, do not in our opinion give any convincing evidence that the blight had anything to do with it.

The father of the children above mentioned wrote as follows: "In reply to your letter regarding the death of my little boys, I wish to state that the children were internally poisoned. They were eating chestnuts the night they were taken sick. These came from a tree that was blighted. There is a brook that runs back of my house, which several houses empty into, and there have been chestnuts taken out of it. The tree hangs over the brook, so therefore my children might have gotten some of these. My brother's little boy, four years old, is seriously sick from the same thing, that is, it seems to be the same, but his doctor claims that the bloody dysentery, with the other conditions of the child, is the same as the epidemic they had here in 1905, when so many children died."

Concerning another case, we received the following letter: "I have your letter of the 27th, asking about the report of chestnut illness, etc. As to myself, I ate the chestnuts, and in about an hour was taken with pain, cramps, and nausea, and violent discharge downward. Mr. —— —— was taken in the same way, but more severely, I should judge from what he told me. A boy nearby was also taken in the same way. That was before we heard that chestnuts had made anyone ill, and had been the cause of a death in this place. After we heard that, we naturally thought that chestnuts had made us ill. It has been said that chestnuts are hard to digest, but when years ago I had the dyspepsia, they cured me. Mr. Blank is a farmer, and says 'I can eat anything and never hear from it.' The same is true of the boy."

Symptoms: The doctor who attended the two boys already mentioned, sends us the following letter concerning their symptoms:

" In reply to your letter of the 13th inst. regarding the death of the two children from so-called chestnut blight poisoning, I will give you the facts so far as I can remember them. The three-year old boy during the evening of October 6th ate some chestnuts. He retired as usual about seven-thirty. Vomited once or twice during the night, was restless and complained of severe pain in the abdomen. His mother gave him castor oil, which was vomited immediately. The following day he began to have loose movements, which were not carefully observed. When seen by me at six p. m. October 7th, temperature was 101, pulse 130, physical examination negative. Great prostration present. Patient lies in stuporous state, taking no notice of surroundings. Tongue dry and coated. Abdomen sunken and negative, not rigid. Deep pressure causes no pain. Mother says patient has not vomited since night before. Outside of loose bowels, temperature, and fact that patient looks sick, nothing else made out on physical examination, most notable features being great prostration and stupor, in which mother says patient has been all day.

October 8. Temperature 100, pulse 120, movements very foul, greenish in color, contain mucus and are streaked with blood. Had a movement about every hour during the night accompanied by abdominal pain. Vomited a brownish fluid three or four times during night. Still continues in stuporous condition, having to be aroused to take teaspoonful doses of albumen water and his medicine.

October 9. Temperature 97 and a fraction. Pulse 120. Bowels still very loose and greenish in color, considerable mucus present, and amount of blood greater than on previous days. Abdomen sunken, but not rigid. Still in state of collapse, but seems brighter than on previous days. Takes more notice of what is going on around him. Tongue dry and coated. Physical examination otherwise negative.

October 10. Temperature 97, pulse 120, practically same conditions exist as on previous days. Frequent greenish, bloody movements containing considerable mucus and accompanied by abdominal pain. Nothing retained by mouth except teaspoonful doses of albumen water. Called at ten p. m. same day. Patient had been vomiting quite freely for the last few hours. Vomitus was copious, greenish, and contained some mucus. Patient in stupor and very weak. He died at five a. m. next morning.

The other child, five years old, was taken suddenly ill on morning of October 10th, while mother was dressing him for school. When seen by me at ten o'clock that morning, he was suffering greatly with abdominal pains. Temperature was in neighborhood of 102. Had not vomited up to that time. On examination, tongue was dry and coated, abdomen sunken and soft, otherwise physical examination negative. Began to have loose bowels that afternoon, at first foecal in character, but soon became watery, greenish, with considerable mucus. Temperature at ten p. m. same day was 103, pulse 140. Delirious, recognizes nobody. Bowels move about every half hour. They are foul smelling, greenish in color, but contain no blood. He vomited a greenish fluid several times during the night. Taken to hospital early in morning, October 10th, where he died October 12th at one p. m.

From the beginning of their sickness both patients were completely overcome by the virulence of the poison. They seemed to offer no resistance whatever. They had both eaten freely of chestnuts from a neighboring tree which was affected by blight. The mother is sure the youngest child had not eaten anything else out of the way. Their surroundings were fairly sanitary. The drinking water was found O. K. on chemical examination.

The symptoms of these two boys agree fairly well with each other, but are not entirely the same as those of some others who were made sick. Dr. Merrill, who has already been referred to, obtained data regarding symptoms of twenty-one persons, whose ages ranged from three to sixty-three years. Thirteen out of twenty-one, however, were under fifteen years of age. He has tabulated these symptoms as positive, negative, or undetermined for each case. From this table we have condensed the following information, giving only those symptoms where the evidence was positive in three or more of the cases enumerated:

Moderate fever 10, high fever 3	13	out of	18	cases	reported
Abdominal cramps	7	" "	18	"	"
Diarrhoea	8	" "	19	"	"
Blood in stool	4	" "	18	"	"
Negative abdomen	12	" "	—	"	"
Constipation	10	" "	19	"	"
Pain in left stomach	8	" "	18	"	"
Vomiting 11, nausea 5	16	" "	19	"	"
Full slow pulse	5	" "	13	"	"
Rapid heart	3	" "	14	"	"
Pallor	3	" "	16	"	"
Vertigo	3	" "	13	"	"
Drowsiness or stupor	3	" "	18	"	"
Restlessness	5	" "	18	"	"
Delirium	3	" "	20	"	"
Coma	3	" "	20	"	"
Prodomal fatigue	8	" "	20	"	"
Great prostration	15	" "	16	"	"
Sweating	3	" "	18	"	"
Diagnosed toxemia	12	" "	21	"	"
Death	4	" "	20	"	"

Ate nuts from blighted trees 3, ate raw nuts 15, ate boiled nuts 2, undetermined 1 =21.

It would appear from the preceding statements that the trouble

was due to some toxic substance taken by or developed in the patient. It likewise seems reasonable to suppose that the chestnuts eaten had some connection with this trouble. It is not clear, however, that the blight bore any definite relationship to it.

Possible Causes of Trouble.

Let us now consider more in detail the possible causes of these apparently unusual cases of sickness. There have occurred to us several possible explanations, mentioned under the following headings:

(1) *Indigestibility of Chestnuts.* It is a matter of common experience with most people that eating heartily of nuts of any kind is liable to bring on indigestion or more serious trouble. We are told that children are very apt to overeat on chestnuts, and that after a diet of these nuts for several days, pimples are liable to break out on the body, especially on the face, thus showing some sort of toxic effect. Abdominal cramps, more or less severe, often accompany this excessive eating. Professor Graves, of the Yale Botanical Department, informs the writer that he read in a local newspaper several years ago of a woman who ate two quarts of chestnuts, and died from the effects of this overeating.

Considering that thirteen of the twenty-one cases reported by Dr. Merrill were children, it seems quite likely that overeating might naturally occur. This was more likely in view of the fact that last year's crop of chestnuts in this state was rather large, especially so when compared with the rather spare crops of the two or three previous years. In the case of the two boys mentioned, we find that the doctor states that both ate freely of chestnuts, though in this case there is another possible explanation, that the trouble was due to bloody dysentery.

(2) *Poisoning Due to Immaturity, etc., of Nuts.* We have failed to find any reference in literature that states specifically that chestnuts under any condition possess poisonous qualities. It is a well known fact, however, that the bark and wood of the chestnut contain from six to twelve per cent. of tannin, an astringent that would produce trouble if taken in large enough quantities. Whether or not this ever occurs in the nuts in sufficient quantities to cause trouble, we do not know. Neither Pammel nor Chesnut, in their articles on poisonous plants, mention the chestnut. The oak and beech, however, belong to the same family as the chestnut, and, as mention of poisoning of stock from eating the nuts of these trees is not infrequent in literature, it is quite possible that some similar poisonous principle is sometimes developed in the chestnut.

Chesnut (Ann. Rept. Ani. Ind. **15**:397) writes: "In Europe the acorns of various species of oak cause sickness and death in hogs and cattle. This effect may possibly be due to bloating, but may also be due in some way to the tannin or bitter principle which they contain."

Pammel (Man. Poisonous Plants, p. 403) among other statements, makes the following: "In some parts of the South it is believed that the mast of oaks makes excellent feed for hogs, but is poisonous to cows, a small amount merely decreasing the flow of milk, while a greater quantity causes death. It is claimed that 'sweet mast,' that of the white and bur oaks, is less poisonous than the 'bitter mast' of black, pin, red and cow oaks. * * * Some say that the coarse hulls or cups clog the digestive tracts, and cause unthriftiness, others that there is actual poison in the mast. * * * That other plants of the order are injurious has been indicated by Freidberger and Fröhner, who state that the European beech produces violent colic, tetanus, mania, and fits of madness resembling those produced by strychnine."

Under the title of "Is There a Toxemia Referable to the Eating of Chestnuts?", Dr. Merrill, in the article previously referred to, says: "Search in the literature has thus far been barren of reference, yet it may be that such reference has been overlooked, or that some physicians have knowledge of conditions occurring as in the present accounts. * * * The fruit (so-called) of the healthy tree is not supposed to be toxic. Germination, however, is remarkable for chemical (enzymic) activity, and it should not be forgotten that at this period liberation of toxic substances may not be impossible. Analogy is seen in the instance of growing sorghum, hydrocyanic acid compounds appearing in the immature plant. Hydrocyanic acid compounds, nitro-benzine, or tox-albumins may not [un-?]reasonably be imagined as being possibly present in germinating chestnuts; whether they are in fact present or absent has not been determined. A period of unusually warm, dry weather in the fall, followed at the time of chestnut maturity

by copious rains, tends to induce germination in the nuts while still on the trees, and after they fall to the ground. [These conditions prevailed in Connecticut last fall.] Such germinating chestnuts, though healthy, cannot be considered as decisively free from substances toxic, as above indicated." He also refers to the blight as indirectly concerned by producing " nuts immature, undersized, or conceivably containing toxic substances absent in the healthy chestnut."

(3) *Poisoning Due to Chestnut Blight.* In the newspaper accounts the blight fungus was held directly or indirectly responsible as the source of poison. In the former case, it is supposed that more or less of the blight fungus is eaten with the chestnuts. This supposition, however, is excluded by the fact that the fungus is confined almost exclusively to the bark. The writer has never found the blight fungus on the nuts, and it evidently rarely occurs there. The only reference to its occurrence on the nuts which we find is that given recently by Collins (Science **38**:857. 1913.), who found the fungus on old nuts that had been lying on the ground for several months. There seems to be no case in which the blight has been found on nuts in edible condition.

The only chance of the blight playing a part, therefore, would be either indirectly, by poisonous matter developed by it and carried in the sap to the nuts, which is highly improbable, or in a still more indirect manner, as suggested by Dr. Merrill, by its injurious action on the tree, causing imperfect ripening of the nuts. As to the assumption that the blight develops a poison, our experiments in feeding white rats with pure cultures of the fungus, details of which are given later on, show plainly that this is not true. This conclusion has been confirmed by our own experience in eating pure cultures of the blight fungus. While this test was not extensive, we certainly ate more of the fungus at one time than one would by eating chestnuts for years.

As regards the indirect effect of the blight on the maturing of the chestnuts, and their possible development of a toxic property of their own, we can at least say that the blight would be no more responsible in this case than any other injury to the tree that interfered with the natural development of the nuts. Since the blight has been present on many of the trees in great abundance during the past four or five years, and no previous complaint

has been made of poisoning, it does not seem very probable that it is responsible even in this indirect way.

(4) *Other Possible Causes.* As mentioned in the letter received from the father of the two young boys who died, they may have had some dysentery trouble induced by bacteria on chestnuts taken from a polluted stream, or contracted in some other way. In the cases of poisoning attributed to eating squirrels, these may have been caused, as already stated, by ptomaine poisoning due to the slightly spoiled condition of the meat, or possibly the squirrels may have eaten some poisonous plant like mountain laurel, which affected their flesh.

As the season when the chestnuts ripened was unusually warm and moist, quite a number of the fallen nuts, as well as the burs, became covered with common blue mold, Penicillium species. While the meats of the nuts were not usually injured by this or other molds, it was thought by the writer that if such nuts were cracked in the mouth the spores might gain access to the digestive tract, and if poisonous, as sometimes supposed, might cause trouble. Hence in our experiments in feeding white rats we used pure cultures of this mold mixed with the food, but without harmful results. We also fed a rat with a mixture of rotten, wormy, moldy nuts, without injurious effects, so that it is not likely that any wormy or moldy nuts that may have been eaten accidentally had anything to do with the trouble.

Feeding Experiments With Rats.

Conditions of Experiments. These experiments were conducted during October and November with white rats, which, with cages and food for the same, were furnished by Dr. Osborne of the proteid research chemical department. The care given these rats was about the same ordinarily given in his feeding experiments. The general character of the cages is shown in Plate VIII, which shows a rat (No. 1) fed with food containing pure cultures of chestnut blight for 57 days, and other smaller rats (Nos. 9–12) fed 34 days with food containing partially decayed ground chestnuts.

The check rats were fed entirely with milk food, on which they thrived. This milk food consists of sixty per cent. milk powder, twelve per cent. starch, and with these is mixed 28 per cent. lard to form a thick paste. In this milk food, as prepared

for the rats used in the experiments, there was mixed at each feeding the top cut from a single agar tube containing a pure culture of the blight fungus, *Endothia gyrosa* var. *parasitica*, the blue mold, Penicillium sp., or the other substances mentioned later. The top was cut off from the cultures of fungi so as to include all the fungus and any toxic substance which it might form in the medium. This food was fed to the rats in small cups, and was renewed as needed, usually about every other day. Some rats ate more than others, however, so that each morning the cages were examined, and those cups that were empty or nearly empty were filled. The rats were given fresh water once a day, and their cages were changed and sterilized twice a week. There were thirteen rats included in the eight feeding experiments, the data for which are as follows:

Rat No. 1. *Fed pure cultures of the blight, grown on oat agar.* This was an old female that weighed at the beginning of the experiment 173½ grams, and at the end, 166 grams. The experiment was begun October 20th, and the rat was chloroformed on December 19th. During that period the food was renewed twenty-four times, the rat thus eating the equivalent of chestnut blight from twenty-four test tube cultures during the sixty days. The autopsy made by Miss Ferry, Dr. Osborne's assistant, showed the rat in good health, and at no time during the experiment did it reveal any signs of illness. The only difference observed between this and the other rats was that it seemed as a rule a little more thirsty, and usually took a drink when its water was renewed. Its loss in weight, according to Miss Ferry, was not unusual in a female rat of its age.

Rat No. 2. *Fed blue mold.* This was an old male. At the beginning of the experiment, October 23d, it weighed 181 grams, and at the end, December 16th, 264 grams. Up to November 6th the blue mold fed was obtained by scraping it from the nuts and burs of old chestnuts kept in a moist chamber, and therefore contained other molds and bacteria. From November 8th to the end of the experiment only pure cultures of blue mold grown on oat agar were used. During the 56 days the rat was fed 27 times, receiving about the equivalent of this number of test tube cultures of the Penicillium. The autopsy showed the rat in good condition (except one bad lung, which had no relation to the feeding), and at no time during the experiment did it show any signs of illness. It was always ready for its food when renewed, and ate more than the others, which accounts for its gain in weight, which was the largest made by any.

Rat No. 3. *Fed pure cultures of blight grown on oat agar containing ground chestnuts.* The ground chestnuts were added to the food to determine whether the blight produced any toxic substance by its action on them which might not be present in ordinary cultures. The rat used was a fairly young female. The experiment was begun November 4th and concluded December 9th, and during these thirty-five days the food was renewed twelve times, containing the equivalent of twelve test tube cultures of the blight, etc. The rat weighted 62 grams at the beginning of the experiment, and 116 grams at the end. No autopsy was made, but the rat showed no sign of sickness during the experiment, and the gain in weight was normal. After the experiment was concluded, one-quarter teaspoonful of lead arsenate was mixed with the food, and this was left in the cage three days, but the rat ate only a little of this, and though sick, was apparently not seriously so, but refused to eat any more of the poisoned food.

Rat No. 4. *Fed pure cultures of blight grown on tannic acid oat agar.* The medium contained 3.2 per cent. tannic acid. This experiment was to determine whether the action of the fungus on tannic acid, which is a common constituent of chestnut bark and wood, produced any unusual toxin. The rat used was a fairly young female. Its weight at beginning of the experiment, November 7th, was 58 grams, and at the end, December 9th, 96 grams. During these thirty-two days the rat was fed ten times, the food containing this number of cultures (old) of blight in tannic acid medium. No autopsy was made, as we attempted to kill the rat with lead arsenate at the end of the experiment, in the same way as Rat No. 3, with similar results. The gain in weight was perhaps a little less than was to be expected in comparison with Rat. No. 3. This was due, no doubt, to the fact that it ate less than the others, as apparently the tannic acid in the food did not add to its attractiveness. The dung of this rat was blacker as a rule, than that of the others, no doubt also due to the tannic acid, and the rat seemed more easily frightened. While the rat was not made noticeably sick, it looked as if the food did not agree well with it, and possibly a long continued diet of this kind would prove fatal. A similar result could probably have been obtained by the use of tannic acid alone. In any case, there was no especially noticeable poisonous property developed by the blight through its action on the tannic acid.

Rat No. 5. *Check. Fed milk food only.* This was a fairly young female, somewhat older than Nos. 3 and 4. The rat was fed with milk food seven times during the thirty-four days from November 12th to December 16th, when it was killed. Its appetite was less than that of the other rats, except possibly No. 4, and its gain in weight was less even than that of No. 4, as it weighed 91 grams at the beginning, and 124 grams at the end of the experiment. This rat was evidently sick from some lung trouble, though no autopsy was made to confirm this, as it coughed considerably, was more sluggish than the others, and did not gain in weight as much as it should have done.

Rats Nos. 6, 7, 8. *Fed good ground chestnuts (including shells).* A teaspoonful of ground chestnuts was mixed with the milk food at each feeding. This experiment was a check on the next one, where spoiled chestnuts were fed. The rats were quite young. The experiment was started November 12th, and ended December 13th and during the thirty-one days the rats were fed twenty-five times, but they lost considerable of their food by pawing it out of the cup. No weights were taken or autopsies made of these rats, but they evidently thrived, as shown by their appetite and lively actions.

Rats Nos. 9, 10, 11, 12. *Fed rotten ground chestnuts (including shells).* In this experiment the chestnuts, including wormy and moldy ones, were left in a moist chamber until somewhat decayed by Penicillium, Mucor and bacteria. They were then ground, and stored in a stoppered bottle, where some alcoholic fermentation took place. They were finally dried, and fed as in the preceding experiment, a teaspoonful mixed in the milk food at each feeding. The rats were the same age as those in the last experiment. The feeding was started November 12th, and ended December 19th. During these thirty-seven days they were fed twenty-two times. These rats were not weighed, but they showed the same external signs of good health all along as did those last mentioned, and an autopsy on one of them showed no signs of disease.

Rat No. 13. *Check. Fed on milk food.* This was an old male rat, perhaps a little older than Nos. 1 and 2. It was under observation for thirty-six days, from November 13th to December 19th, during which period it was fed twelve times. It showed no sign of sickness at any time, and a post mortem examination disclosed no diseased organs. It made a fairly good growth, from 216 grams at the beginning to 252 grams at the end of the experiment.

Summary.

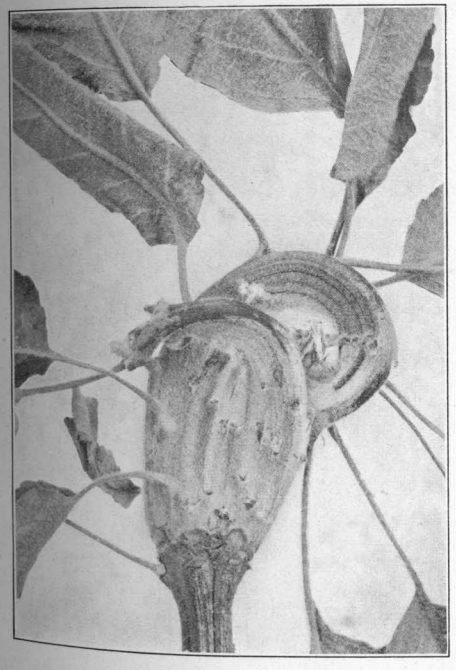
During the fall of 1913 there were reported by the newspapers of this state a number of cases of illness and a few of death, said to be due to eating chestnuts from blighted trees, these accounts usually implying that the blight fungus itself was poisonous, and thus responsible for the trouble.

Investigation shows that there may have been some relation between the sickness of at least some of these persons and the eating of chestnuts. This possibly might have been due to overeating or to the eating of immature or partially germinated chestnuts, or to the age and physical condition of the persons who were made sick, or to a combination of these factors.

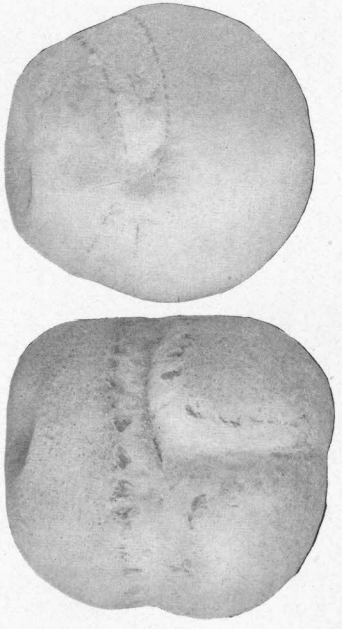
On the other hand, there was no evidence discovered that the blight fungus or other fungi were directly connected with the sickness, since experimental feeding of white rats with these fungi failed to produce any injurious effects. Small amounts of pure cultures of the blight were also eaten by the writer without ill effect.

The only connection the blight could have with such sickness would be indirect, the trees being so injured thereby as to produce a greater proportion than usual of nuts not perfectly matured which possibly contained some self-produced poisonous principle; but even this supposition does not seem very probable.

a. Leaf Spots of Ampelopsis, p. 2.

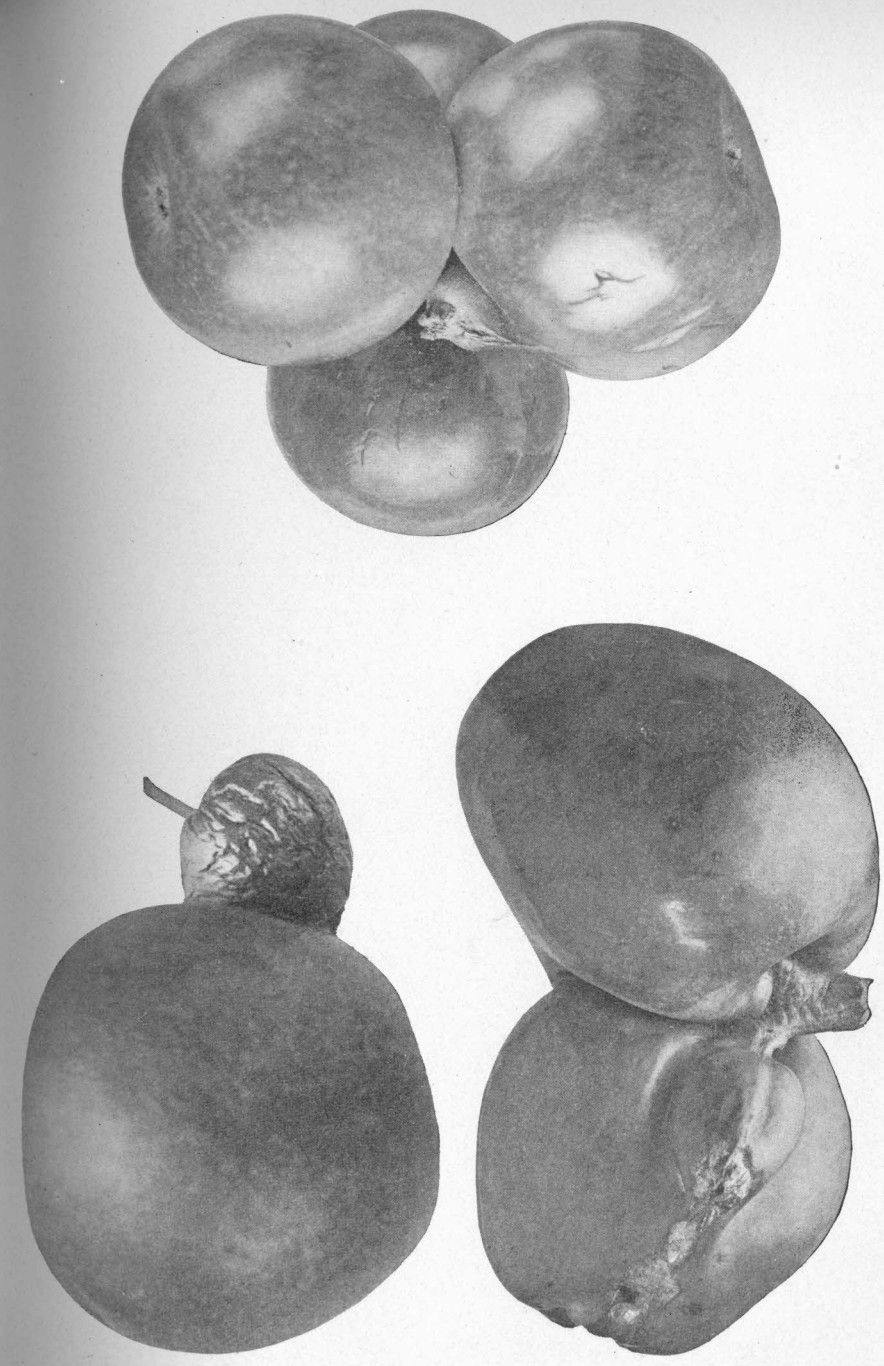


b. Fasciation of Apple, p. 6.

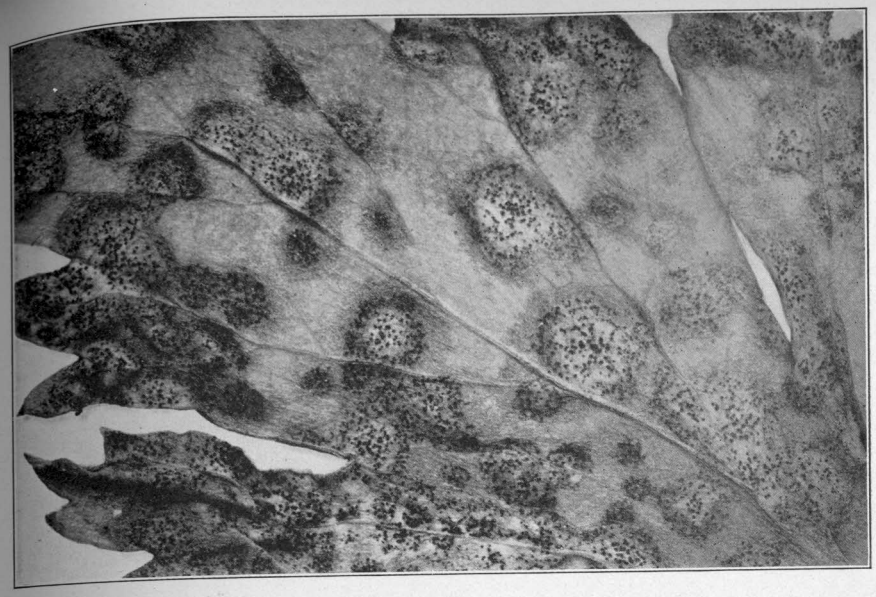


c. Frost Bands, p. 6.

INJURIES OF AMPELOPSIS AND APPLE.



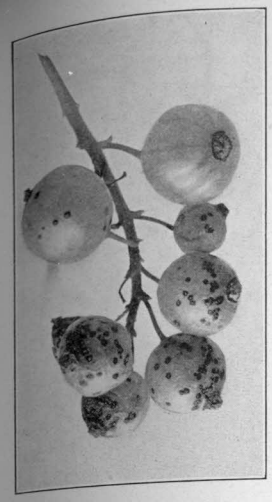
FREAKS OF APPLES (a, b, c.), p. 7.



a. Septoria Leaf Spot, ×4, p. 3.

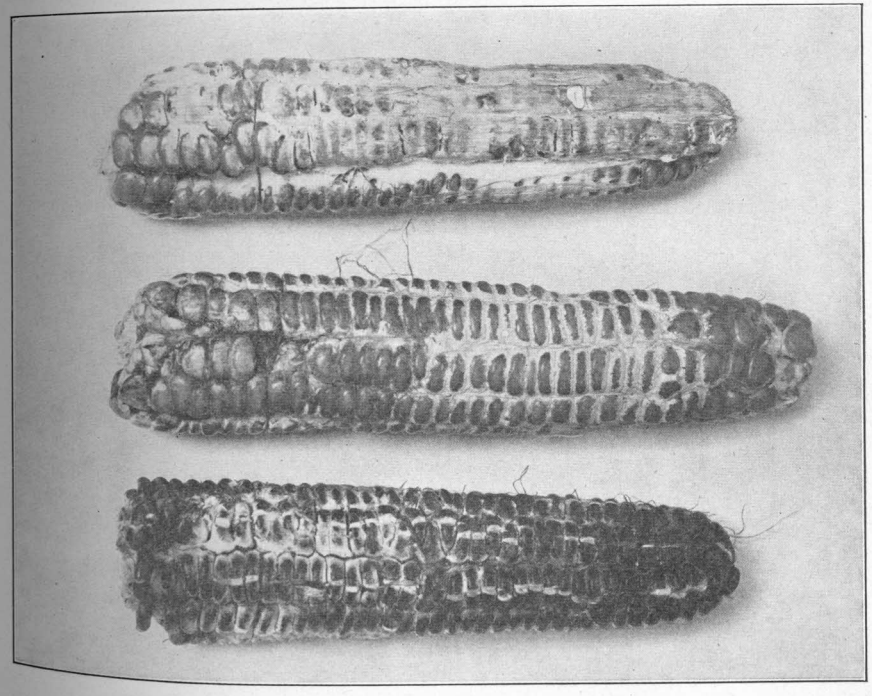
b. Bacterial Heart Rot, p. 10.

DISEASES OF CELERY.



a. Anthracnose, ×2, p. 12.

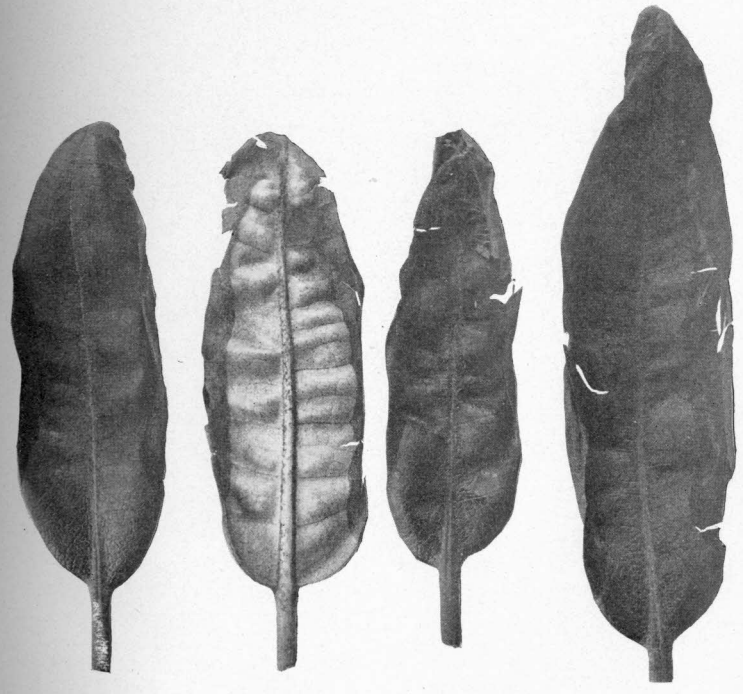
c. Rust of Juniper, p. 17.



b. Pink Mold of Corn, p. 12.

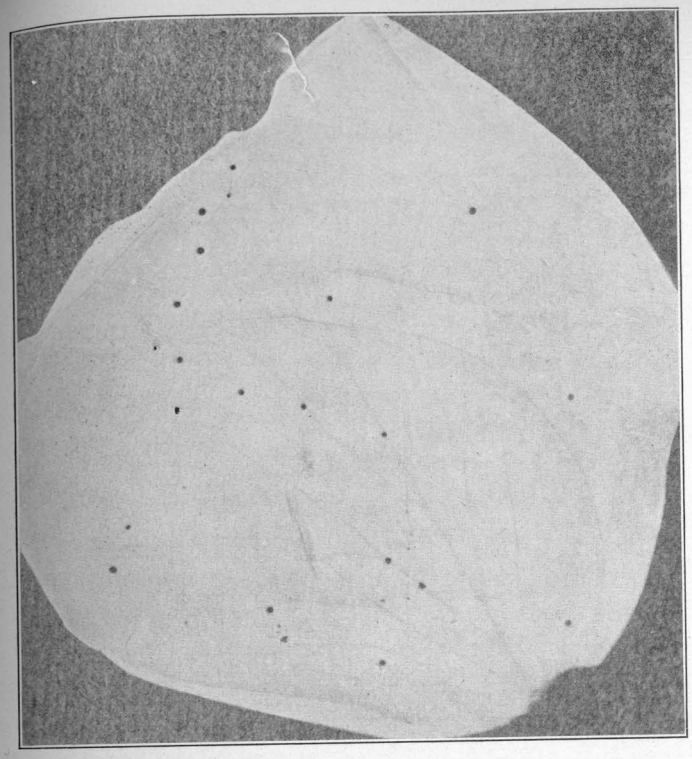
DISEASES OF CURRANT, CORN, JUNIPER.

a. Curl on Peach Fruit, p. 19.



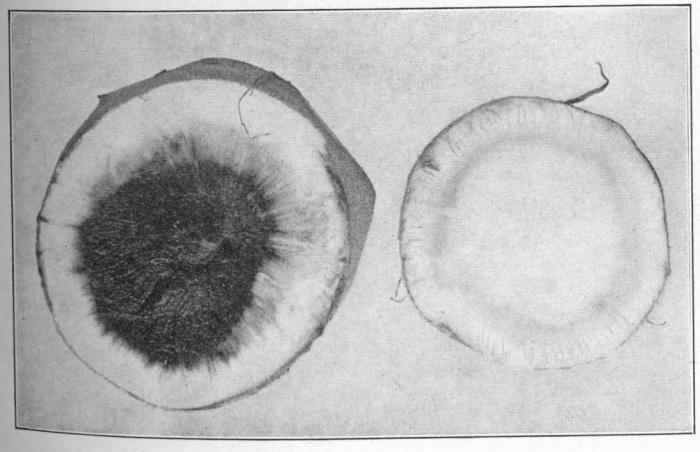
b. Leaf Scorch of Rhododendron, p. 23.

DISEASES OF PEACH AND RHODODENDRON.



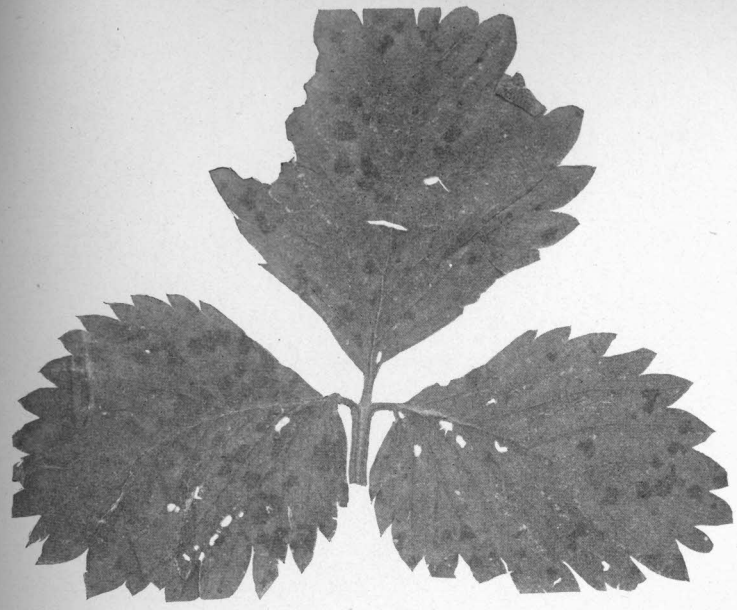
a. Spore Heads of Pilobolus on Rose, p. 24.

Diseased. Healthy.

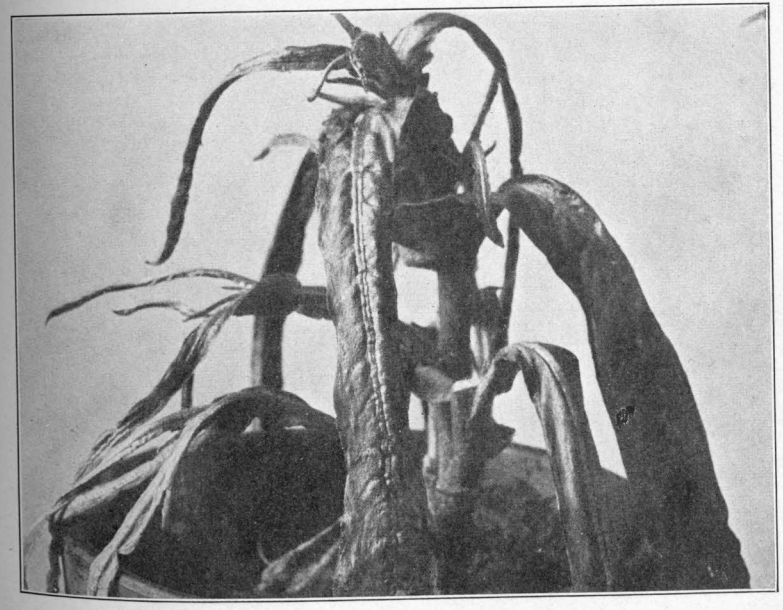


b. Soft Rot of Salsify, p. 25.

INJURIES OF ROSE AND SALSIFY.

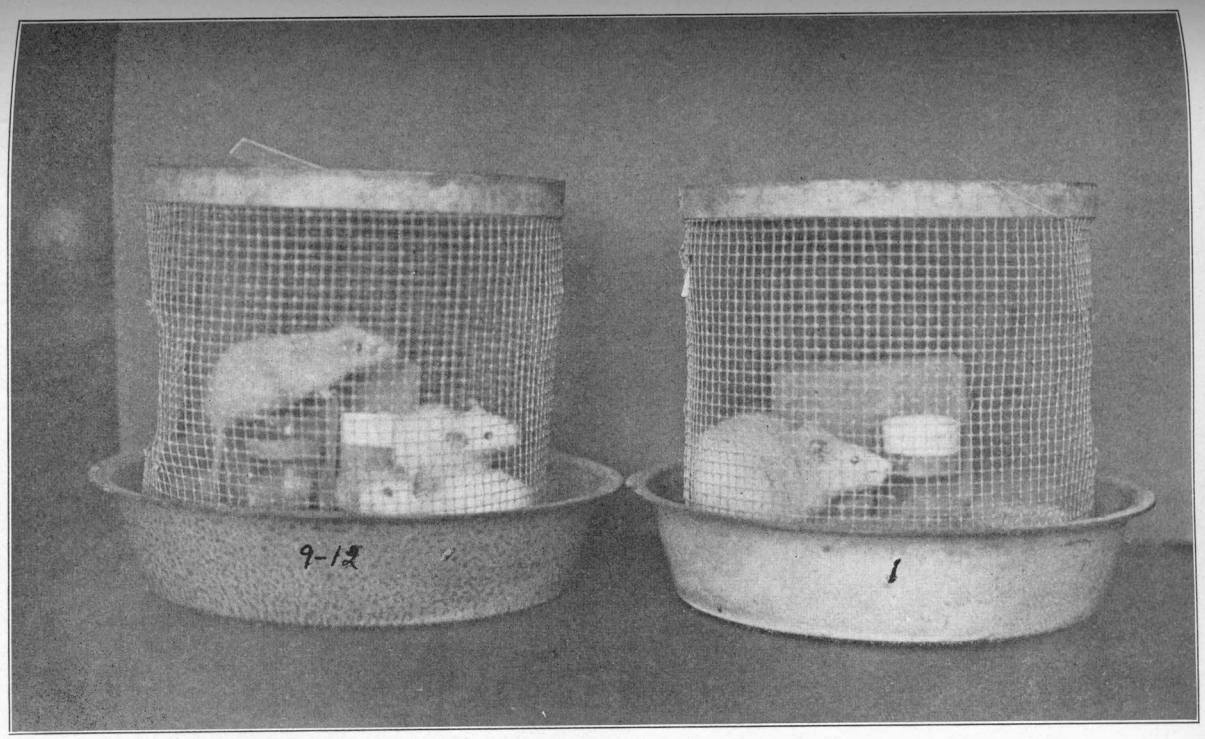


a. Leaf Blotch on Strawberry, p. 5.



b. String Leaves of Tobacco, p. 27.

DISEASES OF STRAWBERRY AND TOBACCO.



White Rats used in Chestnut Blight Feeding Experiment, p. 39.

PLATE VIII.

PART II.

REPORT ON COMMERCIAL FERTILIZERS, 1914

By E. H. JENKINS, *Director, and* JOHN PHILLIPS STREET, *Chemist in Charge of the Analytical Laboratory.*

The object of the analysis of a fertilizer is to find whether it contains as much plant food of the several kinds as the seller says it contains and as is stated on the guaranty, which should be attached to every package. With the help of the analysis it is possible to compare the price charged for this plant food with the ruling market prices of similar material. This is calculated by a "valuation" as will be explained later.

To make the examination of fertilizers of any value it is absolutely necessary that the methods of *analysis and of sampling* shall be accurate and uniform, and the process of analysis shall be free from error. To secure accuracy and uniformity of methods *of analysis* the American Association of Official Agricultural Chemists, in whose work this station has always taken part, is actively engaged and the methods endorsed by it are used by this Station.

To avoid, as far as is humanly possible, errors in the process of analysis, each determination reported is the average of two closely agreeing determinations made independently by two expert analysts. In case the determinations do not agree within narrow limits the work is repeated.

It is self-evident that *the correct sampling of fertilizers is just as important as correct analysis.*

Unless the sample which the chemist tests fairly represents the average quality of the lot of fertilizer sampled, the analysis, if accurately made, will of necessity inaccurately set forth the quality of the goods and work injustice to either the buyer or the seller. It will work harm and not good.

Accurate sampling is in many cases more difficult than accurate analysis. Sometimes goods are unevenly mixed, one package

differing from another; dry raw materials are apt to separate in handling though well mixed at first, so that the bottom of a package will not be like the top of it but will contain more of the heavier material; the outside of a package may be wetter or drier than the inside, due to conditions of storage, etc.

The Station employs a skilled sampling agent and approved forms of sampling tools and endeavors to draw a sample in every case from five packages, taking a core from the top to the bottom, and in case of large lots from a larger number of packages. It does not sample goods which are improperly stored, or in broken packages or which are not fresh stock.

Samples taken by our agent are the official samples and in following pages are tabulated by themselves.

The Station also analyzes yearly a large number of samples for individuals who draw and send them.

The Station can take no responsibility for the accuracy of this sampling. It does, however, furnish directions for sampling and requires, before making an analysis, that the sample shall be fully described on a blank furnished for the purpose and filed at the Station, together with a certificate that the sample has been drawn fairly and substantially according to directions.

The reason for this does not seem to be every where understood and in a few instances has caused resentment. The reason is this:

The Station has no right to use State funds in making analyses for the private use and interest of one particular person. Every analysis made must be of some general interest and use and the Station must decide whether the analysis will have such interest.

To do this it must have some assurance that the sample represents the goods, i. e., that the sampling has been properly done and also that an analysis of the sample will or may be of general interest and value.

Frequently we receive samples with no marks to identify them, broken packages from which a part or all the sample has run out over other mail matter, samples quite too small to be representative, and samples not of stock delivered in the state but of what some shipper *proposes* to supply. These, of course, are worthless, but they are not positively harmful; whereas the analysis of a sample of fertilizer on sale in the state, which is apparently all right,

but has not been carefully drawn, may do great injustice either to buyer or seller.

EXPLANATIONS CONCERNING ANALYSIS.

In the following pages are given, first, the analyses of the chemicals and raw materials which are used singly or in combination by farmers, next of the " complete " factory-mixed or home-mixed fertilizers and lastly of certain miscellaneous waste and by-products which have some value either as fertilizers or amendments.

Prices.

The prices given are those quoted by the sellers of the goods to our sampling agent as their *cash* ton prices.

In some cases, but particularly in case of the nitrogenous superphosphates, widely different prices are charged by different dealers for the same brand, the manufacturers having no control over the retail price asked by the dealer. These quotations, therefore, are only a very general guide or suggestion as to price.

When materials contain either nitrogen, phosphoric acid, or potash, as their single valuable fertilizer ingredient, the cost per pound of that ingredient is easily calculated from the ton price and the analysis. Thus if a sample of muriate of potash contains 50.2 per cent. of potash, which is 50.2 × 20 or 1004 pounds per ton, and costs $40.75 per ton, actual potash costs 4075 ÷ 1004 or 4.06 cents per pound.

Fertilizers which are mixtures of various raw materials and contain two or more fertilizer ingredients are reported with a " valuation."

" Valuation " of Fertilizers.

There is so much misunderstanding as to the meaning of the term valuation as it is used in our fertilizer reports that particular attention is called to the following explanations:

The valuation of a fertilizer is the result of calculating the retail cash cost at freight centers of an amount of nitrogen, phosphoric acid and potash in high grade materials equal to the amount contained in one ton of the fertilizer. It is a valuation of only one factor which makes up the cost of a fertilizer,

namely, the market cost of the three kinds of plant food in it. *Valuation no more shows the fair retail price of a fertilizer than quotations of steel billets can show the fair price for small amounts of structural steel of a specified shape.* If, however, the prices of steel remain fairly uniform, a comparison of these quotations with the rates charged by different companies *in open competition* for the finished product is a help, though not a perfect guide, to the buyer in studying the bids of different manufacturers.

Beside the cost of the plant food contained in a mixed fertilizer many other smaller items go to make up its fair market price; such as grinding, mixing, bagging, freight, agent's commissions, etc.

It cannot be stated too emphatically that valuation is not intended to show the fair retail price of mixed fertilizers but only of one item—the largest item to be sure—of the cost. In fact, one should add ten dollars or more to the "valuation" of such a fertilizer to approximate what would be in most cases a fair selling price.

Readers of this Report should bear in mind that:

1. Valuation represents one item, and the largest item, in the cost of mixed commercial fertilizers. It is a valuation of only one factor which makes up the market price, namely, the average market cost of the untreated raw materials of high quality which enter into its composition.

2. It affords a basis for estimating, approximately, the fair selling price.

3. It affords a basis of comparing fertilizers which differ considerably in composition and price.

4. It does not represent the fair selling price.

5. It does not show the agricultural value of the ingredients in it.

The "valuations" are made by the use of the following table of Trade-Values. These trade-values are only approximately correct, for market prices constantly fluctuate, but they serve the purpose of satisfactorily comparing different fertilizers which are on sale at the same time.

Trade-Values of Fertilizers Element for 1914.

The average trade-values or retail costs in market, per pound, of the ordinarily occurring forms of nitrogen, phosphoric acid and potash in raw materials and chemicals, as found in New England, New York and New Jersey markets during 1913, and adopted at a conference of representatives of the New England, New York and New Jersey Stations in March 1914, are as follows:

	Cents per pound.
Nitrogen in nitrates and ammonia salts	16½
Nitrogen, organic, in fine dry fish, blood and meat	22½
in cotton seed meal and castor pomace	22½
in fine* bone and tankage	21½
in mixed fertilizers	19½
in coarse* bone and tankage	17½
Phosphoric acid, water-soluble	4½
citrate-soluble† and in fine bone and tankage, cotton seed meal and castor pomace	4
in coarse bone and tankage and ashes	3½
insoluble in water or citrate solution, in mixed fertilizers	2
Potash in high grade sulphate and mixtures free from muriates	5
cotton seed meal and castor pomace	5
muriate	4

The foregoing are, as nearly as can be estimated, the average prices, at which, during the six months preceding March last, the respective ingredients were retailed for cash in our large markets, in those raw materials which are the regular source of supply. The valuations obtained by use of the above figures will be found to correspond fairly with the average retail prices, at the large markets, of standard raw materials.

Method of Valuation of Bone and Tankage.

To obtain the valuation of ground bone or tankage the sample is sifted into two grades, that finer than $\frac{1}{50}$ inch, "fine," and that coarser than $\frac{1}{50}$ inch, "coarse."

The nitrogen value of each grade is separately computed by multiplying the pounds of nitrogen per ton by the per cent. of each grade, multiplying the product by the trade-value per pound of nitrogen in that grade, and taking this final product as the result in cents. The sum of the separate values of each grade

* In this report, "fine," as applied to bone and tankage, signifies smaller than $\frac{1}{50}$ inch; "coarse," larger than $\frac{1}{50}$ inch.

† Dissolved from 2 grams of the fertilizer, previously extracted with pure water, by 100 cc. neutral solution of ammonium citrate, sp. gr. 1.09, in thirty minutes at 65° C., with agitation once in five minutes. Commonly called "reverted" or "backgone" phosphoric acid.

of nitrogen and phosphoric acid, thus computed, is the valuation of the sample.

Method of Valuation of Mixed Fertilizers.

The organic nitrogen in mixed fertilizers is reckoned at 19½ cents per pound, nitrogen of nitrates and ammonia salts and phosphoric acid in its three forms of solubility, at the prices given above. Potash is rated at 4 cents, if sufficient chlorine is present in the fertilizer to combine with it to make muriate. If there is more potash present than will combine with the chlorine, then this excess of potash is reckoned at 5 cents per pound, except in certain special cases, to be noted later, where carbonate of potash has been used in the mixture.

To obtain the Valuation of a Fertilizer, multiply the pounds per ton of nitrogen, etc., by the trade-value per pound. The several products give the values per ton of the several ingredients and their sum is the total valuation per ton.

This information helps the purchaser to determine whether it is better economy to buy the commercial mixed fertilizers, of which so many are now offered for sale, or to purchase and mix for himself the raw materials.

ANALYSES OF FERTILIZERS, 1914.

During 1914 forty-four individuals and firms have entered for sale in this State four hundred and fifteen brands of fertilizers, classified as follows:

Nitrogenous superphosphates	311
Bone manures and "bone and potash."	29
Fish, tankage, castor pomace and chemicals	75
Total	415

During the spring months Mr. V. L. Churchill, the sampling agent, visited one hundred and six towns and villages of Connecticut for the purpose and gathered six hundred and eight samples of commercial fertilizers.

These represented all the brands registered with exception of the following:

*American Agricultural Chemical Co.'s** Ground untreated Phosphate Rock; *East India Co.'s* Vegt. Vine and Potato; *Williams & Clark's* Seed Leaf Tobacco Manure (Carb.); *Armour Fertilizer Works'* Star Phosphate†; *Coe-Mortimer Co.'s* Tobacco and Onion Fertilizer; *German Kali Works'* Sulphate Potash; *Ernest L. James'* Ground Bone†; *Lister Agl. Chem. Works'* Special 10 per cent. Potato Fertilizer†, Special Grass Mixture†; Standard PureBone Superphosphate of Lime†; *Lowell Fertilizer Co's.* Nitrate Soda; *Mapes F. & P. G. Co's.* Cereal Brand; *Munroe & Son's* Wood Ashes; *Olds & Whipple's* Grass Fertilizer for Seeding Down; *Parmenter and Polsey's* Special Tobacco Grower; *Rogers & Hubbard Co's.* Fine Ground Bone; *Wilcox Fertilizer Co.'s* H. G. Tankage; *Worcester Rendering Co's* Corn and Grain†, Potato Fertilizer†.

CLASSIFICATION AND NUMBERS OF ANALYSES OF FERTILIZERS.

1.	*Containing nitrogen as the chief active ingredient:*	
	Nitrate of soda	12
	Dried blood	1
	Cotton seed meal	224
	Castor pomace	4
2.	*Containing phosphoric acid as the chief active ingredient:*	
	Ground phosphate rock	3
	Basic phosphate	8
	Precipitated bone meal	6
	Acid phosphate	22
3.	*Containing potash as the chief active ingredient:*	
	Carbonate of potash	4
	Vegetable potash	1
	Cotton hull ashes	2
	High grade sulphate of potash	6
	Double manure salt	3
	Muriate of potash	14
	Kainit	5
4.	*Raw materials chiefly valuable for nitrogen and phosphoric acid:*	
	Fish manures	11
	Tankage	17
	Bone manures	35
5.	*Mixed fertilizers:*	
	Factory-mixed fertilizers	335
	Home-mixed fertilizers	10
6.	*Miscellaneous fertilizers and waste products*	53
	Total	776

* Sample sent by purchaser was analyzed.
† A sample sent by manufacturer was analyzed.

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA OR SODIUM NITRATE.

As offered in the Connecticut market this year, nitrate of soda has contained an average of 15.33 per cent. of nitrogen, equivalent to 93.1 per cent. of pure sodium nitrate.

The following twelve samples have been analyzed:

4019. Sold by Bowker Fertilizer Co., New York. Stock of Goodsell Bros., Bristol.

4175. Sold by Coe-Mortimer Co., New York. Stock of L. A. Gowdy, Somerville.

4485. Sold by Wilcox Fertilizer Co., Mystic. Stock of T. H. Eldredge, Norwich.

4363. Sold by Armour Fertilizer Works, Chrome, N. J. Stock of Farmers Supply and Roof Co., Bridgeport.

3331. Sold by Apothecaries Hall Co., Waterbury. Sampled at the factory.

4026. Sold by Nitrate Agencies Co., New York. Stock of F. S. Platt Co., New Haven, and A. D. Clark, Orange.

4008. Sold by American Agricultural Chemical Co., New York. Stock of G. S. Phelps, Thompsonville.

3804. Stock of Connecticut School for Boys, Meriden.

4029. Stock of M. E. Cooke, Wallingford.

3726. Stock of Highwood Vegetable & Fruit Growers Association.

4022. Stock of H. P. Smith, North Haven.

4569. Stock of R. S. Chisholm, Litchfield.

ANALYSES OF NITRATE OF SODA.

Station No.	4019	4175	4485	4363	3331	4026	4008	3804	4029	3726	4022	4569
Percentage amount of												
Nitrogen guaranteed...	15.0	15.0	15.0	14.8	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.4
Nitrogen found.....	15.70	15.86	15.46	15.04	15.20	15.60	15.44	14.42	15.12	15.36	15.50	....
Cost per ton.....	$54.00	55.00	55.00	55.00	56.00	60.00	60.00	....	.....	.....	.....	....
Nitrogen Costs Cents per pound.....	17.2	17.3	17.8	18.3	18.4	19.2	19.4	.....	.....	.....	.....	....

The cost of nitrogen in form of nitrate in small lots at retail has ranged from 17.2 to 19.4 cents per pound, on the average 18.2 cents. In mixed car lots, for cash, it has been bought for 15.3 cents per pound. Its cost is subject to sudden changes.

DRIED BLOOD.

A single sample from stock bought by the Highwood Vegetable and Fruit Growers Association contained 11.54 per cent. of nitrogen. The guaranty called for 12.4 per cent.

COTTON SEED MEAL.

The Station has examined 224 samples of cotton seed meal this year. Most, if not all, of these samples represented car lots bought for use as a fertilizer. They also represented a cash outlay of at least $180,000. The Station has reported each analysis to the dealer and also to the buyers so far as their names were known to us. Every buyer of fertilizer meal should know the number of the car in which it is delivered, and if the analysis of that car lot is below the guaranty should claim and receive a rebate. Of the 224 analyses 167 are not here reported because they fully met the guaranty and the space which they would require is needed for more important matter.

In the following table are given the analyses of samples *which did not meet the guaranty of the seller* together with a few others of which we have no statement of guaranty.

The cost per pound of nitrogen has been calculated by allowing $4.42 in each case for the phosphoric acid and potash contained in the meal, as determined by numerous analyses.

In the samples which met the guaranty, the average cost of nitrogen was 21.2 cents per pound; in the samples which contained less nitrogen than was guaranteed the cost was considerably higher, 22.6 cents.

The average percentage of nitrogen in the lots which met their guaranty was 6.95; in those which did not meet their guaranty, the average percentage of nitrogen was 6.58 per cent.

Of the samples analyzed 29 were from the Bartlett Co., of which 13, or 45 per cent., were below guaranty. Forty-six were from F. W. Brode & Co. with 6 samples or 13 per cent. below and 114 were from the Humphreys Godwin Co. with 22 per cent. of their number below guaranty.

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
			%	%	$	%
	The Bartlett Co.					
3642	23774	Arthur Sikes	6.10	6.50	31.00	**21.8**
3643	39738	" "	6.05	6.50	31.00	**21.9**
3755	17465	" "	6.66	7.00	34.50	**22.6**
4244	19459	Olds & Whipple	6.40	6.59	34.00	**23.1**
4239	77122	" "	6.40	6.59	34.00	**23.1**
3989	51524	" "	6.40	6.59	34.00	**23.1**
4047	17220	" "	6.38	6.59	34.00	**23.2**
4241	31660	" "	6.34	6.59	34.00	**23.3**
4045	13845	" "	6.32	6.59	34.00	**23.4**
4242	17685	" "	6.30	6.59	34.00	**23.5**
4243	81526	" "	6.30	6.59	34.00	**23.5**
4046	15567	" "	6.25	6.59	34.00	**23.6**
4299	43704	" "	6.17	6.59	34.00	**23.9**
	F. W. Brode & Co.					
3815	88335	Olds & Whipple	7.20	7.62	34.25	**20.7**
3795	74875	Geo. M. Grant	7.45	7.61	35.50	**20.9**
3614	86689	" " "	6.96	7.13	34.00	**21.2**
3617	11391	George T. Soule	6.23	6.50	31.50	**21.7**
3793		W. H. Griswold	6.34		32.00	**21.7**
3863	W	George Watson	6.34		32.50	**22.1**
3647	40390	A. D. Bridges Sons	6.15	6.50	32.25	**22.6**
3666	40390	" "	6.26	6.50	32.25	**22.2**
	Buckeye Cotton Oil Co.					
3915	88973	George S. Phelps & Co.	5.95	6.50	34.00	**24.9**
	S. P. Davis.					
4573		T. F. Young	6.32	6.50	33.00	**22.6**
	Humphreys, Godwin Co.					
3792		Berkshire Fertilizer Co	6.24	6.58	29.60	**20.2**
3517	8026	Olds & Whipple	7.38	7.62	35.50	**21.1**
3518	92278	" "	6.95	7.01	34.00	**21.3**
3750	27070	Spencer Bros	6.23	6.50	31.00	**21.3**

ANALYSES OF COTTON SEED MEALS WITHOUT A GUARANTY OR BELOW THEIR GUARANTY.—*Concluded.*

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
			%	%	$	%
3794	164, 165, 166	Olds & Whipple	6.79	7.01	33.75	**21.6**
3365	926	" "	7.01	7.33	35.00	**21.8**
3749	25764	Spencer Bros	6.16	6.50	31.25	**21.8**
3711	1672	" "	6.31	6.50	32.25	**22.0**
3758	2621	Olds & Whipple	6.70	7.41	34.20	**22.2**
3759	2622	" "	6.55	7.41	34.20	**22.7**
3753	3245	George S. Phelps & Co.	6.35	6.50	33.25	**22.7**
3716	26403	Spencer Bros	6.34	6.50	33.25	**22.7**
4070		Conn. Tobacco Corp.	7.00	7.41	31.80	**22.8**
4065		" " "	6.77	7.09	30.82	**22.8**
4102	47300	Olds & Whipple	6.68	6.92	30.36	**22.8**
3960	81263	F. E. Lord	6.18	6.50	32.75	**22.9**
3610	37376	Olds & Whipple	7.33	7.60	38.00	**22.9**
3831	41099	George S. Phelps & Co.	6.42		34.00	**23.0**
4155	81263	W. W. Thompson	6.12	6.50	32.75	**23.1**
3627	133460	Olds & Whipple	7.46	7.63	39.00	**23.2**
3613	131982	" "	7.34	7.51	38.50	**23.2**
3754	52391	George S. Phelps & Co.	6.15	6.50	33.25	**23.4**
3595	72983	Olds & Whipple	7.28	7.60	38.50	**23.4**
4123	94702x47144	Spencer Bros	6.22	6.50	34.00	**23.8**
4122	75134	" "	6.16	6.50	34.00	**24.0**
3588	3639	Rogers Mfg. Co	6.39			
3591	37941	" "	6.20			

CASTOR POMACE.

This is a residue from the manufacture of castor oil and is used chiefly as a tobacco fertilizer.

Experience indicates that it is a little slower in its action than cotton seed meal and gives a little heavier quality to the tobacco leaf. Stock will eat it greedily if they have the chance, but it is extremely poisonous.

4017. Made by the Baker Castor Oil Co., New York. Sampled from Spencer Bros., Suffield.

4479. Sold by Olds & Whipple and sampled at their warehouse.

3370. Bought of Luther Pomeroy, Suffield. Sampled and sent by G. A. Cleaveland, Windsor Locks.

4007. Sold by the American Agricultural Chemical Co., New York. Sampled from Stock of G. S. Phelps, Thompsonville.

ANALYSES.

Station No.	4017	4479	3370	4007
Percentage amounts of				
Nitrogen guaranteed	4.25	5.0	....	4.53
Nitrogen found	5.02	5.0	4.43	4.56
Cost per ton	$25.00	$25.00	$25.00	$27.00
Nitrogen costs cents per pound	22.2	22.4	25.3	26.7

In calculating the cost of nitrogen an allowance of $2.63 has been made, being the valuation of the average amount of phosphoric acid and potash found in castor pomace.

Castor Pomace containing five per cent. of nitrogen and selling for $25 per ton has furnished nitrogen at about the same cost as in average cotton seed meal.

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

GROUND PHOSPHATE ROCK.

3748. "Floats," bought by Barnes & Hall, East Wallingford, through the Nitrates Agencies Co., New York City, contained 30.22 per cent. of phosphoric acid.

4554. Bought by F. C. Jennings, Bridgeport, from the American Agricultural Chemical Co., New York, contained 30.19 per cent. of phosphoric acid.

3330. Sampled by Station Agent from stock of Apothecaries Hall Co., Waterbury, contained 29.44 per cent. of phosphoric acid.

These were all bought in car lots at prices which ranged from 1.28 cents to 2.11 cents per pound for phosphoric acid.

What observations we have made on Connecticut soils lead us to believe that on land deficient in available phosphates equal money values of acid phosphate and basic phosphate may be expected to yield much larger returns in the first two or three years after application than ground phosphate rock and that the latter may pay to use as a long time investment;—a somewhat more "permanent improvement."

BASIC SLAG, BASIC PHOSPHATE OR THOMAS PHOSPHATE POWDER.

The material is a finely ground slag produced by a special process of removing phosphorus from iron.

It should contain from 17 to 19 per cent. of phosphoric acid and may also carry 35 to 50 per cent. of lime and 13 per cent. of iron.

Very little of the phosphoric acid is soluble in water, but by a conventional method of extraction (Wagner's) the larger part of the phosphoric acid in slag of good quality is soluble in the citric acid used. Pot and field experiments and practical experience alike have shown that the phosphoric acid of basic slag is quite readily available to crops and it has come into rather extensive use, particularly by orchardists. Basic slag of good grade should contain 15 per cent. or more of "available" phosphoric acid.

4171. Sold by the Coe-Mortimer Co., New York. Stock of J. G. Schwink, Jr., Meriden.

4172. Sold by Nitrate Agencies Co., New York. Stock of Spencer Bros., Suffield, and of Pring Bros., Wallingford.

4170. Stock of Apothecaries Hall Co., Waterbury, and R. H. Morgan, West Cheshire.

4169. Sold by American Agricultural Chemical Co., New York. Stock of L. J. Grant, Wapping.

4173. Stock of Wilcox Fertilizer Co., Mystic.

4567. Sold by Nitrate Agencies Co., New York. Sent by R. S. Chisolm, Litchfield.

4566. Sold by American Agricultural Chemical Co., New York. Sent by R. S. Chisolm.

3725. Stock of Highwood Vegetable & Fruit Growers' Association, Highwood.

ANALYSES OF BASIC PHOSPHATE.

Station No.	Guaranteed	Total Found	Citrate-Soluble Found	Cost per Ton	Citrate-Soluble Phosphoric Acid Costs Cents per Pound
4171	17	17.53	15.22	$14.20	**4.6**
4172	17	18.68	15.29	15.00	**4.9**
4170	17	17.78	13.75	16.00	**5.8**
4169	17	18.37	15.51	18.50	**5.9**
4173	16	17.88	14.65	18.00	**6.0**
4567	17	19.13	.....	.....	...
4566	17	19.25	.....	.....	...
3725	17	18.78	.....	.....	...

The citric-soluble phosphoric acid in **4170** is quite below the average or desirable amount, which should be not far from 15 per cent.

The average cost of total phosphoric acid is 4.52 cents per pound; of "available," i.e., citric-soluble phosphoric acid, 5.44 cents. This takes no account of the lime present in the basic phosphate which no doubt adds something to the farm value of this material. Basic phosphate finds great favor especially for use in orchards and on grass land.

PRECIPITATED BONE MEAL.

This is a manufacturing by-product and consists of fine precipitated phosphate of lime, neutral in reaction, and containing no nitrogen.

It is very readily soluble in ammonium citrate and quickly available to crops. It is at present chiefly used as a tobacco fertilizer. We are advised that most of it is imported, sold on foreign analysis only, and "available" is determined by the Wagner method. In our opinion the use of this method for the analysis of such a material is not justified. The Wagner method or citric method can be reasonably used only with basic slag which contains large quantities of iron and some free lime which interfere with the use of the conventional ammonium citrate method. There is no reason for using the Wagner method with precipitated bone other than the desire to make it appear more "available" than it would appear if the method commonly applied to phosphatic material was employed.

The samples examined are as follows, all of them bought through Olds & Whipple, Hartford:

4076 and **4077,** sampled and sent by the Connecticut Tobacco Corporation, Tariffville; marked Nos. 70115 and 82557 respectively.

4108 and **4109.** Sampled and sent by the Silver Lane Plantation of the Conn. Tobacco Corporation.

4238. Sampled and sent by the Keiser & Boasberg Corporation, East Windsor Hill.

4481. Sampled from stock of Olds & Whipple by the Station Agent. The prices quoted below are retail ton prices and not those actually paid by purchasers of car lot quantities.

ANALYSES OF PRECIPITATED BONE.

Station No.....	**4076**	**4077**	**4108**	**4109**	**4238**	**4481**
Percentage amounts of						
Water-soluble phosphoric acid.....	1.38	1.29	1.45	1.47	2.06	1.01
Citrate-soluble phosphoric acid.....	36.28	36.58	36.08	36.64	32.45	37.36
Citrate-insoluble phosphoric acid.....	1.70	1.55	1.43	1.45	4.41	0.49
Total phosphoric acid...	39.36	39.42	38.96	39.56	38.92	38.86
"Available" phosphoric acid.....	37.66	37.87	37.53	38.11	34.51	38.37
Soluble by Wagner method	39.02	39.11	38.63	39.22	.....	.....
Guaranteed soluble by Wagner method.....	38.88	38.88	38.88	38.88	.....	.....
Cost per ton.....	$44.00	44.00	44.00	44.00	.....	44.00
"Available" phosphoric acid costs cents per pound..	**5.8**	**5.8**	**5.8**	**5.8**	.....	**5.8**

DISSOLVED ROCK PHOSPHATE OR ACID PHOSPHATE.

This material is made by treating mineral phosphates or "phosphate rock" with oil of vitriol which converts the larger part of the phosphoric acid into forms soluble in water and at the same time changes into sulphate a large part of the lime which was previously combined with phosphoric acid.

The guaranty usually gives the percentage of "available" phosphoric acid. This is only a trade name for the sum of the water-soluble and citrate-soluble* phosphoric acid. It has no reference to the actual availability of this phosphoric acid to crops. In acid phosphates, however, well made from domestic rock it is fair to assume that the larger part of the "available" phosphoric acid is also agriculturally available.

* See page 47.

4106, 4107, 4075, 4074 and **4105** were sold to the Connecticut Tobacco Corporation, Silver Lane, by Olds & Whipple, Hartford, and sampled by Tobacco Corporation. The prices quoted below for them are the regular retail prices of Olds & Whipple.

4476. Sold by E. Manchester & Sons, Winsted, sampled from stock of H. McKnight, Ellington.

3781. Sold by Sanderson Fertilizer & Chemical Co., New Haven. Sampled from stock of A. D. Clark, Orange.

3801. Sold by Nitrate Agencies Co., New York City. Sampled and sent by E. N. Austin, Suffield.

4486. Sold by Wilcox Fertilizer Co., Mystic. From stock of T. H. Eldredge, Norwich.

4368. Sold by L. T. Frisbie Co., New Haven. Sampled at warehouse.

4013. Sold by Apothecaries Hall Co., Waterbury. From stock of A. Grulich, Meriden.

4027. Sold by Nitrate Agencies Co., New York City. From stock of Spencer Bros., Suffield.

4018. Sold by Bowker Fertilizer Co., New York City. From stock of Goodsell Brothers, Bristol.

4358. Sold by American Agricultural Chemical Co., New York City. From stock of E. E. Burwell, New Haven.

4166. Sold by Rogers Mfg. Co., Rockfall. Sampled at warehouse.

4167. Sold by Lowell Fertilizer Co., Boston. From stock of M. E. Cooke, Wallingford.

4366. Sold by Coe-Mortimer Co., New York City. From stock of L. A. Gowdy, Somerville.

4009. Sold by American Agricultural Chemical Co., New York City. From stock of Gault Bros., Westport.

3489, 3808 and **3776** were sold by Sanderson Fertilizer & Chemical Co., New Haven.

3489. From stock of C. P. Treat, Orange. *Sampled in 1913.*

3808. From stock of Conn. School for Boys, Meriden.

3776. From stock of Highwood Vegetable and Fruit Growers' Association.

4364. Star Phosphate. Sampled and sent by the Armour Fertilizer Works, Baltimore, Md.

ANALYSES OF ACID PHOSPHATE.

Station No.	Water-soluble phosphoric acid.	Citrate-soluble phosphoric acid.	Citrate-insoluble phosphoric acid.	Total phosphoric acid.	"Available" phosphoric acid found.	"Available" phosphoric acid guaranteed.	Cost per ton.	"Available" phosphoric acid costs cents per pound.
4106	16.87	1.74	0.26	18.87	18.61	16.0	$15.00*	**4.03**
4107	16.57	1.95	0.54	19.06	18.52	16.0	15.00*	**4.05**
4075	16.61	1.78	0.45	18.84	18.39	16.0	15.00*	**4.08**
4074	15.84	2.16	0.59	18.59	18.00	16.0	15.00*	**4.17**
4105	15.88	1.87	0.29	18.04	17.75	16.0	15.00*	**4.23**
4476	11.76	4.80	0.38	16.94	16.56	16.0	14.00	**4.23**
3781	13.39	1.61	1.54	16.54	15.00	16.0	13.00	**4.33**
3801	13.94	2.18	0.52	16.64	16.12	14.0	14.00	**4.34**
4486	13.47	3.15	0.65	17.27	16.62	15.5	15.00	**4.51**
4368	10.18	2.93	0.18	13.29	13.11	12.0	12.00	**4.58**
4013	10.94	3.24	1.36	15.54	14.18	14.0	13.00	**4.58**
4027	11.09	3.80	0.59	15.48	14.89	14.0	14.00	**4.70**
4018	9.46	4.25	0.50	14.21	13.71	14.0	13.00	**4.74**
4358	10.13	5.70	0.42	16.25	15.83	16.0	15.00	**4.74**
4166	9.84	5.47	1.77	17.08	15.31	16.0	15.00	**4.90**
4167	9.41	2.65	0.29	12.35	12.06	12.0	12.00	**4.97**
4366	11.66	3.49	0.79	15.94	15.15	14.0	16.00	**5.28**
4009	11.18	2.54	1.20	14.92	13.72	14.0	20.00	**7.28**
3489	12.48	3.72	0.56	16.76	16.20	16.0	.....	....
3808	12.61	3.29	0.36	16.26	15.90	16.0	.....	....
3776	11.81	3.25	0.42	15.48	15.06	14.0	.....	....
4364	10.29	2.84	1.84	14.97	13.13	14.0	.....	....

It will be noticed that there are two grades of acid phosphate, one guaranteed to contain fourteen, the other sixteen, per cent. of phosphoric acid.

The analyses show that the higher grade acid phosphate has furnished "available" phosphoric acid at lower cost than the fourteen per cent. grade.

The average retail price of acid phosphate has been $14.50, and the average cost of available phosphoric acid in this form 4.65 cents per pound. Purchasers in car lots have bought it in some cases for $3\frac{3}{4}$ cents. Co-operative buying for cash is nowhere more profitable to the farmer than in the matter of fertilizers.

Five of the eighteen samples did not contain the full amount of phosphoric acid which was guaranteed.

* Regular retail price.

III. RAW MATERIALS OF HIGH GRADE CONTAINING POTASH.

CARBONATE OF POTASH.

This is a nearly white crystalline material containing a larger percentage of potash than any other used as a fertilizer. It is strongly alkaline and absorbs water very rapidly on exposure to damp air. It can only be correctly sampled by taking a portion from the interior of a freshly opened cask. Failure to observe this precaution may account for the discrepancy between composition and guaranty in some of the following analyses. In case of chemicals like nitrate of soda and carbonate of potash—and the same applies also to any goods which may have absorbed water—a failure to meet the guaranty is not always proof that the guaranteed *amount* of plant food is not in the goods.

An example will make this plain. A cask of carbonate of potash is invoiced at 400 pounds net and guaranteed to contain 66.5 per cent. of potash. That means that the seller promises 266 pounds of potash. But the analysis of a sample taken from a cask which has been open for some time shows only 60.5 per cent. Assuming that the sample is a fair one and that the cask contained only 400 pounds of carbonate, the total potash in it is only 242 pounds, a shortage of 24 pounds. But if, as is quite likely, 25 pounds of water have been absorbed in transit, and especially since opening, so that the net weight of carbonate is 425 pounds, then the percentage of 60.5 potash which it contained equals 267 pounds of potash, which meets the seller's claims. The four analyses given below are from stock bought by the Connecticut Tobacco Corporation, Silver Lane, from Olds & Whipple, Hartford.

4225 is a sample drawn by our agent, with great care, from a cask opened in his presence, before the contents had been exposed for more than a few minutes. The other samples were taken by the purchaser, the method of sampling not being stated.

ANALYSES OF CARBONATE OF POTASH.

Station No.	4225	4078	4079	4104
Percentage amounts of				
Potash	66.08	62.00	59.64	61.44
Equivalent carbonate of potash found	96.9	90.9	87.5	90.1
Carbonate of potash guaranteed	96.00	96.00	96.00	96.00
Cost per ton*	$95.00	95.00	95.00	95.00
Potash costs cents per pound	**7.2**	**7.7**	**8.0**	**7.7**

* Regular ton price. Not the price for large purchases.

VEGETABLE POTASH.

This material is stated to be a residue from the beet sugar manufacture and is used in this state chiefly as a tobacco fertilizer, the potash being mostly in form of carbonate. A single sample **4482,** has been analyzed, drawn from stock bought by Herman Ude, Suffield, from Olds & Whipple, Hartford. It contained 25.47 per cent. of water-soluble potash and cost $45 per ton. The cost of actual potash was, therefore, 8.8 cents per pound.

COTTON HULL ASHES.

Only two samples of this material have been sent for analysis, both sold by Olds & Whipple.

3514. Sampled and sent by C. F. Segee, East Hartford. This contained 26.08 per cent. of water-soluble potash and cost $46 per ton.

3785. Sampled and sent by L. B. Haas & Co., Hartford. Bought of Olds & Whipple, Hartford. This contained 24.32 per cent. of water-soluble potash and cost $50 per ton.

The samples probably contain about 8 per cent. of "available" phosphoric acid. Allowing $6.40 for this, the cost of actual potash in these two samples has been 7.6 cents and 9.0 cents per pound respectively.

HIGH GRADE SULPHATE OF POTASH.

(ANALYSES ON PAGE 63.)

This material should contain about 49 per cent. of potash, equivalent to about 90 per cent. of potassium sulphate, and should be nearly free from chlorides. All of the six samples tested were of good quality, actual potash costing from 4.8 to 5.5 cents per pound.

DOUBLE MANURE SALT.

This salt, besides 46 to 50 per cent. of potassium sulphate, contains over 30 per cent. of magnesium sulphate, chlorine equal to about 3 per cent. of common salt, with small amounts of other salts and varying amounts of moisture.

Sample **4474** was sold and sampled as high grade sulphate apparently through a mistake in shipping. The three samples tested were of standard quality.

MURIATE OF POTASH.

From 48 to 50 per cent. of potash is usually guaranteed in this salt, equivalent to 76 per cent. or more of muriate of potash. It also contains some 15 per cent. of salt and varying quantities of moisture.

Of the 14 samples examined only one, **4016,** was of less than standard composition.

The cost of potash ranged from 4.0 to 4.7 cents per pound and averaged (12 analyses) 4.4 cents. Potash in this form has been bought in mixed car lots for 3.8 cents per pound.

KAINIT.

This is a crude salt containing from 12 to 15 per cent. of potash in form of sulphate and chloride, together with sulphates and chlorides of sodium and magnesium. The five samples tested were of average composition.

POTASH SALTS. PERCENTAGE COMPOSITION AND COST PER POUND OF POTASH.

Station No.		Sampled and sent by	Potash soluble in water.		Cost per ton.	Potash costs per pound.
			Guaranteed.	Found.		
			%	%	$	cts.
	High-Grade Sulphate of Potash.					
4367	Gunther Bros., Rockville, from Coe-Mortimer Co.	Station Agent	48.0	49.60	48.00	**4.8**
4180	E. W. Woodward, Enfield, from Wilcox Fert. Co.	Station Agent	48.0	49.44	49.00	**5.0**
4015	G. S. Phelps, Thompsonville, from Armour Fert. Works	Station Agent	48.0	51.52	52.00	**5.0**
4177	Sanderson Fert. and Chem. Co., New Haven.	Station Agent	48.0	49.20	51.30	**5.2**
4011	H. A. Bugbee, Willimantic, from Amer. Ag. Chem. Co.	Station Agent	48.0	48.80	52.00	**5.3**
3510	Apothecaries Hall Co., Waterbury	Station Agent	48.0	48.90	54.00	**5.5**
	Double Manure Salt.					
4359	E. E. Burwell, New Haven, from Amer. Ag. Chem. Co.	Station Agent	26.0	29.42	30.00	**5.1**
4474	H. H. McKnight, Ellington, from E. Manchester & Sons	Station Agent	....	26.50	.....	...
3809	Conn. School for Boys, Meriden, from Sanderson Fert. and Chem. Co.	Station Agent	26.0	26.63	.....	...
	Muriate of Potash.					
4178	G. C. Bradley, New Haven, from Lowell Fertilizer Co., Boston	Station Agent	50.0	51.12	41.00	**4.0**
4021	Lightbourn & Pond Co., New Haven, from L. T. Frisbie Co.	Station Agent	50.0	50.20	42.00	**4.2**
4023	Edward White, Rockville, from German Kali Works	Station Agent	48.0	48.48	41.00	**4.2**
4475	H. H. McKnight, Ellington, from E. Manchester & Sons	Station Agent	49.0	50.66	43.00	**4.2**

POTASH SALTS. PERCENTAGE COMPOSITION AND COST PER POUND OF POTASH—*Continued.*

Station No.		Sampled and sent by	Potash soluble in water.		Cost per ton.	Potash costs per pound.
			Guaranteed.	Found.		
			%	%	$	cts.
4179	T. H. Eldredge, Norwich, from Wilcox Fert. Co.	Station Agent.....	50.0	52.64	45.00	**4.3**
3513	Apothecaries Hall Co., Waterbury.....	Station Agent.....	48.0	50.42	44.00	**4.4**
4174	S. B. Wakeman, Saugatuck, from Bowker Fert. Co.....	Station Agent.....	49.0	51.52	46.10	**4.4**
4176	L. A. Gowdy, Somerville, from Coe-Mortimer Co.....	Station Agent.....	49.0	50.64	45.00	**4.4**
3512	Apothecaries Hall Co., Waterbury.....	Station Agent.....	48.0	49.45	44.00	**4.5**
4025	J. R. Reinhard & Son, W. Cheshire, from International Ag. Corp.....	Station Agent.....	48.0	49.92	45.00	**4.5**
4016	G. S. Phelps, Thompsonville, from Armour Fert. Works.....	Station Agent.....	48.0	46.68	42.50	**4.6**
4006	Holmes, Keeler & Kent Co., Norwalk, from American Ag. Chem. Co.....	Station Agent.....	49.0	50.52	48.00	**4.7**
3807	Conn. School for Boys, Meriden, from Sanderson Fert. and Chem. Co.....	Station Agent.....	49.0	50.52	.....	...
3723	Highwood Veg. & Fruit Growers' Asso., from Sanderson Fert. and Chem. Co.....	Station Agent.....	49.0	49.14	.....	...
	Kainit.					
3509	Apothecaries Hall Co., Waterbury.....	Station Agent.....	12.0	14.72	15.00	**5.1**
3805	Conn. School for Boys, Meriden, from Sanderson Fert. and Chem. Co.....	Station Agent.....	12.0	13.47	.....	...
4570	R. S. Chisolm, Litchfield, from E. Manchester & Sons.....	Purchaser.....	12.0	13.23	.....	...
4369	C. F. Boehm, Westbrook, from German Kali Works.....	Station Agent.....	12.0	13.63	*13.50	...
4010	H. A. Bugbee, Willimantic, from American Ag. Chem. Co.....	Station Agent.....	12.0	15.44	.....	...

* f. o. b. New York.

IV. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN AND PHOSPHORIC ACID.

FISH MANURES.

Of this well-known and excellent fertilizer eleven samples have been examined. All the samples, with one exception, met their guaranties. The material contains, as an average of the eleven analyses, 7.72 per cent. of nitrogen and 7.36 per cent. of phosphoric acid. The cost has been high, ranging from $45 to $57 per ton.

If we allow the same value for phosphoric acid as in mixed fertilizers, the cost of nitrogen in the samples of fish whose prices are known ranges from 22.3 to 29.8 cents and averages 2.45 cents per pound. (*Table of analyses on page 66.*)

SLAUGHTER HOUSE TANKAGE.

After boiling or steaming various slaughter house wastes, fat rises to the surface and is removed; the soup is run off and the settlings remaining in the tanks ("tankage") are dried, ground and sold as a fertilizer. It has a wide range of composition, depending largely on the relative amounts of bone and of meat scraps which are "rendered" as above, but in general, nitrogen gives more than half the value to the material. Like bone the immediate agricultural value of tankage depends not only on the chemical composition but also on the fineness.

Of the twelve samples drawn by the station, two do not meet their nitrogen guaranty. Both contain however, considerably more phosphoric acid than is guaranteed which nearly, if not quite, compensates in money values for the nitrogen deficiency.

4370, made by Lister's Agricultural Chem. Wks. is a mixture of animal and chemical wastes selling at the same price as tankage which contains twice as much nitrogen and considerably more phosphoric acid.

Of the brands sampled by the Station, the prices of which are known, the average cost is $35.12 and average valuation $33.65 per ton. With the usual valuation allowance given to phosphoric acid, the nitrogen in eight samples, excluding **4370,** has ranged in cost from 22.4 to 16.8 cents per pound, averaging 19.8 cents. (*Table of analyses, pages 68 and 69.*)

GARBAGE TANKAGE.

A single sample marked "Tankage", stock of S. D. Woodruff & Sons, Orange, No. **3783** contained nitrogen 3.78 per cent. and

ANALYSES OF FISH MANURES.

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen. As Ammonia.	Nitrogen. As Organic.	Nitrogen. Total found.	Nitrogen. Total Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Total Phosphoric Acid. Found.	Total Phosphoric Acid. Guaranteed.	Cost per ton.	Valuation per ton.
	Sampled by Station.		%	%	%	%	%	%	%	%	%	$	$
4360	American Agr. Chem. Co.	A. D. Bridges Sons, Hazardville	0.30	8.34	8.64	**8.23**	0.68	5.55	1.13	7.36	**6.0**	57.00	44.02
4365	Bowker Fertilizer Co.	M. McGrath, E. Windsor Hill	0.10	7.85	7.95	**8.23**	0.93	5.68	0.41	7.02	**6.0**	.....	41.19
4024	International Agr. Corporation	F. S. Bidwell & Co., Windsor Locks	1.44	5.46	6.90	**6.58**	0.77	6.16	1.19	8.12	...	46.00	35.42
4480	Olds & Whipple	Factory	0.50	8.40	8.90	**7.40**	0.67	5.27	1.54	7.48	**5.5**	49.00	44.89
4484	Sanderson Fert. and Chem. Co	A. A. & W. G. Forbes, Silver Lane	0.62	7.87	8.49	**8.20**	1.15	5.40	1.13	7.68	**6.0**	52.00	43.28
4487	Wilcox Fertilizer Co. *	E. W. Woodward, Enfield	0.20	8.96	9.16	**8.24**	0.68	4.84	1.13	6.65	**6.0**	50.00	45.91
4488	Wilcox Fertilizer Co.*	Factory	0.92	7.22	8.14	**7.81**	1.63	4.05	0.59	6.27	**6.0**	.....	40.48
	Sampled by Purchaser.												
3970	Apothecaries Hall Co.	I. B. Barnard, Bloomfield	0.10	8.63	8.73	**8.23**	0.38	5.33	2.03	7.74	...	46.25	44.58
4151	Berkshire Fertilizer Co.	J. Rostek, Melrose	0.10	8.69	8.79	**8.23**	0.49	5.56	1.69	7.74	**6.0**	45.00	45.01
3381	A. W. Higgins	Spencer Bros., Suffield	0.45	9.36	9.81	**9.05**	....	....	....	8.38	**7.6**	50.00	.....
3802	Nitrate Agencies Co.	E. N. Austin, Suffield	0.32	9.08	9.40	**8.84**	0.86	4.83	0.82	6.51	**6.4**	47.00	46.88

* Acidulated.

phosphoric acid 2.55. This has the composition of garbage tankage which is very inferior to slaughter house tankage in agricultural value.

BONE MANURES.

Of the twenty-five samples of bone drawn by the Station Agent six did not meet their guaranteed nitrogen, two were deficient in phosphoric acid and one, **4491**, was deficient in both ingredients. In all but two cases, **4491** and **4498**, a deficiency of one ingredient was fully made up in money value by an excess of the other.

Of the twenty-one samples, the prices of which are given, the average cost is $33.67 and the average valuation $29.55.

The cost of nitrogen in bone is somewhat higher than in tankage. Making the same money allowance in bone as in tankage for phosphoric acid, the average cost of nitrogen in bone would be 25.8 cents per pound. (*Table of analyses, pages 70 and 71.*)

RETAIL COST OF NITROGEN, PHOSPHORIC ACID AND POTASH.

A review of the preceeding pages shows that the figures given below represent approximately the cost to the buyer at retail, of nitrogen, phosphoric acid and potash in fertilizer chemicals during the last season.

COST OF NITROGEN, PHOSPHORIC ACID AND POTASH, CENTS PER POUND.

Nitrogen	in nitrate of soda, 17.2–19.4, average	18.3
	in nitrate of soda, mixed car lots, cash	15.2
	in dried blood, mixed car lots, cash	21.4
	in dry ground fish, 22.3–29.8, average	25.1
	in tankage, 16.8–22.4, average	19.8
	in bone, 20.1–33.1, average	25.8
Phosphoric Acid	"available" in precipitated phosphate	5.8
	"available" in acid phosphate	4.7
	"available" in acid phosphate, car lots	3.75
	"available" in basic slag	5.44
	Total in basic slag	4.52
	Total in ground phosphate rock, in bulk car lots cash	1.28–2.11
Potash	as carbonate in pure carbonate of potash	7.2–8.0
	as carbonate in "vegetable potash"	8.8
	as carbonate in cotton hull ashes	7.6–9.0
	in high grade sulphate	4.8–5.5
	in double sulphate	5.1
	in muriate, 4.0–4.7, average	4.4
	muriate, in mixed car lots, cash	3.76

ANALYSES OF TANKAGE.

Station No.	Manufacturer.	Dealer or Purchaser.
	Sampled by Station.	
4012	American Agricultural Chemical Co.	H. A. Bugbee, Willimantic
4361	American Agricultural Chemical Co.	E. E. Burwell, New Haven
4014	Apothecaries Hall Co	Sampled at factory
4020	L. T. Frisbie Co	Sampled at factory
4370	Lister's Agricultural Chem. Works	J. O. Fox, Putnam
4028	Nitrate Agencies Co	Pring Bros., Wallingford
4483	Rogers Manufacturing Co	Sampled at factory
3806	Sanderson Fert. and Chem. Co.	Conn. School for Boys, Meriden
3782	Sanderson Fert. and Chem. Co.	A. D. Clark, Orange
3756	Sanderson Fert. and Chem. Co.	W. S. Hine, Derby
3722	Sanderson Fert. and Chem. Co.	Highwood Veg. and Fruit Growers' Association
3488	Sanderson Fert. and Chem. Co., Stock of 1913	C. R. Treat, Orange
	Sampled by Purchaser.	
3832	Apothecaries Hall Co	A. Greenbacker, Meriden
3630	Mystic Rendering Co	L. M. Allyn, Mystic
4592	Rogers & Hubbard Co	Manufacturer
4089	Shay Fertilizer Co	C. R. Burr & Co., Manchester

V. MIXED FERTILIZERS.

MIXTURES OF PHOSPHATES WITH POTASH SALTS.

4371. Lister's Dissolved Phosphate and Potash, made by Lister's Agricultural Chemical Works, Newark, N. J., and sampled from stock of F. C. Benjamin, Danbury.

4362 and **4591.** Wheeler's Grass and Oats, made by the American Agricultural Chemical Co., New York City. **4362** was sampled from stock of R. H. Hall, East Hampton, **4591** from stock of L. G. Tolles, Southington.

ANALYSES OF TANKAGE.

Chemical Analysis. Nitrogen. As Ammonia.	Nitrogen. As Organic.	Nitrogen. Total found.	Nitrogen. Total guaranteed.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical Analysis. Finer than 1-50 in.	Mechanical Analysis. Coarser than 1-50 in.	Dealer's cash price per ton.	Valuation per ton.
%	%	%	%	%	%	%	%	$	$
0.14	4.95	5.09	4.94	16.53	13.73	37	63	35.00	31.52
0.14	7.33	7.47	7.41	10.94	9.15	67	33	40.00	38.55
0.08	4.97	5.05	4.94	15.22	13.73	37	63	34.00	30.40
0.12	4.98	5.10	4.94	15.48	15.00	46	54	30.00	31.28
0.04	2.76	2.80	2.67	11.96	12.00	50	50	30.00	19.89
0.00	7.04	7.04	5.75	13.43	13.73	71	29	34.00	39.01
0.26	4.72	4.98	4.83	17.03	15.00	52	48	.....	32.31
....	....	5.18	4.94	18.70	12.00	54	46	.....	34.44
0.18	7.83	8.01	7.41	10.78	9.00	55	45	39.00	39.71
....	....	7.67	7.41	11.67	9.00	53	47	39.00	38.90
....	....	6.96	7.41	10.39	9.00	53	47	.....	35.14
....	....	6.28	7.41	12.47	.....	44	56	.....	33.47
0.09	4.84	4.93	4.94	14.92	15.00	46	54	30.00	30.20
....	....	5.28	....	16.06	.....	15	85	.....	30.61
....	....	4.66	....	14.02	.....	..	..	.....	.....
....	....	6.10	6.58	5.01	.....	25	75	.....	26.21

ANALYSES.

Station No	**4371**	**4362**	**4591**
Percentage amounts of			
Water-soluble phosphoric acid	7.30	6.36	7.12
Citrate-soluble phosphoric acid	2.77	4.00	3.26
Citrate-insoluble phosphoric acid	0.27	1.60	1.25
Total phosphoric acid found	10.34	11.96	11.63
Total phosphoric acid guaranteed	11.00	12.00	12.00
"Available" phosphoric acid found	10.07	10.36	10.38
"Available" phosphoric acid guaranteed	10.00	11.00	11.00
Potash as muriate	1.85	2.36	2.71
Total potash found	1.85	2.36	2.71
Total potash guaranteed	2.00	2.00	2.00
Cost per ton	$28.00	25.00	22.00
Valuation per ton	$10.38	11.45	11.68

ANALYSES OF

Station No.	Manufacturer and Brand.	Dealer or Purchaser.
	Sampled by Station.	
4491	American Agr. Chem. Co., Fine Ground Bone	J. A. Glassnap
4490	American Agr. Chem. Co., Bone Meal	F. H. Smith
3511	Apothecaries Hall Co., Bone Meal	Factory
4492	Armour Fertilizer Works, Bone Meal	F. S. Bidwell & Co
4493	Berkshire Fertilizer Co., Fine Ground Bone	A. E. Hayes
4494	Valentine Bohl, Self-Recommending Fert	C. A. Templeton
4495	Bowker Fertilizer Co., Fresh Ground Bone	A. D. Bridge's Sons
4496	Coe-Mortimer Co., Fine Ground Bone	W. A. Burr
4497	L. T. Frisbie Co., Fine Bone Meal	Factory
4498	International Agr. Corp., Bone Meal	J. R. Reinhard & Son
4500	Lister's Agr. Chem. Works, Bone Meal	F. C. Benjamin
4509	Lowell Fertilizer Co., Ground Bone	M. E. Cooke
4501	E. Manchester & Sons, Fine Ground Bone	W. J. Warner
4502	Nitrate Agencies Co., Ground Bone	E. White
4503	Olds & Whipple, Steamed Bone Meal	Factory
4504	Parmenter & Polsey Fert. Co., Ground Bone	J. P. Barstow & Co
4505	Rogers & Hubbard Co., Pure Raw Knuckle Bone Flour	Rackliffe Bros. Co
4538	Rogers Mfg. Co., Fine Ground Bone	G. W. Strant
4506	Rogers Mfg. Co., Knuckle Bone Flour	Meriden Grain & Feed Co
3721	Sanderson Fert. & Chem. Co., Ground Bone	Highwood Veg. & Fr. Grow. Asso.
4507	C. M. Shay Fertilizer Co., Ground Bone	Knowles-Lombard Co
4508	M. L. Shoemaker & Co., Swift-Sure Bone Meal	F. A. Forbes
4510	Van Iderstine Co., Ground Bone	C. Buckingham
4511	Wilcox Fertilizer Co., Pure Ground Bone	T. H. Eldredge
3784	S. D. Woodruff & Sons, Ground Bone	S. D. Woodruff & Sons
	Sampled by Purchaser.	
3971	Valentine Bohl, Ground Bone	I. B. Barnard
3653	Consumers Fertilizer Co., Ground Bone	G. A. Drew
3327	Nitrate Agencies Co., Ground Bone	Pring Bros
4085	Lowell Fertilizer Co., Pure Ground Bone	L. Palmieri
4086	Lowell Fertilizer Co., Pure Ground Bone	L. Palmieri
4136	Lowell Fertilizer Co., Pure Ground Bone	L. Palmieri
4635	Sanderson Fert. & Chem. Co., Fine Ground Bone	O. G. Beard
4568	Ground Bone	R. S. Chisolm
3916	Ground Bone	W. H. Lyon
4499	E. L. James, Ground Bone	Factory

BONE MANURES.

Chemical Analysis.				Mechanical Analysis.		Dealer's cash price per ton.	Valuation per ton.
Nitrogen.		Phosphoric Acid.					
Found.	Guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.		
%	%	%	%	%	%	$	$
2.13	2.47	22.52	22.88	68	32	34.00	25.91
1.84	1.65	16.27	13.73	72	28	38.00	20.06
2.54	2.26	22.69	22.88	73	27	30.00	27.93
2.68	2.47	25.82	22.00	52	48	33.00	29.91
2.59	2.50	22.77	20.00	62	38	30.00	27.70
3.89	3.82	23.05	23.03	52	48	33.00	32.56
2.60	2.47	26.10	22.88	59	41	35.00	30.17
2.36	2.47	26.51	22.88	64	36	35.00	29.72
2.14	2.47	25.84	23.00	59	41	30.00	28.14
2.65	2.40	16.50	22.00	55	45	30.00	22.91
3.00	2.67	26.23	22.88	61	39	32.00	31.95
2.18	2.46	26.76	23.00	59	41	.....	29.00
2.55	2.47	23.92	22.88	73	27	29.00	28.92
2.24	2.46	23.64	22.88	69	31	31.00	27.28
2.50	2.50	24.82	22.00	80	20	33.00	29.71
2.92	2.46	24.56	23.00	68	32	35.00	30.67
4.01	3.82	25.36	24.50	50	50	43.00	34.66
3.44	3.50	25.84	25.00	92	8	37.00	35.04
3.80	3.80	25.84	25.00	57	43	38.00	34.62
2.28	2.47	24.87	20.00	52	48	.....	27.63
3.78	2.50	24.54	20.00	42	58	33.00	32.71
4.13	4.53	20.65	20.00	70	30	36.00	32.67
1.82	2.00	29.04	27.00	49	51	.....	28.86
2.64	2.46	22.39	22.00	58	42	32.00	27.43
3.09	....	23.37	.....	75	25	.....	30.81
4.18	3.82	23.31	23.03	..	..	29.00	.....
4.17	3.70	21.46	.....	17	83	.....	.....
2.48	2.47	24.56	22.88	67	33	28.00	.....
3.03	....	.....	.....	..	..	.....	.....
2.62	....	.....	.....	..	..	.....	.....
2.35	....	.....	.....	..	..	.....	.....
2.76	2.90	29.17	21.00	52	48	34.00	.....
3.00	....	25.00	.....	60	40	.....	.....
4.00	....	.....	.....	..	..	.....	.....
3.90	3.00	21.11	20.00	1	99	37.00	28.50

These samples appear to be mixtures of acid phosphate and muriate of potash. Twelve hundred pounds of acid phosphate and 150 pounds of muriate of potash which could be bought in any city of the State for $13.00, or less, would supply as much available plant food as either of these brands which costs $20.00 or more per ton and would cost less for teaming.

MIXED TOBACCO FERTILIZERS CONTAINING CHIEFLY PHOSPHORIC ACID AND POTASH.

4124. Tobacco Ash Manure. Made by the American Agricultural Chemical Co., New York; Stock of J.C. Thompson, Unionville.

4341. Same brand; Stock of Spencer Bros., Suffield.

4133. Tobacco Ash Elements. Made by Bowker Fertilizer Co., New York; Stock of Seth Viets, West Suffield.

4282. Tobacco Ash Constituents. Made by Mapes Formula and Peruvian Guano Co., New York; Stock of Spencer Bros., Suffield.

4289. Ash Compound for Tobacco. Made by National Fertilizer Co., New York; Stock of C. D. Cannon, Windsor Locks.

4478. Vegetable Potash and Bone. Made by Olds & Whipple Hartford; Stock of B. N. Alderman, East Granby.

	4124	4341	4133	4282	4289	4478
Nitrogen, total	0.28	0.50	0.20	0.65	0.48	0.10
Nitrogen, guaranteed				0.50		
Phosphoric acid, water-soluble	1.92	1.58	1.01	0.34	1.54	0.58
Phosphoric acid, citrate-soluble	6.97	7.22	5.57	2.11	7.15	12.01
Phosphoric acid, citrate-insoluble	0.97	1.23	2.38	3.56	1.19	1.87
Phosphoric acid, total found	9.86	10.03	8.96	6.01	9.88	14.46
Phosphoric acid, total guaranteed	9.00	10.00	9.00	5.70	9.00	12.00
Potash calculated as muriate	1.28	2.31	0.90	1.24	1.20	1.63
Potash calculated as sulphate	13.75	12.10	14.83	0.88	13.40	1.35
Potash calculated as carbonate	.....	.....	.....	14.63	.....	14.15
Potash total found	15.03	14.41	15.73	16.75	14.60	17.13
Potash total guaranteed	16.00	16.00	15.00	15.00	16.00	15.00
Cost per ton	$.....	34.50	32.50	36.00	34.00	44.00
Valuation per ton	$23.56	23.49	22.65	31.24	23.68	36.56

NITROGENOUS SUPERPHOSPHATES.

In the following tables, pages 80 to 101, are given the analyses of 308 samples of fertilizers, drawn by the Station agent, which represent 295 different brands. There are also added at the end of the table 18 analyses of samples sent by manufacturers or buyers.

All of these analyses have been made in duplicate by different chemists and have been reported as soon as made to the manufacturers and selling agents.

Analyses Requiring Special Notice.

The analysis of the American Agricultural Chemical Co.'s Quinnipiac Branch Potato Phosphate, **4234**, did not at all correspond with the guaranty. On investigation the company reported that by mistake a 3–6–6 brand was shipped to the buyer instead of the 2½–8–3. The Station endeavored, without success, to find another sample in a different locality for analyses.

The A. A. C. Co.'s Wheeler's Havana Tobacco Grower, **4129**, being found deficient in nitrogen and potash, a second sample, **4356**, was drawn and analyzed which met the guaranty of nitrogen, but failed to meet the potash guaranty by 0.3 per cent.

The A. A. C. Co.'s Williams & Clark Branch Mammoth Oak Phosphate, **4255**, having shown less potash than was guaranteed, a second sample, **4560**, was analyzed which contained 0.9 per cent. more potash than the first, but less than was guaranteed.

The A. A. C. Co.'s Williams & Clark Branch Meadow Queen Fertilizer, **4054**, showed a large deficiency of nitrogen and overrun of potash, suggesting that the brand name was incorrect. A second sample was therefore drawn, **4342,** the analysis of which more than met the guaranty.

Apothecaries Hall Co.'s Victor Potato and Vegetable Special, **4033,** was deficient in both nitrogen and potash. A second sample was therefore drawn from a different stock, **4343,** which fully met the guaranty.

Apothecaries Hall Co.'s Victor Top Dressing for Grass and Grain, **4093,** had less nitrogen than was guaranteed. A second sample was therefore analyzed, drawn from other stock, **4344,** which contained more nitrogen and potash than the first sample

but less than half as much "available" phosphoric acid. The form of phosphate used in the two formulas was evidently quite unlike.

Armour's Brewer's Special Tobacco Fertilizer, **4034,** contained less nitrogen than was guaranteed. It was impossible to get a second sample for analysis.

The Coe-Mortimer Co.'s Double Strength Top Dressing, **4276,** showed a large shortage of both nitrogen and potash and an over-run of phosphoric acid. A second sample, **4539,** was therefore drawn for analysis from a different stock. Both the potash and phosphoric acid in this sample fully met the guaranty, while nitrogen was still deficient.

The National Fertilizer Co.'s H. G. Top Dressing, **4143,** had considerably less nitrogen and potash than was guaranteed. A second sample from another lot, **4345,** showed similar deficiencies.

Olds & Whipple's Grass Fertilizer Top Dressing, **4294,** contained less potash than guaranteed. The analysis of the firm's chemist showed "available" phosphoric acid 6.76, while the Station's figure was 4.96 per cent.

The Rogers & Hubbard Co.'s Hubbard's Bone Base Oats and Top Dressing, **3821,** had 0.11 per cent. less nitrogen than guaranteed. At request of the manufacturer a second sample, **4346,** was analyzed from a different stock, which contained very considerably more of each ingredient than was guaranteed.

The Rogers & Hubbard Co.'s Hubbard's Soluble Tobacco Manure, **4305,** was found to contain 1.71 per cent. of chlorine which the manufacturer claimed was more than the brand should contain and asked for the analysis of another sample. A second sample, **4557,** was found to contain less chlorine, 1.08 per cent. Neither percentage is large enough to damage a tobacco fertilizer in our opinion.

The analyses of Rogers Manufacturing Co.'s Complete Potato and Vegetable, Complete Corn and Onion, H. G. Soluble Tobacco and Potato, Nos. **3889, 4186** and **4184,** showing less of one ingredient than was guaranteed, second analyses were made from different stock. In dry-mixed goods a mechanical separation of the ingredients often takes place, which results in a deficiency of one ingredient in any given sample and a surplus of another.

Regarding Guaranties.

Of the 295 brands sampled by the Station, 115, or about one in every three, failed in some particular to meet the minimum guaranteed composition. Ninety-five were deficient in respect of a single ingredient, twenty in respect of two and one in respect of all three ingredients. An examination of these deficiencies shows the following:

Deficient in nitrogen alone	30	brands.
" " total phosphoric acid alone	22	"
" " "available" phosphoric acid alone	7	"
" " potash alone	36	"
" " nitrogen and potash	7	"
" " nitrogen and phosphoric acid	2	"
" " potash and phosphoric acid	10	"
" " all ingredients	1	"
	115	

In two cases the trouble was very likely a mistake in the brand name, the contents of packages representing a brand different from that given on the label.

In most cases a deficiency in one ingredient was fully made up, as far as value given is concerned, by an over-run of another ingredient. The sixteen brands named below, however, failed to make up the deficiency per ton of fertilizer by the amounts named.

4198. Bradley Branch, A. A. Chem. Co.'s Complete Top Dressing for Grass and Grain. Deficiency $0.23.

4129. Wheeler Branch A. A. Chem. Co's Havana Tobacco Grower.* Deficiency $0.83.

4093 and **4334.** Apothecaries Hall Co.'s Top Dresser for Grass and Grain, two analyses. Deficiencies, $1.42 and $4.48.

4193. Armour Fertilizer Co.'s Bone, Blood and Potash. Deficiency $1.24.

4034. Armour Fertilizer Co.'s Brewer's Special Tobacco Fertilizer. Deficiency $0.84.

4276. Coe-Mortimer's Double Strength Top Dressing.† Deficiency $8.70. We are advised that the manufacturer gave a rebate to the buyer on account of the unexpected shortage.

* See note, p. 73. † See note, p. 74.

4539. Coe-Mortimer's Double Strength Top Dressing.* Deficiency $1.65.

4138. International Agricultural Corporation's High Grade Manure. Deficiency $1.19.

4137. International Agricultural Corporation's Top Dressing. Deficiency $0.55.

4320. Lowell Fertilizer Co.'s Special Potato Fertilizer with Ten Per Cent. Potash. Deficiency $0.32.

4119. National Fertilizer Co.'s Formula A. Deficiency $0.86.

4143 and **4345.** National Fertilizer Co.'s H. G. Top Dressing.* Deficiencies $3.11 and $2.74 respectively.

3824. C. M. Shay Fertilizer Co.'s Complete Fertilizer. Deficiency $0.56.

4318. C. M. Shay Fertilizer Co.'s Market Garden. Deficiency $1.08.

Regarding Valuation.

The method and meaning of valuation are explained on pages 45 and 46 and the table of trade values will be found on page 47.

It must be remembered that "valuation" as used in this report *is not a valuation of the brand in question but of the nitrogen, phosphoric acid and potash in it;* that is, it shows approximately what the same amounts of these ingredients as are contained in a ton of the mixed fertilizer would cost, unmixed, for cash, at freight centers in this State, in their unground and unmixed condition. To make a fair valuation of the manufactured fertilizer itself would necessitate adding to our valuation the average cost of mixing and bagging, bags, shrinkage, cost of storage, selling, collecting, freight, etc., items which would probably aggregate $8.00 to $12.00 per ton.

The Solubility of the Organic Nitrogen in Nitrogenous Superphosphates.

The solubility and ready decomposition of nitrogenous matters is believed to stand in close relation to their availability to crops. A method has been provisionally adopted by the Association of Official Agricultural Chemists for determining nitrogen solubility and this has been described in former reports.

* See note, p. 74.

Two hundred and sixty-one brands of fertilizers have been tested by this method during the year. The brands which were not tested were those in which the organic nitrogen was known to be chiefly in form of cotton seed meal or castor pomace and a few others in which the percentages of organic nitrogen were very small or in which the total nitrogen exceeded the quantity by more than the amount of the water-insoluble nitrogen.

The separate determinations made by the method need not here be given but only the general results. Fertilizers are passed as unobjectionable when more than 55 per cent. of the water-insoluble nitrogen is soluble in the reagent used and can therefore be classed as "active-insoluble" nitrogen. If the solubility of the water-insoluble nitrogen is between 55 and 50 per cent. the nitrogen it is classed as doubtful and if it is under 50 per cent. it is presumably inferior.

In 27 brands between 55 and 50 per cent. only of the water-insoluble nitrogen was "active-insoluble" which raises doubt as to the quality of the organic nitrogen in them. The organic nitrogen of three brands had so low a solubility that it could only be classed as inferior. These brands were:

			Organic Nitrogen.		
			Total	Water-Soluble	Percentage permanganate solubility of Water-insoluble Nitrogen
3981	Virginia-Carolina	Star Brand.....	1.23	0.28	32.0
3827	" "	Owl Brand.....	0.58	0.16	36.5
3828	" "	XXX Fish & Potash	1.49	0.83	29.5

Regarding the Purchase of Fertilizers.

The yearly analysis of the large number of commercial fertilizers sold in this State, a work which takes the time of six men for four or five months, is useful in calling immediate attention both to the introduction of grossly inferior goods—a very rare happening now—and also to mistakes in the brands which are shipped and to failures in manufacture.

The publication of these tables of analyses gives wider publicity to the facts which they show and their chief value to the individual farmer is, perhaps, as a guide to purchasing next spring.

In consequence of the facts that little or no potash is imported from Germany at present, and that we have no adequate domestic

supply, manufacturers will be obliged to very radically change their formulas which will contain much less potash than hitherto, and probably different percentages of nitrogen and phosphoric acid. Some manufacturers will use the same brand names as before but will change their composition. Others will add something to the former brand name to indicate that for the time being the formula is changed, and still others plan to withdraw their present brands and introduce substitute brands. In the aggregate a great reduction in the total number of brands is to be anticipated.

Those who buy factory-mixed goods will need to pay special regard to the *guaranteed composition of fertilizers*, for brand names in the coming season will have largely lost their distinctive meaning and purchasers will be forced to do what is too often not done, *buy by the analysis and not by the brand name alone.*

Table of Analyses

of

Nitrogenous Superphosphates

Sold in Connecticut

1914

Nitrogenous Superphosphates.

Station No.	Manufacturer and Brand.	Place of Sampling.	Valuation per ton.
	Sampled by Station Agent:		
	The American Agricultural Chemical Co., New York City.		
4248	Excelsior Top Dresser	Sharon	$41.27
3892	Grass and Lawn Top Dressing	Southport	22.22
4194	H. G. Fertilizer with 10% Potash	Putnam	22.83
	Bradley Branch:		
4196	B. D. Guano	Moodus	15.52
4197	Complete Manure for Potatoes and Vegetables	Norwich Town	24.51
4198*	Complete Manure for Top Dressing, Grass and Grain	Pomfret	25.27
4199	Complete Manure with 10% Potash	Norwich	25.48
3994	Corn Phosphate	Norwich Town	15.99
4200	Eclipse Phosphate for All Crops	Norwich	13.48
3995	Excelsior Fish and Potash	Suffield	16.69
4201	Farmers' New Method Fertilizer	Putnam	17.39
4202	Greyhound Fertilizer	Glastonbury	26.62
3996	Half Century Fertilizer	Middletown	18.05
3893	Menhaden Fish Phosphate	Hazardville	16.37
4203	New Rival Fertilizer	Stamford	14.48
4213	Niagara Phosphate	Putnam	12.79
3894	Patent Superphosphate	Stamford	18.20
4214	Potato Fertilizer	Stafford Springs	18.17
4215	Potato Manure	Pomfret	18.43
4048	Potato and Vegetable Manure	Milford	26.91
3950	Retriever Manure	Norwalk	19.85
3997	Sure Growth Phosphate	Hazardville	22.66
4126	Tobacco Manure (Carbonate)	Glastonbury	28.64
4125	Tobacco Manure (Sulphate)	Glastonbury	26.08
3951	Top Dresser	Hazardville	27.46
3933	Weymouth Staple Phosphate	Hazardville	22.97
4216	XL Superphosphate of Lime	Stafford Springs	19.05
	Church Branch:		
4217	Fish and Potash	Ellington	15.40
	East India Branch:		
3998	Black Hawk Fertilizer	Burnside	20.68
4050	Cabbage and Potato Manure	Milford	26.84
4055	Church's Fish and Potash	Burnside	15.31
4218	Corn King	Gaylordsville	22.50
4226	Fish and Potash	Branford	17.23

* See note, p. 75.

Analyses and Valuations.

Nitrogen.					Phosphoric Acid.							Potash.			
			Total Nitrogen.					Total.		So-called "Available"		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
3.85	1.86	2.57	8.28	8.23	4.21	2.81	0.14	7.16	8.0	7.02	7.0	7.87	7.87	8.0	4248
2.33	0.50	1.55	4.38	3.91	3.02	2.36	0.79	6.17	6.0	5.38	5.0	2.38	2.38	2.0	3892
0.91	0.76	0.99	2.66	2.47	2.58	3.70	0.69	6.97	7.0	6.28	6.0	9.87	9.87	10.0	4194
...	0.10	0.97	1.07	0.82	6.48	2.55	1.06	10.09	9.0	9.03	8.0	3.90	3.90	4.0	4196
0.87	1.02	1.29	3.18	3.29	2.64	5.55	1.60	9.79	9.0	8.19	8.0	7.23	7.23	7.0	4197
1.51	1.98	1.29	4.78	4.94	2.78	1.60	0.20	4.58	5.0	4.38	4.0	6.09	6.09	6.0	4198
1.23	1.20	1.09	3.52	3.29	3.74	2.48	0.50	6.72	7.0	6.22	6.0	9.58	9.58	10.0	4199
0.74	0.45	0.82	2.01	2.06	3.72	4.44	1.28	9.44	9.0	8.16	8.0	1.81	1.81	1.5	3994
...	0.04	1.18	1.22	1.03	4.47	3.24	1.05	8.76	9.0	7.71	8.0	2.15	2.15	2.0	4200
1.13	0.08	1.11	2.32	2.47	0.94	3.84	2.26	7.04	5.0	4.78	4.0	4.44	4.44	4.0	3995
0.67	0.70	0.77	2.14	1.65	5.45	2.47	0.68	8.60	9.0	7.92	8.0	3.39	3.39	3.0	4201
...	1.95	1.34	3.29	3.29	5.45	1.42	1.02	7.89	7.0	6.87	6.0	10.61	10.61	10.0	4202
0.21	0.44	1.15	1.80	2.06	5.53	3.39	1.51	10.43	9.0	8.92	8.0	3.91	3.91	3.0	3996
1.04	0.10	1.15	2.29	2.06	3.74	3.10	1.36	8.20	7.0	6.84	6.0	2.16	2.16	2.0	3893
...	0.10	1.00	1.10	1.23	3.78	2.96	1.51	8.25	7.0	6.74	6.0	4.85	4.85	5.0	4203
0.11	0.08	0.93	1.12	0.82	3.89	3.97	1.22	9.08	8.0	7.86	7.0	1.71	1.71	1.0	4213
...	1.15	1.16	2.31	2.06	6.58	2.52	1.85	10.95	9.0	9.10	8.0	1.50	1.50	1.5	3894
0.80	0.44	0.88	2.12	2.06	4.33	4.58	1.20	10.11	9.0	8.91	8.0	3.26	3.26	3.0	4214
0.65	0.90	0.83	2.38	2.47	3.79	2.84	0.87	7.50	7.0	6.63	6.0	5.05	5.05	5.0	4215
...	1.12	2.42	3.54	3.29	7.34	1.25	1.13	9.72	9.0	8.59	8.0	7.14	7.14	7.0	4048
0.20	1.40	1.05	2.65	2.47	4.90	1.85	1.25	8.00	7.0	6.75	6.0	5.10	5.10	5.0	3950
0.46	0.80	1.21	2.47	2.47	7.34	2.92	2.11	12.37	10.0	10.26	9.0	4.99	4.99	4.0	3997
0.94	0.05	3.47	4.46	4.53	0.58	3.65	0.12	4.35	4.0	4.23	3.0	0.73	†5.83	5.5	4126
0.91	...	3.59	4.50	4.53	0.72	2.86	0.96	4.54	4.0	3.58	3.0	0.68	5.90	5.5	4125
2.26	0.15	2.61	5.02	4.94	2.30	2.83	1.13	6.26	6.0	5.13	4.0	5.67	5.67	6.0	3951
0.02	0.88	0.96	1.86	1.65	6.57	2.44	0.97	9.98	9.0	9.01	8.0	10.01	10.01	10.0	3933
0.73	0.56	1.10	2.39	2.47	3.48	5.98	1.61	11.07	10.0	9.46	9.0	2.44	2.44	2.0	4216
0.50	0.80	0.92	2.22	2.06	4.10	2.25	0.52	6.87	7.0	6.35	6.0	2.28	2.28	2.0	4217
0.08	1.52	1.05	2.65	2.47	7.48	2.78	1.32	11.58	10.0	10.26	9.0	2.28	2.28	2.0	3998
0.55	2.00	1.39	3.94	4.11	6.04	1.98	1.19	9.21	8.0	8.02	7.0	6.88	6.88	7.0	4050
0.98	0.10	1.04	2.12	2.05	3.60	2.68	1.28	7.56	7.0	6.28	6.0	2.25	2.25	2.0	4055
...	1.12	1.50	2.62	2.47	4.69	3.64	1.84	10.17	9.0	8.33	8.0	6.35	6.35	6.0	4218
1.15	...	1.40	2.55	2.47	2.33	2.29	1.33	5.95	5.0	4.62	4.0	4.39	4.39	4.0	4226

† 0.65 as sulphate, 4.45 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.[1]	Place of Sampling.	Valuation per ton.
	Sampled by Station Agent:		
	The American Agricultural Chemical Co., New York City. (*Continued.*)		
	East India Branch: (*Continued.*)		
4219	Garden and Farm Manure	Southport	$25.40
4220	Pilgrim Fertilizer	Watertown	15.64
4221	Potato Manure	Burnside	26.54
3999	10% Vegetable and Potato	Southport	22.53
4127	Tobacco Special (Carbonate)	Burnside	28.81
4222	Tobacco Special (Sulphate)	Gaylordsville	26.02
4223	Unexcelled Fertilizer	Southport	18.15
	Great Eastern Branch:		
4224	General	East Hampton	15.92
4227	H. G. Vegetable, Vine and Tobacco Fertilizer	Granby	20.71
4056	Northern Corn Special	East Hampton	18.86
	Packers' Union Branch:		
4228	Animal Corn Fertilizer	Waterford	18.17
4057	Gardeners' Complete Manure	East Hampton	26.19
4229	Potato Manure	East Hampton	20.45
	Quinnipiac Branch:		
4230	Corn Manure	New London	16.67
4058	Fish and Potash Manure	Westport	17.17
4231	Market Garden Manure	Westport	25.04
4232	Phosphate	New London	18.49
4233	Potato Manure	New London	20.01
4303	Potato Manure	Westport	20.73
4234*	Potato Phosphate	Westport	19.87
4059	Wrapper Leaf Brand Tobacco Manure	Windsor	26.22
	Wheeler Branch:		
4128	Connecticut Tobacco Grower	Tariffville	26.47
4235	Corn Fertilizer	Granby	17.01
4129*	Havana Tobacco Grower	Granby	23.45
4356*	Havana Tobacco Grower	Tariffville	24.34
4236	Potato Manure	Granby	18.17
	Williams & Clark Branch:		
4237	Americus Ammoniated Bone Superphosphate	Clark's Corner	18.45
4249	Americus Corn Phosphate	Ellington	16.43

* See notes, pp. 73 and 75.

ANALYSES AND VALUATIONS—*Continued.*

Nitrogen.					Phosphoric Acid.							Potash.			
			Total Nitrogen.					Total.		So-called "Available"		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
0.30	1.80	1.32	3.42	3.29	6.24	2.09	1.07	9.40	9.0	8.33	8.0	6.22	6.84	7.0	4219
...	0.02	0.97	0.99	0.82	5.28	3.06	1.38	9.72	9.0	8.34	8.0	4.31	4.31	4.0	4220
0.20	1.82	1.31	3.33	3.29	4.71	1.93	0.68	7.32	7.0	6.64	6.0	10.89	10.89	10.0	4221
0.17	0.80	0.82	1.79	1.65	6.46	2.52	1.19	10.17	9.0	8.98	8.0	9.78	9.78	10.0	3999
0.95	...	3.69	4.64	4.53	0.40	3.97	0.18	4.55	4.0	4.37	3.0	0.99	†5.65	5.5	4127
0.99	...	3.44	4.43	4.53	0.77	3.32	0.90	4.99	4.0	4.09	3.0	0.60	5.74	5.5	4222
0.08	1.42	0.64	2.14	2.06	5.09	3.36	2.03	10.48	9.0	8.45	8.0	3.27	3.27	3.0	4223
0.17	0.20	0.98	1.35	0.82	2.58	6.03	1.00	9.61	9.0	8.61	8.0	4.17	4.17	4.0	4224
0.11	1.28	0.96	2.35	2.06	5.76	2.46	1.00	9.22	9.0	8.22	8.0	6.05	6.05	6.0	4227
0.20	0.80	1.26	2.26	2.47	6.22	3.51	1.13	10.86	10.0	9.73	9.0	2.24	2.24	2.0	4056
0.73	1.00	0.65	2.38	2.47	5.52	3.63	1.15	10.30	10.0	9.15	9.0	1.99	1.99	2.0	4228
...	1.20	1.45	2.65	2.47	4.22	2.60	1.73	8.55	7.0	6.82	6.0	1.20	10.24	10.0	4057
0.13	1.17	1.02	2.32	2.06	5.89	2.37	1.27	9.53	9.0	8.26	8.0	5.59	5.59	6.0	4229
0.98	0.02	1.24	2.24	2.06	4.73	3.32	0.65	8.70	9.0	8.05	8.0	1.69	1.69	1.5	4230
1.06	0.10	1.25	2.41	2.47	1.63	3.48	1.48	6.59	5.0	5.11	4.0	4.53	4.53	4.0	4058
0.77	1.42	1.21	3.40	3.29	4.93	3.24	1.04	9.21	9.0	8.17	8.0	7.05	7.05	7.0	4231
0.15	0.85	1.40	2.40	2.47	4.46	4.03	1.68	10.17	10.0	8.49	9.0	2.28	2.28	2.0	4232
0.97	0.70	0.95	2.62	2.47	2.67	4.43	1.22	8.32	7.0	7.10	6.0	5.45	5.45	5.0	4233
...	0.68	2.08	2.76	2.47	1.48	5.18	2.01	8.67	7.0	6.66	6.0	5.14	5.14	5.0	4303
1.32	0.44	0.90	2.66	2.06	2.97	3.41	0.72	7.10	9.0	6.38	8.0	6.07	6.07	3.0	4234
0.90	0.10	3.65	4.65	4.53	0.44	3.90	0.14	4.48	4.0	4.34	3.0	0.84	5.27	5.5	4059
1.02	0.04	3.52	4.58	4.53	0.50	3.72	0.73	4.95	4.0	4.22	3.0	0.28	5.58	5.5	4128
0.13	0.42	1.37	1.92	1.65	4.49	3.66	1.83	10.08	9.0	8.25	8.0	2.57	2.57	2.0	4235
...	1.06	1.30	2.36	2.47	3.31	3.01	1.42	7.74	7.0	6.32	6.0	1.24	9.17	10.0	4129
0.18	1.15	1.13	2.46	2.47	3.32	3.13	1.29	7.74	7.0	6.45	6.0	0.94	9.72	10.0	4356
0.50	0.60	1.17	2.27	2.06	4.20	3.88	1.11	9.19	9.0	8.08	8.0	3.33	3.33	3.0	4236
0.71	1.10	0.65	2.46	2.47	5.12	3.85	1.29	10.26	10.0	8.97	9.0	2.16	2.16	2.0	4237
0.68	0.84	0.63	2.15	2.06	5.47	2.92	0.88	9.27	9.0	8.39	8.0	1.69	1.69	1.5	4249

† 0.96 as sulphate, 3.70 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Valuation per ton.
	Sampled by Station Agent:		
	The American Agricultural Chemical Co., New York City *(Continued.)*		
	Williams & Clark Branch: (Continued.)		
4250	Americus Fertilizer	Waterbury	$22.40
4251	Americus Potato Manure	Clark's Corner	17.88
4252	Aroostook Potato Phosphate	Wapping	24.54
4000	Chesterfield Manure	Waterbury	21.74
4052	Elk Brand	Milford	14.78
4051	Fish Guano	Milford	16.87
4253	Good Grower	South Manchester	14.72
4254	Great Planet Manure	Norfolk	25.74
4560*	Mammoth Oak Phosphate	Burlington	22.72
4255*	Mammoth Oak Phosphate	Norfolk	25.23
4054*	Meadow Queen Fertilizer	Milford	19.85
4342*	Meadow Queen Fertilizer	Wapping	20.76
4256	Potash and Fish	South Manchester	16.96
4130	Seed Leaf Tobacco Manure	Wapping	26.58
4053	Sterling Plant Food	Milford	16.90
4257	Clark's Root Manure	Botsford	18.27
	Apothecaries Hall Co., Waterbury, Conn.		
3866	Victor Corn Phosphate	Waterbury	21.57
4033*	Victor Potato and Vegetable Special	Windsorville	26.20
4343*	Victor Potato and Vegetable Special	Thomaston	27.57
4094	Victor Tobacco Special	Windsorville	26.09
4093†	Victor Top Dresser for Grass and Grain	Waterbury	38.77
4344†	Victor Top Dresser for Grass and Grain	Windsorville	37.26
	Armour Fertilizer Works, Balto., Md.		
3895	All Soluble	South Manchester	21.39
4095	Ammoniated Bone with Potash	Bridgeport	17.85
3879	Bone, Blood and Potash	Hazardville	28.04
4193‡	Bone, Blood and Potash	Danielson	26.37
3952	Bidwell's Formula for All Crops	Windsor Locks	21.48
4034†	Brewer's Special Tobacco Fertilizer	East Hartford	25.28
4111	Complete Potato Fertilizer	Danielson	17.05
3896	Conn. Valley Tobacco Grower	Rockville	26.30
4258	Conn. Valley Tobacco Starter	South Manchester	18.48
4260	Corn King	Guilford	21.09
4032	Fish and Potash Mixture	Hazardville	15.24
4110	Fruit and Root Crop Special	Danielson	18.02
3880	Grain Grower	Stamford	15.09
3867	H. G. Potato Fertilizer	Hazardville	22.03
4261	Market Garden Special	Bridgeport	25.81

* See note, p. 73. † See notes, pp. 73 and 75. ‡ See note, page 75.

ANALYSES AND VALUATIONS—*Continued.*

NITROGEN.					PHOSPHORIC ACID.							POTASH.			
			Total Nitrogen.					Total.		So-called "Available"		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
0.08	0.54	1.16	1.78	1.65	4.91	3.50	0.99	9.40	9.0	8.41	8.0	10.28	10.28	10.0	4250
0.24	0.90	1.06	2.20	2.06	4.93	3.41	1.10	9.44	9.0	8.34	8.0	2.98	2.98	3.0	4251
0.06	1.56	1.83	3.45	3.29	3.10	3.26	1.00	7.36	7.0	6.36	6.0	9.45	9.45	10.0	4252
0.33	0.28	2.12	2.73	2.47	2.26	4.53	1.01	7.80	7.0	6.79	6.0	6.76	6.76	5.0	4000
0.15	0.15	0.72	1.02	0.82	4.75	3.23	1.33	9.31	9.0	7.98	8.0	4.48	4.48	4.0	4052
0.30	0.50	1.46	2.26	2.06	4.33	2.60	1.07	8.00	7.0	6.93	6.0	2.66	2.66	2.0	4051
0.05	0.10	1.17	1.32	1.23	1.37	4.40	2.43	8.20	7.0	5.77	6.0	4.93	4.93	5.0	4253
1.27	0.76	1.77	3.80	3.29	5.76	2.73	0.67	9.16	9.0	8.49	8.0	5.64	5.64	7.0	4254
0.25	1.32	1.11	2.68	2.47	2.89	3.27	1.43	7.59	7.0	6.16	6.0	9.26	9.26	10.0	4560
0.18	1.42	1.40	3.00	2.47	4.24	4.03	1.96	10.23	7.0	8.27	6.0	8.34	8.34	10.0	4255
0.18	0.70	1.07	1.95	2.47	6.72	2.78	1.13	10.63	10.0	9.50	9.0	5.08	5.08	2.0	4054
0.54	1.30	1.06	2.90	2.47	5.96	3.39	1.18	10.53	10.0	9.35	9.0	2.53	2.53	2.0	4342
0.94	0.30	1.18	2.42	2.47	2.81	2.39	1.00	6.20	5.0	5.20	4.0	4.29	4.29	4.0	4256
0.94	...	3.64	4.58	4.53	0.67	3.50	0.82	4.99	4.0	4.17	3.0	0.72	5.69	5.5	4130
0.32	0.30	1.38	2.00	2.06	5.69	2.90	1.45	10.04	9.0	8.59	8.0	1.81	1.81	1.5	4053
0.12	0.22	0.65	0.99	0.82	5.57	3.56	0.82	9.95	10.0	9.13	9.0	8.01	8.01	7.0	4257
0.47	0.10	1.77	2.34	2.50	4.99	4.05	1.00	10.04	...	9.04	8.0	5.83	5.83	5.0	3866
0.51	0.32	1.50	2.33	2.46	6.67	3.57	0.51	10.75	...	10.24	8.0	1.36	8.82	10.0	4033
1.10	0.04	1.36	2.50	2.46	4.20	4.87	0.78	9.85	...	9.07	8.0	0.88	10.70	10.0	4343
2.66	0.22	1.40	4.28	4.10	0.62	5.09	1.45	7.16	6.0	5.71	4.0	1.04	6.12	6.0	4094
3.13	4.40	0.13	7.66	8.25	6.00	1.99	0.52	8.51	...	7.99	7.3	7.76	7.76	7.3	4093
5.32	0.10	2.29	7.71	8.25	0.25	3.20	2.75	6.20	...	3.45	7.3	8.19	8.19	7.3	4344
0.19	0.72	1.84	2.75	2.88	5.28	3.25	1.27	9.80	8.5	8.53	8.0	4.17	4.17	4.0	3895
0.68	0.30	1.60	2.58	2.47	4.70	1.60	0.74	7.04	6.5	6.30	6.0	3.21	3.21	2.0	4095
0.78	1.35	1.94	4.07	4.11	6.13	2.62	0.52	9.27	8.5	8.75	8.0	7.01	7.01	7.0	3879
1.00	1.10	1.66	3.76	4.11	5.11	2.72	0.81	8.64	8.5	7.83	8.0	7.34	7.34	7.0	4193
1.16	0.10	1.16	2.42	2.47	5.90	1.99	1.13	9.02	8.5	7.89	8.0	3.79	6.21	5.0	3952
1.04	0.06	3.08	4.18	4.52	3.50	1.11	0.51	5.12	4.5	4.61	4.0	0.40	5.48	5.5	4034
0.29	0.22	1.12	1.63	1.65	3.13	3.46	1.15	7.74	7.5	6.59	7.0	6.18	6.18	6.0	4111
1.16	0.04	3.24	4.44	4.52	3.07	1.73	0.50	5.30	4.5	4.80	4.0	1.07	5.57	5.5	3896
1.54	0.04	0.86	2.44	2.47	7.10	1.27	0.78	9.15	8.5	8.37	8.0	1.95	2.59	3.0	4258
0.21	0.78	1.72	2.71	2.47	4.75	3.53	1.29	9.57	8.5	8.28	8.0	4.37	4.37	4.0	4260
0.21	0.28	1.31	1.80	2.05	4.56	2.66	0.97	8.19	6.5	7.22	6.0	2.38	2.38	2.0	4032
0.16	0.06	1.44	1.66	1.65	4.58	2.95	1.62	9.15	8.5	7.53	8.0	5.68	5.68	5.0	4110
0.05	0.08	1.47	1.60	1.65	4.71	2.93	1.32	8.96	8.5	7.64	8.0	2.28	2.28	2.0	3880
0.05	0.36	1.30	1.71	1.65	4.99	2.99	1.23	9.21	8.5	7.98	8.0	10.29	10.29	10.0	3867
0.42	0.96	1.94	3.32	3.29	5.93	2.85	0.90	9.68	8.5	8.78	8.0	7.12	7.12	7.0	4261

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Valuation per ton.
	Sampled by Station Agent:		
	Berkshire Fertilizer Co., Bridgeport, Conn.		
3881	Ammoniated Bone Phosphate	Waterbury	$16.71
3897	Complete Fertilizer	Norwich Town	23.15
4262	Complete Tobacco Fertilizer	Glastonbury	24.17
4263	Economical Grass Fertilizer	Chester	40.04
4098	Fish and Potash	Chester	18.66
4097	Grass Special	Norwich Town	26.31
4035	Long Island Special	Milldale	24.86
4096	Potato and Vegetable Phosphate	Waterbury	16.04
4132	Tobacco Special with Carbonate	Glastonbury	33.57
	F. E. Boardman, Middletown, Conn.		
3882	Complete for Potatoes and General Crops.	Middletown	27.45
4264	Tobacco Fertilizer with Carbonate	Middletown	29.60
	Bowker Fertilizer Co., New York City.		
4134	Complete Alkaline Tobacco Grower (Carbonate)	West Suffield	26.78
4038	Complete Alkaline Tobacco Grower (Sulphate)	Hazardville	24.67
4003	Corn Phosphate	Norwich	15.20
3868	Early Potato Manure	Hazardville	24.95
3898	Farm and Garden Phosphate	Bristol	15.72
4100	Fisherman's Brand Fish and Potash	Yalesville	16.09
4099	Gloucester Fish and Potash	New Haven	13.23
4101	Hill and Drill Phosphate	Hazardville	19.82
4001	Lawn and Garden Dressing	New Haven	21.02
4037	Market Garden Fertilizer	Yalesville	24.01
3884	Potato and Vegetable Fertilizer	Hazardville	21.05
4039	Potato and Vegetable Phosphate	Rockville	14.65
4265	Special Crop Grower	Westport	22.60
3899	Stockbridge Special Complete Manure for Corn and all Grain Crops	New Britain	26.64
3883	Stockbridge Special Complete Manure for Potatoes and Vegetables	New Haven	26.19
3934	Stockbridge Special Complete Manure for Seeding Down, Etc	Yalesville	26.79
4135	Stockbridge Special Complete Manure for Tobacco	Unionville	34.05
4036	Stockbridge Special Complete Manure for Top Dressing and for Forcing	New Haven	26.38
4002	Sure Crop Phosphate	Yalesville	13.63
4112	Tobacco Starter	Rockville	20.46

ANALYSES AND VALUATIONS—*Continued.*

Station No.	Nitrogen.					Phosphoric Acid.							Potash.			Station No.
	As Nitrates.	As Ammonia.	Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available" Found.	So-called "Available" Guaranteed.	Found. As Muriate.	Found. Total.	Guaranteed.	
3881	0.06	...	1.72	1.78	0.80	5.57	2.44	0.75	8.76	9.0	8.01	8.0	3.17	3.17	2.0	3881
3897	0.31	1.20	1.42	2.93	2.50	2.73	5.31	0.24	8.28	9.0	8.04	8.0	7.27	7.27	6.0	3897
4262	...	1.22	1.76	2.98	2.50	5.23	2.83	0.59	8.65	9.0	8.06	8.0	1.08	6.29	6.0	4262
4263	6.83	...	1.25	8.08	8.00	0.07	6.15	2.24	8.46	8.0	6.22	4.0	8.42	8.42	8.0	4263
4098	...	0.02	2.48	2.50	2.50	3.48	2.78	0.71	6.97	6.0	6.26	4.0	4.11	4.11	3.0	4098
4097	4.94	0.02	0.99	5.95	5.00	2.88	1.47	0.32	4.67	5.0	4.35	4.0	2.72	2.72	2.0	4097
4035	...	1.46	2.21	3.67	3.30	1.73	4.98	0.33	7.04	8.0	6.71	6.0	7.19	7.19	7.0	4035
4096	...	0.04	1.78	1.82	1.70	1.15	5.14	0.23	6.52	7.0	6.29	6.0	4.66	4.66	4.0	4096
4132	1.08	0.02	4.36	5.46	4.50	0.33	3.66	0.43	4.42	4.0	3.99	3.0	0.15	*6.16	5.5	4132
3882	0.68	1.09	1.55	3.32	3.09	1.01	7.97	1.13	10.11	...	8.98	7.0	9.78	9.78	9.0	3882
4264	1.24	0.06	2.43	3.73	3.30	0.14	7.12	0.54	7.80	...	7.26	7.0	1.14	†8.58	9.0	4264
4134	1.12	0.03	3.07	4.22	4.11	0.53	3.92	0.35	4.80	5.0	4.45	4.0	1.08	‡5.86	5.0	4134
4038	1.08	0.02	2.96	4.06	4.11	1.01	3.71	0.27	4.99	5.0	4.72	4.0	0.64	5.64	5.0	4038
4003	0.52	0.70	0.48	1.70	1.65	5.34	2.95	0.88	9.17	9.0	8.29	8.0	2.22	2.22	2.0	4003
3868	0.22	1.85	1.31	3.38	3.29	4.85	2.46	1.20	8.51	8.0	7.31	7.0	7.72	7.72	7.0	3868
3898	0.09	0.22	1.38	1.69	1.65	5.23	2.85	1.45	9.53	9.0	8.08	8.0	2.17	2.17	2.0	3898
4100	0.09	1.26	1.07	2.42	2.47	2.59	1.90	0.88	5.37	5.0	4.49	4.0	4.08	4.08	4.0	4100
4099	0.13	0.10	0.97	1.20	0.82	5.42	2.69	1.33	9.44	9.0	8.11	8.0	1.41	1.41	1.0	4099
4101	0.15	1.16	1.35	2.66	2.47	5.90	3.17	1.48	10.55	10.0	9.07	9.0	2.23	2.23	2.0	4101
4001	1.30	0.70	1.51	3.51	3.29	1.75	3.16	0.78	5.69	5.0	4.91	4.0	5.14	5.14	5.0	4001
4037	0.58	1.04	1.15	2.77	2.47	3.25	3.32	0.72	7.29	7.0	6.57	6.0	10.37	10.37	10.0	4037
3884	0.62	1.03	1.08	2.73	2.47	5.88	2.77	1.32	9.97	9.0	8.65	8.0	4.19	4.19	4.0	3884
4039	0.51	0.60	0.43	1.54	1.65	5.32	2.98	0.87	9.17	9.0	8.30	8.0	2.24	2.24	2.0	4039
4265	0.39	0.14	1.23	1.76	1.65	4.22	4.16	2.17	10.55	9.0	8.38	8.0	10.06	10.06	10.0	4265
3899	0.32	1.70	1.31	3.33	3.29	5.44	4.74	1.01	11.19	11.0	10.18	10.0	7.21	7.21	7.0	3899
3883	...	1.68	1.65	3.33	3.29	3.68	2.88	0.74	7.30	7.0	6.56	6.0	10.38	10.38	10.0	3883
3934	...	1.78	0.96	2.74	2.47	8.18	2.36	1.23	11.77	11.0	10.54	10.0	1.12	7.66	8.0	3934
4135	...	2.80	2.66	5.46	5.76	1.87	3.10	0.83	5.80	5.0	4.97	4.0	0.67	10.08	10.0	4135
4036	1.09	2.48	1.35	4.92	4.94	2.30	2.31	1.39	6.00	5.0	4.61	4.0	6.06	6.06	6.0	4036
4002	0.08	0.16	0.74	0.98	0.82	5.85	3.05	0.96	9.86	10.0	8.90	9.0	2.32	2.32	2.0	4002
4112	0.13	1.50	1.03	2.66	2.47	6.36	2.26	1.04	9.66	9.0	8.62	8.0	1.08	3.33	3.0	4112

* 0.32 as sulphate, 5.69 as carbonate. † 5.05 as sulphate, 2.39 as carbonate.
‡ 2.09 as sulphate, 2.69 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Valuation per ton.
	Sampled by Station Agent:		
	The E. D. Chittenden Co., Bridgeport, Conn.		
4269	Complete Tobacco and Onion Grower	Broad Brook	$23.98
4266	Connecticut Tobacco Grower	Windsorville	30.69
4268	Grain and Vegetable	Westport	22.87
4682	Ten Per Cent. Potato	Broad Brook	26.48
4267	Tobacco Special	Windsorville	24.30
	The Everett B. Clark Seed Co., Milford, Conn.		
3817	Special Mixture for General Use	Milford	26.25
3818	Special 10% Brand	Milford	27.67
	The Coe-Mortimer Co., New York City.		
4275	Celebrated Special Potato Fertilizer	West Hartford	18.10
3954	Complete Manure 10% Potash	West Cheshire	23.66
4287	Connecticut Wrapper Grower	Suffield	35.18
4276*	Double Strength Top Dressing	West Hartford	33.10
4539*	Double Strength Top Dressing	Somers	39.91
4040	Gold Brand, Excelsior Guano	West Hartford	22.23
3953	H. G. Ammoniated Superphosphate	West Hartford	18.29
4113	Ideal Tobacco Fertilizer	Windsor	26.53
4270	New Englander Corn and Potato Fertilizer	Winsted	15.40
4114	Red Brand, Excelsior Guano	Somerville	26.43
	Conn. Valley Orchard Co., Berlin, Conn.		
4302	H. G. Special Fertilizer	Berlin	21.69
	T. H. Eldredge, Norwich, Conn.		
3900	H. G. Fish and Potash	Norwich	21.69
3901	Special Superphosphate	Norwich	15.69
	Essex Fertilizer Co., Boston, Mass.		
4277	Complete Corn, Grain and Grass	East Hartford	25.35
3869	Complete Manure, Potatoes, Roots and Vegetables	Suffield	25.46
3935	Market Garden and Potato Manure	East Hartford	19.22
3870	New Tobacco Fertilizer	Hazardville	26.09
4278	Special Tobacco Manure	East Hartford	33.08
3886	Tobacco Starter and Grower	Hazardville	27.52
3885	X X X Fish and Potash	Suffield	17.61
	The Fertilizer Materials Supply Co., New York City.		
3718	No. 1 Potato and General Truck Fertilizer.	Highwood	25.12

* See notes, pp. 74 and 75.

NITROGENOUS SUPERPHOSPHATES.

ANALYSES AND VALUATIONS—*Continued.*

Nitrogen.					Phosphoric Acid.							Potash.			
			Total Nitrogen.					Total.		So-called "Available"		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
0.20	2.20	0.93	3.33	3.30	6.11	2.69	0.78	9.58	9.0	8.80	8.0	0.84	4.64	5.0	4269
0.17	3.22	1.96	5.35	4.95	3.20	1.43	0.26	4.89	5.0	4.63	4.0	0.90	7.92	8.0	4266
0.10	1.54	1.01	2.65	2.47	6.08	2.95	0.95	9.98	9.0	9.03	8.0	6.64	6.64	6.0	4268
0.08	1.76	1.37	3.21	3.30	6.68	1.45	0.42	8.55	7.0	8.13	6.0	9.66	9.66	10.0	4682
0.19	2.60	1.77	4.56	4.50	2.52	0.73	0.14	3.39	4.0	3.25	3.0	0.40	5.36	5.5	4267
1.51	0.12	1.61	3.24	3.29	7.01	2.53	0.52	10.06	...	9.54	8.0	7.56	7.56	7.0	3817
1.37	0.10	2.00	3.47	3.29	4.77	2.36	0.55	7.68	...	7.13	6.0	10.77	10.77	10.0	3818
...	0.84	1.02	1.86	1.65	5.75	2.95	1.47	10.17	9.0	8.70	8.0	4.03	4.03	4.0	4275
0.30	1.20	1.19	2.69	2.47	3.31	3.17	1.77	8.25	7.0	6.48	6.0	9.80	9.80	10.0	3954
1.69	1.00	2.93	5.62	5.76	3.12	2.59	0.41	6.12	6.0	5.71	5.0	0.88	10.01	10.0	4287
2.91	2.00	1.12	6.03	8.23	3.33	5.01	0.82	9.16	8.0	8.34	7.0	6.49	6.49	8.0	4276
3.42	1.88	2.24	7.54	8.23	3.92	4.22	0.58	8.72	8.0	8.14	7.0	8.17	8.17	8.0	4539
...	1.14	1.35	2.49	2.47	6.99	2.17	1.27	10.43	9.0	9.16	8.0	5.82	5.82	6.0	4040
0.23	0.85	1.04	2.12	1.85	5.90	2.81	1.65	10.36	9.0	8.71	8.0	3.05	3.05	3.0	3953
0.94	0.10	3.48	4.52	4.53	0.72	3.52	0.10	4.34	4.0	4.24	3.0	0.48	6.12	5.5	4113
0.17	0.20	0.79	1.16	0.82	5.57	3.25	1.48	10.30	9.0	8.82	8.0	3.63	3.63	3.0	4270
...	2.10	1.45	3.55	3.30	7.21	1.44	1.16	9.81	9.0	8.65	8.0	7.18	7.18	7.0	4114
...	0.95	1.67	2.62	2.47	6.12	3.28	1.41	10.81	10.0	9.40	9.0	4.19	4.19	4.0	4302
1.36	0.02	1.00	2.38	2.46	5.81	1.89	0.23	7.93	6.0	7.70	5.0	4.03	7.21	4.0	3900
0.96	0.02	0.45	1.43	1.23	5.71	3.41	0.36	9.48	10.0	9.12	9.0	2.61	2.61	2.0	3901
...	1.10	2.12	3.22	3.28	4.15	2.25	0.32	6.72	7.0	6.40	6.0	9.73	9.73	10.0	4277
...	1.20	1.97	3.17	3.28	4.14	2.20	0.38	6.72	7.0	6.34	6.0	10.23	10.23	10.0	3869
0.42	0.60	1.02	2.04	2.00	6.38	2.56	0.46	9.40	9.0	8.94	8.0	4.87	4.87	5.0	3935
1.06	0.10	3.04	4.20	4.10	2.55	1.61	0.64	4.80	5.0	4.16	4.0	0.84	6.72	6.0	3870
1.64	0.08	2.53	4.25	4.10	2.76	5.42	1.48	9.66	7.0	8.18	6.0	1.44	10.42	10.0	4278
2.22	0.03	1.87	4.12	4.10	1.63	3.74	0.83	6.20	5.0	5.37	4.0	1.74	8.36	6.0	3886
...	0.74	1.38	2.12	2.00	5.71	2.51	0.77	8.99	9.0	8.22	8.0	2.91	2.91	3.0	3885
2.21	0.08	1.05	3.34	3.30	3.40	4.98	0.68	9.06	...	8.38	8.0	7.70	7.70	7.0	3718

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Valuation per ton.
	Sampled by Station Agent:		
	The L. T. Frisbie Co., New Haven, Conn.		
3902	Connecticut Special Fertilizer	Manchester	$24.34
3955	Corn and Grain Fertilizer	Manchester	17.07
3871	Potato Manure	Hartford	20.92
4115	Top Dresser	New Haven	27.03
3819	Vegetable Grower	New Haven	25.36
	International Agricultural Corporation, Buffalo, N. Y.		
4116	Buffalo Farmers' Choice	Ansonia	15.40
4140	Buffalo Fish Guano	Stafford Springs	13.74
4138†	Buffalo High Grade Manure	Norwich	25.30
3957	Buffalo New England Special	Ansonia	19.08
3872	Buffalo Tobacco Producer	Windsor Locks	28.34
4137†	Buffalo Top Dresser	Norwich	29.15
3956	Buffalo Two-Eight-Ten	Norwich	22.57
4139	Buffalo Vegetable and Potato	Putnam	21.92
	Lister's Agricultural Chemical Works, Newark, N. J.		
4117	Ammoniated Dissolved Superphosphate	North Branford	16.81
4131	Complete Tobacco Manure (Carbonate)	Warehouse Point	27.12
4280	Complete Tobacco Manure (Sulphate)	Glastonbury	25.12
4118	Corn and Potato Fertilizer	Stafford Springs	16.34
4005	Potato Manure	Burnside	25.74
4004	Success Fertilizer	Hamden	15.62
4279	3–6–10 for Potatoes	Glastonbury	22.80
	Lowell Fertilizer Co., Boston, Mass.		
3944	Animal Brand for all Crops	New Britain	21.46
3874	Bone Fertilizer, Corn, Grain, Grass and Vegetables	Guilford	17.82
3875	Empress Brand	Southington	12.77
4324	Market Garden Manure	South Manchester	26.80
4322	Perfect Tobacco Grower for Tobacco, Fruit and Vines	Rockville	25.92
4323	Potato Grower with 10% Potash	Granby	25.28
4319	Potato Manure	Guilford	16.81
3876	Potato Phosphate	Suffield	22.91
4321	Special Grass Mixture for Top Dressing and Lawns	Rockville	27.65
4320†	Special Potato Fertilizer with 10% Potash	Warehouse	21.99
4328	Special Tobacco from Vegetable and Animal matter	Windsor	28.61
3980	Superior Fertilizer with 10% Potash	Rockville	30.21

† See note, page 76.

ANALYSES AND VALUATIONS—*Continued.*

Nitrogen.					Phosphoric Acid.							Potash.			Station No.
			Total Nitrogen.					Total.		So-called "Available"		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	
0.50	0.02	1.90	2.42	2.46	3.80	2.55	0.40	6.75	7.0	6.35	6.0	11.25	11.25	10.0	3902
...	0.02	1.70	1.72	1.64	3.26	5.39	1.65	10.30	9.0	8.65	8.0	3.09	3.09	3.0	3955
...	1.44	0.99	2.43	2.46	3.52	4.44	1.06	9.02	8.0	7.96	6.0	6.46	6.46	6.0	3871
0.52	0.08	3.66	4.26	4.10	3.80	4.12	0.97	8.89	8.0	7.92	7.0	4.59	4.59	4.0	4115
0.42	1.00	1.94	3.36	3.28	3.94	3.41	0.61	7.96	7.0	7.35	6.0	8.22	8.22	8.0	3819
...	0.32	0.71	1.03	0.82	4.66	3.71	0.97	9.34	9.0	8.37	8.0	5.02	5.02	5.0	4116
...	0.15	0.77	0.92	0.82	4.13	4.77	2.03	10.93	10.0	8.90	9.0	2.36	2.36	2.0	4140
1.41	0.14	1.68	3.23	3.30	1.63	5.05	2.01	8.69	8.0	6.68	7.0	9.16	9.16	10.0	4138
...	0.72	1.01	1.73	1.64	5.53	4.02	1.52	11.07	10.0	9.55	9.0	4.94	4.94	5.0	3957
...	1.58	3.06	4.64	4.50	2.98	3.86	1.28	8.12	6.0	6.84	5.0	0.44	5.01	5.5	3872
2.91	0.95	1.43	5.29	5.70	1.52	5.12	2.05	8.69	7.0	6.64	6.0	5.67	5.67	5.0	4137
0.48	0.28	1.01	1.77	1.64	5.89	3.44	0.84	10.17	9.0	9.33	8.0	9.67	9.67	10.0	3956
0.32	0.82	1.31	2.45	2.46	3.70	4.39	1.79	9.88	9.0	8.09	8.0	6.85	6.85	7.0	4139
...	0.62	1.44	2.06	2.06	5.80	2.83	1.22	9.85	9.0	8.63	8.0	1.46	1.46	1.5	4117
1.25	...	2.69	3.94	4.11	0.48	3.57	1.96	6.01	5.0	4.05	4.0	0.15	‡5.47	5.0	4131
1.72	0.10	2.31	4.13	4.11	2.31	2.50	0.82	5.63	5.0	4.81	4.0	1.14	5.92	5.0	4280
...	0.32	1.44	1.76	1.65	5.20	2.96	0.99	9.15	9.0	8.16	8.0	2.76	2.76	3.0	4118
...	1.82	1.54	3.36	3.29	5.42	2.83	1.19	9.44	9.0	8.25	8.0	7.62	7.62	7.0	4005
...	0.15	1.25	1.40	1.23	6.96	2.25	1.02	10.23	10.0	9.21	9.0	2.21	2.21	2.0	4004
0.14	0.86	1.43	2.43	2.47	3.75	2.40	0.82	6.97	7.0	6.15	6.0	10.36	10.36	10.0	4279
...	0.08	2.32	2.40	2.46	3.89	5.54	1.79	11.22	9.0	9.43	8.0	4.38	4.38	4.0	3944
...	0.08	1.72	1.80	1.64	2.85	5.75	1.62	10.22	9.0	8.60	8.0	3.79	3.79	3.0	3874
0.37	0.08	0.79	1.24	1.24	5.14	2.01	0.68	7.83	8.0	7.15	7.0	2.13	2.13	2.0	3875
0.87	1.15	2.22	4.24	4.10	4.85	2.25	0.51	7.61	8.0	7.10	7.0	6.37	6.37	6.0	4324
2.05	0.03	1.61	3.69	4.10	0.63	6.04	1.65	8.32	5.0	6.67	4.0	0.64	6.84	6.0	4322
...	1.28	1.95	3.23	3.28	4.37	1.76	0.52	6.65	7.0	6.13	6.0	9.88	9.88	10.0	4323
...	0.06	1.56	1.62	1.64	3.55	5.00	1.06	9.61	8.0	8.55	7.0	3.64	3.64	4.0	4319
...	0.48	1.96	2.44	2.46	3.68	5.77	1.71	11.16	9.0	9.45	8.0	6.35	6.35	6.0	3876
0.15	1.55	2.22	3.92	4.10	2.68	5.65	2.42	10.75	8.0	8.33	7.0	6.84	6.84	6.0	4321
0.81	0.40	1.33	2.54	2.46	4.66	1.55	0.51	6.72	7.0	6.21	6.0	8.98	8.98	10.0	4320
1.30	0.06	2.64	4.00	4.10	5.76	1.03	0.69	7.48	7.0	6.79	6.0	0.64	7.67	8.0	4328
0.65	0.12	2.72	3.49	3.69	3.70	4.69	1.65	10.04	8.0	8.39	7.0	11.64	11.64	10.0	3980

‡ 0.33 as sulphate, 4.99 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Valuation per ton.
	Sampled by Station Agent:		
	E. Manchester & Sons, Winsted, Conn.		
4141	Formula	Gilead	$26.46
4281	Helper	Litchfield	21.04
4142	Special	Gilead	32.37
	The Mapes Formula and Peruvian Guano Co., New York City.		
3888	Average Soil Complete Manure	Winsdor Locks	27.81
3936	Complete Manure "A" Brand	Meriden	21.35
3887	Corn Manure	Meriden	22.55
4477	Dissolved Bone	Rockville	25.01
3937	Economical Potato Manure	Southington	26.39
4288	Fruit and Vine Manure	Hawleyville	23.75
3903	Potato Manure	Suffield	27.44
4041	Seeding Down Manure	Forestville	32.80
4283	Tobacco Manure, Wrapper Brand	Windsor	44.41
3938	Tobacco Starter Improved	Windsor Locks	25.95
3958	Top Dresser Improved, Half Strength	Meriden	24.15
3940	Top Dresser Improved, Full Strength	Forestville	45.85
3939	Vegetable Manure for Light Soils	Windsor Locks	33.30
	The National Fertilizer Co., New York City.		
4144	Ammoniated Bone Phosphate	Willimantic	14.86
4286	Complete Grass Fertilizer	South Manchester	25.02
4148	Complete Root and Grain Fertilizer	Silver Lane	24.87
4147	Complete Tobacco Fertilizer	Broad Brook	24.87
4291	Conn. Valley Tobacco Grower	Broad Brook	32.43
3941	Eureka Potato Fertilizer	Willimantic	22.37
4284	Fish and Potash	South Manchester	19.84
4119*	Formula "A"	Willimantic	21.22
4143†	H. G. Top Dressing	South Manchester	37.91
4345†	H. G. Top Dressing	Warehouse Point	38.31
4285	Market Garden Fertilizer	South Manchester	20.91
4145	Potato Phosphate	Wallingford	20.60
3974	Tobacco Special	Silver Lane	26.33
4290	Tobacco Special with Carbonate of Potash.	Windsor	28.22
4146	XXX Fish and Potash	Guilford	16.98
	New England Fertilizer Co., Boston, Mass.		
3976	Corn and Grain Fertilizer	Plantsville	15.53
4157	Corn Phosphate	Unionville	17.09
4158	H. G. Potato Fertilizer	Plantsville	22.84
3975	Perfect Tobacco Grower	Glastonbury	27.89
3959	Potato Fertilizer	Rockville	17.17
4156	Potato Grower with 10% Potash	Rockville	22.49
3977	Superphosphate	Meriden	21.50

* See note, p. 76. † See notes, pages 74 and 76.

ANALYSES AND VALUATIONS—*Continued.*

Nitrogen.					Phosphoric Acid.							Potash.			
			Total Nitrogen.					Total.		So-called "Available"		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
0.10	1.88	1.54	3.52	3.50	6.10	2.23	0.77	9.10	...	8.33	7.5	7.93	7.93	8.0	4141
0.09	0.80	0.93	1.82	1.64	5.85	2.91	1.32	10.08	...	8.76	8.0	7.93	7.93	8.0	4281
0.07	5.00	0.18	5.25	5.00	5.95	2.79	0.73	9.47	...	8.74	7.5	0.72	7.20	7.5	4142
2.32	1.54	0.68	4.54	4.12	0.86	6.19	0.96	8.01	8.0	7.05	7.0	0.72	6.46	5.0	3888
1.06	1.00	0.82	2.88	2.47	0.91	9.21	2.15	12.27	12.0	10.12	10.0	2.87	2.87	2.5	3936
1.47	0.46	0.91	2.84	2.47	0.80	7.40	2.70	10.90	10.0	8.20	8.0	6.14	6.14	6.0	3887
...	0.20	2.30	2.50	2.06	3.56	14.40	1.65	19.61	...	17.96	12.0	....	....	....	4477
1.64	0.98	1.02	3.64	3.29	0.34	4.97	1.59	6.90	6.0	5.31	4.0	0.88	9.02	8.0	3937
1.31	...	0.69	2.00	1.65	0.41	5.68	1.59	7.68	7.0	6.09	5.0	0.74	11.34	10.0	4288
1.99	1.00	0.89	3.88	3.71	1.34	6.97	1.22	9.53	8.0	8.31	8.0	0.94	7.01	6.0	3903
2.74	...	0.39	3.13	2.47	0.10	12.76	6.33	19.19	18.0	12.86	...	11.76	11.76	10.0	4041
3.75	0.02	2.77	6.54	6.18	0.12	4.21	1.16	5.49	4.5	4.33	...	1.20	‡11.69	10.5	4283
1.85	0.10	2.76	4.71	4.12	0.34	7.83	0.86	9.03	8.0	8.17	6.0	0.74	1.99	1.0	3938
2.81	2.00	0.26	5.07	4.94	0.56	3.65	1.19	5.40	4.0	4.21	2.5	0.74	3.52	2.0	3958
6.39	3.34	0.87	10.60	9.88	0.20	6.94	0.64	7.78	8.0	7.14	5.0	0.92	4.54	4.0	3940
3.42	1.26	1.54	6.22	4.94	0.29	6.19	1.73	8.21	8.0	6.48	6.0	0.80	6.10	6.0	3939
0.48	0.80	0.46	1.74	1.65	5.76	2.31	0.49	8.56	9.0	8.07	8.0	2.03	2.03	2.0	4144
1.92	0.75	1.41	4.08	4.11	4.75	2.05	1.07	7.87	7.0	6.80	6.0	5.44	5.44	5.0	4286
0.97	1.52	1.03	3.52	3.29	4.43	3.99	0.96	9.38	9.0	8.42	8.0	6.34	6.34	6.0	4148
0.30	1.50	1.62	3.42	3.29	5.47	2.86	1.20	9.53	9.0	8.33	8.0	1.95	5.31	5.0	4147
1.18	...	3.77	4.95	4.94	0.34	2.71	3.19	6.24	4.0	3.05	1.0	0.44	§6.80	8.0	4291
0.70	1.00	0.95	2.65	2.47	4.29	2.24	0.38	6.91	7.0	6.53	6.0	9.06	9.06	10.0	3941
0.95	0.26	1.59	2.80	2.88	3.35	3.29	1.16	7.80	7.0	6.64	6.0	4.41	4.41	4.0	4284
0.81	0.72	1.61	3.14	3.29	2.26	3.64	0.93	6.83	7.0	5.90	6.0	5.73	5.73	6.0	4119
2.51	3.54	1.53	7.58	8.23	2.93	4.62	0.64	8.19	8.0	7.55	7.0	6.72	6.72	8.0	4143
2.45	3.55	1.68	7.68	8.23	2.85	3.80	0.64	7.29	8.0	6.65	7.0	7.60	7.60	8.0	4345
0.83	0.66	0.71	2.20	2.47	7.13	2.04	0.87	10.04	9.0	9.17	8.0	6.03	6.03	6.0	4285
0.19	1.18	0.91	2.28	2.06	5.81	2.58	0.91	9.30	9.0	8.39	8.0	6.10	6.10	6.0	4145
1.10	...	3.50	4.60	4.53	0.62	3.07	0.61	4.30	4.0	3.69	3.0	0.60	5.91	5.5	3974
0.87	0.05	3.72	4.64	4.53	0.43	3.95	0.78	5.16	4.0	4.38	3.0	0.76	¶5.07	5.5	4290
...	0.10	2.21	2.31	2.47	2.98	2.12	0.87	5.97	6.0	5.10	5.0	4.12	4.12	3.0	4146
0.01	0.20	1.61	1.82	1.24	4.18	3.72	1.18	9.08	8.0	7.90	7.0	2.43	2.43	2.0	3976
0.51	0.40	0.89	1.80	1.64	6.43	2.05	0.92	9.40	9.0	8.48	8.0	3.53	3.53	3.0	4157
...	0.44	2.01	2.45	2.46	3.46	5.63	1.46	10.55	9.0	9.09	8.0	6.70	6.70	6.0	4158
2.24	0.05	1.63	3.92	4.10	1.71	4.10	0.77	6.58	5.0	5.81	4.0	1.08	9.06	6.0	3975
...	0.40	1.44	1.84	1.64	4.70	3.07	0.70	8.47	8.0	7.77	7.0	4.08	4.08	4.0	3959
0.95	0.28	1.23	2.46	2.46	4.75	1.64	0.52	6.91	7.0	6.39	6.0	9.79	9.79	10.0	4156
1.10	0.10	1.56	2.76	2.06	4.37	4.96	1.48	10.81	9.0	9.33	8.0	3.71	3.71	4.0	3977

‡ 0.88 as sulphate, 9.61 as carbonate. § 0.75 as sulphate, 5.61 as carbonate.
¶ 1.16 as sulphate, 3.15 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Valuation per ton.
	Sampled by Station Agent:		
	Niantic Menhaden Oil and Guano Co., South Lyme, Conn.		
4562	Bone, Fish and Potash	Saybrook	$17.52
4563	Corn and Grain Fertilizer	Moodus	18.01
4564	H. G. Tobacco Fertilizer	Mystic	25.83
4561	Potato and Vegetable Manure	Norwich	21.62
	Olds & Whipple, Hartford, Conn.		
4159	Complete Corn and Potato Fertilizer	Silver Lane	26.17
4204	Complete Tobacco Fertilizer	Weatogue	30.29
4295	Fish and Potash	Hartford	20.35
4294*	Grass Fertilizer, Top Dressing	Hartford	23.00
4160	H. G. Potato Fertilizer	Windsorville	29.08
4296	Special Phosphate	Hartford	24.87
	Parmenter & Polsey Fertilizer Co., Boston, Mass.		
4161	Grain Grower	Plantsville	13.32
3873	Plymouth Rock Brand	Plantsville	20.70
4297	Potato Grower with 10% Potash	Thomaston	23.47
	F. S. Platt Co., New Haven, Conn.		
4165	Platco Market Garden Phosphate	New Haven	23.17
	The Rogers & Hubbard Co., Middletown, Conn.		
4162	"Bone Base" All Soils All Crops Phosphate	Ellington	26.49
3820	"Bone Base" Complete Phosphate	Wallingford	18.61
4346*	"Bone Base" Oats and Top Dressing	Windsor Locks	42.92
3821*	"Bone Base" Oats and Top Dressing	Wallingford	41.46
4163	"Bone Base" New Market Garden Phosphate	East Hampton	22.75
4164	"Bone Base" Potato Phosphate	Glastonbury	20.90
3822	"Bone Base" Soluble Corn and General Crops	Wallingford	22.51
3823	"Bone Base" Seeding Down and Fruit Fertilizer	Wallingford	30.86
4304	"Bone Base" Soluble Potato Manure	Putnam	32.00
4305*	"Bone Base" Soluble Tobacco Manure	Granby	35.58
4306	Tobacco Special	Portland	27.26
	The Rogers Mfg. Co., Rockfall, Conn.		
3942	All Round Fertilizer	South Manchester	15.89

* See note, page 74.

ANALYSES AND VALUATIONS—*Continued.*

Nitrogen.					Phosphoric Acid.							Potash.			
			Total Nitrogen.					Total.		So-called "Available"		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
1.03	0.12	1.37	2.52	2.46	2.31	3.64	1.32	7.27	6.0	5.95	5.0	3.58	3.58	3.0	4562
1.16	0.10	1.48	2.74	2.46	1.49	4.54	1.22	7.25	6.0	6.03	5.0	3.27	3.27	3.0	4563
0.95	1.00	1.63	3.58	3.30	5.88	2.23	0.64	8.75	8.0	8.11	7.0	0.70	†5.84	6.0	4564
1.16	0.14	1.27	2.57	2.50	5.70	1.71	0.36	7.77	8.0	7.41	7.0	4.31	6.60	6.0	4561
0.17	1.22	2.05	3.44	3.30	1.49	6.96	2.64	11.09	6.0	8.45	6.0	7.01	7.01	6.0	4159
0.93	0.10	3.86	‡4.89	4.50	0.24	3.67	0.18	4.09	3.0	3.67	3.0	0.64	§5.82	5.5	4204
0.55	0.04	2.25	2.84	2.50	2.30	4.62	1.57	8.49	6.0	6.92	5.0	4.03	4.03	3.0	4295
3.21	...	0.53	3.74	3.30	0.10	4.86	2.97	7.93	7.0	4.96	6.0	0.12	5.19	6.0	4294
1.25	...	2.26	3.51	3.30	0.62	5.73	2.67	9.02	6.0	6.35	6.0	7.50	11.43	10.0	4160
2.32	0.02	1.98	4.32	4.18	0.96	4.39	3.08	8.43	...	5.35	4.0	0.60	3.94	3.0	4296
...	...	1.28	1.28	1.24	3.74	3.60	0.72	8.06	9.0	7.34	7.0	2.24	2 24	2.0	4161
0.78	0.10	1.54	2.42	2.47	4.84	4.45	1.61	10.90	9.0	9.29	8.0	4.03	4.03	4.0	3873
0.82	0.50	1.32	2.64	2.46	4.85	1.53	0.52	6.90	7.0	6.38	6.0	10.20	10.20	10.0	4297
1.59	...	1.11	2.70	2.47	7.63	1.96	0.29	9.88	9.0	9.59	8.0	6.29	6.29	6.0	4165
2.45	...	1.14	3.59	3.30	3.94	4.84	1.77	10.55	9.0	8.78	8.0	7.28	7.28	7.0	4162
0.37	0.04	1.37	1.78	1.50	5.18	3.02	1.66	9.86	8.0	8.20	7.0	5.22	5.22	5.0	3820
7.75	0.05	1.15	8.95	8.50	0.12	6.68	1.32	8.12	8.0	6.80	4.5	8.37	8.37	8.0	4346
7.46	0.04	0.89	8.39	8.50	0.05	7.11	1.91	9.07	8.0	7.16	4.5	8.42	8.42	8.0	3821
1.06	...	1.12	2.18	2.00	2.83	4.28	1.14	8.25	7.0	7.11	6.0	10.56	10.56	10.0	4163
0.96	...	1.21	2.17	2.00	6.69	3.08	0.78	10.55	10.0	9.77	9.0	5.28	5.28	5.0	4164
1.16	0.10	1.50	2.76	2.50	1.98	4.19	1.51	7.68	8.0	6.17	6.0	8.46	8.46	8.0	3822
0.27	0.05	2.34	2.66	2.20	0.14	9.09	7.66	16.89	16.0	9.23	6.5	12.76	12.76	12.0	3823
2.63	0.20	2.35	5.18	5.00	1.54	6.57	2.39	10.50	10.0	8.11	7.0	1.40	6.16	5.0	4304
2.14	0.10	2.71	4.95	5.00	1.21	6.96	2.70	10.87	10.0	8.17	7.0	2.27	10.33	10.0	4305
0.35	0.05	4.16	4.56	4.10	0.24	4.21	1.11	5.56	5.5	4.45	3.0	0.76	5.83	5.0	4306
...	0.60	1.16	1.76	1.60	3.19	4.87	1.61	9.67	10.0	8.06	8.0	2.47	2.47	2.0	3942

‡ Five other samples showed from 4.78 to 4.80 nitrogen.
† 5.14 per cent. as sulphate. § 0.32 as sulphate, 4.86 as carbonate.

Nitrogenous Superphosphates.

Station No.	Manufacturer and Brand.	Place of Sampling.	Valuation per ton.
	Sampled by Station Agent:		
	The Rogers Mfg. Co., Rockfall, Conn. *(Continued.)*		
3889*	Complete Potato and Vegetable Fertilizer	Meriden	$21.91
4349*	Complete Potato and Vegetable Fertilizer	South Manchester	22.23
4186*	H. G. Complete Corn and Onion Manure	Somerville	26.61
4347*	H. G. Complete Corn and Onion Manure	Cromwell	28.15
4181	H. G. Fertilizer, Oats and Top Dressing	Meriden	36.45
4182	H. G. Grass and Grain	Rockfall	34.72
4185	H. G. Soluble Tobacco Manure	Wapping	35.73
4184*	H. G. Soluble Tobacco and Potato Manure	Glastonbury	29.87
4348*	H. G. Soluble Tobacco and Potato Manure	West Hartford	30.80
4187	H. G. Tobacco Grower	East Haddam	24.99
4183	H. G. Tobacco Grower, Vegetable and Carbonate Formula	Glastonbury	33.59
	F. S. Royster Guano Co., Baltimore, Md.		
4192	Champion Crop Compound	Stamford	17.62
4189	Gold Seal Potato and Cabbage Special	Burnside	22.74
4307	H. G. Tobacco Manure	Ellington	32.75
4188	Ideal Tobacco Guano	Burnside	27.11
4191	Special Corn and Tomato Guano	Stamford	17.54
4190	Universal Truck Fertilizer	Stamford	25.06
	Sanderson Fertilizer and Chemical Co., New Haven, Conn.		
3943	Atlantic Coast Bone, Fish and Potash	Guilford	18.46
4311	Brown's Special Formula	Leonards Bridge	26.94
4120	Brown's Special Formula for Oats and Top Dressing	Leonards Bridge	30.53
4309	Complete Tobacco Grower	Silver Lane	28.13
4315	Corn Superphosphate	Shelton	18.93
4314	Formula A	Shelton	24.28
4308	Formula B	Glastonbury	28.24
4312	Kelsey's Bone, Fish and Potash	Meriden	20.09
4313	Potato Manure	Plainville	19.22
4316	Special with 10% Potash	Torrington	24.28
4310	Top Dressing for Grass and Grain	Guilford	29.21
	The C. M. Shay Fertilizer Co., Groton, Conn.		30.28
4317	Bone Base Grass and Lawn	Groton	18.94
3824†	Complete Fertilizer	Guilford	27.60
4318†	Market Garden	Putnam	24.66
3825	Potato Manure	Guilford	

* See note, p. 74.

† See note, p. 76.

Analyses and Valuations—*Continued.*

Nitrogen.					Phosphoric Acid.							Potash.			
			Total Nitrogen.					Total.		So-called "Available"		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
0.58	0.23	2.28	3.09	2.25	3.24	4.22	3.76	11.22	10.0	7.46	8.0	5.69	5.69	5.0	3889
0.53	0.12	2.16	2.81	2.25	2.10	5.21	3.90	11.21	10.0	7.31	8.0	5.05	5.05	5.0	4349
1.44	0.48	1.83	3.75	3.60	2.66	5.17	3.30	11.13	8.0	7.83	6.0	6.61	6.61	7.0	4186
1.27	0.40	1.64	3.31	3.60	4.46	6.15	2.09	12.70	8.0	10.61	6.0	8.09	8.09	7.0	4347
4.81	0.08	2.00	6.89	6.30	1.82	5.69	1.45	8.96	9.0	7.51	7.0	7.19	7.19	7.5	4181
0.28	...	2.76	3.04	3.00	0.05	12.16	7.24	19.45	16.0	12.21	...	12.95	12.95	12.5	4182
1.66	0.12	3.30	5.08	5.00	0.96	5.06	2.55	8.57	7.0	6.02	5.0	1.20	11.29	10.5	4185
1.60	0.12	2.36	4.08	3.50	1.49	5.27	3.47	10.23	9.0	6.76	7.0	0.88	8.22	8.8	4184
1.26	0.42	2.27	3.95	3.50	1.14	7.13	3.08	11.35	9.0	8.27	7.0	1.16	8.67	8.8	4348
1.15	0.14	3.05	4.34	4.10	0.38	2.85	2.23	5.46	4.0	3.23	3.0	0.84	5.49	5.0	4187
1.02	0.16	4.07	5.25	5.00	0.72	4.11	1.69	6.52	4.0	4.83	3.0	0.84	§6.49	5.0	4183
0.14	0.80	0.73	1.67	1.65	5.52	3.48	0.77	9.77	8.5	9.00	8.0	4.51	4.51	4.0	4192
...	0.68	1.12	1.80	1.65	6.62	2.41	0.56	9.59	8.5	9.03	8.0	10.03	10.03	10.0	4189
...	2.04	2.74	4.78	4.94	4.32	1.79	0.41	6.52	5.5	6.11	5.0	1.24	10.10	10.0	4307
0.31	1.30	2.77	4.38	4.11	3.12	1.60	0.27	4.99	4.5	4.72	4.0	0.90	6.98	6.0	4188
...	0.88	0.84	1.72	1.65	4.66	3.24	0.79	8.69	7.5	7.90	7.0	5.33	5.33	5.0	4191
...	1.95	1.38	3.33	3.29	5.88	2.84	0.75	9.47	8.5	8.72	8.0	6.73	6.73	7.0	4190
...	0.24	2.11	2.35	1.67	3.70	2.02	0.20	5.92	6.0	5.72	4.0	0.44	4.50	4.0	3943
1.28	0.06	2.37	3.71	3.33	4.60	3.25	1.04	8.89	9.0	7.85	8.0	7.65	7.65	7.0	4311
1.78	1.06	1.86	4.70	3.33	6.07	2.21	0.96	9.24	9.0	8.28	8.0	7.87	7.87	7.0	4120
0.35	0.15	4.40	4.90	4.50	2.72	1.71	0.24	4.67	4.0	4.43	3.0	0.40	5.47	5.5	4309
0.58	0.02	1.54	2.14	1.67	5.08	3.87	0.70	9.65	8.0	8.95	7.0	3.74	3.74	2.0	4315
0.73	0.10	2.49	3.32	3.33	2.64	5.17	1.59	9.40	8.0	7.81	6.0	5.84	5.84	6.0	4314
1.22	0.05	2.38	3.65	3.33	3.53	5.05	1.27	9.85	10.0	8.58	6.0	1.20	7.27	6.0	4308
...	0.20	2.05	2.25	2.47	4.65	3.13	0.51	8.29	5.0	7.78	4.0	0.55	4.65	4.0	4312
0.23	0.04	1.83	2.10	1.67	2.94	3.29	0.95	7.18	7.0	6.23	5.0	6.91	6.91	6.0	4313
0.43	0.50	1.79	2.72	2.47	4.41	2.35	0.29	7.05	7.0	6.76	5.0	10.32	10.32	10.0	4316
2.15	0.10	1.88	4.13	4.00	5.75	3.40	0.83	9.98	8.0	9.15	7.0	7.77	7.77	7.0	4310
2.26	0.04	1.66	3.96	3.30	0.62	6.65	4.70	11.97	10.0	7.27	...	10.57	10.57	10.0	4317
...	0.14	2.16	2.30	2.47	2.06	3.52	3.22	8.80	8.0	5.58	...	5.13	5.13	5.0	3824
2.22	...	0.60	2.82	3.30	6.73	3.47	0.74	10.94	10.0	10.20	...	10.99	10.99	10.0	4318
1.19	0.10	1.93	3.22	3.30	3.75	3.79	1.80	9.34	8.0	7.54	...	7.18	7.18	7.0	3825

§ 0.85 as sulphate, 4.80 as carbonate.

Nitrogenous Superphosphates.

Station No.	Manufacturer and Brand.	Place of Sampling.	Valuation per ton.
	Sampled by Station Agent:		
	M. L. Shoemaker & Co., Philadelphia, Pa.		
3978	"Swift-Sure" Guano for Truck, Corn and Onions	East Haven	$21.69
4121	"Swift-Sure" Superphosphate for Potatoes.	Granby	27.05
3979	"Swift-Sure" Superphosphate for Tobacco and General Use	Windsor Locks	26.45
	Tanner & Wilcox, Winsted, Conn.		
4329	Reliable Grass and Corn Phosphate	Winsted	32.57
4330	Reliable Potato and Garden Phosphate	Winsted	29.89
	Virginia-Carolina Chemical Co., New York City.		
3826	General Crop Grower	Guilford	15.10
4331	Indian Brand for Tobacco	East Hartford	24.42
3982	National Corn, Grain and Grass Top Dressing	Hartford	26.55
3827	Owl Brand Potato and Truck Fertilizer	Guilford	.....
3981	Star Brand Potato and Vegetable Compound	East Hartford	.....
4332	Tobacco and Onion Special	Windsor Locks	26.19
3828	XXX Fish and Potash	Guilford	.....
	Wilcox Fertilizer Co., Mystic, Conn.		
4338	Complete Bone Superphosphate	Norwich	19.23
3983	Corn Special	Norwich	21.24
3890	Fish and Potash	Suffield	18.51
4336	4–8–10 Fertilizer	Norwich	28.29
4334	Grass Fertilizer	Enfield	26.60
4337	H. G. Fish and Potash	Norwich	24.81
4335	H. G. Tobacco Special	Ellington	27.35
4339	Potato Fertilizer	Mystic	18.94
4333	Potato, Onion and Vegetable Fertilizer	Norwich	26.44
4340	Special Superphosphate	Norwich	15.82
	S. D. Woodruff & Sons, Orange, Conn.		
3984	Home Mixture	Orange	23.67
	Sampled by Purchasers and others:		
4153	Berkshire Fish and Potash	*Melrose:*—Joseph Rostek	.....
4154	Berkshire Tobacco Special with Carbonate Potash	*Melrose:*—Joseph Rostek	.....

Analyses and Valuations—*Continued.*

Station No.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Nitrogen. Total Nitrogen. Found.	Nitrogen. Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. So-called "Available". Found.	Phosphoric Acid. So-called "Available". Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.	Station No.
3978																3978
4121	0.85	...	1.21	2.06	1.65	6.72	3.66	1.01	11.39	...	10.38	8.0	5.97	5.97	5.0	4121
3979	0.89	...	2.10	2.99	2.88	7.39	4.03	1.25	12.67	...	11.42	8.0	6.94	6.94	7.0	3979
	0.76	0.04	2.10	2.90	2.88	8.45	3.19	0.64	12.28	...	11.64	9.0	0.76	5.35	4.5	
4329																4329
4330	1.72	1.20	2.00	4.92	4.50	2.07	7.00	3.08	12.15	11.0	9.07	...	8.05	8.05	7.5	4330
	0.88	0.72	2.12	3.72	3.30	4.99	4.78	1.92	11.69	9.3	9.77	8.0	9.07	9.07	9.0	
3826																3826
4331	0.11	0.42	0.39	0.92	0.82	4.11	4.74	1.04	9.89	9.0	8.85	8.0	4.90	4.90	5.0	4331
3982	...	1.70	2.38	4.08	4.12	2.90	1.34	0.81	5.05	5.0	4.24	4.0	1.01	5.73	5.0	3982
3827	...	2.05	1.41	3.46	3.29	5.59	2.65	1.18	9.42	9.0	8.24	8.0	8.33	8.33	7.0	3827
3981	0.12	1.10	0.58	1.80	1.65	5.07	3.96	1.18	10.21	9.0	9.03	8.0	10.42	10.42	10.0	3981
4332	...	2.26	1.23	3.49	3.29	3.76	2.65	1.13	7.54	7.0	6.41	6.0	10.66	10.66	10.0	4332
3828	...	1.72	1.89	3.61	3.29	5.87	2.96	1.15	9.98	9.0	8.83	8.0	0.48	5.13	5.0	3828
	...	0.32	1.49	1.81	1.65	1.72	6.76	1.61	10.09	9.0	8.48	8.0	2.44	2.44	2.0	
4338																4338
3983	0.20	1.18	0.85	2.23	2.05	5.27	3.97	1.65	10.89	9.0	9.24	8.0	3.47	3.47	3.0	3983
3890	1.57	0.08	0.91	2.56	2.47	7.08	1.59	0.68	9.35	9.0	8.67	8.0	5.42	5.42	5.0	3890
4336	...	1.12	1.51	2.63	2.47	2.46	3.81	1.06	7.33	6.0	6.27	5.0	4.05	4.05	3.0	4336
4334	1.26	1.40	0.86	3.52	3.29	6.31	2.52	0.83	9.66	9.0	8.83	8.0	6.78	9.49	10.0	4334
4337	2.33	0.96	1.10	4.39	4.12	4.88	2.25	0.67	7.80	7.0	7.13	6.0	3.35	5.66	5.0	4337
4335	...	0.90	2.68	3.58	3.30	4.71	2.48	0.45	7.64	7.0	7.19	6.0	3.07	5.60	5.0	4335
4339	...	0.04	3.62	3.66	3.30	0.14	5.86	0.12	6.12	7.0	6.00	5.0	0.74	8.38	7.0	4339
4333	1.14	0.02	1.11	2.27	2.05	5.70	1.55	0.17	7.42	7.0	7.25	6.0	5.43	5.43	5.0	4333
4340	1.03	1.00	1.56	3.59	3.30	5.22	3.27	0.81	9.30	9.0	8.49	8.0	6.02	7.23	7.0	4340
	...	0.10	1.24	1.34	1.23	7.44	1.96	0.50	9.90	9.0	9.40	8.0	2.72	2.72	2.0	
3984	1.12	0.02	1.85	2.99	3.30	2.80	5.89	3.11	11.80	8.0	8.69	...	5.26	5.26	8.0	3984
4153	...	...	...	2.58	2.50	...	....	....	7.01	6.0	....	...	....	4.66	3.0	4153
4154	...	...	...	5.14	4.50	...	....	....	4.67	4.0	....	...	....	5.98	5.5	4154

Nitrogenous Superphosphates.

Station No.	Manufacturer and Brand.	Place of Sampling.	Valuation per ton.
	Sampled by Purchasers and others:		
3865	Olds & Whipple Special Mixture	*Silver Lane:*—Martin Roberts	$30.21
4091	Rogers' H. G. Vegetable and Carbonate Tobacco Fertilizer	*North Granby:*—P. J. Rogers	30.60
4092	Rogers' H. G. Fertilizer for Oats and Top Dressing	*North Granby:*—P. J. Rogers	36.55
4030	Sanderson's Special	*Shelton:*—O. G. Beard	29.30
4049	Sanderson's Flight's 4–6–10	*Highwood:*—S. A. Flight	25.88
4211	Shay's 3–8–6	*Manchester:*—C. R. Burr & Co	.....
4210	Shay's 4–10–10	*Manchester:*—C. R. Burr & Co	.....
4090	Shay's 4–10–10	*Manchester:*—C. R. Burr & Co	27.34
4357*	Shay's 4–10–10	*Manchester:*—C. R. Burr & Co	27.13
4271	Apothecaries Hall Special Formula	*Terryville:*—F. P. Tolles	23.97
4298	Williams & Clark's Great Planet Manure	*Plainville:*—Peck Bros.	25.93
4587	Royal Worcester Corn and Grain Fertilizer	*Auburn, Mass.:*—Worcester Rendering Co.	22.00
4588	Royal Worcester Potato Fertilizer	*Auburn, Mass.:*—Worcester Rendering Co.	30.23
4351	Lister's Special Grass Mixture	*Newark, N. J.:*—Lister's Agr. Chemical Works	25.15
4355	Lister's Special 10% Potato Fertilizer	*Newark, N. J.:*—Lister's Agr. Chemical Works	22.37
4350	Lister's Standard Pure Bone Superphosphate of Lime	*Newark, N. J.:*—Lister's Agr. Chemical Works	20.56

* Sampled by Station Agent.

Analyses and Valuations—*Concluded.*

Nitrogen.					Phosphoric Acid.							Potash.			
			Total Nitrogen.					Total.		So-called "Available"		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
0.40	0.08	4.38	4.86	...	0.08	2.40	0.58	3.06	...	2.48	...	0.48	†6.21	....	**3865**
0.78	0.10	4.28	5.16	5.00	0.29	4.20	0.37	4.86	4.0	4.49	3.0	0.39	‡4.90	5.5	**4091**
4.82	0.10	2.00	6.92	6.30	1.34	6.46	1.79	9.59	9.0	7.80	7.0	6.76	6.76	7.5	**4092**
2.00	0.10	1.96	4.06	4.50	4.32	4.29	1.43	10.04	...	8.61	8.0	8.55	8.55	8.0	**4030**
1.49	0.04	1.47	3.00	3.30	4.82	2.88	0.49	8.19	6.0	7.70	...	10.32	10.32	10.0	**4049**
...	...	...	2.20	2.47	...	....	....	7.29	8.0	....	...	....	9.87	6.0	**4211**
...	...	...	2.98	3.30	...	....	....	9.79	10.0	....	...	....	11.18	10.0	**4210**
0.16	0.10	3.03	3.29	3.30	3.12	3.92	1.66	8.70	10.0	7.04	...	10.06	10.06	10.0	**4090**
0.15	0.10	2.81	3.06	3.30	2.89	4.25	1.71	8.85	10.0	7.14	...	10.82	10.82	10.0	**4357**
0.75	0.10	1.45	2.30	...	5.39	3.79	2.79	11.97	...	9.18	...	8.13	8.13	....	**4271**
0.12	1.35	1.91	3.38	3.29	4.85	3.37	1.20	9.42	9.0	8.22	8.0	7.59	7.59	7.0	**4298**
0.50	0.08	1.86	2.44	2.25	4.46	4.89	11.12	20.47	8.0	9.35	9.0	3.42	3.42	3.0	**4587**
0.80	0.10	2.80	3.70	3.50	4.82	5.56	0.88	11.26	9.0	10.38	8.0	8.60	8.60	7.0	**4588**
...	0.14	1.81	1.95	1.65	7.64	2.29	0.56	10.49	11.0	9.93	10.0	10.87	10.87	10.0	**4351**
0.10	0.14	1.68	1.92	1.65	3.38	4.04	1.47	8.89	9.0	7.42	8.0	10.21	10.21	10.0	**4355**
...	1.00	1.70	2.70	2.47	6.00	3.53	1.41	10.94	10.0	9.53	9.0	2.31	2.31	2.0	**4350**

† 0.37 as sulphate, 5.36 as carbonate.

‡ 0.48 as sulphate, 4.03 as carbonate.

HOME MIXTURES—FORMULAS.

Station No.	Made by or for	Formula.											
		Nitrate of Soda.	Sulphate of Ammonia.	Dried Blood.	Dried Fish.	Tankage.	Ground Bone.	Cotton Seed Meal.	Acid Phosphate.	Muriate of Potash.	Sulphate of Potash.	Kainit.	*Carbonate of Lime.*
4301	E. B. Clark Seed Co., Milford	250	....	...	500	...	...	....	850	400	....	...	....
4031	H. E. Clark, Middlebury, Grass Mixture	400	....	300	...	...	900	....	....	....	400	...	....
3948	Conn. School for Boys, Meriden, Grass	500	....	...	...	500	...	....	400	250	....	350	....
3949	Conn. School for Boys, Meriden, Vegetable	100	....	...	...	750	...	....	750	200	200	...	....
4354	H. B. Pomeroy, Rockville	400	....	...	...	...	...	....	1200	400	....	...	....
3973	Wm. J. Reeves, Windsorville, Tobacco	150	....	...	...	...	...	1000	300	....	300	...	250
4259	L. S. White, Collinsville, Trees, Potatoes, etc.	666	*222	...	...	...	...	....	1112	....	....	...	....
3671	†S. D. Wicks, Pomfret	...	....	...	...	...	...	....	....	....	....	...	....
3672	†S. D. Wicks, Pomfret	...	....	...	...	...	...	....	....	....	....	...	....
3673	†S. D. Wicks, Pomfret	...	....	...	...	...	...	....	....	....	....	...	....

* Substituted by error for sulphate of potash.
† Mixed in spring of 1913.

HOME MIXTURES.

In the above tables are the analyses of ten home mixtures of chemicals with the formulas by which they were made. These analyses do not call for special comment.

HOME MIXTURES—ANALYSES

Station No.	Nitrogen.				Phosphoric Acid.				Potash.	Cost per ton.
	In Nitrates.	In Ammonia.	Organic.	Total.	Water-Soluble.	Citrate-Soluble.	Citrate-Insoluble	Total.		
4301	2.12	0.05	1.92	4.09	6.34	2.44	0.74	9.52	6.85	$32.42
4031	2.90	0.04	2.11	5.05	0.29	6.39	4.45	11.13	*11.59	40.00
3948	3.63	....	1.41	5.04	2.24	3.52	2.15	7.91	10.05	....
3949	0.85	....	1.91	2.76	4.66	5.31	2.70	12.67	†8.44	.....
4354	2.98	....	0.08	3.06	4.32	5.32	0.81	10.45	10.47	29.00
3973	1.07	0.04	3.05	4.16	1.78	1.07	0.43	3.28	‡6.21	40.00
4259	5.54	2.30	0.38	8.22	6.79	1.61	0.18	8.58	0.25	36.11
3671	....	....	....	2.37	....	....	....	10.46	11.53	.....
3672	....	....	....	3.28	....	....	....	10.40	9.51	.....
3673	....	....	....	3.32	....	....	....	9.95	10.46	.....

* 0.48 as muriate, 11.11 as sulphate.
† 7.34 as muriate, 1.10 as sulphate.
‡ 0.20 as muriate, 6.01 as sulphate.

VI. MISCELLANEOUS FERTILIZERS, LIME, ASHES, ETC.

SHEEP MANURE.

4195. Pulverized Sheep Manure, sold by American Agricultural Chemical Co., New York; from stock of C. A. Templeton, Waterbury.

4292. "Sheep's Head" Pulverized Sheep Manure, sold by Natural Guano Co., Aurora, Ill.; from stock of F. S. Platt Co., New Haven.

4293. Wizard Brand Manure, sold by Pulverized Manure Co., Chicago; from stock of F. S. Platt Co., New Haven.

3803. Sheep and Goat Manure, sampled from stock of Sanderson Fertilizer and Chemical Co., New Haven.

	4195	4292	4293	3803
Nitrogen inorganic	0.12	0.28	0.10	0.16
" organic	2.08	2.22	2.14	1.38
" total, found	2.20	2.50	2.24	1.54
" " guaranteed	2.06	2.25	1.80	1.25
Phosphoric acid, water-soluble	0.42	1.27	0.43	0.10
" " citrate-soluble	1.09	0.56	1.35	0.82
" " citrate-insoluble	0.19	0.14	0.14	0.10
" " total, found	1.70	1.97	1.92	1.02
" " " guaranteed	1.25	1.25	1.00	1.00
Potash, found	4.39	2.49	2.75	4.19
" guaranteed	1.00	1.50	1.00	3.50
Chlorine	1.05	0.45	0.18	1.82
Cost per ton	$38.00	$30.00	$30.00	$30.00

This material, being dry, having little odor while dry, and few if any weed seeds, has uses in the greenhouse and on our small city lawns. The question is often asked, how the fertilizing value of this manure compares with that of horse manure.

These various dry manures are not at all constant in composition. The high content of potash in two of them is very likely due to an addition of some potash salt. The statement below is, however, accurate enough for a rough comparison and gives the average amounts of nitrogen, phosphoric acid and potash in 11 samples of sheep manure analyzed within the last three years, and also the composition of horse manure of average quality as it is shipped from New York City stables.

	Sheep Manure.	N. Y. Horse Manure.
Water	10.16	73.38
Organic and volatile matters	71.32	18.33
Mineral matter	18.52	8.29
	100.00	100.00
Nitrogen	2.16	0.69
Phosphoric acid	1.47	0.67
Potash	2.78	0.63

At present, New York horse manure costs, in New Haven, about $2.90 per ton delivered, and sheep manure $30.00. For $30 there can be bought the following quantities of plant food in these two fertilizer-amendments:

	In Sheep Manure.	In Horse Manure.
Organic matter (humus formers)	1426	3792
Nitrogen	43	142
Phosphoric acid	29	138
Potash	56	130

Of course, these figures will be somewhat different in the case of particular lots but will not alter the facts that for general farm use sheep manure could not probably be profitably used at present even if its present price were cut by half.

Two samples of dried manure sent for analysis were merely mailed samples sent by the manufacturer and therefore could not be regarded as representative of any thing on sale within the State.

One was **4688,** Excelsior Pulverized Sheep Manure, the other, **4689,** Excelsior Hog Manure, both made by A. H. Case & Co., East Buffalo, N. Y.

ANALYSES.

	4688	4689
Nitrogen	2.04	2.17
Phosphoric acid	1.46	2.49
Potash	0.51	1.17

OTHER DRIED MANURES.

3005. Sent by A. A. Young, Jewett City, is stated to be dried stable manure.

3293. Sent by Elm City Nursery Co., New Haven. It is stated to be horse manure, turned daily for two weeks and the thermometer never allowed to rise above 110° F. This was done under cover.

ANALYSES.

	3005	3293
Water	13.28	8.15
Organic and volatile	60.64	42.09
Mineral matter	26.08	49.76
	100.00	100.00
Nitrogen	2.39	1.53
Phosphoric acid	2.60	....
Potash	1.36	....

Obviously **3293** contains a large amount of soil.

ANALYSES OF MUCK AND LEAF MOLD.

The following analyses were made on request of individuals but are not of much public interest or value.

3659. Swamp muck sent by J. M. Jennings, Gale's Ferry. "I have about ten acres of this land and want to find out if it will pay me to clear it up."

4601. Muck dried and pulverized. "Would like report on its fertilizing value." Sent by C. A. Page, Harwinton.

3364. Sent by E. V. Austin, N. Woodstock. Described as "humus taken out of a ditch" It is stated to be at least 16 feet deep.

3829. "Leaf Mold" sent by E. M. Tice, Cheshire.

3295. "Muck" sent by A. P. Gimlee, Abington. Ten acres covered with it, varying in depth from a few inches to 3 feet. This is underlaid by fine sand to a depth of at least 8 feet.

3765. "Humus" from A. E. Hammer, Branford.

4060. "Muck" from S. H. Street, New Haven.

4565. "Boston Humus," stated to be from a large deposit in the bottom of a drained lake. Sampled and sent by Everard Thompson, New Haven.

ANALYSES.

	3659	4601	3364	3829	3295	3765	4060	4565
Water	56.66	32.75	6.35	....	18.16	....	....	10.72
Organic matter	10.56	40.20	41.03	....	30.56	....	....	50.18
Mineral matter	32.78	27.05	52.62	....	51.28	....	....	39.10
	100.00	100.00	100.00	....	100.00	....	....	100.00
Nitrogen	0.34	1.11	1.00	1.28	1.32	2.24	0.72	1.70
Phosphoric acid.	....	....	....	0.01	....	....	....	none
Potash	....	....	....	0.13	....	....	....	....
Insoluble in acid	....	....	47.03	....	....	....	....	....

These samples show the usual range of composition. They consist of the residue left from the decay under water or in water-soaked condition, of a great variety of vegetable matter, leaves, grass, trees, etc.

They never contain more than a fraction of one per cent. of either phosphoric acid or potash. The amount of nitrogen—in dried peat—is often considerable, sometimes 3 per cent. or more, but it is of very little present agricultural value because it is in compounds which are most resistant to decay hence least valuable to the plant. The soluble nitrogen has long since been dissolved in water and carried off from the peat. The less destructible part remains.

Real peat; *i. e.*, those deposits which consist largely of vegetable matter unmixed with much sand, are of very considerable value, when sun-dried, as absorbents in stables. There is scarcely any other material which will absorb and hold as much water as peat, proportionally to its weight. Two of these samples, **4601** and **4565**, have more than fifty per cent. of this true "humus" in their dry matter and should make good absorbents.

Muck which is rich in vegetable matter also has value as an amendment on light sandy soils by supplying "humus" which will increase the water-holding capacity of the soil.

Only muck with high percentages of vegetable matter in them will pay for handling and they should be sun-dried as far as possible before hauling.

APPLE POMACE.

3006. Sent by J. M. White, Bristol, Conn. It had stood in a pile for five years or more, and represented a lot of several car loads. It contained 79.76 per cent. of water, 18.62 per cent. of vegetable matter, with 0.56 per cent. of nitrogen, and 1.62 per cent. of mineral matter.

When dry it would contain about 92 per cent. of vegetable matter. It had a decided acid reaction. Its fertilizing value is very small and, considering that three quarters of its weight is water and that it would need to be well limed before putting on the land, it is not easy to see any economy in using it.

MISCELLANEOUS WASTES.

3985. Unhulled cotton seed sent by The Cauto Tree Cotton Co., Meriden, contained 3.48 per cent. of nitrogen.

4637. Sample of 10 tons of Tobacco Stems sent by E. B. Hurlburt, Glastonbury, contained 7.06 per cent. of potash.

3294. Leather waste, sent by the H. B. Ives Co., New Haven, contained 2.93 per cent. of nitrogen of no farm value.

3972. Ground leather and planing chips used in tumbling barrels with nickel plated wheel spokes, sent by William H. Hull, Essex, contained 4 per cent. of nitrogen, worthless as a fertilizer.

4080. A sample of ground kelp, sent by J. W. Musselman of the Pacific Kelp Mulch Co., Los Angeles, Cal.

It is claimed to be made of kelp, harvested while alive, dried by artificial heat and then "blended" to have a properly balanced ration. The sample contained:

Water	8.20
Organic matter	51.25
Mineral matter	40.55
	100.00

Nitrogen 2.71, phosphoric acid 2.43, and potash 9.17 per cent.

4352. A sample of a pond deposit stated to be brought down by a river, sent by W. J. Vessey, Putnam, contained 0.30 per cent. nitrogen, 0.07 of phosphoric acid and 0.02 of potash.

3375. An "iron sand" sent by Amanda Allen, Groton, with the statement that when spread on a cranberry bog it seemed to produce a good yield. More than half of this material was coarse

stone of no value. The fine sand contained only 0.15 per cent. of phosphoric acid and 0.11 of potash soluble in strong acid. No favorable action which it had can be ascribed to its value as a fertilizer.

4576. A sample of soft rock, sent by W. F. Buckland, Weatogue, with inquiry as to its value. It contained no potash, and about 0.12 per cent. of nitrogen and the same per cent. of phosphoric acid Worthless.

BURNED AND SLAKED LIME AND GROUND LIMESTONE.

Burned Lime.

3780. A burned and slaked lime nearly free from magnesia. **3779.** A burned and slaked magnesian lime. **3778.** A burned and air-slaked lime nearly free from magnesia. **3777.** A burned and air-slaked lime containing magnesia. These four were from stock used in experiments at Mt. Carmel Farm.

4489. Lime made by Cheshire Lime Co., Farnham, Mass. Sampled from stock of C. B. Sikes, Jr., Ellington.

Ground Limestone.

4665. From the quarry and mill of W. F. Coe & Son, Northford.

3740. Made by Stearns Lime Co., Danbury. Sent by P. J. Rogers, North Granby.

3931 and **3932.** Made by Stearns Lime Co., Danbury. Sampled and sent by G. B. Treadwell, superintendent of Gilbert Farm.

3009 and **3010** were samples sent by W. F. Tomlinson, Danbury, for determination of insoluble matter. The samples contained 3.80 and 1.07 per cent., respectively, and only traces of magnesia.

4686 and **4687.** Sent by H. P. Morgan, South Norwalk, contained, respectively, 12.14 and 0.84 per cent. of insoluble matter.

3810. Made by Grangers Marble and Lime Co., Danbury. Sent by W. H. Lee, Orange.

3665. Made by Edison Portland Cement Co., Stewartsville, N. J. Sold by F. J. Pease, Thompsonville. Sampled and sent by William Miller, Enfield.

3376. Limestone from Salisbury. Sampled and sent by William B. Rand, Salisbury. **4593.** Sampled and sent by W. D. Honess, Rocky Hill. **4681.** Sampled and sent by H. S. Pomeroy, Suffield, contained 19.60 per cent. of insoluble matter. **4088.** Sampled and sent by E. L. Peabody, Lakeville.

The samples of burned and slaked lime show the usual range of composition. **3780** has about 95 per cent. of pure water-slaked lime (calcium hydrate), and **3779** has about the same amount of the mixed hydrates of lime and magnesia. The other three are partly "air-slaked"; *i. e.*, they are mixtures of hydrate and carbonate of lime.

Of the ground limestones, **4088** is magnesian, the others consist chiefly of carbonate of lime, though **3810** and **4593** contain too much insoluble mineral matter to pay for shipping unless sold at very low prices.

No prices were given by the senders of most of these samples.

ANALYSES OF BURNED LIME AND LIMESTONE.

	Burned Slaked Lime.					*Ground Limestone.*								
Station No.	**3780**	**3779**	**3778**	**3777**	**4489**	**4665**	**3740**	**3931**	**3932**	**3810**	**3665**	**3376**	**4593**	**4088**
Percentage amounts of														
Lime	72.06	43.50	63.70	57.98	59.76	53.10	45.40	44.90	47.36	40.40	48.80	48.15	42.50	30.60
Magnesia	0.72	29.07	1.19	9.05	2.33	0.31	4.12	4.13	3.48	6.76	2.25	5.74	0.55	21.36
Insoluble in acid	0.75	0.90	3.35	0.95	2.30	2.85	9.06	10.40	8.65	15.00	8.14	2.00	21.40	2.15

4716 and **4717** are two samples of ground limestone drawn by our agent from stock of the Long Hill Concrete Co., Long Hill.

ANALYSES.

	4716	**4717**
Percentage composition		
Lime	36.40	40.54
Magnesia	0.75	0.72
Insoluble matter	31.82	24.88
Finer than 100 mesh	95	65
80–100	1	1
50–80	3	6
Coarser than 50 mesh	1	28
	100	100

Both samples contain a large amount of insoluble matter which would make their use unprofitable if it involved freight charges.

CANADA WOOD ASHES.

Of the analyses given below, three are called "Canada" Ashes. One of them has more than 65 per cent., a second more than 41 and a third more than 23 per cent. of worthless ballast, water, earth, coal, etc., on which freight is paid. None of them has more soluble potash nor as much lime as lime-kiln ashes, which can be bought for less money in this State.

4643 and **4667** are obviously lime-kiln ashes. If we allow 8 cents for each pound of potash and 3 cents for each pound of phosphoric acid, then lime and magnesia cost $2.00 per 100 lbs. in **3769** and $1.40 in **4680,** while in the lime-kiln ashes at $6.50 per ton, delivered, they cost about 18 cents. In agricultural lime they cost from 35 to 50 cents per 100 pounds.

4670. Canada Ashes, bought of E. Eggert, Hartford, by Hatheway & Steene, Hartford, and sampled by them.

3769. Canada Ashes sold by John Joynt, Lucknow, Canada. Sampled by Station agent from stock of W. A. Haviland, East Windsor Hill.

4680. Canada Wood Ashes sold by John A. Meehan & Son, Philadelphia. Sampled and sent by F. W. Judson, Waterbury.

4643. Wood Ashes made by the New England Lime Co., Canaan. Sampled and sent by George Mitchelson, Tariffville.

4667. Wood Ashes sent by F. A. Carlson, New Milford.

ANALYSES.

Station No.	**4670**	**3769**	**4680**	**4643**	**4667**	**4668** (Incinerator Ashes)
Percentage amounts of						
Water	15.88	15.48	8.98	4.85	.....	13.98
Sand and insoluble	25.20	49.90	14.70	4.70	2.00	22.85
Potash	1.47	1.90	1.63	2.57	2.33	4.37
Lime	27.60	13.58	36.40	37.16	44.90	25.70
Magnesia	1.67	1.09	1.63	13.16	17.70	1.81
Phosphoric acid	1.15	1.02	1.41	1.02	1.34	0.96
Cost per ton	.....	$9.50	$14.00†	$4.00*	.....	$28.00

* f. o. b. Canaan.
† Delivered.

The analyses made in recent years show that in almost all cases the cost of Canadian wood ashes is out of all proportion to their value.

They can only be bought safely with a very strict agreement that they shall be analyzed *on arrival* and paid for on some such basis as the following: Potash to be valued at 8 cents; phosphoric acid at 3½ cents per pound, and lime and magnesia at not more than 60 cents per 100 pounds.

The last analysis in the table is of Incinerator Ashes sent by E. Eggert, Hartford, with an inquiry as to their value.

They contain more than 36 per cent. of worthless material and, calculated as above, lime and magnesia cost somewhere about $3.70 per 100 pounds. A preposterous price.

Sample **4572** was sent with request for immediate attention "because I wish to buy a car lot if the potash and lime are high enough to warrant." The "ashes" contained 0.40 per cent. of water-soluble potash!

SLUDGE FROM THE MANUFACTURE OF LIME-SULPHUR SPRAYING SOLUTIONS.

This material is a wet paste and has been recommended and used with apparent success for protecting the trunks of young trees from borers.

An analysis showed it to contain no sulphides but to consist mainly of a mixture of sulphates, sulphites and thiosulphates, with some carbonate of lime. The determinations were as follows:

Loss at 100° C (moisture)	26.53
Oxide of iron, alumina and phosphoric acid	1.40
Lime	28.82
Magnesia	3.76
Total sulphur in combination	16.16
Free sulphur	0.27
Sulphur as SO^2	13.66
" " SO^3	2.23

PART III.

FOURTEENTH REPORT

OF THE

State Entomologist of Connecticut

To the Director and Board of Control of the Connecticut Agricultural Experiment Station:

I beg leave to submit the following as my fourteenth report as State Entomologist of Connecticut for the fiscal year ending September 30, 1914. Some of the nurseries were inspected and the certificates issued later than that date, but they have been included because it was desirable to have on one list all nurseries inspected during the Calendar year.

Respectfully submitted,

W. E. BRITTON,
State Entomologist.

REPORT OF THE RECEIPTS AND EXPENDITURES OF THE STATE ENTOMOLOGIST FROM OCTOBER 1ST, 1913, TO SEPTEMBER 30TH, 1914.

Insect Pest Account.

RECEIPTS.

From E. H. Jenkins, Treasurer	$4,000.00
Account of 1913, balance	430.09
	$4,430.09

EXPENDITURES.

For Field, office and laboratory assistance:		
B. H. Walden, salary	$1,500.00	
Q. S. Lowry, salary	716.65	
I. W. Davis, salary	125.00	
M. P. Zappe, salary	375.00	
Frances M. Valentine, salary	520.00	
Other assistance	60.00	
		$3,296.65

Printing and illustrations		17.28
Postage		58.93
Stationery		24.90
Telegraph and telephone		3.15
Office supplies		18.43
Library		106.46
Laboratory apparatus and supplies		94.31
Express, freight and cartage		2.98
Tools and supplies		6.55
Traveling expenses		299.92
Balance, cash on hand		500.53
		$4,430.09

*Gypsy Moth Control Account.**

RECEIPTS.

From E. H. Jenkins, Treasurer		$4,000.00
Account of 1913, balance		600.33
		$4,600.33

EXPENDITURES.

For Salaries, board of scouts, etc.:		
I. W. Davis, salary	$ 875.00	
Q. S. Lowry, salary	233.33	
F. J. Rimoldi, salary	451.50	
Other assistance, labor, etc.	1,513.35	
Board of scouts	538.95	
		$3,612.13
Printing and illustrations		265.30
Postage		.56
Telegraph and telephone		11.85
Express, freight and cartage		5.88
Rental of storehouse		18.00
Tools and supplies		54.07
Traveling expenses:		
Inspecting imported stock	$382.32	
Other work	247.83	
		630.15
Balance, cash on hand		2.39
		$4,600.33

Memorandum:—These accounts of the State Entomologist have been duly audited by the State Auditors of Public Accounts.

* Including cost of inspecting imported nursery stock.

SUMMARY OF INSPECTION AND OFFICE WORK.
OCT. 1, 1913, TO SEPT. 30, 1914.

439 samples of insects received for identification.
74 nurseries inspected
74 regular certificates issued
40 parcels inspected and certificated.
75 orchards and gardens examined.
303 shipments, 1,477 cases, 1,646,130 plants, imported nursery stock inspected.
58 shipments found infested with insects or fungi.
463 apiaries, containing 3,882 colonies inspected.
151 apiaries containing 543 colonies found infested with European foul brood.
5 apiaries containing 27 colonies found infested with American foul brood.
12 apiaries containing 28 colonies found infested with Sac or Pickled brood.
2588 letters written on official work.
60 circular letters sent out.
313 reports of inspection to Federal Horticultural Board.
1350 bulletins, etc., mailed on request or to answer inquiries.
106 packages sent out by mail or express.
20 lectures and addresses made at institutes, granges, etc.

PUBLICATIONS OF ENTOMOLOGICAL DEPARTMENT, 1914.

Thirteenth Report of the State Entomologist (Part III of Station Report for 1913): 77 pages, XII plates: 10,000 copies distributed in February.

Bulletin 181, "Some Common Lady Beetles of Connecticut," 24 pages, 24 figures: 10,000 copies distributed in April.

Bulletin 182, "The Brown-Tail Moth," 26 pages, 16 figures: 12,000 copies distributed in April.

Report of Committee on Injurious Insects; Proceedings Connecticut Pomological Society, page 47, 5 pages, 1914. (Also printed in *Connecticut Farmer*, Feb. 14, 1914.)

Mites on Snapdragon; *Florist's Exchange*, Vol. XXXVII, page 557, March 7, 1914. (Brief note.)

Spray Mixtures for Orchard and Garden; *Rural New Yorker*, March 7, 1914.

Some Problems in Economic Entomology; *Connecticut Agricultural College Outlook*, page 117. 2 pages, Feb. 14, 1914.

"New Jersey State Anti-Mosquito Convention" at Atlantic City, N. J., *Journal of Economic Entomology*, Vol. VII, page 244, 2 pages, April, 1914.

A Remarkable Outbreak of *Culex pipiens*; *Journal of Economic Entomology*, Vol. VII, page 257, 2½ pages, June, 1914.

The Army Worm; *Connecticut Farmer*, July 25, 1914.

The Army Worm; *Rural New Yorker*, August 22, 1914, page 1027; continued August 29, page 1047; 6 figures.
Two Oncoming Insect Pests; *Tree Talk*, 1½ pages, May, 1914.

Entomological Staff.

W. E. Britton, Ph. D. ..... *State and Station Entomologist.*
B. H. Walden, B. Agr. ..... *First Assistant.*
Quincy S. Lowry, B. Sc. ..... *Assistant.*
Irving W. Davis, B. Sc. ..... *Assistant.*
Max P. Zappe, B. S.* ..... *Assistant.*
Miss Frances M. Valentine ..... *Stenographer.*

As in former years, Mr. Walden has continued as first assistant, and has been in charge of all work in the absence of the Entomologist. Mr. Walden has also done most of the photographic work of the department and has helped in inspecting nurseries and imported nursery stock and in carrying out investigations.

Mr. Lowry has also assisted in inspection work and carried on a series of field experiments in controlling the cabbage maggot.

Mr. Davis has been in charge of the field work of controlling the gypsy and brown-tail moths, and when not thus engaged, has assisted in the inspection work.

Mr. Zappe, a graduate of the Connecticut Agricultural College, class of 1912, was employed temporarily during the month of April to inspect imported nursery stock. Since that time he has served as general assistant and has looked after the insectary and collection and breeding records. He also helped inspect the growing stock in the Connecticut nurseries.

Mr. Frank J. Rimoldi, a short course student of the Connecticut College, was employed throughout the winter and during the summer on gypsy and brown-tail moth work. During the inspection season he helped inspect imported and growing nursery stock, but left September 16th, to enter Cornell University for further study.

Miss Valentine has done the stenographic and clerical work of the office, considerable time being required to keep records of the apiary inspection and of the imported nursery stock and attend to the accompanying notices and reports. During her vacation Miss Jessie F. MacMillan was employed as a substitute.

As in the past seasons, Messrs. H. W. Coley of Westport and A. W. Yates of Hartford, have continued to serve as apiary inspectors, each receiving *per diem* wages and the necessary traveling expenses.

* Beginning April 1st, 1914.

All the persons mentioned above have labored faithfully to make the work of the department a success and their efforts are not unappreciated.

Chief Lines of Work.

As in previous seasons, the routine, control and inspection work requires the attention of the members of the staff of the department for most of the time during the year. For instance, all men are engaged in inspecting imported nursery stock for a short time when this stock arrives in greatest abundance. Thus, during October, most of the shipments of *Azalea indica* come into the state. In December and January there are shipments of Rhododendrons, roses, especially Manetti stock, seedling fruit stock, and flowering shrubs for forcing. Some straggling shipments arrive during February, but it is in March and April that the great rush of general nursery stock arrives.

All men of the force are also needed to inspect growing nursery stock the latter part of August and through September.

Mr. Davis has had charge of the scouting for gypsy moth eggs and for brown-tail nests, which is done during the winter months while the trees are bare. Most of the gypsy moth scouting must also be done while the ground is bare, but brown-tail work can be done with snow upon the ground. In severe cold weather or stormy weather scouts cannot work outside. The summer work extends from May until August.

Mr. Lowry has conducted field experiments in controlling the cabbage maggot at the Station farm at Mt. Carmel and on the land of Mr. A. N. Farnham of New Haven. He has also made observations on this and other cabbage insects in these localities and in the fields of other vegetable growers in various parts of the state.

In co-operation with the botanical department the orchard trees at the Station farm have been sprayed each year with various materials and a careful record kept.

Mr. Walden has carried on field tests in attempting to control the white pine weevil in forest plantations, both at the Station experiment forest at Rainbow, and the State forest at Portland. The forestry department has co-operated in this work, and Mr.

Filley, State Forester, and Mr. Walden have made many observations in various plantations in different parts of the State, relating to the weevil and to other insects attacking white pine. These investigations are of such a nature that the work must be continued for a number of years.

The Entomologist, as President of the Anti-Mosquito Committee, Inc., of the Civic Federation of New Haven has had general supervision over the work of the Committee. Mosquitoes were found breeding again in West River, though not as extensively as in 1913, and one oiling was given. All ditches in the salt marshes near New Haven, cut in 1912, were maintained free from obstructions and in working condition in 1914. The Entomologist was also called in as arbitrator in settlement of a disagreement over a mosquito drainage contract in Greenwich, several days being spent in inspecting the work and in preparing a report of findings.

The general studies on insects attacking vegetable crops, and those injuring peach and apple orchards in Connecticut have been continued.

Minor studies, notes and observations have been made on many different kinds of insects, and much work has been done on the collection and in working out life histories in the insectary.

Considerable time was spent in preparing, installing and explaining an exhibit showing the work of this department, which with other departments composed the Station exhibit shown at four agricultural fairs as follows: Salisbury, September 7th; Norfolk, September 10th, 11th and 12th; Brooklyn, September 22nd, 23rd and 24th; Berlin, September 29th, 30th, October 1st and 2nd.

Considerable attention has been given to the preparation of Bulletin No. 22, of the Connecticut Geological and Natural History Survey, "The Hymenoptera of Connecticut," which is now in press.

INSPECTION OF NURSERIES.

The annual inspection of the trees, shrubs and other plants growing in the nurseries of the State, as required by statute, was commenced August 24th, the larger nurseries being inspected first. Messrs. Walden, Lowry, Davis, Zappe, Rimoldi and Britton all worked inspecting a part of the time, and all worked together in some of the larger nurseries.

During September the services of one man were needed a part of the time to attend to the entomological exhibits at the fairs. Mr. Lowry was delegated for this purpose, and it took his time for nearly three weeks. On account of the war, few shipments of imported Azaleas were expected, but more came than ever before. As these require immediate inspection, their arrival in October somewhat interrupted the other inspection work. Nevertheless it was all finished before November 1st.

As in 1913, the inspection was more thorough than in previous seasons, and all kinds of woody plants were examined, particularly for those pests named in last year's report, page 187. The nurseries, as a whole, were remarkably free from pests, particularly of San José Scale.

A few chestnut trees were found in each of several nurseries, showing the bark disease or blight, and were ordered burned.

In many nurseries no pests could be found. A common infestation is that of Oyster-Shell Scale, which is found on poplar, willow, ash, lilac, etc. San José Scale on fruit trees and currants was present in some of the nurseries. In all cases where trees or shrubs were badly infested with any pest, directions were given that they be destroyed. Where San José Scale was found, in addition to destroying the worst infested trees, all others in the same rows or blocks were ordered fumigated, dipped, or if allowed to remain undug, sprayed.

Besides the regular nursery inspections there are each year a number of cases where persons, not regularly engaged in the nursery business wish to ship small packages of stock. Package certificates are issued for this purpose, after the contents of each package has been duly examined, and apply only to the contents of the package. Most transportation companies now refuse to accept any packages of nursery stock or cuttings unless accompanied by a certificate, and it is against the postal rules and regulations to send any such goods by mail without such a certificate. Persons wishing to obtain certain varieties of apples or other fruit often write to the college at Storrs for scions. In order to have these small parcels properly examined and certificated without undue trouble and expense, Professor G. H. Lamson, Jr., of the college, was appointed a deputy inspector, without salary for this

purpose. Altogether 40 of these packages or parcel certificates were issued during the year.

In the work of inspecting imported nursery stock (chiefly Azaleas) during October, it was found that many florists sell nursery stock and grow small areas of conifers and flowering shrubs for local sale. As this must be regarded as regular nursery stock, a number of such nurseries were inspected this season for the first time. The number of names on the list has increased from 54 to 72. Of the firms on the 1913 list, two have gone out of business, two have changed ownership, and 20 new ones appear in the present list. Six of these are both florists and nurserymen. There has been some increase in the total acreage in Connecticut devoted to the growing of nursery stock, but no careful estimates were secured.

The list of nurserymen for 1914 is as follows:

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1914.

Name of Firm.	Address.	Certificate Issued.	Number of Catalogue.
Barnes Brothers Nursery Co.	Yalesville	Oct. 8,	598
Beattie, Wm. H.	New Haven	Oct. 27,	623
Bowditch, J. H.	Pomfret Center	Sept. 10,	583
Brainard Floral and Nursery Co.	Thompsonville	Sept. 21,	588
Bradley, H. M.	Derby	Nov. 9,	632
Braley & Co., S. A.	Burnside	Sept. 18,	587
Bretschneider, A.	Danielson	Nov. 10,	637
Brooks Bros.	Westbrook	Oct. 8,	601
Burroughs, Thos. E.	Deep River	Oct. 13,	608
Burr & Co., C. R.	Manchester	Sept. 26,	591
Chapman, C. B.	Groton	Oct. 21,	615
Chapman, C. E.	North Stonington	Oct. 21,	613
Comstock & Lyon	Norwalk	Nov. 10,	634
Conine Nursery Co., The F. E.	Stratford	Oct. 9,	602
		Nov. 13,	643
Conn Agricultural College (Prof. A. G. Gulley)	Storrs	Oct. 28,	626
Conn. Agr. Experiment Station (W. O. Filley, State Forester)	New Haven	Oct. 21,	616
Conway, W. B.	New Haven	Sept. 9,	582
Cross Highway Nurseries	Westport	Nov. 10,	636
Dallas, Inc., Alexander	Waterbury	Nov. 13,	643
Dehn & Bertolf	Greenwich	Oct. 10,	603
Dowd, Frank C. (2)	Madison	Nov. 10,	635
Elm City Nursery Co	New Haven	Sept. 10,	584
Fairfield Landscape & Nurseries Co. (2)	Cannon Station	Nov. 10,	639

Name of Firm.	Address.	Certificate Issued.	Number of Certificate.
Fuller, H. C.	New London	Dec. 10,	647
Gardner's Nurseries	Cromwell	Oct. 27,	624
Geduldig, G., Estate of	Norwich	Oct. 26,	620
Hartford Park Commissioners (G. A. Parker, Supt.)	Hartford	Nov. 6,	631
Hartridge, S.	Norwich	Oct. 24,	618
Heath & Co., H. S.	Manchester	Sept. 29,	593
Holcomb, Irving	Granby	Oct. 7,	597
Horan & Son, Jas.	Bridgeport	Nov. 9,	633
Houston & Sons, J. R.	Mansfield	Nov. 10,	638
Hoyt's Sons Co., The Stephen	New Canaan	Oct. 12,	605
Hubbard & Co., Paul M.	Bristol	Oct. 15,	610
Hunt & Co., W. W.	Hartford	Oct. 8,	599
Intravaia, Joseph	Middletown	Oct. 27,	625
Kellner, Herman H.	Danbury	Dec. 30,	648
Kelsey & Sons, David	West Hartford	Nov. 24,	645
Long, J. A.	East Haven	Aug. 29,	581
Mallett-Cockfield & Co.	Bridgeport	Oct. 21,	612
Manchester Nurseries	Manchester	Sept. 18,	586
McDermott, E. F.	Windsor	Nov. 12,	642
Meier & Gillette	West Hartford	Oct. 13,	607
*Mt. Carmel Forestry & Nursery Co. (H. L. Johnson, Mgr.)	Etowah, Tenn.	Oct. 26,	619
Munro, Chas.	New Haven	Aug. 29,	580
New Haven Nurseries Co.	New Haven	Aug. 28,	577
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	Oct. 5,	595
New London Cemetery Association (F. S. Newcomb, Pres.)	New London	Oct. 21,	614
New London County Nurseries (W. J. Schoonman, Prop.)	New London	Nov. 11,	641
Northeastern Forestry Co.	Cheshire	Sept. 22,	590
Park Gardens	Bridgeport	Oct. 26,	622
Phelps, J. Wesson	Bolton	Oct. 28,	627
Phelps & V. T. Hammer Co., The J. W.	Branford	Aug. 28,	578
Pierson, Inc., A. N.	Cromwell	Sept. 30,	594
Platt Co., The Frank S.	New Haven	Nov. 27,	646
Pomeroy, Edwin C.	Northville	Oct. 26,	621
Purinton, C. O.	Hartford	Sept. 21,	589
Reck, Julius	Bridgeport	Oct. 6,	596
Roehrich, W. G.	Stratford	Oct. 29,	628
Saxe & Floto	Waterbury	Oct. 30,	630
Schleichert, F. C.	Bridgeport	Oct. 19,	611

* Nursery stock located at Mt. Carmel, Conn.

Name of Firm.	Address.	Certificate Issued.	Number of Certificate.
Scott, J. W.	Hartford	Nov. 11,	640
Seavey, Wallace	New Haven	Aug. 29,	579
Sierman, C. H.	Hartford	Oct. 22,	617
South Wilton Nurseries	South Wilton	Oct. 10,	604
Steck, Chas. A.	Bethel	Oct. 29,	629
Streckfus, H. P.	Litchfield	Sept. 14,	585
Turner & Co., Chas.	Hartford	Sept. 29,	592
Vidbourne & Co., J.	Hartford	Oct. 13,	606
Woodruff, C. V.	Orange	Oct. 14,	609
Yale University Forest School	New Haven	Nov. 14,	644
Young, Mrs. Nellie A.	Pine Orchard	Oct. 8,	600

INSPECTION OF IMPORTED NURSERY STOCK.

By W. E. Britton and B. H. Walden.

There has been no decrease in the shipments of nursery stock into Connecticut from foreign countries since the rules and regulations of the Federal Horticultural Board became operative two years ago. On the other hand, these shipments increase each year, and were it not for the system of notices and permits established by the Board it would be difficult to trace many of them. As it is, we are able to follow up and inspect most of them. All woody field-grown plants are supposed to be inspected whether consigned to nurserymen, florists, or private owners.

The regulations of the Federal Horticultural Board require that the importer, who is usually the broker, shall send a notice of each shipment to the state nursery inspector of the state to which the shipment is consigned. The Federal Horticultural Board issues a permit before the stock can enter the United States, and this Board also sends to each state inspector a notice, in duplicate, of each shipment consigned to that state. Both copies are to be filled out after the stock has been inspected; one is returned to the Federal Horticultural Board and the other kept on file as a record in the state inspector's office.

On receipt of the first notice of each shipment a post card containing the following, is sent from this office to the consignee or importer:

Office of State Entomologist.

Agricultural Experiment Station, New Haven, Conn.

Dear Sir:—This office has just received notice from.....

.....

regarding.....case or package of imported nursery stock consigned to you. Under the Federal Horticultural Law, we shall try to inspect all woody plants imported into Connecticut.

Please notify this office as soon as the stock arrives at your grounds (but not before) and we will try to inspect it promptly. It is illegal for you to unpack it until the inspector arrives, unless permission is granted from this office.

Very truly yours,

W. E. Britton,

State Entomo'ogist.

During the year ending September 30, 1914, 303 separate shipments of imported nursery stock have been inspected by this department. These shipments contained 1,477 boxes and packages and 1,646,130 plants. Of 32 other cases in 10 shipments at first reported, two were not received, ten were reshipped without unpacking; one was damaged on reaching New York and was replaced by New York grown stock; one was a box of seeds; one contained carnations; nine contained herbaceous stock; two were greenhouse grown; three were inspected by Federal authorities; and three small shipments were unpacked and distributed before they could be traced. These shipments, therefore, were not inspected. This stock came from the following countries:

County.	*No. Shipments.*	*No. Cases.*
Holland	123	771
Belgium	96	450
France	29	127
England	24	65
Ireland	10	17
Germany	8	8
Scotland	6	16
Japan	3	19
Italy	2	2
Hungary	1	1
Locality not given	1	1
Total	303	1,477

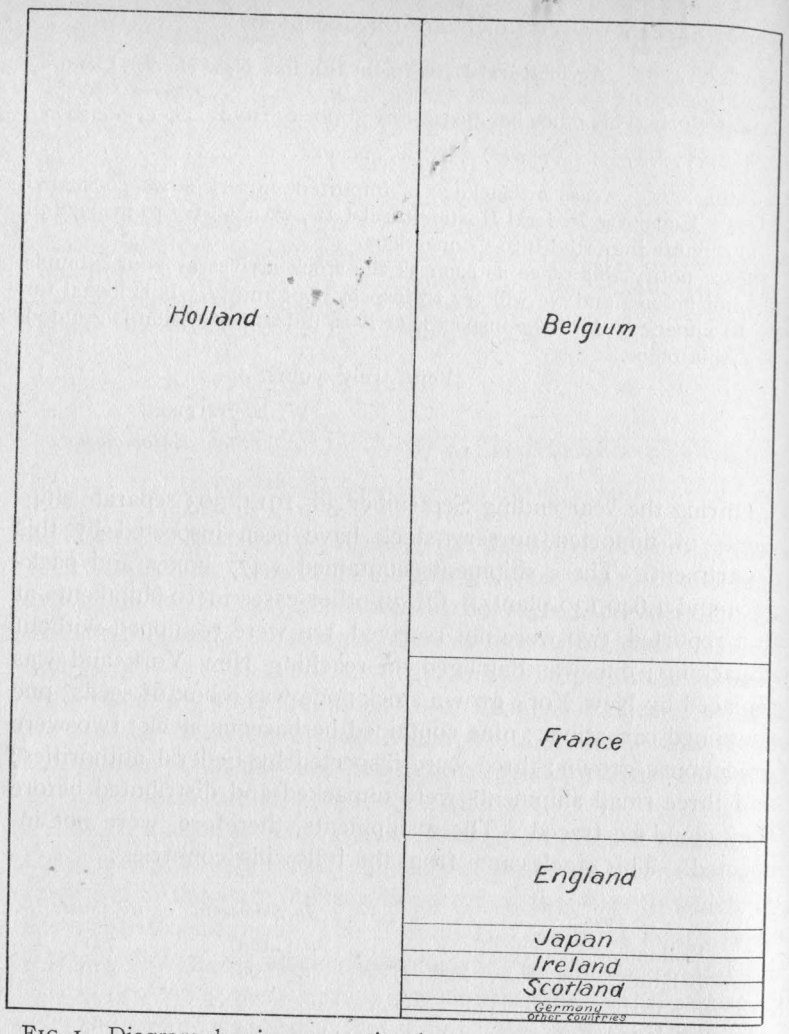


FIG. 1. Diagram showing proportional amounts of nursery stock grown in the different foreign countries sending stock into Connecticut.

In the inspection of this imported nursery stock, in 1914, insects and plant diseases were found in 58 shipments as follows:

PESTS FOUND.

Crown gall, *Bacterium tumifaciens* Smith & Towns. (6 shipments)

On Manetti rose stock.
James Palmer & Son, Ltd., Annan, Scotland. King Acre Nurseries, Hereford; Walter S. Slocock, Woking, Surrey; R. H. Bath, Wisbech; Stuart Low & Co., Enfield, England.

Black Fungus. Apparently *Sclerotinia Fuckliana* DeBy. (Fckl.) Sclerotial stage. (1 shipment)
On grape cuttings. (Shipper unknown) Hungary.

Fungus (unidentified) on Rhododendron leaves. (1 Shipment)
A. Ouwerkerk, Boskoop, Holland.

Fungus, *Exobasidium* on *Azalea indica.* (18 shipments)
O. & Th. de Raeve Freres, K. J. Kuyk, C. Petrick, Arthur De Meyer, Ghent; August Haerens, Somergem; Bier & Ankersmit, Melle, Belgium.

Fungus, *Graphiola Phoenicis* Moug. (Poit.) (1 shipment)
On Phoenix palm. K. J. Kuyk, Ghent, Belgium.

White Fly. *Aleyrodes* (undescribed) on *Azalea indica.* (7 shipments.) K. J. Kuyk, C. Petrick, Ghent, Belgium.

Soft Scale, *Coccus hesperidum* Linn. (6 shipments)
On bay trees. Arthur DeMeyer, K. J. Kuyk, Ghent, Belgium.

Hemispherical Scale, *Saissetia hemisphericum* Targ. (1 shipment)
On palms. K. J. Kuyk, Ghent, Belgium.

Mealy bug. *Coccus* sp. (2 shipments)
On *Araucaria.* Bier & Ankersmit. On rubber plant, De Coster Bros., Melle, Belgium.

Oyster-shell Scale, *Lepidosaphes ulmi* Linn. (6 shipments)
On Box, *Buxus.* H. den Ouden & Son, Koster & Co., Van Kleef Bros., Schaum & Van Tol., H. M. Hardyzer, Boskoop, Holland.

Chionaspine Scale in egg stage, probably *Hemichionaspis aspidistræ* Sign. (1 shipment)
On *Aspidistra.* P. & L. Vander Sypt, Loochristy, Belgium.

Diaspine Scale, *Chrysomphalus* sp. (1 shipment)
On bay tree. Arthur DeMeyer, Ghent, Belgium.

Mites. Probably common red spider. (3 shipments)
On Kentia palm. Arthur DeMeyer, Ghent, Belgium.
On Box, *Buxus.* W. C. Hage & Co., Boskoop, Holland.
On *Rhododendron.* Ebbinge & Van Gross, Boskoop, Holland.

Spring-tails—Collembola. (1 shipment)
On roses. P. Loef Az, Boskoop, Holland.

Aphids (immature) (1 shipment)
On *Viburnum.* Van den Willik & Koetner, Hazerswoude, Holland.
Work of borer in ash. (1 shipment)
F. J. G. Van der Bom, Oudenbosch, Holland.
Rusty Tussock Moth, *Notolophus antiqua* Linn. Eggs. (1 shipment)
On *Spiraea.* Kallen & Lunneman, Boskoop, Holland
Lepidopterous cocoons. (3 shipments)
On Manetti rose stock. Vincent Le Breton's Nurseries, Angers, France. F. L. Van Leeuwen & Son, Sassenheim, Holland.
Noctuid Larva. (1 shipment)
On *Retinospora.* G. W. Van Gelderen, Boskoop, Holland.
Pierid Larva. (1 shipment)
On *Azalea indica.* K. J. Kuyk, Ghent, Belgium.
Lepidopterous eggs (unidentified) (2 shipments)
Probably Tortricid egg-mass. On *Azalea indica.* L. Van Leeuwen & Son, Meirelbecke, Sassenheim, Holland. On *Rhododendron,* Boskoop, Holland.

INSPECTION OF APIARIES.

The inspections made in 1914 represent the first season's work under the new law passed by the General Assembly of 1913, which provides for quarantines, for inspection without complaints, and an appropriation of $750.00 annually, which is more than double the amount available in previous years. So far the new law seems to be satisfactory. On account of the increased appropriation much more area was covered and many more apiaries inspected than ever before.

As during the preceding four years, Messrs. H. W. Coley of Westport and A. W. Yates of Hartford, have served as inspectors, receiving wages for the time actually engaged in the work. Mr. Coley has jurisdiction over the four counties, Fairfield, New Haven, Middlesex and New London, in the southern part of the state, while Mr. Yates has the northern counties, Litchfield, Hartford, Tolland and Windham.

This year, for the first time, some American Foul Brood was found in the State in the towns of Bethlehem and Old Lyme (Blackhall).

In the inspection work the State was quite thoroughly covered, as may be seen from the following table, which gives the number of apiaries and colonies inspected in each town where work was done, and the number of each found diseased:

APIARIES INSPECTED, 1914.

Arranged by Towns.

Town.	No. Apiaries Inspected.	Diseased.	Quarantined.	No. Colonies Inspected.	Diseased.
FAIRFIELD COUNTY					
Bethel	4	1	1	10	2
Bridgeport	2	1	0	44	9
Danbury	3	0	0	51	0
Darien	2	1	1	66	1
Fairfield	13	5	4	260	8
New Canaan	6	4	4	59	20
Norwalk	2	0	0	5	0
Ridgefield	7	5	5	34	6
Stamford	6	2	2	72	12
Stratford	2	0	0	71	0
Westport	2	1	1	28	12
Wilton	16	5	4	94	6
Total	65	25	22	794	76
NEW HAVEN COUNTY					
Beacon Falls	5	2	2	45	27
Cheshire	3	0	0	43	0
Derby	3	0	0	40	0
Hamden	2	2	1	24	4
Madison	1	0	0	22	0
Middlebury	5	0	0	41	0
Milford	7	4	1	39	31
Naugatuck	3	0	0	21	0
Prospect	8	0	0	57	0
Seymour	1	1	1	8	1
Waterbury	2	1	0	51	1
Total	40	10	5	391	64
MIDDLESEX COUNTY					
Chatham	15	8	7	117	27
East Haddam	14	7	7	97	23
Haddam	6	6	6	31	26
Total	35	21	20	245	76

Town.	No. Apiaries Inspected.	Diseased.	Quarantined.	No. Colonies Inspected.	Diseased.
NEW LONDON COUNTY					
Colchester	2	2	2	29	25
Lisbon	3	3	2	82	18
Montville	8	2	1	47	9
New London	3	2	0	25	6
Norwich	5	4	3	97	24
Old Lyme	6	4*	4	30	26
Waterford	2	0	0	46	0
Total	29	17	12	356	108
LITCHFIELD COUNTY					
Bethlehem	1*	1	1	3	1
Goshen	2	0	0	15	0
Harwinton	1	1	0	6	6
Plymouth	8	4	0	63	7
Sharon	1	0	0	3	0
Thomaston	11	6	0	44	24
Torrington	14	6	1	124	28
Watertown	12	4	0	119	10
Winchester	21	5	1	83	10
Woodbury	5	0	0	44	0
Total	76	27	3	504	86
HARTFORD COUNTY					
Berlin	18	4	0	67	11
Bloomfield	3	0	0	24	0
Bristol	13	5	0	75	13
Burlington	9	2	0	37	5
East Granby	7	4	0	41	5
East Hartford	3	2	1	17	3
East Windsor	9	2	0	102	8
Enfield	10	4	0	59	17
Farmington	12	2	0	62	3
Glastonbury	11	1	0	33	1
Granby	7	1	0	70	7
Hartford	10	1	0	34	7
Manchester	9	2	0	45	3
New Britain	14	5	0	91	8
Newington	2	0	0	42	0
Plainville	7	3	1	65	9
Rocky Hill	4	1	0	17	2
Southington	5	3	0	51	13
South Windsor	6	2	1	27	2
Suffield	5	3	0	42	4

*American Foul Brood.

Town.	No. Apiaries Inspected.	Diseased.	Quarantined.	No. Colonies Inspected.	Diseased.
HARTFORD COUNTY—*Continued.*					
West Hartford	5	3	0	101	4
Wethersfield	5	0	0	40	0
Windsor	3	0	0	43	0
Windsor Locks	2	0	0	47	0
Total	179	50	3	1232	125
TOLLAND COUNTY					
Bolton	2	0	0	7	0
Coventry	2	0	0	5	0
Somers	2	0	0	26	0
Stafford	6	3	0	82	22
Vernon	12	10	0	164	29
Willington	1	0	0	7	0
Total	25	13	0	291	51
WINDHAM COUNTY					
Brooklyn	2	1	0	13	1
Canterbury	2	0	0	8	0
Hampton	2	0	0	7	0
Pomfret	8	4	0	41	11
Total	14	5	0	69	12

SUMMARY OF APIARY INSPECTION.

	Apiaries.	Colonies.
Number inspected	463	3,882
Infested, European foul brood	151	543
Per cent. infested	32.6	13.9
Infested, American foul brood	5	27
Per cent. infested	1.07	.7
Sac or Pickled brood	12	28
Average number of colonies per apiary		8.38
Cost of inspection		$749.76
Average cost per apiary	$1.62	
Average cost per colony	.19	

GYPSY MOTH CONTROL WORK IN 1914.

By W. E. Britton and Irving W. Davis.

Since 1906 the gypsy moth has been known to be present in Stonington, and in December, 1909, was discovered in Wallingford. Previous reports of this station describes the vigorous measures which have been taken to exterminate the pest in each of these infestations. We now believe that the gypsy moth was actually exterminated in each locality, but that a reinfestation due

to wind spread of the newly-hatched caterpillars in 1913 occurred at Stonington, and at the same time infested nearly the whole eastern end of Connecticut. Outside of the area previously infested at Stonington the new infestations were discovered by Federal scouts, after learning of the caterpillars found by the state men on the banded trees near Stonington village. Most of the control work outside of Stonington and Wallingford has been also done by Federal men, to whom Connecticut is greatly indebted for help at the time when state funds were entirely inadequate to cope with the situation. The following pages describe the work in detail:

Wallingford.

Here the colony was steadily reduced under the careful work of Mr. Caffrey, and in 1913 only three caterpillars were taken. Nevertheless, work was continued. The State scouts commenced work on December 22nd and made a careful examination of the area banded in 1913, bounded by the New York, New Haven and Hartford Railroad tracks on the west, Ward Street on the south, Fair and Main Streets on the east and Center and Church Streets on the north. Special attention was given to the district near Orchard street, where caterpillars were last found. No egg-clusters were found and the scouting was finished January 10th.

Outside of the area mentioned above, the entire town was searched by Federal scouts without finding any egg-clusters. Nevertheless, the trees in the central area were banded as in 1913, and three men, Messrs. C. W. Bolton, R. H. Hillbom and O. C. Malmquist, in charge of Mr. Bolton, were employed by this department to turn the bands and to search for caterpillars from May 18 to August 8. None were found.

The figures showing the results of the work in the Wallingford infestation, not including the caterpillars killed by spraying, or those caught in the tanglefoot bands, are given below:

Summary of Work at Wallingford.

	1910	1911	1912	1913	1914
Egg-masses destroyed	8,234	23	5	2	0
Cocoons destroyed	95	15	1	0	0
Caterpillars destroyed at burlap bands	8,936	1,551	26	3	0
Trees banded with burlap	10,000	8,556	5,379	2,135	2,135
Trees banded with tanglefoot	365	469	128	128	128
Trees sprayed with poison	219	116	11	0	0
Trees pruned	904	33	0	0	0
Cavities filled with cement	27	0	0	0	0
Cavities covered with tin patches	1,959	100	0	0	0

Stonington.

Winter Scouting.

During the summer of 1913 several gypsy moth caterpillars were captured on the Stanton estate and at one or two other places within the area formerly infested, but where nothing had been found since 1911. It was, therefore, imperative that the entire area of the old infestation be scouted during the winter, and accordingly scouts were sent to Stonington on December 2, remaining there until December 19th.

The area contained in the old infestation, which consisted of the borough of Stonington and north to the road leading to Elihu's Island on the east, thence westerly to the southern boundary of the cemetery, was all scouted. Particular attention was given to the grounds around the Stanton place and to the other localities where caterpillars were taken the previous summer. Scouting was also done outside of this section already mentioned, at Stonington Manor and on Elihu's Island. At the former place, where many automobiles from the infested district stop during the course of the summer, the trees and bushes were examined as it was thought that the caterpillars might possibly have been introduced through that medium.

Trees on the farm of Mr. West, who resides about 1½ miles north of Stonington, were also examined. Mr. West has the hay from the Stanton estate, and as this has been the center of infestation, it was deemed best to scout around this farm since there was a possibility that a colony might have become established in that section. No egg-masses were found.

Outside of the area examined by the state scouts and mentioned above, Federal scouts examined the remaining area in the town of Stonington, and also the towns of Groton, North Stonington and many other towns in the eastern end of the State, as is mentioned on page 133. In Stonington seven infestations were found, all outside of and north of the area previously infested where state men had worked. One was found just west of the river at Mystic, this being in the town of Groton.

Summer Work.

Two of the infestations mentioned above were near Westerly, R. I., and were taken care of by the Federal men. All others in

Stonington and that in Groton were looked after by state men. The other five Stonington infestations were located as follows: One in the oak woods back of Stonington Manor Inn, on the land owned by Mr. E. P. Edwards. One in an old apple orchard on what is commonly known as the Gallup place and now occupied by Mrs. Schrorer. The third infestation was in the orchard of Mr. Davis, who lives on an old "'pent road" about one-half mile south of the North Stonington town line. The two remaining infestations were on opposite sides of the road in what is known as the Anguilla district and on land owned by Mr. York.

In the town of Groton there was but one infestation and that on Pearl Street, Mystic, on land owned by Mr. Edgecomb.

The work commenced on April 29th and closed August 8th. During this time seven men, including Mr. F. J. Rimoldi, John L. Wright, Stanley M. Prouty, George W. Smith, Paul McDermott and F. Hoadley, with Mr. Davis in charge, were engaged in the work, but the average number employed was four.

The first week was spent in banding trees in the various infested areas, in cutting brush and thinning out the nearby trees.

The number of tanglefoot bands applied was as follows:

Gallup Place	10
Manor	82
Mystic	4
Anguilla (right)	13
Anguilla (left)	13
Davis	8
	130

In addition to the above, at the Manor infestation burlap was also used, while within the limits of the old infestation seventy-one tanglefoot and one hundred and thirty-eight burlap bands were applied.

All of the bands were examined daily until the middle of June, and from then on until the work closed they were examined every other day.

Wherever possible various sections of woodland were scouted, and although the most of this work was done in Stonington, at various times the work was carried into the edges of both Groton and North Stonington.

The work closed on August 8th without any gypsy moth caterpillars or new infestations having been found.

Work Done by Federal Scouts.

Men employed by the Federal Bureau of Entomology scouted the open area in two tiers of towns across the eastern end of the State during the winter. They found a large number of small infestations one or two egg-clusters in a place, scattered over ten towns. The summer work in these towns, except in Stonington and Groton, as previously noted, was also done by Federal men. The egg-clusters were creosoted when found, their location indicated on maps, and significant guiding marks were placed on trees or fences at the nearest point along the highway, to enable one to reach the spot without unnecessary searching. In general, the trees were banded over a circular area extending, perhaps, 100 feet from the egg-cluster, in order to catch the caterpillars hatching from scattered eggs. A number of caterpillars were found on the bands. Later scouts were sent into the woodland areas and many more small and scattered infestations were found. The infestations in both open country and woodland were thickest in the northeast corner of the State, the town of Thompson leading in number.

Altogether the Bureau of Entomology expended $17,555.66 in scouting and other work in Connecticut, in 1914, previous to September 15. Colonies of Calosoma beetles and their larvæ, which feed upon gypsy caterpillars, were planted in Stonington and in Thompson by the Federal men. We wish to acknowledge the cordial help and co-operation which Connecticut has received from Mr. A. F. Burgess, Mr. L. H. Worthley and their associates of the Bureau of Entomology, who are engaged in this work.

Present Infested Area.

Thus the ten towns of Thompson, Woodstock, Putnam, Pomfret, Killingly, Brooklyn, Voluntown, North Stonington, Stonington and Groton must now be considered as infested with gypsy moths, though the pest is not yet abundant in any of them. Consequently these towns were quarantined August 1st, 1914, by the

Federal Horticultural Board. The location of these towns and the quarantine lines are shown in figure 2.

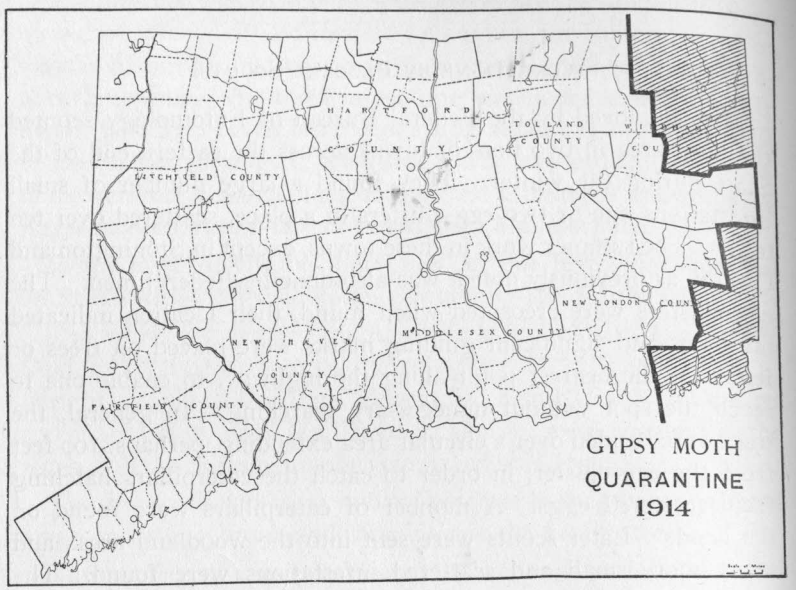


FIG. 2. Map of Connecticut showing area quarantined on account of gypsy moth.

FUTURE NEEDS AND PROSPECTS.

As the present infestation in Connecticut is on the edge of the large gypsy moth area covering Rhode Island, eastern Massachusetts, southeastern New Hampshire and southwestern Maine, it is evident that it cannot be easily exterminated, as might be the case with a separate colony, and as has been done at Wallingford and at Stonington. The methods of control to be adopted in future work must be quite different from those employed in extermination work in the past. Much scouting must be done each year, and this with the use of tanglefoot bands around the infestations will serve to hold the pests from gaining a firm foothold, and from spreading across the State. This means constant, careful work. The Federal force will aid us, but cannot assume the whole burden. In order to properly cope with the situation the State must appropriate a larger amount for this work.

SUPPRESSION WORK AGAINST THE BROWN-TAIL MOTH IN 1914.

BY W. E. BRITTON AND IRVING W. DAVIS.

Scouting to determine the extent of spread and the abundance of the brown-tail moth in 1913 was commenced January 15, 1914. The force of scouts in charge of Mr. Davis consisted also of Messrs. F. J. Rimoldi, John H. Osgood, E. R. Sherman, John L. Wright, A. J. Bibeault, J. S. Shepard and George Capwell.

By comparing the following pages with last year's report (page 204) it will be seen that while the pest has spread westward and several new towns were found infested, the nests were much fewer in the old infestations than in 1913. Mr. Davis' notes follow:

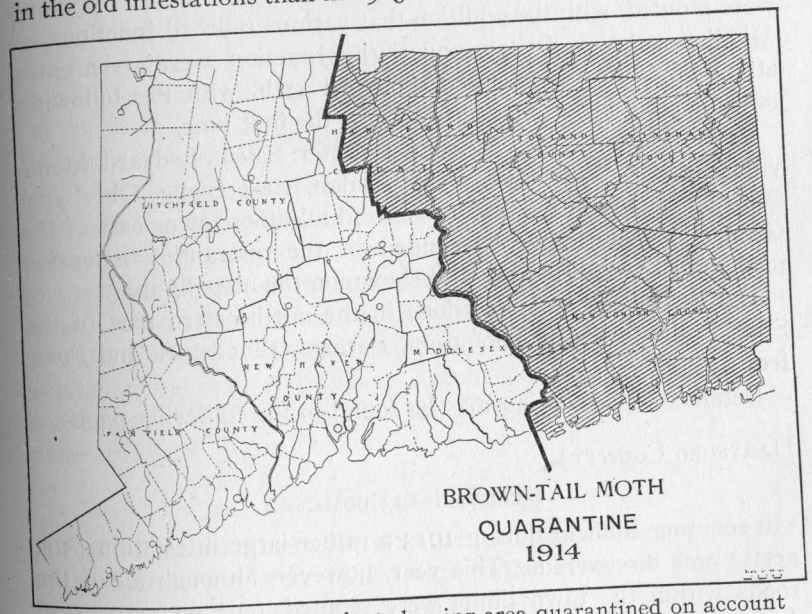


FIG. 3. Map of Connecticut showing area quarantined on account of brown-tail moth.

Owing to the spread of the brown-tail moths during the last two years it became impracticable to scout the entire section of the State infested. Accordingly the work done this year consisted of scouting the towns just east of the Government quarantine line and the towns to the westward until no moths were found. East of the quarantine line the scouting consisted of a strip approximately one town in width. In the northern part of the State,

however, begining with Hartford and West Hartford and extending to the Massachusetts line, two towns within the quarantine line were covered. All towns west of the Connecticut river and within the quarantined area were scouted, and from East Hartford to Stonington a strip one town in width east of the quarantine line was worked.

Outside of this district the towns scouted varied with the nests found in each section. All of the towns from the quarantine line to the Connecticut river were covered, as was Old Saybrook. The Federal scouts reported a nest in Old Saybrook, but since they had scouted westward without finding anything, no further work was done in that immediate vicinity. Northward, where the line crosses to the west side of the river, from one to two towns westward were scouted, with the addition that various railroad junctions, as Middletown, New Britain and Berlin Junction, were given extra attention. The work closed on April 11th, with the following towns having been found infested for the first time.

Granby, Simsbury, Lebanon, Colchester, Salem, Ledyard, Montville, Groton, Waterford, New London, East Lyme, Old Lyme and Old Saybrook. These towns and all other towns east of the Connecticut River were included in the quarantine extension made effective August 1st, and shown on the map, figure 3.

Extra scouting was also done in the northeastern part of the State in the towns of Thompson, Putnam, Woodstock and Pomfret.

Details of the scouting may be found in the following pages:

HARTFORD COUNTY:

Suffield—23 nests.

In scouting Suffield during 1913 a rather large infestation (565 nests) was discovered. This year, however, although all of the roads within the town limits were scouted, only 23 nests were found. Nineteen of these were on the West Suffield road near Suffield Center. The remainder, 4 in number, were scattered along the northern section of the town near the Massachusetts line.

Granby—1 nest.

All of the roads in Granby were scouted and resulted in the finding of a single nest on the main road between Granby Center and North Granby, very near the latter village. It might also be well to note that the nest was within a mile of the Southwick (Mass.) line.

Simsbury—4 nests.

The entire town, which includes the villages of Simsbury, West Simsbury, Tariffville and Weatogue, was scouted and four nests were found on two roadside trees standing on land owned by William Kelly on the Firetown Road, about two miles northwest of the village of Simsbury.

West Hartford—1 nest.

West Hartford was one of the towns found infested last year, and although all of the town was scouted again this year, the only nest found was at 1014 Farmington Avenue, a short distance west of the post office in West Hartford.

Hartford—94 nests.

It was the intention to scout the entire city of Hartford, but after working a few days in that section it was learned that Federal scouts had covered part of the city. The State men, therefore, confined their efforts to the remaining section and found 94 nests. As was the case last year, the most of the nests were found near the large infestation around John and Main Streets. Three isolated cases, one on Windsor Avenue near the Windsor town line, one at 48 Imlay Street, and the third at 3 Queen Street, concludes the list.

East Hartford—48 nests.

Forty-eight nests were found as the result of scouting the entire town of East Hartford. These were in the village of East Hartford very near the Connecticut river.

Of the remaining towns in Hartford County, which were scouted all of the roads in East Granby, Windsor Locks, Windsor, Bloomfield, Avon, Farmington, Newington, Wethersfield and Glastonbury, were covered but no nests were found.

The following towns were partially scouted:

Hartland—A few of the roads in the eastern part of the town.

Canton—The village itself and main roads adjacent to it.

Plainville—The center and road leading to New Britain.

New Britain—The central portion of the city and streets along the various railroads.

Berlin—Around the railroad station, and roads in that vicinity.

Rocky Hill—The village and main roads.

Marlboro—The principal roads.

Manchester—Covered by Federal scouts, so only partially scouted by State men.

TOLLAND COUNTY:

Mansfield—2 nests.

Only two nests were found as the result of scouting all of the roads in this town. One of these was found on the South Coventry road near the town line, while the other was in the southwest corner of the town.

Columbia—1 nest.

All of the roads in Coventry, Hebron, Bolton and Andover were scouted but no nests were found.

WINDHAM COUNTY:

Windham—7 nests.

This town, which includes the city of Willimantic, was thoroughly scouted and seven scattered nests found, only one of which was in the city. Three nests were taken in the north part of the town and two near the Franklin line on the farm of Mr. Chamberlain. The remaining nest was found near the Poor Farm.

Putnam, Thompson, Woodstock, and Pomfret, which have been found badly infested the last two years, were not scouted this winter. One man, however, visited the sections which were badly infested last year and estimated the number of nests to be about 15 per cent. of the number found in 1913.

NEW LONDON COUNTY:

Franklin—5 nests.

The roads in this town were all scouted, and although no nests were found here a year ago, five were cut there this season. Three of these were taken near the Windham line, in the north part of the town. At Franklin Station one was found, and the fifth came from the southern part near the Norwich line.

Lebanon—13 nests.

In scouting Lebanon all of the roads were covered and 13 nests cut. Near Lebanon Station, which is very near the Franklin line, 8 nests were found, three of them being about one-half mile south of the Station on the farm of Mrs. E. J. Warner. The others were also found in the same section of the town but nearer the Bozrah line, one being within a mile of Bozrahville.

Sprague—2 nests.

Only the western roads of this town were scouted and two nests were found.

Bozrah—3 nests.

The villages of Fitchville, Bozrah Street and Bozrahville and all connecting roads were scouted with the result that three nests were found. Two of these were in Bozrah Street and the third was found in the southern part of the town near the Montville line.

Norwich—169 nests.

In 1913 only two nests were found in the town of Norwich, both being within the city limits. This year in scouting the entire town a marked increase was noted, 169 nests being found. The city of Norwich contained the most of them, 115 nests being cut within the city limits. The remaining nests were near the various villages, of which there are several in the town. In Greenville and vicinity 22 nests were found, while at Occum 18 were taken and 10 more in and about Norwich town. The last four were cut in Taftville.

Colchester—2 nests.

All the territory within the limits of this town was scouted and two nests were found. These were widely separated, one being in the northwestern section of the town and the other in the southern part near the Salem line.

Salem—1 nest.

Only one nest was found as a result of scouting all of the roads in Salem. This nest was found at Salem Street about one-half mile north of the church.

Montville—9 nests.

The entire town of Montville, which includes the villages of Chesterfield, Uncasville, Montville, Fair Oaks, Massapeag and Mohegan, was scouted. Two nests were found in the village of Massapeag and two more in the village of Montville. Single nests were taken at Uncasville, Raymond Hill, Fair Oaks and on the Salem Road. The road south toward Waterford yielded two more, making a total of nine nests found in the town of Montville.

Waterford—168 nests.

This was one of the few coast towns in which anything resembling a colony of brown-tail moths was found. Near Durfy Hill in the southwestern part of the town 156 nests were cut on three adjoining farms. Twelve other scattering nests were found in this town, two on Millstone Point and 6 on the turnpike leading to New London. In the central portion of Waterford no nests were found, but in the eastern part, on the road leading to Montville four more were taken, making a total of 168 nests for Waterford.

New London—34 nests.

All of the territory in this city was scouted and resulted in finding 34 nests. Here again the nests were so well distributed that no one locality can be mentioned as having a bad infestation. If any section contained fewer nests than another it was that in the vicinity of Ocean Beach, but this can be explained by the lack of fruit trees in that section.

Ledyard—14 nests.

Fourteen scattered nests were the result of scouting the entire town of Ledyard. In the southeastern part of the town six nests were taken along the Norwich road. At Ledyard Center two nests were found and three more on the road leading north from this point. The three other nests were found along the road which leads to North Stonington.

Groton—103 nests.

In this town a very large percentage of the nests taken were found along the coast and in the valley of the Mystic River. This section also contains the greater part of the population, for it includes the villages of Mystic, Old Mystic, Noank, Poquonoc Bridge and Groton. Ninety-one of the 103 in Groton were found in these villages and along connecting roads. The remaining 12 were scattered through the central portion of the town, six being a little west of Burnett's corners, two at Center Groton, and four on the main road between Groton and Center Groton.

Stonington—50 nests.

The brown-tail work done in this town was in connection with the gypsy moth scouting, and the 50 nests found were, therefore, in the southern part of the town near the borough of Stonington. A small colony of twenty nests was taken from a few pear trees at Dr. Thurber's on Water Street, but the others were widely separated.

East Lyme—13 nests.

Flanders Village, Niantic, East Lyme and all of the main roads in this town were scouted and 13 nests were found, all of them south of the Shore Line trolley tracks. Two were found in the village of Niantic and six on the road north from there to Flanders Village. The other four were found, two each on Black Point and along the turnpike near Flanders.

Old Lyme—64 nests.

All of the roads in this town were scouted and 64 nests were found near the village of Blackhall. A colony of 58 nests was found on the farm of Mr. John DeWolf about one-half mile south of the Lyme and Blackhall station. The other six nests were taken from neighboring farms.

Lyme.

The southern roads of this town, including the village of Hamburg and vicinity, were scouted but no nests were found.

MIDDLESEX COUNTY:

Old Saybrook—1 nest.

The entire town of Old Saybrook was scouted but no nests were found, although the Federal scouts found one on College Street.

East Haddam, including the various villages and principal roads were scouted. The main roads in Portland and Chatham and a few of the roads in Cromwell were also covered. In Middletown the central portion of the city and streets along the various railroad lines were covered, but in none of these towns were any nests found.

NESTS TAKEN DURING 1914

HARTFORD COUNTY.	
Granby	1
Simsbury	4
Suffield	23
W. Hartford	1
E. Hartford	48
Hartford	94
TOLLAND COUNTY.	
Mansfield	2
Columbia	1
WINDHAM COUNTY.	
Windham	7
MIDDLESEX COUNTY.	
Old Saybrook...(reported)	1
NEW LONDON COUNTY.	
Lebanon	12
Franklin	5
Sprague	2
Colchester	2
Bozrah	3
Norwich	169
Salem	1
Montville	9
Ledyard	14
Groton	103
Waterford	168
New London	34
East Lyme	13
Stonington	50
Old Lyme	64
Total	831

THE CABBAGE ROOT MAGGOT.

Phorbia brassicæ Bouché.

Order Diptera: Family Anthomyiidæ.

BY QUINCY S. LOWRY.

Growers of cabbages, cauliflowers and allied plants are more or less bothered by the cabbage root maggot, which feeds on the roots of plants belonging to the Cruciferæ or Mustard family, causing serious damage to those which are cultivated as crops.

DISTRIBUTION.

This pest, like several others of the most serious pests of this country, was introduced from Europe some seventy-odd years ago, and was first studied in this country by Dr. Harris, in 1835. It made its first appearance in Massachusetts, and has gradually spread, until now it is undoubtedly injurious in every state where its food plants are grown. It has been recognized as a serious pest in Europe, since the early part of the nineteenth century, especially in England and Germany. Already it has been reported from nearly every state in the United States, and as early as 1885 Fletcher reported it as destroying from 25% to 75% of the cauliflowers in Canada.

LIFE HISTORY.

(a) The egg of the cabbage maggot is about 1/25 of an inch in length (plate XII, a, twice enlarged) slightly curved in outline, somewhat pointed at the ends, and is white or yellowish white in color. These eggs are deposited on or just below the surface of the ground, near the stem of the plant; each female is capable of laying from 50 to 60 eggs. As the ovipositor of the female is soft, it is not capable of puncturing the tissues of the food plant and is forced to deposit the eggs on the ground. If the female can find a crevice near the stem of the plant she will crawl just beneath the surface of the ground and deposit her eggs as closely as possible to the stem of the plant. The egg is quite delicate, and, therefore, must be laid where it will receive no injury, and as the young maggot is helpless it will perish unless the egg is close to the plant, which supplies its food. If the eggs are laid on the surface of the ground and allowed to stay in the sun, they will soon dry up. The period of the egg-stage varies, from four to ten days. In this locality the eggs are generally found from May 1st to 15th, according to weather conditions. This year the first eggs were collected May 18th, this being a late spring, having frost enough on May 1st and 2nd to injure some of the larger leaves of the young cabbage plants. Most of the eggs found at this time (May 18th) were just beneath the soil near the stem of the plant—two eggs were found attached to the base of a leaf which had been covered with soil. (See plate XII, a.)

(b) The (larva) maggot is white or yellowish in color, cylindrical in outline, and is always footless. The posterior end bears two spiracles and is surrounded by twelve conical tubercules, the middle two being slightly cleft. The anterior (pointed) end bears the mouth opening, which is surrounded by fleshy lip-like prominences and contains two dark hook-like structures. These are connected interiorly with a chitinous framework which serves for muscular attachment. This is the only means the maggot has to

secure its food. Although it cannot bite, it is, however, capable of scraping the soft tissue of the plant, breaking up the plant cells. Following this injury decay immediately sets in, causing a further softening of the plant tissue and making it easier for the maggots to penetrate. On each side of the body, just back of the head, is a dark spot, which consists of ten fan-like lobes.

The maggot reaches its growth in from three to four weeks, and then is slightly over one-quarter of an inch long. In 1914, the first maggots were found and brought to the laboratory on May 22nd.

Sometimes cabbage plants become infested in the seed-bed, and, therefore, all plants should be examined before setting in the field. While setting some plants at the Experiment Station Farm at Mt. Carmel, June 6th, several plants were found thus infested. All seed-beds should be examined carefully before the plants are set, thus preventing what would result in a great loss to the crop.

(c) When the maggot is full grown it generally leaves its food plant (very often it is found in the galleries it has made in the stem) going into the earth for an inch or so away from the root of the plant upon which it has been feeding. It is unlike most insects, in that it does not separate from its own skin when it pupates, but uses it as a protection while changing to the so-called pupa. It is of a brownish color, varying from light to dark brown, and elliptical ovate in form. In Connecticut these pupæ can usually be found about the middle of June. This year the first pupæ were collected June 8th. The pupæ are about one-fourth of an inch in length or a trifle shorter than the full-grown maggot. Plate XII, b.

(d) The adult is known as the fly of the cabbage root maggot. It resembles the common house fly but is considerably smaller. It has two wings (placing it in the order Diptera) which extend farther back beyond the end of the body and when the fly closes its wings over its back they shut farther over each other than the wings of the common house fly. See plate XII, b.

The fly, especially the female, has no special markings, making it difficult to distinguish it from the other common Anthomyians, unless found with its male. The female is much lighter in color than the male, and is quite bristled, but not as much as the male. The male fly is dark gray in color, having the abdomen and thorax quite distinctly striped with rather broad blackish stripes. The

legs are black and strongly bristled. The body of the male is very bristly, this being its chief character. On the underside of each hind femur is a tuft of these bristles, by means of which one may distinguish it from allied species. The abdomen is narrow and tapering, being cylindrical in form. The eyes occupy most of the head and nearly touch each other.

The first brood of flies appear early in the spring, the first being captured this year April 30th. As to the number of broods it has been agreed by several entomologists that there are at least three, and, possibly, four broods annually.

The first brood works on the early varieties of cabbage, turnip, radish, etc., usually causing the most damage. This year the maggot was not very abundant in the fields where experiments were carried on. Some turnips were planted at the Station farm adjoining the cabbage plant. They were examined on May 23rd and found to be quite badly infested. On June 25th, when harvested, the injuries had grown over, but they appeared unsightly.

A second brood has been recorded as appearing the middle of June and the maggots feeding on cabbages and turnips during July. During July most of the food plants, such as early cabbages, radishes and turnips, are harvested, and, therefore, it is a question as to what the third and fourth broods have to feed on. Late cabbage has been reported as being damaged more or less, but in Connecticut they are seldom attacked, and only the early crop is seriously injured. In 1891, a large field of turnips, in Ithaca, N. Y., were greatly damaged, and maggots were feeding on them as late as October 2nd. It is, therefore, evident that there is a third brood, and possibly a fourth brood of this pest.

On November 5, 1914, a field of late Swedish turnips, or rutabagas, belonging to Mr. A. E. Plant of Branford, Conn., was inspected. Nearly every root showed more or less injury by maggots, resembling that caused by the cabbage root maggot. Adjoining this field Mr. Plant had a field of early turnips which had been destroyed by maggots, and the crop was a complete failure. Several maggots were found feeding at this time on the late turnips and brought to the laboratory in order to secure adults. The maggots are undoubtedly of a late brood of the cabbage root maggot.

The flies are known to hibernate in rubbish, holes and crevices for the winter. It has also been recorded that the pest passes the

winter in both the larval and pupal stages. The general belief is that the most common form in which the winter is passed is the puparium stage, although it's passed in all three stages—the maggot, puparium and the adult.

Food Plants.

The cabbage root maggot confines its food chiefly to the Cruciferæ or Mustard family. Cabbages, cauliflowers, radishes, turnips, brussels sprouts, kales and collards, being the most common food of the pest. It also feeds on some mustard-like weeds, the hedge mustard, *Sisymbrium officinale,* and the common winter cress, *Barbarea vulgaris.*

Enemies.

Chickens are sometimes turned into an infested field and destroy many maggots, but they generally cause considerable damage to the plants themselves. A small hymenopterous parasite, a Cynipid, belonging to the genus *Trybliographa,* has been found to work on this pest. One of the Staphylinidæ, or Rove beetles was found in 1870 by Mr. Sprague and described as *Aleochara anthomyiæ.* Some rove beetles were found this year attacking maggots. In 1887 another enemy was found in Michigan, in the form of a mite, a species of *Trombidium,* three of which sucked on an average of 28 eggs per day. A four-winged Ichneumon, *Alysia manducator,* Panzer, belonging to the order Hymenoptera, family Ichneumonidæ, known as the Ichneumon-flies, lives in the pupæ of flies allied to Anthomyidæ in Europe. It transforms in a thin yellow case within the pupa and emerges during the summer. It has often been found about decaying turnips, and, therefore, it may be a general parasite of these flies.

Methods of Control.

Cultural Practices.

To obtain the best results cabbages should not be planted on ground that has previously been infested with maggots. This will not prevent the attack, but on new ground there is less damage from hibernating flies near infested territory. The adult has a tendency to hibernate in old stumps and rubbish near where the attack has been made the previous season. It will not travel far beyond the infestation if it can find a sheltered place in which to hibernate.

Rotation of crops is strongly recommended on ground that has been infested, using care that such crops are other than those of plants belonging to the Cruciferæ family, or onions.

Clean culture is most important in controlling the cabbage maggot, as well as several other pests infesting truck crops. During the season, clean culture will lessen the attack, especially if all weeds of the Cruciferæ family are destroyed. In the fall all refuse should be removed from the field, such as the stumps, and burned. If this is practiced, the attack the following spring will be greatly lessened.

It has been stated by Riley and Fletcher, that fall plowing will undoubtedly destroy many pupæ, and, therefore, lessen the attack the following spring. These cultural methods are only recommendations and help to some extent. In Connecticut, however, they are not sufficient means of control, some artificial means being necessary.

Artificial Applications.

Tarred Paper Disks.

Tarred paper disks have been used and recommended since 1889 and have up to the present time proved to be the one best mechanical method of preventing the adult fly from laying its eggs on or near the plant. Many other repellents have been tested out from time to time and have proved to be either ineffective or too expensive. No injury to the plant is caused by these disks, and once applied they are effective for the season and require less attention than any other method of control thus far recommended.

The idea of using paper disks originated with Professor W. W. Tracy of Detroit, Michigan, who tried manila paper, which proved unsuccessful. Professor E. S. Goff of the Wisconsin Station, tried one-ply tarred disks, which have since proved successful. Later, Slingerland conducted some experiments with tarred paper disks on Long Island, N. Y. In 1908 tarred paper disks were tried by this Station at Mt. Carmel and Branford, with favorable results.

The disks are not a destructive method of control but act as a preventive. They are made with a tool devised by Professor Goff, which will cut a six-sided card with a slit reaching from the

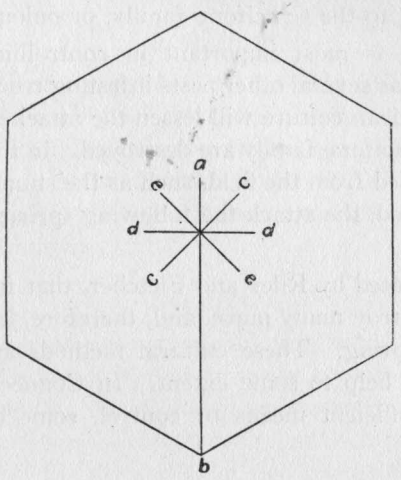


FIG. 4. Hexagonal disk of tarred paper for use on stems of cabbage plants.

center of one side to the center of the disk and with a star-shaped cut at the center. (See plates X, b, XI, b, and figures 4, 5 and 6.)

This cut at the center is made so that the disk will fit closely around the stems of different sized plants. The six-sided disks are used for convenience and economy in making. These disks should be applied as soon as the plants are set in order that the adult fly will have no chance to lay its eggs beforehand.

To apply, slip the disk around the plant through the slit from the side to the center. It is very essential that the disks be applied properly. They should fit tightly around the stem of the plant and rest flat on the ground so that the fly cannot crawl beneath the disk and lay her eggs near the stem of the plant. Care must be taken, when cultivating, not to cover the disks with too much soil; if this is the case their effectiveness will be lost.

The disks are easily made with the tool (Plate XI, b.) one man being able to cut from 300 to 500 disks per hour. Enough paper can be bought for fifteen cents to make 1,000 disks.

One-ply tarred paper is used in the making of these disks with the tool (Plate XI, b); the paper being cut along at the edge at the start, with one angle of the tool. Starting on the left hand side the second cut is made by placing the cutting edge as shown by dotted line in figure 5.

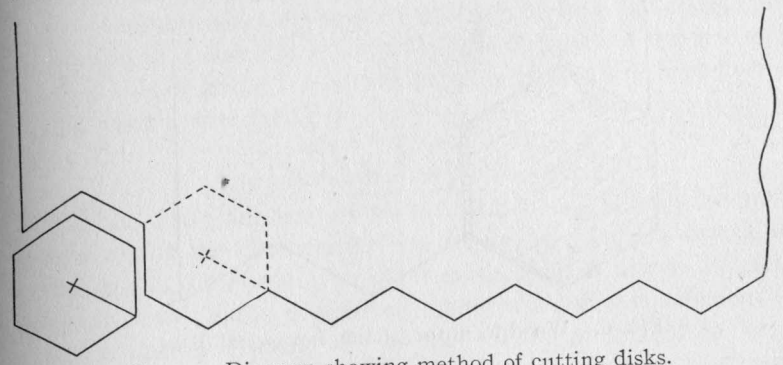


FIG. 5. Diagram showing method of cutting disks.

In 1908, this Station being unable to purchase any ready-made disks devised a method a method of making them, without any special tool. They were cut from a roll of tarred paper, hexagonal in shape and four inches across. Figure 5 and Figure 6 show the method of cutting them. A block of wood hexagonal in form, and one-quarter inch thick was used as a pattern. A tack being driven through to mark the center, and to prevent the form from slipping. The form was placed on the paper and cuts were made around it with a sharp knife. When several disks were cut in this way, they were piled one upon another and the cut a—b made (Fig. 4); with the knife. With a chisel 1⅛ inches wide cuts c—c, d—d, e—e, were made. When the first row of disks have been cut from the roll of paper, it will have an edge with regular points, forming two sides on the second row of disks. This method of cutting disks, while being practicable where only a few are needed would not be practicable for large growers of cabbages.

Mr. Farnham of New Haven had a tool made this season cutting the paper three inches square, with a slit from the center of one side to the center of the disk where a circle had been cut. As this circle at the center was cut the same size for all plants, it consquently did not fit snugly around different sized stems, thus

losing the effectiveness of the disk. They did not remain in place as well as the disks used by the Experiment Station and made by Hirsch Bros., of Middle Village, L. I., N. Y.

There are several concerns which sell these disks, the following having been recently recommended: Hirsch Bros., 2257 Metropol-

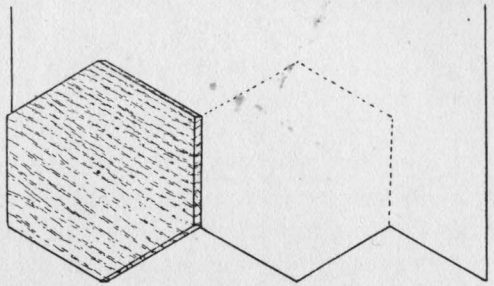


FIG. 6. Wood form for cutting hexagonal disks.

itan Ave., Middle Village, L. I., N. Y.; Smith Bros., Green Bay, Wisconsin, and A. B. Cowles, 25 South Water Street, Rochester, N. Y.

Crude Carbolic Acid Emulsion.

In the experiments carried on in New York State and in Connecticut, Crude Carbolic Acid Emulsion has proved to be one of the most effective methods of control. It acts, not only as a probable preventive, but also kills the eggs and young larvæ of the maggots, if present at the time the application is made.

The emulsion was used according to the formula recommended by the New York (Geneva) Experiment Station.

Hard soap 1 lb. or soft soap 1 qt.
Boiling water, 1 gal.
Crude Carbolic Acid, 1 pt.

The soap is dissolved in the water while boiling hot, the acid is then added and the whole is churned, as in making kerosene emulsion. This emulsion is to be diluted 30 times its bulk of water. If any injury should be caused from the emulsion, dilute still more. Use *crude* carbolic acid as it is cheaper and just as effective.

Mr. W. J. Schoene of the Geneva Station carrier on some very successful experiments determining the effect of this acid emulsion upon the eggs and larvæ of the maggot. In 1913, Mr. Schoene found by his experiments that when Crude Carbolic Acid Emulsion was diluted until it contained only .33 per cent. acid it would prevent the eggs of the maggot from hatching. At this strength it was also found to kill the maggots of the first and second instars, also a few of the maggots of the third instar were killed when first molted.

Carbon Disulphide.

Carbon disulphide has proved practicable, and is both the most effective and the cheapest method for killing maggots attacking cabbage and cauliflower; for other crops, such as onions and turnips, it would be too expensive. One teaspoonful is sufficient to treat a fair-sized plant, and as this can be purchased in large quantities, from 10 to 12 cents per pound, 10 plants can be treated for one cent. One treatment is sufficient and should be applied in May when the first maggots are found. The method of applying the liquid is to first make a hole with a stick, two or three inches from the stem on the surface and slanting towards and underneath the roots. Pour the liquid into this hole and close it at once with the foot. Do not have the liquid come in direct contact with the roots, and care should be taken not to breathe the fumes as it is very poisonous. The fumes will penetrate through the soil around the plant and kill the maggots. The "McGowen Injector" was devised for this purpose and was recommended by Slingerland as the most effective method of applying the liquid, but at the present time it is not on the market.

Kerosene Emulsion.

Kerosene Emulsion has been recommended as a method for the control of the maggot. The following formula, recommended by this Station, was used in our experiments this season:

2 gal. Kerosene
½ lb. Common soap
1 gal. Water.

Dissolve the soap in hot water, add the kerosene and churn together until a white creamy mass is formed, which thickens on cooling. Dilute nine times before using. Although this emul-

sion will probably not be as effective and practicable as the carbon disulphide, or the crude carbolic acid emulsion, it has nevertheless, proved quite effective if applied properly. Two or three applications for cauliflower and cabbage is recommended, while for onions several applications are necessary. In several cases injury to the plants has been reported from the use of it.

Corrosive Sublimate.

In an article in the Market Grower's Journal, May 1, 1914, Mr. J. Peterson, Cuyahoga County, Ohio, states that corrosive sublimate applied to cabbage as soon as there are any indications of maggots, will prove very effective. Two applications were made and applied with a watering can, from which the rose had been removed, at the rate of one teacupful to a plant.

Formula used: Four ounces of corrosive sublimate to 55 gallons of water. One man being able to treat 1,000 plants in three hours.

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FIELD EXPERIMENTS IN CONTROLLING THE CABBAGE ROOT MAGGOT IN 1914.

By W. E. Britton and Quincy S. Lowry.

Experiments in controlling the cabbage root maggot were conducted in three places in 1914, as follows: At the Station farm, Mt. Carmel, on the truck farms of Mr. A. N. Farnham, New Haven, and Mr. W. G. Griswold, Wethersfield, to whom we are indebted for their kind help and co-operation.

The following materials were used:

1. Tarred paper disks.

2. Sludge, (residue from manufacture of lime-sulphur mixture.)
3. Kerosene Emulsion.
4. Crude Carbolic Acid Emulsion.
5. Naphthalene (Moth balls.)
6. Fish Oil. (With sand and with sawdust.)
7. Sirenia Oil.
8. Cresol.

The details of the treatment are given in the following pages:

EXPERIMENTS AT MR. FARNHAM'S, NEW HAVEN.

The field where these tests were made is located between Derby Avenue and Chapel Street and nearly west of the new Yale Bowl. It is one of many fields devoted to the growing of truck crops by Mr. A. N. Farnham. The plants were grown by Mr. Farnham, and were set by his men, on April 22nd, in rows three feet apart and 465 feet long, extending northeast and southwest. The plants were set 18 inches apart, and 310 in a row. About 30,000 plants were set on the whole field.

Five rows, containing approximately 1,550 plants, on the east side of the field were placed at our disposal for experimental tests. The varieties were Early Jersey Wakefield and Early Flat Head, and the plants showed no signs of being infested at time of setting. The rows were divided crosswise into five equal sections, each containing about 310 plants, and treated as follows:

Section I.	Section II.	Section III.	Section IV.	Section V.
Tarred paper disks.	Check.	Crued Carbolic Emulsion 3-applications.	Sludge 2-applications.	Kerosene Emulsion 2-applications.

On June 26th, after the insects had done most of its damage for the year, all plants were examined and records made.

SECTION I. The disks were applied the same day that the plants were set and were of the hexagonal type, described on page 147. Five plants out of 307, or 1.6 per cent., were afterwards killed by maggots. This is as small a proportion as was obtained from any treatment in our experiments this season.

SEC. II. Section II, adjoining the tarred paper disk section was left untreated as a check. Here 28 plants out of 308 or 9.1 per cent. were subsequently killed by maggots.

SEC. III. Treated with Crude Carbolic Acid Emulsion, prepared according to the formula used and recommended by the N. Y. (Geneva) Experiment Station, and described on page 150 of this report. This emulsion was applied the day following the setting of the plants, April 23rd, using about 3 ounces to each plant. (This emulsion has been recommended to apply about the base of the plant the day after setting and to repeat every ten days until about May 25th, and to use ½ cupful to each plant, pouring it about the roots with a sprinkler.) On May 4th and May 22nd, second and third applications of Crude Carbolic Acid Emulsion were given to this section, making three in all. There was no apparent injury from the emulsion, and the total number of plants killed by maggots was five, or 1.6 per cent., the same as where the tarred paper disks were used, these two treatments giving the best results.

SEC. IV. Sludge. This is a residue of lime and sulphur having the form of a gray paste, and was applied to the plants of this section April 27th. The following analysis was made by the Chemical department of this Station:

Water	26.53
Oxides of iron and alumina	1.40
Lime	28.82
Magnesia	3.76
Free sulphur	0.27
Sulphur as SO_3 (Sulphate)	2.23
Sulphur as SO_2 (Sulphite and thiosulphate)	13.66

No sulphides present.

A mixture of sulphate (very small) sulphite and thiosulphate of lime and magnesia with carbonates.

The sludge, as received from the manufacturer, was diluted about five times its bulk with water, 3 ounces being used for each plant. The paste was applied with a ladle around the base of the plant and was very easy to prepare and apply. When it dries it hardens, forming a disk-like coating about 4 inches in diameter around the stem of the plant on the surface of the ground. On May 21st, a second treatment was given. On May 27th, when a comparison was made of the entire five sections, this section treated with sludge, had by far the best looking plants, as one glanced over the field. Mention should also be made that cut worms did the least damage in this section. The total number of plants killed by maggots were 10 out of 302, or 3.3 per cent.

SEC. V. Kerosene Emulsion, was applied to this section, using the standard formula from the Spray Calendar of this Station as follows:

Kerosene	2 gals.
Common soap	½ lb.
Water	1 gal.

Dissolve the soap in hot water, add the kerosene and churn together until a white creamy mass is formed, which thickens on cooling. Dilute this emulsion nine times before using.

On April 30th the first application was made, using two ounces to each plant, applied with a ladle. On May 22nd a second treatment was given. When examined, May 27th, this section compared unfavorably with the other sections and had much smaller plants, and more had been killed by maggots. Possibly some injury was caused by the emulsion, as the total number of plants killed was 52, or 16.7 per cent. more than in any other section.

The following results, therefore, were obtained this year at Mr. A. N. Farnham's.

SUMMARY OF RESULTS AT MR. FARNHAM'S

Treatment.	Results.	
Tarred Paper Disks	1.6%	Maggoty
Crude Carbolic Acid Emulsion	1.6%	"
Lime Sulphur Sludge	3.3%	"
Kerosene Emulsion	16.7%	"
Check	9.1%	"

EXPERIMENTS AT STATION FARM, MT. CARMEL.

A small plat of ground, on which cabbages have not been grown for many years, being assigned for this work, plants were purchased from a local dealer and set May 6th and 7th, 18 inches apart in 20 rows, extending east and west, and containing 54 plants each. Beginning on the lower or north side, rows 1-4 were treated with tarred paper disks: rows 5-10 received sludge prepared as described on page 154; rows 11-14 untreated, as a check; rows 15-17, fish oil, mixed with sand on row 15, and on rows 16 and 17 the same kind of oil was mixed with sawdust. In each case a handful of the material was scattered around each plant on the surface of the ground; rows 18-20, naphthalene (moth balls) a ball being placed 1½ inches from the stem of the plant and pressed firmly into the soil.

The plants mentioned above were of the Early Jersey Wakefield variety. When setting it was noticed that some of the plants showed that they were infested with "Club-root," a fungous disease, and were discarded. Some affected plants must have been overlooked, because this trouble afterward became so bad as to spoil the results of the experiments.

The 20 rows did not fill the ground available, so on May 16th five rows of a later variety of cabbage called "Succession" and four rows of "Snowball" cauliflower were set.

On rows 21 and 22 of cabbage sludge was used, as on rows 5-10, mentioned above. Row 23 was treated with an oil called "Sirenia" designed "for driving flies from horses and cattle." This oil has a strong odor, and one pint was mixed with four pints of sawdust, and a handful scattered around the stem of each plant in the same manner as the fish oil on rows 15-17, mentioned above. On rows 24 and 25 an emulsion of Cresol (Merck) U. S. P., diluted 30 times, was applied by pouring from a ladle, about three ounces around each plant. The next day the plants were all dead. The ground was dug up and on May 19th more "Succession" plants were set but left untreated. Of the four remaining rows planted to cauliflower, row 26 was treated with sludge, row 27, left as a check, rows 28 and 29 were treated with kerosene emulsion.

The late-planted cabbages and cauliflower plants were not greatly injured by maggots and nearly all produced good heads. There was no apparent injury from the treatment, except in case of Cresol, which has been mentioned.

The early-set plants, however, were so badly attacked by "Club-root" that many plants died, and though some of these were also attacked by maggots, no accurate record could be made regarding the amount of damage caused by that insect.

Experiments on Mr. Griswold's Farm, Wethersfield.

On May 19th, Mr. Lowry visited "Fair View Farm," owned by Mr. W. G. Griswold, Wethersfield. Early Jersey Wakefield plants had been set a few days before, and though no maggot injury was apparent wire-worms had already caused considerable damage. A section of the field was placed at our disposal for experiment. On one end of the first two rows, 500 tarred paper disks were placed. The third row was left untreated, as a check, and on the fourth row sludge was applied to 250 plants.

There was very little damage from maggots to the field as a whole. When examined on July 3rd, plants were missing from these rows as follows:

Row 1.	Tarred paper disks	17	plants.
" 2.	" " "	27	"
" 3.	Check	24	"
" 4.	Sludge	36	"

The cause of the missing plants, as has already been explained, was chiefly due to the attack of wire-worms instead of the cabbage maggot.

The only positive results of these tests may be seen in the summary of results at Mr. Farnham's on page 155, from which it appears that the tarred paper disks and the carbolic acid emulsion are about equally effective in preventing damage from maggots, and that sludge is fairly satisfactory.

In tests made at the Station farm, Mt. Carmel in 1913, the tarred paper disks reduced the injury to one-half of one per cent., though the untreated plants showed 12 per cent. injury.

Directions for making these disks at home and information about purchasing them are given on page 147.

OUTBREAK OF THE ARMY WORM.

Heliophila unipuncta Haw.

Order Lepidoptera: Family Noctuidæ.

In 1896 the army worm appeared in Connecticut at Hartford, Springdale, New Haven, and probably other places, and a brief account of the outbreak may be found in the report of this Station for that year, page 236.

On July 20, 1914, during the writer's vacation absence from the State, it was reported to the office that army worms were abundant and devouring the grass on lawns, as well as corn, in private gardens in New Haven. Mr. Walden, who was in charge of the office, gave directions for treatment and sent Mr. Zappe to investigate the report. In a garden owned by Mr. Kligerman at 334 York Street, Mr. Zappe helped the owner to spray his corn with lead arsenate, 1 oz. in a gallon of water, and to spray the ground with kerosene. The next day when Mr. Zappe examined

the garden, he found many dead army worms. The following day, July 21st, it was reported that this insect was present on the grounds of Mr. Morton F. Plant at Groton, and that Professor G. H. Lamson, Jr., of the Connecticut Agricultural College at Storrs, had visited the place and had directed Mr. Plant's men in their efforts to control the pest. On July 23rd the army worm was said to be causing great damage in Bridgeport, and the Associated Press telephoned to this office for information. During the next week, or ten days, newspapers each day gave accounts of injury in some part of the State.

Mr. Walden prepared a brief account of the pest, giving control methods, which was published in the *Connecticut Farmer,* issue of July 25th.

The writer returned to Connecticut, Saturday, July 25, and took up his duties at the office on the 27th, when the telephone calls and letters about the army worm were the most abundant.

On July 27, Mr. Walden visited the farm of Mr. H. B. Clark in New Canaan, where considerable injury had already been done to a 5-acre field of oats. Along the east side and north end, many of the leaves and heads had been eaten off. The owner had plowed a furrow around the field to keep the worms from the corn field and the garden, and had sprayed a few rows of corn with poison. At this time the worms were less abundant than two days before, and were apparently under control.

On July 28, the writer visited "Fairlea Farm," owned by Mr. Wilson H. Lee, in Orange. The worms were abundant in three oat fields where in spots they had devoured all the leaves and had eaten off the heads which had dropped to the ground, leaving only the bare stalks. They were also present in grass fields and some were found on alfalfa, though apparently they had not been feeding upon it. They had commenced to attack the corn along one side of the field, but had not caused much damage to it. A part of the worms had already gone into the ground and transformed to pupæ. Many birds, especially starlings, barn swallows and English sparrows, were abundant on the field and were apparently eating the worms. Many worms were collected and brought to the laboratory: forty per cent. of these had Tachinid eggs fastened on their backs near the head. Clusters of small hymenopterous cocoons were present in great abundance, particularly under piles of straw where the worms congregated in large numbers coiled up

like cut worms, to which they are closely related. Dead and diseased worms were common on stalks of grass and alfalfa, having been attacked by a "wilt" disease. Specimens were collected of all these parasitized caterpillars, and the parasites causing their death are mentioned under Natural Enemies, on page 166.

On July 31, Mr. Walden visited the farm of Mr. I. H. Todd, Centerville, where an acre field of millet had been completely stripped of leaves and heads, leaving only the stalks. The worms were about through feeding, and the contracted larvæ and pupæ were found in the soil where they had gone to transform. There was considerable evidence of the presence of Tachinid parasites. A corn field near by had not been damaged.

At one place in Orange the worms were reported as attacking corn, oats and melons, and in Cheshire they were feeding upon wheat.

Circular letters were prepared giving a brief account of the insect and how to control it, and copies were sent to all known addresses of those who had written or telephoned to this office about the army worm. A shorter abstract was given to the press associations, and a more complete article with illustrations, was prepared by the writer and sent on August 10 to the *Rural New Yorker,* wherein it was published in two instalments, in the issue of August 22, page 1027, and August 29, page 1047.

The outbreak was not confined to Connecticut, but occurred throughout the Northeastern States as far west as the Mississippi River. From newspaper reports it was present in Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, Maryland, Virginia and Michigan. Its attack was said to be particularly severe on Long Island, in Maryland, and also in Michigan, where the damage was estimated at $1,000,000.00.

Localities Infested.

Specimens of the worms were received from several places in New Haven, where they were feeding on the grass of lawns and upon corn; from East Haven, on corn; Bridgeport, on grass; Hartford, on corn; Colchester, on rye; New London, on grass; and from Stamford, on oats. By telephone, or letter, the army worm was reported also from North Haven, Orange, Hamden, Cheshire, Foxon, Old Lyme, Moosup, Northfield, Newtown, Fairfield and New Canaan. Mr. Davis reports the insect present in

Stonington, North Stonington and Waterford. Newspapers printed reports of its occurrence at Groton and Monroe. Subsequent additional reports have been given verbally for Milford, Hebron, Lebanon and Salisbury.

Army worm moths were received from Stony Creek and from Southington the last week in August. No doubt the insect was present in every town in the State. If not abundant, however, there would be little or no injury, and it would escape notice altogether.

Former Outbreaks.

Occasional outbreaks of the army worm have occurred in the United States, during the past 172 years, the first of which we have any record being in 1743, of which the Reverend Thomas Smith of Falmouth, Me., wrote in his diary under date of June 27th. "There are millions of worms in armies appearing and threatening to cut off every green thing: people are exceedingly alarmed." Other outbreaks have been recorded as follows: In 1762, some kind of worms, probably army worms, were exceedingly numerous in Massachusetts and ate up the corn. Considerable damage has been recorded in New England by army worms in 1770, and in 1790, "Millions of the same black worm reappeared in Hartford and Norwich, Conn." Then in 1817 "it appeared in Worcester; also in Albany."

In Illinois, army worms appeared in 1818 or 1820, 1825, 1826, 1834, 1835, 1838, 1839, 1841, 1842, 1845, 1849, 1850, 1856, 1858, 1861, 1865, 1869, 1871, 1872 and 1875, though usually not in the same locality in successive years. It appeared in Missouri in 1854 and in Ohio in 1855.

The outbreak of 1861 seems to be one of the worst on record and reached from Maine westward to Kansas, and as far south as Tennessee.

In 1865, 1866, 1869 and 1872, the insect appeared in Missouri; in 1869 in Indiana and in 1871 and 1872 in Iowa. In 1872 outbreaks occurred in Wisconsin, Ohio, Kentucky and New York. In 1875, the outbreak was even more widespread, and in 1880 the worms caused considerable damage in New Jersey, New York and Connecticut.

The army worm is also recorded as appearing in Nebraska in 1888, in Michigan in 1897, in New Jersey in 1889, 1896 and 1906, and in Kentucky in 1908. The 1896 invasion was one of the worst in the history of New York State, and also extended through Connecticut, Massachusetts, New Hampshire, Vermont, Pennsylvania, and into Michigan and Iowa.

Food Plants and Damage.

The chief damage is done to crops of the grass family including the cereals and corn. The worms eat the leaf-blades and often the heads of the grass or grain, leaving only the stalks. Many oat fields in Connecticut this season were thus stripped of their leaves; the heads were also eaten off and fell to the ground. The writer saw a five-acre oat field similarly injured in 1896, at Hartford; the caterpillars in marching to the adjoining field literally covered the ground over an area perhaps twenty feet wide and more than a hundred feet long. Within this area it was impossible to walk without crushing a dozen or more caterpillars at each step. One could actually hear them crawl upon the ground. Thus when in search of food, army worms will attack fields of corn and many kinds of garden vegetables, which are not ordinarily their first choice. In some places cranberries have been severely injured by them. Clover and alfalfa are not often greatly damaged, yet in New Jersey in 1880 there were cases where the army worm seemed to prefer clover. They seldom attack trees and have only once been recorded as eating the leaves of fruit trees.

During the present season, at least in Connecticut, they were not sufficiently abundant to cause them to migrate from one field to another in large numbers; they were able to get plenty of food in the fields where they were hatched, and in most cases without eating all of it. Oats, barley, rye, wheat, grass, corn and millet were the principal crops damaged.

Like cutworms, to which they are closely allied, army worms feed mostly at night and hide under something near the ground during the day, as shown on plate XIV, b. When the worms are numerous and their food scarce, they are not able to satisfy themselves at night and therefore feed during the daytime.

Identity of the Army Worm.

Though periodical outbreaks have occurred since 1743, it was not until 1855 or more than one hundred and ten years after

the first recorded outbreak, that the adult moths were first reared by Mr. J. Kirkpatrick in Ohio. In 1861 the life history was worked out by Doctors Walsh and Thomas in Illinois, Dr. Fitch in New York State, and by several others less well known as entomologists. Though the synonymy was very complicated, Dr. Fitch finally succeeded in proving that this species is identical with *Leucania unipuncta* of Haworth, and in most of the literature the army worm still appears under this name. Some writers, however, especially in the later publications, adopted Hubner's generic name *Heliophila* for this species. The name *unipuncta* was probably given to this moth on account of the small white discal spot near the center of each fore-wing, much more prominent in the female than in the male. Dyar's "List of North American Lepidoptera" includes thirty-six other species of the genus *Heliophila*, fifteen of which are found along the Atlantic Seaboard.

The common name "Army Worm" refers to the habit of the caterpillars when abundant, after devastating one field of marching *en masse* onward like an army, seeking another to devour.

There are two other kinds of army worms, the "Wheat Head Army Worm, *Heliophila* (*Leucania*) *albilinea* Hbn., which attacks and eats off the heads of grain at the time of ripening, and the "Fall Army Worm" *Laphygma frugiperda* S & A., which appears in September and devours grass, millet, grains, corn and some other crops. The "Fall Army Worm" was described and figured in the Report of this Station for 1912, page 284, and plate XIV.

Distribution.

Slingerland states *that although a native of North America, the army worm is now known to occur in South America, England, Australia, New Zealand, India, Java and Madeira, but is not destructive in these countries.

Dyar's "List of North American Lepidoptera" gives *H. unipuncta* as occurring in the Atlantic States, but according to the records mentioned under "Former Outbreaks" on page 160, it has caused damage as far west as Kansas and Nebraska. This insect is common in the Southern States,† though according to some writers it is seldom injurious there. Slingerland quotes‡

* Cornell Agr. Expt. Station. Bull. 133, 1897.
† Report on Noxious Insects of New York, 6, page 113, 1865.
‡ Cornell Agr. Expt. Station, Bull. 133, 1897.

without giving the authority, that it is injurious as a pest in the Gulf region from Texas to Alabama, but east of the Blue Ridge Mountains it causes little damage south of North Carolina.

It has been believed by some entomologists that because the caterpillars have not been seen early in the season and the moths appear in swarms, that the species winters only in the South and that the moths migrate northward in large numbers and then lay eggs which develop into the broods of caterpillars which cause the damage. This theory has not been proven, however, and there is some evidence to the contrary. For instance, Dr. Thomas shows* that the moths have been captured in Illinois as early as April 2, and that the larvæ have been seen as early as April 29th. In Missouri the adults appear early in April and the larvæ were noticed during the early part of May.

In the Station collection, besides material collected in 1914, there are adults bearing the following records: New Haven, Conn., 12 May, 1903, H. W. Foote; 5 May, 1905, 1 August, 1906, B. H. Walden; Hartford, 28 July, from larvæ collected 9 July, 1906, W. E. Britton; Pemaquid Point, Me., August, 1906, H. W. Foote.

From the foregoing it may be seen that the army worm may be considered as occurring throughout the Eastern United States and westward nearly to the Rocky Mountains. Nevertheless it is true that most of the outbreaks in the New England States have been in July.

Habits of Worms and Moths.

It has already been mentioned that the worms naturally feed at night and crawl under some shelter near the ground to hide during the day. In ordinary years they feed upon the grasses and weeds which grow in low meadows and swampy places, usually on land not pastured or cultivated. It should be borne in mind that the great destruction caused by them, and the habit of traveling in armies, is unusual, or rather abnormal, and occurs only when they are very abundant and in need of food. They are then one-half or two-thirds grown. During the years intervening they are doubtless present in their natural habitat, prob-

*Report State Entomologist of Illinois, 10, pages 5–43, 5 figures, 1881

ably in nearly every grass field, and are not noticed by man. Nevertheless, they multiply in these places, and increase to such an extent that they finally overflow and attack the cultivated crops in the vicinity. On corn a worm is often found coiled up in the lower part of the cavity in the funnel-shaped top where the new leaves appear.

The adults, when abundant, are attracted by lights, and fairly swarmed around some of the electric lights in New Haven on August 19 and 20. In the daytime one would find hundreds of them crushed on the walks, some resting on poles or on the sides of buildings or in store windows.

No swarms of moths were noticed at any other time during the season. It might be expected that a swarm late in June, or early in July, would naturally precede such an outbreak of caterpillars, but no such swarm was observed by any members of the entomological staff or reported to the department as occurring in Connecticut.

An Accompanying Species.

During the writer's visit to Fairlea Farm he noticed that there were two species of caterpillars at work on the oats and corn. Besides the army worms there were others having darker diagonal shadings on the dorsal surface of each segment. These were distinct after reaching a certain molting stage (probably the fourth), but in earlier stages were not recognized or distinguished from the army worms.

These caterpillars were placed in separate breeding cages and soon pupated. No adults, however, were obtained. Inflated larvæ sent to the Bureau of Entomology at Washington were identified as the W-marked cut worm *Noctua clandestina* Harr.

These caterpillars were feeding with the army worms on the same plants and doing the same kind of damage, but in no case where observed were they anything like as abundant as were the army worms.

Life History.

The female moth lays upwards of 700 eggs, usually in clusters of 50 or less, placed in the sheath or at the unfolded base of a blade of grass or grain. She seems to prefer the rankest and most vigorous tufts or bunches of grass for this purpose, and

after depositing a cluster of eggs covers them with a whitish adhesive substance which holds them together and fastens the edges of the leaf firmly around them. From eight to ten days are required for these eggs to hatch.

The young caterpillars have the habit of looping when they crawl, like Geometrid larvæ, and also spin down on silken threads like canker-worms. Their first food is the egg shells and the glutinous substance covering them, which are wholly devoured before vegetation is attacked. After feeding for a few days, the caterpillars molt and in the second larval stage, as in the first, they are loopers. But after molting the second time, they lose this habit. They molt five times before reaching caterpillar maturity, all within a period varying from twenty to thirty days.

The full-grown army worms work their way into the ground an inch or two beneath the surface, and wriggle about, forming cells or cavities in which they transform to the chrysalis stage. From ten to fifteen days later the moths emerge.

The number of annual broods or generations has not yet been definitely settled for this latitude, but there are at least two complete broods and probably a partial third, or perhaps three complete broods in certain seasons. It is probable that the insect hibernates, or passes the winter as a caterpillar, yet Smith *records the finding of the moth "during the entire winter in sheltered places." Slingerland† concludes that it does not winter as a moth in the latitude of Ithaca, N. Y. Some entomologists believe that the winter is passed as a chrysalis or pupa, but this has not been demonstrated.

Our own records of adults, taken early in May, would indicate that they passed the winter either as adult moths or as pupæ from which the moths emerged early.

Description.

Egg. The egg is white or pale yellow, nearly spherical, almost smooth, but marked with white striæ or ridges, and slightly less than one millimeter in diameter. The eggs are laid in rows in clusters containing from 10 to 50, in the sheath, or in the unfolded leaf, and covered with a transparent gelatinous substance.

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*New Jersey Agr. Expt. Station, Report, page 450, 1896.

†Cornell Agr. Expt. Station, Bull. 133, p. 249, 1897.

Larva. The caterpillar is about one and one-half inches long, when full grown, though varying from one and a quarter to one and three-fourths inches. The color is generally brown, though varying considerably, and usually shows tints of green or red, much darker above than beneath, and marked dorsally with fine longitudinal lines of white, yellow, or lighter brown. A broader yellow stripe extends along each side just below the region in which the spiracles or breathing pores are situated. The entire under surface is brown but usually lighter than the upper surface. Head light brown, shining with inverted V-shaped mark on face and reticulated margins on the lateral surfaces, of darker brown. Legs light yellowish brown. Prolegs are of same color as under surface, except that each has a transverse dark band on the outer side, and the tip is marked with black on the inner side.

Chrysalis. The chrysalis is a naked pupa nearly three-quarters of an inch in length and of a light reddish-brown color with glossy surface. The apex bears a pair of spines which are incurved or coiled at the tips.

Moth. The female moth has a wing-spread of about one and three-fourths inches. The fore-wings are light brown or fawn, more or less mottled, with a white discal spot or dot just beyond the center of each, with a dark streak often rather inconspicuous, nearly bi-secting the apical angle. The rear wings are usually lighter at the base and darker on the outer margins than the fore-wings. Under surface of fore-wings dark brown in center, with margins and rear wings light brown; rear wings have a black dot near the center. Head, body above and beneath, with legs and antennæ, all of nearly the same color as the upper surface of the fore-wings, though varying somewhat.

The male is smaller than the female, having a wing-expanse of about one and three-eighths inches, paler and more uniform in color on fore and rear wings, and with less conspicuous markings. The under surface is about the same tint as the upper surface.

Natural Enemies.

Domestic fowls and native birds devour large numbers of army worms. Of the birds occurring in Connecticut the most important destroyers of army worms are the blackbirds, starlings, robins, thrushes, bobolinks, catbirds and barn swallows. Even the much despised English sparrow has been observed to feed upon them.

Among other vertebrate animals, hogs, skunks, toads and frogs are known to eat many army worms. Certain predaceous insects like ground beetles, and soldier bugs destroy a limited number of them. The larger ground beetles, *Calosoma scrutator* Fabr., *C. calidum* Fabr., *C. willcoxi* Lec., *C. externum* Say., and *C. frigidum* Fabr., are probably the most important for this purpose. We may also expect that the European *C. sychophanta* Linn., which has been brought to this country and planted in the eastern end of the State to aid in destroying gypsy and brown-tail moths, will devour army worms. The five species of the genus *Carabus* occurring in the State, are large-sized ground beetles and may be expected to feed upon them. There are probably many other smaller ground beetles which occasionally devour small army worms.

The soldier bugs belonging to the family Pentatomidæ, spear the caterpillars with their proboscides and suck out the interior juices for food. These are not important checks, however, and it is upon the parasites that we must depend to hold the army worms in check. Of these the most important in Connecticut are a large two-winged fly called the red-tailed fly, *Winthemia quadripustulata* Fabr., and a small four-winged fly, *Apanteles militaris* Walsh.

Forty per cent. of the worms collected at random at Fairlea Farm, Orange, on July 28, bore Tachinid eggs, from which were reared 30 flies all of the same species, *Winthemia quadripustulata* Fabr. Of those collected at New Canaan, July 27, by Mr. Walden, 47 per cent. had Tachinid eggs, from which were reared one specimen of *W. quadripustulata* and three specimens of another Tachinid, *Goniomima* (*Belvosia*) *unifasciata* Desv. Of material collected by Mr. Walden at Hamden, July 31, the percentage of parasitism by Tachinid flies was not noted, but from it were reared six specimens of *W. quadripustulata* and one Muscid fly, *Muscina stabulans* Fabr., which formerly was not supposed to be a parasite, but was thought to breed in decaying animal or vegetable matter. In fact, the conditions under which it was reared would hardly preclude the possibility of its breeding in the bodies of some of the worms which had died from the bacterial "wilt" disease.

From army worms collected by Mr. Zappe in New Haven, July 20, six flies were reared, one being *W. quadripustulata,* and the other five *G. unifasciata.* The former is shown on plate XVI, b.

The determinations were made by Mr. W. R. Walton of the Bureau of Entomology, through the kindness of Mr. F. M. Webster, who has charge of the Division of cereal and forage crop insects.

W. quadripustulata is mentioned in many of the early writings on the army worm under the name of *leucaniæ,* and was placed first in the genus *Nemoræa* and later in the genus *Exorista.*

In the foregoing pages, the abundance of a hymenopterous parasite has been mentioned. Clusters of the cocoons were observed by the writer in oat fields at Fairlea Farm, Orange, where they rested on the surface of the ground between the stalks of oats. The larvæ had evidently emerged from the bodies of the army worms before the latter entered the ground to pupate, and consequently the parasites made their cocoons above ground, though more or less covered with rubbish and by the grass and oat stalks growing in the field. Clusters of these cocoons were also very abundant under the windrows and bunches of dried oats in the field and later the same kind of cocoons were obtained in the breeding cages. They were much more abundant in the material from Fairlea Farm than in that collected at other points. Through the kindness of Mr. F. M. Webster, this parasite was identified by Mr. A. B. Gahan of the Bureau of Entomology as *Apanteles militaris* Walsh. This species was described by Dr. B. D. Walsh in the Tenth Report on Insects of Illinois, page 38, 1881, as *Microgaster militaris.*

Several other hymenopterous parasites have been recorded as attacking the army worm in various parts of the country. These include the ichneumon flies, *Amblyteles* (*Ichneumon*) *suturalis* Say., *A. flavizonatus* Cress., *Ophion purgatus* Say., *Apanteles flaviconche* Riley, *A. congregatus* Say., *Microplitis* sp., *Aleiodes terminalis* Cress., and the chalcids, *Haltichella* (*Hockeria*) *perpulchra* Walsh, *Glyphe viridescens* Walsh, and *Smicra* (*Chalcis*) *albifrons* Walsh.

The literature also mentions the Ichneumonids, *Mesochorus vitreus* Walsh, *Pezomachus minimus* Walsh, and *Hemiteles laticinctus* Ashm., but these are now all regarded as hyperparasites, i. e., they are parasitic upon some of the parasites of the army worm. Probably in Connecticut, at least, *Apanteles militaris* is the most important of all the hymenopterous parasites of the army worm.

The "wilt" disease, already mentioned, has been studied somewhat by Mr. E. M. Stoddard, Assistant Botanist of this Station. He found it to be caused, apparently, by bacteria, which he isolated. He has made several inoculations in apparently healthy caterpillars and in each case produced the disease. Mr. Stoddard kindly furnished the following note:

During the latter part of July, 1914, dead larvæ of the army worm were collected in the field which apparently had died of a "wilt" disease. These larvæ were hanging on blades of grass by the last pairs of false legs and presented a wilted and shrunken appearance and were soft and flaccid to the touch. During the last week in July larvæ in the rearing cages of the entomological department developed what was apparently the same trouble, the infection spreading through a large number of larvæ very rapidly. The interior tissue of the diseased worms was in a semi-fluid state, of a greenish yellow color, with a characteristic odor. The digestive tract was largely disintegrated in most of the specimens examined.

An examination of the diseased larvæ showed an abundant infection of bacteria in all parts. An examination at the same time of health larvæ failed to show bacteria in any greater abundance than would naturally be present in the digestive tract or be introduced from the exterior part of the larvæ. On August 1st, Petrie dish cultures on potato agar were made from the diseased worms. These cultures showed colonies of a brilliant pink organism, also colonies of a white organism, the pink colonies being much more abundant than the white. Both organisms were motile rods, the ones from the pink colonies being very sluggish, while the white organisms were very active.

Inoculation experiments were tried, which, owing to the scarcity of suitable healthy material did not give any conclusive results. The ten larvæ taken for inoculation were divided into two lots. Lot 1, three larvæ, taken from cage of healthy worms, two inoculated with the pink organism, and one with the white. Lot 2, seven larvæ, taken from cage of diseased worms, two inoculated with pink organism, three with white, and two checks; the inoculation being done by smearing the mouth parts with material from Petrie dish cultures. All larvæ were put in fresh cages in another room, where the chances of accidental infection were very small. The results of these inoculations were as follows: Two larvæ of Lot 1, inoculated with pink organism, died showing characteristic symptoms of "wilt" and one giving pink colonies in subculture. The larva inoculated with the white organism remained healthy until it pupated. In Lot 2, one larva inoculated with pink organism developed appearance of "wilt" and separation cultures showed pink colonies. However, parasites were later found to be present, which may have caused its death. The remaining larvæ of Lot 2 were either parasitized or pupated in healthy condition.

The results of these inoculations show that of four larvæ inoculated with pink organisms three died of "wilt" presumably and of these three the pink bacterium was recovered in cultures from two of them, while none inoculated from white colonies showed symptoms of wilt at all. Inoculations on red-humped caterpillars gave negative results in all cases.

This disease does not seem to correspond in any particular with bacterial or other diseases described on insect larvæ except in the manner in which the dead larvæ cling to the feeding plants, this being similar to wilted gypsy moth caterpillars, as described by Reiff. No attempt has been made to identify the species of bacteria found, and no further work with inoculation could be done owing to lack of larvæ to work on. The writer, realizing the meager amount of work done, has drawn no conclusions, but simply states the few facts gathered in regard to what is apparently a bacterial wilt disease of the army worm.

Prospects for Next Year.

From a study of the history of former outbreaks in the United States, it appears that seldom, if ever, does the army worm cause serious damage for two consecutive seasons in the same locality. There was practically no damage by the September or late brood of caterpillars this season in Connecticut. The abundance or scarcity of individuals in any species bears an inverse ratio to the numbers of its natural enemies. Thus natural enemies and weather conditions are factors which never cease to exist, and which, though variable and uncertain, occasionally form such a combination as to permit an outbreak. We are not yet far enough advanced in the subject to be able to predict with any degree of accuracy when an outbreak may occur.

From the very great prevalence of the parasites, *Winthemia quadripustulata*, and *Apanteles militaris* it seems reasonable to expect that the army worm will be held in check and that there will be no damage by it in 1915, in Connecticut.

Control Measures.

Various methods of control have been recommended from time to time, and, though prompt action is necessary in case of an army worm outbreak, the local conditions must be considered before adopting a line of treatment. Some measures will fit one place, some another and often various combinations of two or more of them may be necessary to bring about the best results. Some of these methods of control are described below:

Pasturing with Domestic Fowls.—In small infestations near the house the hens, turkeys, ducks and geese may be utilized to eat the worms. This method of destruction may often be facilitated by turning windrows, cocks or bunches of hay, straw, or cured oats, in order to expose the worms hiding underneath.

Rubbish around the edges of the field may also be disturbed for the same purpose. The native birds of the locality will also assist the domestic fowls in disposing of the caterpillars when once they are uncovered.

Rolling or Cultivating the Ground.—Small areas in the field, and especially lawns, may be gone over with a heavy roller to crush the caterpillars. On badly infested grain fields it is usually best to remove the straw at once, then to thoroughly disk-harrow the field, or give it a shallow plowing and then harrow thoroughly. By this process many of the pupæ are exposed and eaten by birds, and many more are crushed by the plow and harrow.

Barriers.—Where army worms are very abundant they will strip one field and may be prevented from marching to an adjacent field by the use of barriers such as ditches, walls and highways. These do not act as absolute obstructions, but check the advance of the worms, and, like a fire lane in the forest, give the fighters a favorable place upon which to concentrate their efforts toward control. It is often possible to take advantage of existing walls, roads or ditches for this purpose. In many cases it may be necessary to plow deep furrows across the line of march, around fields to be protected, or around an infested field to prevent the worms from going elsewhere. In such cases the furrow should be at least six inches deep, with the perpendicular or land side straight and clean and opposite the direction of approach of the worms. The furrow may soon fill with worms which can be killed by crushing or by sprinkling with kerosene. In some cases a log drawn back and forth in the furrow was found to be an excellent method of crushing the caterpillars. Deep holes, ten or fifteen feet apart, in the bottom of the furrow are an advantage, because the worms in their attempts to get out of the furrow will crawl along and collect in the holes, where a great many of them can be killed with a quart of kerosene. As with all other barriers, this furrow is not a permanent bar, but serves as a temporary check and as a line of attack where we can easily kill the worms which collect there. In some cases this may be done by crushing, in others by sprinkling with kerosene, or by covering with straw and burning, or by a combination of two or all three methods.

In some cases the worms when migrating from one field to another cover the ground so thoroughly and closely that they may be killed by sprinkling or spraying kerosene upon them. It has

been noticed that the worms will not cross a road which has just been treated with asphaltum oil. In a similar manner they may be deflected from their line of march by sprinkling kerosene or some heavier petroleum oil along the ground, or upon a windrow of hay or straw.

Poisoned Bait.—Army worms, like cut worms, will eat bran mash. To 25 pounds of wheat bran, add one pound of white arsenic or Paris green and mix thoroughly; then add two quarts of cheap molasses, the juice of lemons or oranges and enough water to make a fairly stiff mash which can be thinly scattered at dusk upon the ground. This method is well adapted to prevent damage in the vegetable garden and around the edges of the corn field but, of course, chickens must be kept away from it. Mr. W. J. Warner of Hebron was successful in saving his corn this year by plowing a deep furrow around the field and placing poisoned bran mash in the bottom of the furrow.

Spraying with Poison.—Strips of grass, grain or corn may be sprayed with Paris green or with lead arsenate (6 lbs. of the paste, or 3 lbs. dry, in 50 gallons of water) to kill the advancing worms which feed upon it. If surrounded by such a poisoned strip, uninfested fields may thus be protected.

Cultural Practices.—Fall plowing is usually advisable for the control of army worms. Even immediate plowing and thorough harrowing of badly infested fields will destroy many worms and pupæ by crushing, and by bringing them to the surface where birds can eat them. Grain, if nearly ready to cut when first attacked, may be saved by prompt harvesting, and carting it to a field not infested, to be cured. As soon as it has partially dried the worms will not eat the leaves or pedicels.

Literature.

The following list of references is not intended to be complete but only contains some of those most easily accessible articles which are thought to be of greatest value to Connecticut readers.

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EXPERIMENTS IN CONTROLLING THE WHITE PINE WEEVIL.

By B. H. Walden.

The white pine weevil continues to do much damage to the white pine plantations in the State. The only practicable remedy that we have been able to advise is to cut the infested leaders in early July before the adults emerge, and either burn them at once or store them in tight receptacles covered with wire netting, with a mesh of the right size to confine the weevils that emerge, and to allow any parasites that may be present to escape.

This treatment, where carried out over a considerable area for several years, will greatly reduce the number of weevils and consequently the amount of damage, as has been demonstrated in the white pine plantations of the state forest at Rainbow. Here the infested leaders are cut each season and stored in large garbage cans, the covers of which have large holes covered with wire netting. While no actual record has been kept, the amount of injury has rapidly decreased, especially during the past two or three seasons.

The objection to the above treatment is that a large number of the leaders will be destroyed during the period that the trees are most likely to be injured—when they are from three to fifteen feet in height.

The adult weevils hibernate throughout the winter and appear on the leaders early in spring, where they feed for about two weeks before laying their eggs. Any method that can be directed against the weevils at this time to prevent them from depositing their eggs is preferable, even though the cost is slightly more, to cutting the leaders after the injury has been done.

In the Eleventh Report of the State Entomologist, page 307, a note was published regarding the spraying of the leaders with either a poison or a repellant.

More extensive tests were made in 1912, using commercial lime-sulphur and lead arsenate. While the results obtained were not considered definite enough to publish, the indications were that either substance was of considerable value in preventing injury by the weevil, when sprayed upon the leaders before the eggs were deposited.

In large plantations it would be too expensive to follow this method of treatment, but in ornamental plantings, where expense is of minor importance, this treatment appears to be worth trying. Commericial lime-sulphur at the rate of one part in eight parts of water, has caused no injury to the pine foliage in our experiments.

Lead arsenate at the rate of six pounds of paste in fifty gallons of water, can also be used without injury.

Dr. E. P. Felt, State Entomologist of New York, in the *Tribune Farmer*, of August 7, 1913, recommended using a net having a diameter of about 15 inches, to collect the weevils on the pine leaders. "This work should begin in April, as soon as the weather is moderately warm, and be continued for several weeks at intervals of approximately a week or ten days. Practical work done this season shows that it is possible to make four collections from an acre of young pine at a cost of $1.28 an acre."

Experiments Against the White Pine Weevil in 1914.

During the past season experiments against the weevil were started in a block of about 3,000 young pines, in which the weevil first appeared in 1913, on the State plantation at Rainbow. This work must be continued a number of seasons before the results will be of value to publish.

Collecting the weevils with a net was tried at Rainbow, as well as in the State plantation at Portland. Nets were made having a diameter of sixteen inches, with a notch about three inches deep on one side, against which to strike the leader. After trying the nets it was found that a larger proportion of the weevils could be captured by placing the net well down on one side of the leader and rapping the opposite side of the leader above the net with a stick or lath. (See plate XVIII, a.)

The spring was backward and the first weevils were observed on May 6th. The results from collecting the weevils are as follows:

Rainbow.

The trees were from five to eight feet high, with no under-brush to obstruct the work. Five collections were made on the following dates,—May 8, 14, 21, 28 and June 3.

		Leaders Infested	
	No. Trees.	No.	Per cent.
Net used	337	9	2.64
Check	116	8	6.79

Portland.

The trees averaged somewhat taller than those at Rainbow, and were in thick under-brush, the conditions being decidedly unfavorable for using the net. Four collections were made,—May 15, 23, 29, and June 5.

		Leaders Infested	
	No. Trees.	No.	Per cent.
Net used	1,462	141	8.00
Check	1,009	191	18.91

While the figures in the above tables do not show striking results, the percentage of injured leaders where the net was used was less than half the percentage of those injured on the checks.

If the treated trees, next to the checks had been omitted in the count, the results in favor of the treatment would have been greater, as these trees were considerably injured by the weevils from the check trees.

Additional collections would have further reduced the injury, and our experience during the past season indicates that at least six collections could be made at an expense not to exceed $1.50 to $2.00 per acre.

EXPERIMENTS IN CONTROLLING A MITE (*TARSONEMUS PALLIDUS* BANKS.) INJURING SNAPDRAGON PLANTS IN THE GREENHOUSE.

By W. E. Britton, B. H. Walden and Quincy S. Lowry.

On January 5, 1914, Mr. Smith T. Bradley, a New Haven florist, brought to the Station some snapdragon plants from his greenhouses. The leaves were badly curled and his entire season's crop of bloom was threatened. An examination showed the plants to be quite badly infested with very small mites, which were identified later as *Tarsonemus pallidus* Banks, by Mr. Nathan Banks of the Bureau of Entomology.

Naturally Mr. Bradley wished to save his plants, and especially their crop of bloom, if possible. Knowing that these mites have an extremely primitive respiratory system, and that it is often difficult to control them satisfactorily by fumigating even with hydrocyanic acid gas, we resorted to sprays as a control measure.

As there seemed to be few or no accessible published records to guide us in controlling this pest, we arranged with Mr. Bradley to carry out some experiments in his greenhouse for this purpose. Consequently on January 7th, Messrs. Walden and Lowry made the first application.

The mites first appeared on the plants in the east bench, and consequently these plants were the worst infested. On some of them every shoot had curled leaves. All had been cut back, except 12 or 14 rows at the end near the entrance, which had been left as checks. On this bench adjoining the checks, 14 rows, containing 56 plants, were sprayed with the nicotine solution "Black Leaf 40," using 5 c.c. (1 teaspoonful) to 1 gallon of water, with naphtha soap added in the proportion of 4 lbs. to 100 gallons of water. The next section of 15 rows, containing 58 plants, was sprayed with "Fir-tree Oil" 6 fluid ounces in 2 gallons of water.

On the west bench the plants were from six to eight inches in height, and had not been cut back. These plants were less badly infested and the leaves were just beginning to curl from the attacks of the mites. Here 8 rows, containing 40 plants, were sprayed with "Black Leaf 40," using 5 c.c. (1 teaspoonful) in 1½ gallons (6 quarts) of water. At the further end and adjoining the plants just mentioned, 7 rows, containing 35 plants, were sprayed with "Fir-tree Oil" 4 fluid ounces in 2 gallons of water.

The spraying was done as thoroughly as possible with a compressed air hand outfit, as shown on plate XVIII, b. The west bench contained a few plants having shoots from 12 to 15 inches tall, which were difficult to cover. The stems were slender and the force of the spray bent them away, so that it was necessary to throw the spray from the opposite direction or from both sides of the bench, in order to drive the liquid into the whorl of leaves at the tips. It would be difficult to thoroughly spray large plants when in bloom.

The applications were repeated on January 14, 22 and 30.

More than half of the plants in the east bench died. Mr. Bradley considered it to be due to the shock of severe cutting back, together with too copius watering.

The plants were examined on February 6. There was no evidence of injury from any of the applications. Some of the checks on the east bench showed some curling from the attacks of the mites, but there was no mite injury to be seen on the sprayed plants on this bench. It was too early to detect any results from the treatment on the west bench.

On February 20, the plants were again examined. The treated plants from the east bench had been removed because so many had died from the causes mentioned. Some of the checks which had not been so severely cut back, remained and showed considerable curling from the mites.

On the west bench, on the portion treated with "Fir-tree Oil" 4 ounces in 2 gallons of water, only two or three stalks showed any evidence of mite injury to the new growth. Some of the plants

which showed curled leaves before treatment, made a clean growth afterward, as is shown on plate XIX, a.

The mites were still causing some injury where the less concentrated "Black Leaf 40" solution was applied, showing that this dilution was not wholly satisfactory for eradicating them. It is believed that the stronger mixture was effective for the purpose, though too many of the plants died to make the test conclusive. The "Black Leaf 40" solution with soap seemed to spread more uniformly, and to coat the foliage better than the "Fir-tree Oil," though the latter was fairly satisfactory in this respect, and was adopted by the owner for future use in controlling these mites.

Summary: Though the foregoing tests are not conclusive and further trials should be made, they present evidence, which may serve as a guide, that "Black Leaf 40" (1 teaspoonful in 1 gallon of water) with the addition of soap, and "Fir-tree Oil" (4 to 6 ounces in 2 gallons of water) will control this mite on snapdragons if four thorough applications in the form of a spray are made at intervals of about a week. On account of expense, the nicotine solution is to be preferred.

Other Plants Injured by *Tarsonemus pallidus*.

Chrysanthemum.

On November 12, 1912, Mr. H. B. Kirk, while inspecting imported nursery stock at a florist's in Bridgeport, was asked to examine some chrysanthemum blossoms which had withered and some of the petals had died and turned brown. Mr. Kirk brought blooms to the laboratory where they were examined by both botanists and entomologists. The only parasites found were very small mites at the base of the petals. The mites seemed to be the cause of the trouble, and were identified by Mr. Banks as *T. pallidus*. A note was published in the Report for 1912, page 296, regarding the matter. This form of trouble was again brought to our attention on October 27, 1914, when we received from Mr. John Coombs, Hartford, some freshly cut chrysanthemum flowers, which had likewise drooped, and some of the petals had withered and died. The same kind of mites were also found at the base of the petals.

In cases where the opening flower is infested it would seem to be a matter difficult to control; yet the mites are probably present elsewhere on the plant before the blossoms open. Perhaps a careful examination might reveal them around the buds or on the smaller leaves. If so, the proper treatment would be a thorough spraying with "Black Leaf 40" and soap, or with Fir-tree Oil, as described in the foregoing pages, just before the buds break open.

Cyclamen.

While inspecting imported nursery stock on the grounds of J. J. Goodwin, Hartford, on December 12, 1913, Mr. Lowry was shown some Cyclamen plants in the greenhouse which failed to bloom, and which had leaves and buds that were curled and considerably distorted by this same mite *T. pallidus*. On March 16, 1914, Cyclamen plants in a similar condition were received from Branford where they had been grown in a dwelling house. These plants were infested with mites which appeared to be the same species. The leaves were curled and rusty and the plants did not bloom. The owner was informed of the cause of the trouble and of the experiments at Mr. Bradley's, and we have received a recent report that the plants are in thrifty condition and as yet seem to be unaffected with the pest of last year.

Tarsonemus pallidus was originally described by Nathan Banks of the Bureau of Entomology, in Proceedings of the Entomological Society of Washington, Vol. IV, page 295, 1899. The type material was collected on the leaves of chrysanthemum in a greenhouse near Jamaica, N. Y., by Mr. F. A. Sirrine of the New York State Agricultural Experiment Station.

Several other species are known to live on the leaves of woody and herbaceous plants in Europe.

A TENT-CATERPILLAR EGG CONTEST.

The tent-caterpillar was unusually abundant in Connecticut in 1912 and even more so in 1913. For a complete account of this insect see Bulletin 177 of this Station, issued in August, 1913.

On account of the great abundance of this insect the Extension Service of the Connecticut Agricultural College at Storrs, arranged a contest for school children in collecting egg-clusters, the child securing the largest number before April 30, 1914, receiving $25.00.

The teacher whose school collected the largest number was given a scholarship valued at $25.00 in the summer school of the Connecticut Agricultural College. The Extension Department also offered a certificate of appreciation to the child making the highest score in each town.

Supervisors were appointed to look after the matter. All egg-clusters were brought to the teacher who credited each pupil with the number collected, and destroyed them.

In addition to these prizes, many individuals, granges, village improvement associations and schools offered prizes for the largest number collected locally. All of these agencies together induced the children to gather an enormous number of egg-clusters. I have recently been informed by the Extension Service of the Connecticut Agricultural College that more than 10,000,000 egg-masses were destroyed according to their records. As a matter of fact, none were counted unless a child secured more than 3,000.

Besides the inducement to collect egg-clusters the *Hartford Courant* offered prizes in three series for the best essays by school children on different phases of the life history of the tent-caterpillar and damage caused by it, or on their experiences in working for the prizes. The State Entomologist acted as judge in one of these literary contests. The best essays and the pictures of the winners were afterward published in the *Courant*. All such efforts, of course, help educate the people and would seem to have an important influence on the control of any pest. Yet in spite of these efforts, the caterpillars were exceedingly abundant over large areas of the State. Their nests fairly covered certain apple and wild cherry trees in some parts of the State, particularly in Newtown, Stonington, Waterbury and along the Naugatuck Valley.

Many caterpillars died from a wilt disease and were found stuck to fences, stone walls, and the trunks of trees. On June 5, the writer visited Stonington, and on North Main Street saw the fully grown caterpillars crawling along the sidewalks, swarming on tree trunks, on fences and walls. A wire fence supported by wood posts had from ten to fifteen caterpillars on every post. They were seeking a place to pupate. From the high percentage of parasitization it surely seems as though the pest would soon begin to subside.

MOSQUITO WORK IN CONNECTICUT IN 1914.

In the Report of this Station for 1912, page 270, will be found an account of the great amount of mosquito drainage work done that year in Connecticut, amounting to about 2,700 acres at a cost of about $26,000. In 1913, less work was done, and a record of this may be found in the Report for that year, page 242. The chief reason that less work was done may be explained by the fact that many waited for the action of the legislature, expecting that the much needed State supervision would be provided. Though the House and Senate passed the measure with the appropriation cut to $10,000.00, the bill was vetoed by Governor Baldwin after the Legislature adjourned. It was then too late to plan and finance much new work. Nevertheless, some permanent work was done and the ditches previously cut in each town were maintained.

GREENWICH.

In the town of Greenwich, where the chief problem was of an inland nature and concerned with the malarial mosquito, a contract was let to the United States Drainage and Irrigation Co., of New York, N. Y., to overcome by draining, filling, etc., all mosquito breeding places in the southern portion of the town extending back one mile from the coast to a line running parallel with the northern border of the town. This work was done in the summer and fall of 1913, but not completed until winter. This work has been mentioned on page 118 of this Report, as the State Entomologist was called to act as arbitrator, on account of a disagreement between the local health officer and the contractor. A settlement was finally effected, and the writer has since learned upon good authority that where cases of malaria were formerly very numerous, being unofficially estimated as high as 900 in a season, up to September in 1914 there were only 36 cases of which only 15 were new ones. This tremendous decrease in malaria is generally ascribed to the drainage work, and most of the people are enthusiastic over it. It is needless to state that the work will be maintained, and a number of covered tile drains will be installed next year to prevent the breeding of malarial mosquitoes in the now open ditches which constantly contain water, many of them being fed by springs.

Madison.

A tract of 250 acres at Hammonassett Point in the town of Madison, owned by the Winchester Repeating Arms Co., of New Haven, and used as a testing ground and as a source of salt hay which is used for packing, was drained in the summer of 1914. This work was also done under contract by the United States Drainage and Irrigation Co. Before it was completed owners of adjacent marsh land decided to have their land drained at the same time, so that in all about 310 acres of salt marsh were drained and the breeding grounds of salt marsh mosquitoes in the State were diminished to that extent.

New Haven.

No new drainage contracts were let in New Haven in 1914, but by means of an item of $3,000.00 for the purpose in the city budget, the Board of Park Commissioners were able to clean out the old ditches and cut several new ones in the meadows in Edgewood Park and Beaver Ponds Park, thus greatly improving mosquito conditions in these localities.

Two dump breeding areas, one in Beaver Swamp between Henry and Munson Streets, and the other in Mill River Meadows just above the State Street bridge, have now been acquired by the city and will be cleaned and made parts of the park system.

The Anti-Mosquito Committee of the Civic Federation made no general effort to raise funds for mosquito work in 1914, but an unexpended balance enabled it to maintain the ditches cut in 1912. Mr. James E. Hitchcock, a high school student employed on the work both in 1912 and in 1913, was employed during his summer vacation. He patrolled the ditches on the salt marsh after each high tide and removed obstacles.

The ditches are often filled by hay-makers who wish to drive across; and they always leave the sods in the ditches, thus forming a mosquito breeding area. Mr. Hitchcock remedied several such defects; the remainder of his time was spent in scouting for breeding places, in looking up records of the ownership of land where mosquitoes breed, and in placing evidence in the hands of health officers. The law (Chapter 143, of Public Acts of 1913) declares all such mosquito breeding places a public nuisance and makes it the duty of the health officer to cause such nuisances to be abolished or abated.

One important improvement is the new tide gate on Morris Creek, between South End Road and Lighthouse Point, which was installed late in 1914. This prevents the flooding of the meadows at Morris Cove, ditched in 1912, except by fresh water, and should prove a great benefit, not only from the anti-mosquito standpoint but also to the owners of the land.

West River.

In August it was found that West River, which was such a prolific breeding place of *Culex pipiens* Linn, in 1913 was also furnishing a lesser number in 1914. This matter was reported to the local board of health, and at a meeting of the board the State Entomologist was called in conference with some of the factory owners chiefly responsible for the pollution of the stream. It is on account of this pollution which kills or drives away the fish, that the river is a mosquito breeding place. It was arranged that the factory owners equally contribute money to defray the cost of oiling and that Mr. Hitchcock should be furnished by the Civic Federation to take charge of the work. Consequently the stream was oiled once about the middle of August, at a cost of $102.35. Cooler weather followed with heavy rains in October so that it was unnecessary to oil again.

It is expected that a sewer will soon be installed in this section to take care of the refuse from the factories, thus removing the pollution from the stream which can then be restocked with fish and no more be a breeding place and a public nuisance.

CATERPILLARS FEEDING ON GREENBRIAR.

On August 29, 1912, caterpillars of a noctuid moth were received from Mr. T. I. Coe, of Kidd's Island, off Stony Creek, Branford, where they were feeding on the wild *Smilax* or "greenbriar" *Smilax rotundifolia.* Mr. Coe wrote, "I am sending you herewith several specimens of a worm which came to my notice for the first time this morning. A careful search of the foliage revealed dozens of the worms ranging in size from one-fourth to one and one-fourth inches. They were usually found in clusters on the stems of the vines or on the underside of the leaves. Though I have been a summer resident on this Island, one of 'The Thimbles,' for ten years and have noticed many varieties of

interesting insects, etc., I have not seen the accompanying species before, and its presence in apparently large numbers leads me to wonder if it is something we should endeavor to exterminate."

As we did not recognize the caterpillars and the material was rather scanty, we asked Mr. Coe to send more. This arrived August 31, and though we gave it the best of care, did not succeed in obtaining any adult moths. Consequently again August 7, 1913, we wrote to Mr. Coe for additional material which reached the laboratory September 13, 1913. From this lot of caterpillars there emerged on June 18 and 22, 1914, two moths which proved to be *Hadena turbulenta* Hubn.

The caterpillars are characteristically and strikingly marked and are well shown on Plate XII, d. The following description was made at the time the first lot of caterpillars were received in 1912:

Length 30 mm. (1 1/5 inch) thickness 4 mm. Dorsal surface extending laterally to spiracles, striped longitudinally with narrow yellow and black lines of equal width. First and anal segments have markings of a striking and peculiar pattern shown in the illustration. Lateral view shows below spiracles a ground color of light yellow with longitudinal orange stripes. Ventral surface yellow. Head black, shining, face with a $\wedge$-shaped indentation all black. Legs black outside, marked with yellow inside. Tips of pro-legs black, bases yellow. Smooth throughout, no tubercles or hairs.

The cervical shield is also black, with a narrow rear margin and a front marginal row of spots which are yellow. The anal extremity is also black above, with spots of yellow arranged as shown in the illustration.

The adult is a light brown moth, with fore-wings marked with darker brown and having a wing-spread of about one and one-fourth inches, shown on plate XII, c.

This species is listed in "Insects of New Jersey" by J. B. Smith, as occurring "throughout the State, local; larva gregarious on 'Smilax'-greenbriar and horse nettle."

Though the greenbriar is generally considered a nuisance and insects feeding upon it would hardly be called injurious, there are places where the owners wish to preserve the native plant growth and in such places this insect might be called a pest. On account of its striking appearance it is mentioned here. Spraying with lead arsenate would, of course, destroy the caterpillars and thus prevent defoliation of the vines.

TEST OF A COMMERCIAL PREPARATION TO PROTECT SEED CORN.

By W. E. Britton and Quincy S. Lowry.

This preparation sold under the name of "Corbin" was stated on the label to be "a protection for seed grain, for corn, wheat, barley, white beans, etc. Use 1 pint of Corbin to 3½ bushels of seed. Do not mix Corbin with water. Price, 75 cents per pint. Use enough Corbin to cover seeds with a brown coating." This is apparently a coal tar preparation dark brown in color, and with a coal tar odor.

On May 18, 1914, three pints of seed corn were treated with Corbin, and planted in hills, each containing four seeds. The treated seeds were planted in every second row, the intervening alternate rows being planted in the same way with untreated seed of the same variety. There were ten rows of each.

On June 1, plants from the seed treated with "Corbin" were much smaller than those from the untreated seed. There was apparently no particular injury from seed maggots or wire worms. A careful count was made of the plants on this date. The treated seed gave an average stand of 3.03 instead of four plants per hill; the untreated seed gave an average stand of 3.74 plants per hill. A difference in size of plants could be noticed for several weeks.

In order to make sure that the coating retarded or otherwise affected the germination of the seed, laboratory tests were made later by an assistant in the botanical department with the seed testing apparatus. Of the untreated seed, 95.5 per cent. germinated within one week, while the seeds treated with "Corbin" showed a comparatively low percentage. Thinking that the treatment retarded germination only, the treated seeds were allowed to remain in the apparatus for one month, at the end of which time only 53 per cent. had germinated.

Even though this preparation does protect seed against injury from seed maggots, wire worms, squirrels and crows, it appears to reduce the percentage of germination, and also to retard development where the vitality is not impaired, to such an extent that its value is questionable.

ENTOMOLOGICAL FEATURES OF 1914.

The winter of 1913-1914 was marked by long periods of low temperature, the mercury several times dropping a number of points below zero in New Haven and going much lower inland. Peach buds were killed, except the hardiest varieties, and for a strip along the coast. The severe winter might be expected to destroy some forms, at least, of insect life, and so we made observations to see if the absence of any injurious species could be attributed to the severity of the winter.

The spring was late and when the leaves unfolded it was seen that canker worms and tent-caterpillars were as abundant as in other seasons. Green and rosy aphids were also present and considerable damage may be charged up against them.

Rainfall was heavy in May and June, but a severe drought occurred in August and September.

There was the usual amount of damage from cutworms and wire-worms. The Colorado potato beetle was scarce, but the reason, we believe, was due not to the weather but chiefly to the abundance of its dipterous parasite *Doryphorophaga* (*Phorocera*) *doryphoræ* which was so common in 1913.

The winter nests of the brown-tail moth were unusually small, and many of them did not contain any living caterpillars in the spring. This may have been caused by the weather, but that point has not been determined. As a result the nests are few this winter, though they are scattered about as widely as usual and the insect has continued to spread toward the west.

Probably the chief entomological feature of the season, was the gypsy moth invasion, described on page 133. Next in importance is the army worm outbreak, described on page 157.

Grasshoppers were not especially prominent, and certainly did not cause notable injury as was the case in New York State where poisoned bait was used to control them.

Hickory trees have continued to die and in most cases the hickory bark borer is apparently responsible for their death.

The elm leaf beetle, which for many years has defoliated the elm trees near the sea level, has now become destructive at the higher altitudes, and in 1914 did more damage in such towns as Winsted, Norfolk, Canaan, Salisbury, Falls Village and West Cornwall than near the coast. People in these places are now adopting control measures for the first time.

MISCELLANEOUS INSECT NOTES.

Pink Grasshoppers.—On September 21, two pink grasshoppers or more properly angular-winged Katydids were sent to the Station from Derby. These belong to the species *Scudderia furcata* Bruner. Though usually bright green, occasionally bright pink individuals are found, and several such captures are on record.

Abundance of Polygonia interrogationis on Elm.—The spiny brown caterpillars of this species were unusually common on elm in 1914, stripping branches and small trees. Hop, hackberry, nettle and linden are other food plants. The adult is known as the "violet tip" or "interrogation point butterfly" and is common on ripe fruits in autumn. It hibernates as an adult. (See plate XXIII).

Cherry or Pear Slug.—The cherry or pear slug *Caliroa limacina* Retz., occasionally does damage late in the season by eating the green tissue from the upper surface of the leaf often ruining it. In one of the nurseries, at inspection time, a block of pear stock had been attacked and on some of the young trees the leaves were ruined. Spraying with lead arsenate or hellebore will prevent this injury.

Rare Lady Beetles in Connecticut.—Since the publication of Bulletin 181, Some Common Lady Beetles of Connecticut, Mr. I. W. Davis has collected three specimens of *Harmonia similis* Rand, and four specimens of a northern form new to our list, *Anisocalvia 12-maculata* Gebl. The latter was known to occur in British Columbia, Minnesota, Michigan, New Hampshire, Utah, and possibly Northern New York State, but according to C. W. Leng, has never before been taken so far south as Connecticut.

The Tulip Tree Scale.—The tulip tree scale *Toumeyella liriodendri* Gmel., which was mentioned in the Report of this Station for 1912, page 294, is abundant and attracting attention. This year specimens were received from Killingworth, Deep River, Middletown, East Hartford, New London, Lyme and Ridgefield. Since publishing the note mentioned above, we have heard of certain cases of injury where the tulip tree was sprayed with mis-

cible oils. Spraying the dormant trees with lime-sulphur as for San José Scale is perhaps the best control measure.

The Strawberry White Fly.—On September 5, 1914, strawberry plants were received from Branford, which were quite badly infested with the strawberry white fly *Asterochiton* (*Aleyrodes*) *packardi* Morrill. Eggs, larvæ and adults were abundant on the underside of the leaves.

This insect is occasionally destructive, and the writer observed it in a strawberry field in West Hartford, June 30, 1905. In some cases in small garden plantations it may be possible to underspray the leaves with "Black Leaf 40" and soap to kill the adults and larvæ. Where large areas are infested this treatment would be impracticable and burning over the field in the fall would be the best method of destroying the pest.

The Chinch Bug.—Though causing great damage to grass, grain and other crops in the middle west, the chinch bug *Blissus leucopterus* Say, is seldom troublesome in Connecticut. It occurs here, however, as there are a number of specimens in the Station collection taken in New Haven and Orange. The late Dr. J. B. Smith in his list of the insects of New Jersey, states that it is a rare insect in that State and that its scarcity is due to climate and not to any particular parasites or other natural enemies. On September 5, the Director of this Station, brought in some specimens from Bristol, where they were found on some brown spots on a lawn. It is uncertain whether or not they were responsible for killing the grass in these small areas.

The Saddle-Back Caterpillar.—Each year the saddle-back caterpillar *Sibine stimulea* S. & A. is sent to the Station with requests for information regarding its status as a pest. We always run across these curious caterpillars when inspecting nurseries. They have a varied food plant list and we may expect to find them on almost any plant. The name comes from the characteristic markings of the larva, which is shown on plate XXIV, b. The four branched spines will cause an intense stinging and itching sensation when brought in contact with the human skin. The adult is a reddish brown moth with a wing-spread of about one and one-half inches.

The Hickory Leaf Stem Gall Louse.—Each summer hickory trees in Connecticut shed many of their leaves in June on account of the hickory leaf stem gall louse *Phylloxera caryæcaulis* Fitch. This insect makes galls on the petioles of the compound leaves and the stems often break off at the point where the galls occur. The presence of the galls and the fact that the stem breaks off leaving a portion on the tree, distinguishes this trouble from that caused by the hickory bark borer, where the entire compound leaf and petiole fall, the stem showing that it has been eaten at the base. There seems to be no practicable remedy.

Injury by Bill Bugs.—These insects cause much damage to young corn in the Middle and Southern States, by eating into the upper part of the stem. As the plant grows and the leaves unroll a row of holes across the blade is apparent. The blade often breaks over at this point. There are several species responsible for such injury all being snout bettles, weevils, or curculios of the genus *Sphenophorus*.

On June 15, specimens of *Sphenophorus sculptilis* Uhler, were received from Woodbury, together with some of the soil and several plants with leaves perforated in the manner described. Most of these bill-bugs breed in the roots of sedges and rushes in meadows, and it is well not to plant corn near such a place. Except for crop rotation, there is no other control measure known.

The Four-Lined Leaf Bug.—A number of samples of this insect and its injury are received each year. It attacks currants, gooseberries, parsnip, sage, mint, rose, dahlia, and many other plants. Slingerland* gives a list of fifty-seven kinds of plants, and common weeds. The injury is caused by sucking out the sap from the young terminal leaves, causing the formation of brown depressed spots. Later these leaves often become brown and dry. The four-lined leaf-bug, *Pœcilocapsus lineatus* Fabr., is rather more than one-fourth of an inch in length, bright yellowish green, marked above with four black longitudinal stripes. The eggs are laid in the stems of the plants and remain here through the winter, hatching late in May and early in June. The bugs become mature about the middle of June and remain and cause injury for about a month. Spraying with "Black Leaf 40" 1 teaspoonful in 1 gallon

* Bulletin 58, Cornell University Agr. Expt. Station, 1893.

of water with a little soap is the best remedy. This bug and its injury to currant leaves are shown on plate XX, b.

The Grape Plume Moth.—Every year in May and June, nearly all grape vines are infested by small spiny green larvæ which spin webs drawing together the new leaves at the tip of each terminal shoot. There is one larva in each nest thus formed and it feeds on the leaves inside. (See plate XXIV, a.)

Many samples and inquiries are received regarding this insect. As a matter of fact the injury is more apparent than real. The end of the shoot is seldom eaten, and therefore, the growth is hardly checked. Smith* states that "they do no real injury in most cases because as a rule they spin up the tip beyond the blossom cluster." On arbors the vines are rendered unsightly by its attacks, and remedies are sought. As the insect remains wholly inside the nest of folded leaves there is no way of reaching it by spraying. In large vineyards no remedial treatment is attempted. In the home garden, the simplest method is to crush each larva by pinching its nest with the thumb and forefinger.

The grape plume moth, *Oxyptilus periscelidactylus* Fitch, belongs to the lepidopterous family Pterophoridæ, the moths having the wings split into separate plumes or feathers.

The Colorado Potato Beetle and Zinc Arsenite.—The Colorado Potato Beetle was unusually scarce in most Connecticut potato fields in 1914. In fact some growers did not find it neceassry to use poison at all on their potatoes.

This scarcity may be partly explained by the fact that nearly all adults and larvæ noticed and collected by members of this department in 1913 bore the white eggs of Tachinid flies. Adult flies were reared from parasitized larvæ and were kindly identified by Mr. Harrison E. Smith as *Doryphorophaga* (*Phorocera*) *doryphorae* Riley.

At the Station farm in 1914, the potatoes were sprayed only once, on June 25, with poison. On most of the field lead arsenate was used but on ten rows on the west side powdered zinc arsenite was applied. The spraying was done by Messrs. Stoddard and Graham of the botanical department. No particular difference could be seen in the results of the application of the two poisons.

* Insects of New Jersey, page 536, 1909.

Both killed the larvæ satisfactorily, and there was no injury to the foliage.

Curious Pupæ of an Unfamiliar Fly.—On May 20, 1914, some curious specimens of an unfamiliar insect were received from Wallingford, Conn., with a statement that they were found close to the crowns of strawberry plants. The correspondent wished to know what they were, what harm they did, and how to get rid of them. We could not give this information, but acknowledged the receipt of the letter and specimens, placed the latter in a breeding cage in the insectary and on June 1 obtained an adult two-winged fly. Another emerged June 15th. The material was kindly identified by Mr. C. W. Johnson as *Macrosargus cuprarius* Linn., supposedly a European species which during the last few years has been found to be rather abundant and widely distributed in the United States.

The pupæ were gray, about 10 mm. long, nearly 3 mm. broad and less than 2 mm. thick. The lateral margins are nearly parallel for about three-fourths of the length from the anal extremity, then taper toward the head which is narrow, elongated, with a hemispherical projection on each side resembling an eye. The segmentation is prominent throughout.

The Walnut Caterpillar.—Occasionally the Walnut Caterpillar *Datana integerrima* G. & R. is abundant in Connecticut and is found in clusters on black walnut, butternut or hickory trees stripping them. (See plate XIX, b.)

On August 12, nearly a pint of the caterpillars were brought to the Station from North Haven, where they were gathered from the trunk of a tree. The larvæ have this habit of resting in clusters on the trunk or under side of the branches like a piece of gray fur. The full grown caterpillar is slightly less than two inches in length, body black and covered with long whitish hairs, head black and shiny. The adult is a light reddish brown moth with wings marked transversely with lighter and darker bands and lines. It has a wing-spread of nearly two inches, and closely resembles the moth of *D. ministra* Dru., the adult of the yellow-necked caterpillar of the apple.

Leaf Hopper Injuring Japanese Barberry.—On July 23 two badly crushed specimens of a large leaf hopper were received from Mr.

W. A. Muirhead, Superintendant of Trees, City of Hartford, accompanied by a statement that they were injuring Japanese barberry. Mr. Walden who was then in charge of the office during the vacation of the writer, identified the leaf hoppers as belonging to the genus *Gypona*, but they were too badly crushed for specific recognition. At the writer's request Mr. Muirhead sent more material. Some of this was sent to Prof. Herbert Osborn one of our leading authorities on this group, who identified the species as *Gypona flavilineata* Fitch. Mr. Muirhead was advised to spray with a nicotine solution. This he did and under date of July 27, wrote that he had tried Black Leaf 40, 1 pint in 100 gallons water, but that it seemed to have but little effect. The leaf hoppers at this time were about mature and probably needed a more concentrated solution. Perhaps earlier in the season it might prove effective on the nymphs.

Controlling Green Apple Aphis.—Late in July it was noticed that the apple trees in the young orchard at the Station farm at Mt. Carmel were badly infested with the green apple aphid, *Aphis pomi* Deg. The trees were set in the spring of 1910. The lice were nearly all on the leaves and stems of the terminal shoots, and the leaves were more or less curled. Though the trees had made nearly all their growth for the season, it was thought best to destroy the aphids. Consequently Messrs. Lowry and Zappe on July 25, 30 and 31 dipped the ends of the branches in a pail of liquid to kill the aphids. Beginning on the south side the rows running east and west were treated as follows:

Rows 1 to 6. Pratt's nicotine, 1 teaspoonful in 3 quarts of water, with soft soap.
Rows 6 to 9. Imp Soap, 1 pint in 14 quarts of water.
Rows 9 to 17. Black Leaf 40, 1 teaspoonful in 1 gallon of water.

The trees were carefully examined August 6. Only a few living aphids were found on rows 1 to 6. None were found on any of the other rows. On small trees dipping is far more effective than spraying, and this trial shows that by this treatment the aphis can be controlled at least on small trees.

Mites on California Privet.—California privet is seldom injured by mites and it is doubtful if any species has heretofore been recorded from it unless, possibly "red spider." A short hedge of

this plant growing in the writer's garden was attacked early in the summer of 1914 by a mite which Mr. Nathan Banks has kindly identified as belonging to the genus *Phyllocoptes*. Apparently it is a new species.

Nothing unusual was noticed on this hedge in 1913, but the present season, the first growth had peculiar slender shoots with the narrow leaves curled backward. On examining them with a hand lens, the under side of each leaf was found to be literally covered with very small, elongated, crawling mites. Previous to July 1st, apparently all terminal shoots on this hedge bore infested and curled leaves. The hedge was allowed to remain without trimming or spraying. The writer returned from a vacation late in July, when the hedge presented a changed appearance as a number of the stronger shoots were normal and the mites had then disappeared from all of the leaves.

Harlequin Cabbage Bug in Connecticut.—The first and only record which we have of this insect occurring in Connecticut, is a single specimen collected at Meriden, July 4, 1910, by Mr. Harry Johnson. Mr. Walden visited Meriden and looked over Mr. Johnson's collection and saw this specimen and obtained it for the Station collection.

In the Southern states the Harlequin Cabbage Bug *Murgantia histrionica* Hahn, is an important cabbage pest. In the "Insects of New Jersey" Smith states that this southern species under certain conditions extends into New Jersey and has been taken as far north as Morris County which is in the latitude of New York City.

In a recent letter Mr. F. A. Sirrine informs the writer that he has not seen the Harlequin Cabbage Bug on Long Island since 1894, and that it has never done any harm there. This being the case one need hardly expect it to become a pest in Connecticut.

The most important control measures are cleaning up and destroying all cabbage refuse in the fall and planting early in the spring trap crops of kale or mustard upon which the young bugs may be killed by a spray of kerosene emulsion.

European Pine Shoot Moth.—On August 10 Mr. August Busck of the Bureau of Entomology called at the office and stated that he happened to be in Connecticut and was looking about to see if he could find the European Pine Shoot Moth present; that it had evidently been introduced into this country from Europe and was

abundant on Long Island. This insect attacks the Scotch, Mugho and probably some other species of pines in Europe. On Long Island Scotch pines were attacked. The writer understood that Mr. Busck did find it in Connecticut. Mr. Busck published an article calling attention to this insect in Journal of Economic Entomology for August, page 340. The larvæ pass the winter in holes eaten in the buds and in the spring begin to feed upon the growing buds often feeding upon one side only causing a curved growth.

The adults reared from the Long Island material enabled Mr. Busck to readily identify the species as *Evetria buoliana* Schiff, one of the small Tortricid moths closely related to the Nantucket Pine Moth which has caused so much damage.

It it yet too early to recommend control measures for this insect but all growers of pine trees should be on the watch and should report at once to this office sending specimens in case any are found.

The Oak Pruner.—A number of complaints are received each year of damage to shade trees by a borer in the twigs which causes them to break off and fall in midsummer. The oak is the tree most commonly attacked, but maple, apple and other trees are sometimes injured. During 1914 this form of injury has been sent to the Station from Fairfield, Middletown, Milford, New Haven Salisbury and South Killingly. The insect causing this trouble is a long-horned or Cerambycid beetle *Elaphidion villosum* Fabr.

According to Chittenden* this insect is found from New England through the eastern United States westward to Michigan and as far south as North Carolina and Texas. The egg is laid on a small twig in early summer. The minute larva tunnels in the wood under the bark following the grain toward the base of the branch. When nearly full grown it cuts the branch nearly off. This breaks in the first strong wind and falls to the ground with the insect in the severed portion. The larva withdraws into its burrow and plugs the opening with sawdust, then pupates and the adult beetle appears the following spring.

The injury is usually not serious, but the litter on a lawn soon becomes a nuisance. As the borers fall with the twigs, collecting and burning them will help as a control measure. This is the only

* Bureau of Entomology Circular 130, 1910.

treatment to be recommended, and if carried out generally and thoroughly will result in diminishing the number of pruners the following season.

Abundance and Control of Pear Psylla.—In many pear orchards in 1914, especially where the dormant trees were not sprayed with lime-sulphur, the pear psylla did considerable damage, causing some of the leaves to fall in July and on the remaining leaves and on the fruit which was covered with "honey dew" the black mold grew abundantly, giving it the appearance of having been sprinkled with soot. The sooty appearance at harvest time, of course, renders the fruit unsalable and for this reason several growers wished to spray in July or early in August to clean up the fruit. Mr. W. F. Platt of Milford, is one of the fruit growers who sprayed about August 1st with "Black Leaf 40" one-half pint in 50 gallons of water. Mr. Platt was well satisfied with the treatment as it seemed to kill the insects and to clean up the fruit.

In order to test the effect of this mixture on the pear psylla, Mr. Zappe sprayed portions of a large pear tree on the Station grounds. One branch was treated with the "Black Leaf 40", 1 pint in 50 gallons of water containing soap, and another branch with the same preparation, ½ pint in 50 gallons. There were many adults on the branches at the time of the treatment. Most of them flew into the air but were hit with the spray and brought down. A white cloth was spread under the tree and caught all that fell upon it. It was thought that possibly the psyllids were stupefied by the spray and that they might recover. This cloth was, therefore, brought into the laboratory and watched. Apparently not a single psylla recovered or showed any signs of life after being hit with the weaker nicotine solution.

The Stalk Borer.—The stems of herbaceous plants are often attacked by a larva which tunnels up and down in the pith, causing the stem to wilt and die. Though there are several species thus attacking different plants, one of the commonest is called the Stalk Borer, *Papaipema nitela* Guen., formerly *Gortyna nitela*. This species is also a general feeder and is known to attack many native weeds and such cultivated plants as corn, potato, tomato, aster, lily, dahlia and many others. In 1914, stalk borers were abundant and there was much injury, especially to dahlias. The larva enters the stem and is seldom noticed until the leaves at the

top begin to droop. Then a careful inspection will show that a borer is at work in the stem. By cutting a slit lengthwise of the stem it is possible to kill the borer without greatly injuring the plant. As a rule, however, so much eating has been done before the pest is found that the shoot does not recover and blossoms can be obtained only from axillary branches which grow afterward. The larva is about an inch long, dirty white striped longitudinally with yellowish-brown stripes with a brown girdle covering three or four segments back of the true legs. The adult of the stalk borer is a Noctuid moth having a wing-spread of about one and one-half inches, and gray in color with a cluster of conspicuous white and yellow dots near the center of each fore wing.

This insect and its work has been received in 1914 from Mystic and New Haven in dahlia, from Pomfret in corn, and from Simsbury in tobacco.

There are some species of the genus *Papaipema* which feed only in the stems of certain plants, and Mr. Henry Bird of Rye, N. Y., has bred and described a number which proved new to science.

Injury to Geraniums by White Ants.—On May 23, a Hartford florist wrote to this office describing a trouble of bedding geraniums (*Pelargonium zonale* or other species) in the field of a customer at New Rochelle, N. Y. More than 200 plants had been ruined by some insect which tunneled out the inside of each stem and main root. The plants, of course, soon turned yellow, wilted and died.

From the description we failed to recognize the trouble, and advised to have the customer send specimens if possible. In due time, about July 1, we received from New Rochelle, a stem from one of these plants together with some of the soil in which it was grown. In the stem and in the soil there were a few immature termites or white ants, probably belonging to the genus *Termes*, which undoubtedly were the cause of the trouble. They had devoured the entire inner portion of the stem leaving only a thin outer layer of the woody tissue and bark.

Termes flavipes Kollar is our commonest species and often breeds in woodwork near the ground, such as fence posts, bridges, trestles, buildings, etc. We have found it in old stumps, in the board walks of greenhouses, and in the strips of wood along the edges of tar walks. One winter they were quite abundant in the Station greenhouse. The writer observed swarms of them a few

years ago emerging from the board strips along the sidewalk on Church Street, New Haven, next to the "Green."

At New Rochelle, however, the white ants could not be traced to any woodwork but seemed to be all through the soil. They may, therefore, belong to a different species, but as our material was immature we could not identify it. There are several destructive kinds in the tropics and at least six species in the Southern United States.

On a visit to the Bussey Institution, Forest Hills, Mass., July 7, I was shown a geranium stem which had been hollowed out by white ants in exactly the same manner as those from New Rochelle.

A possible remedy is carbon disulphide used in the soil as for ordinary ants, but many tests must be made before any treatment can be recommended.

False Apple Red Bug in Connecticut.—For three seasons at least, red bugs have been present and caused considerable damage in the apple orchards at Conyers Manor, Greenwich, Conn. We did not see specimens of the insects responsible for the damage, nor visit the orchard, until August, 1914, too late to find the bugs at work. The species was not identified.

During June, 1914, Mr. Zappe discovered some red bugs at work on the leaves of some small apple trees planted in nursery rows on the Station grounds. These trees bore no fruit but the leaves had been curled, red-spotted, and distorted by the bugs as shown on plate XX, a. The species causing the trouble seemed to be the false red bug *Lygidea mendax* Reut., and this identification was later confirmed by Mr. O. Heidemann of the U. S. National Museum at Washington, D. C. This insect is shown on plate XX, a.

There are two similar species injuring apple, the red bug *Heterocordylus malinus* Reut., and the false red bug *Lygidea mendax* Reut. Both belong to the family Capsidæ. Not only do these two species look much alike to the untrained observer but they cause similar damage to the fruit and foliage, by sucking out the sap. Their punctures in the young fruit cause it to devolop unevenly resulting in irregular or gnarled fruit, and the leaves are also curled and distorted by them.

Both species were described by the late Doctor O. M. Reuter of Helsingfors, Finland, in *Acta Soc. Sci. Fennicæ* XXXVI, pp. 47, 71, 1909. The best economic account of these insects may be

found in Bulletin 291 of the Cornell University Agricultural Experiment Station, by C. R. Crosby, published under date of January, 1911.

Any one noticing the presence of red bugs in 1915, or the injury caused by them, should communicate with the State Entomologist.

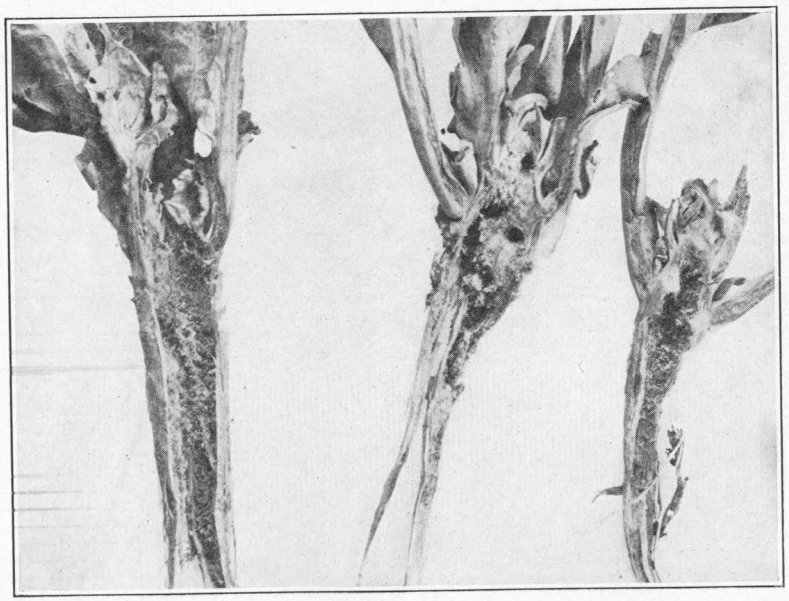
Mr. Crosby found in New York State that red bugs could be controlled by thoroughly spraying with "Black Leaf 40", ½ pint in 50 gallons of water, to which about 2 pounds of soap has been added. This nicotine solution may be used in combination with lead arsenate, lime-sulphur, or Bordeaux mixture in the regular spray treatment. Soap is hardly necessary when the nicotine is used thus in combination.

The Hickory Bark Borer.—In the Report for 1913, page 237, is an account of the hickory trees dying on the Station grounds and elsewhere in the vicinity. It is true that following a severe drought a few trees died and that we could find few bark beetles present—not nearly enough to have caused their death. On the other hand, sections of the trees were placed in breeding cages and all insects emerging from the wood or bark were caught and saved. A considerable number of weevils *Magdalis olyra* Hbst., were bred from these trees.

Other trees did not put out leaves in the spring of 1914 and most of these showed abundant evidence of the attacks of the hickory bark borer *Scolytus quadrispinosus* Say., and were removed. Late in June several trees which had previously appeared healthy began to drop their leaves which had been eaten partially off at the base by the adult beetles. On July 3, these trees were thoroughly sprayed with powdered lead arsenate, 4 pounds in 50 gallons of water. It was rather late for the treatment anyway and there was not much opportunity to observe the result. Many leaves had been eaten partially off before the spraying and continued to break and fall for sometime afterward. Nevertheless more fresh leaves dropped from an unsprayed tree nearby than fell from the sprayed trees. This insect and its work are shown on plates XXI and XXII.

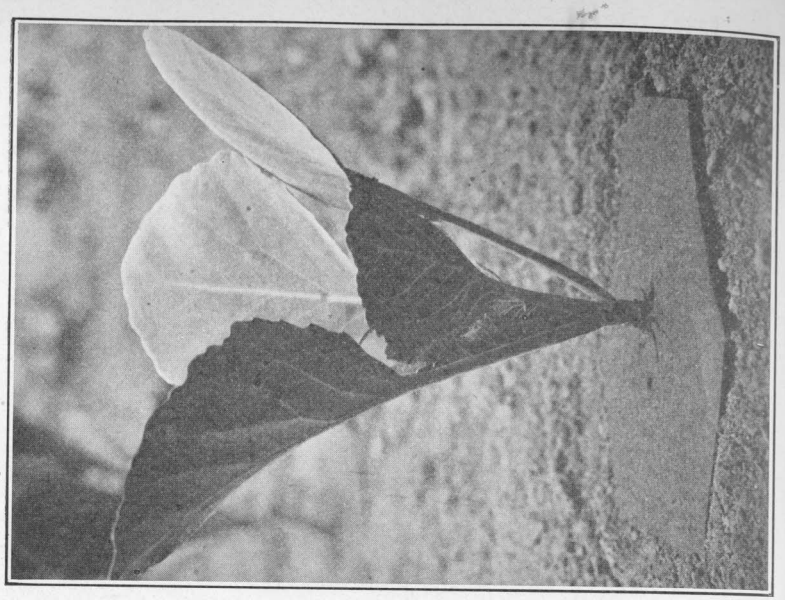
Particularly where lead arsenate and "Black Leaf 40" were used dead beetles were found on the tar walk underneath the trees on July 5, and a few were observed each time we looked for them until about the first of August. Next year we shall spray again at least a month earlier in the season.

a. View in Field showing an Infested Plant among Healthy Ones.

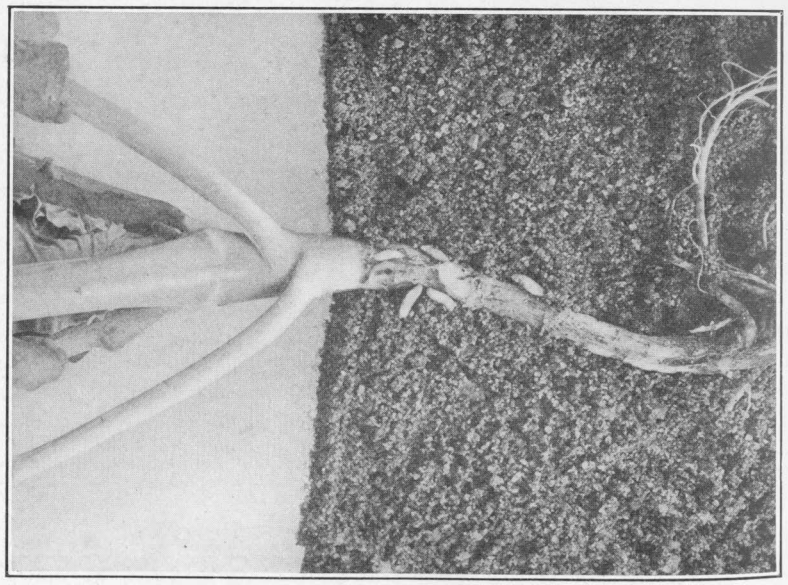


b. Cabbage Stems Hollowed out by Maggots. Nearly Natural Size.

THE CABBAGE MAGGOT.

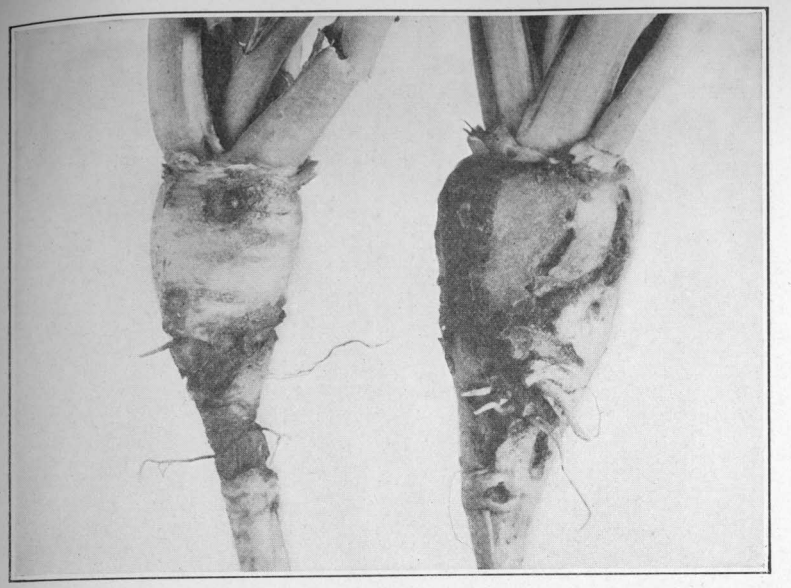


b. *Plant Protected by Tarred Paper Disk.*

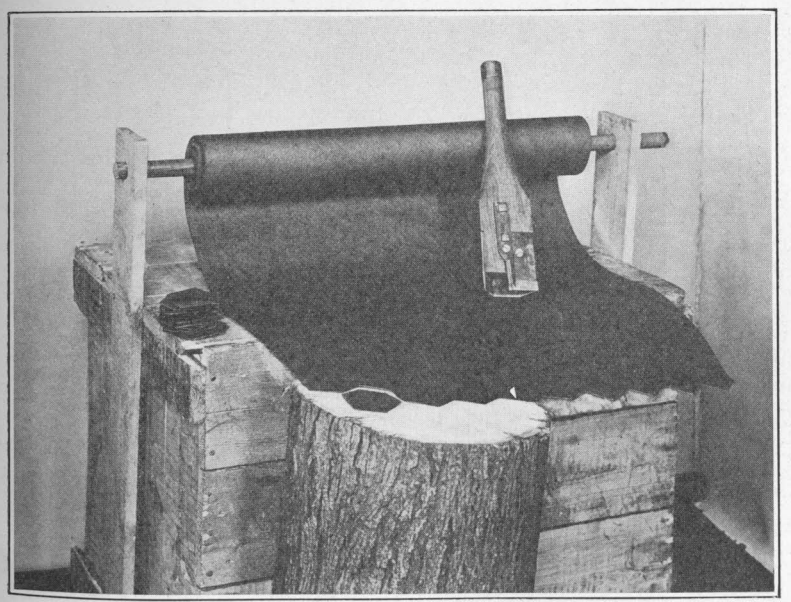


a. Young Cabbage Plant showing Maggots on outside of Stem. Natural size.

THE CABBAGE MAGGOT.

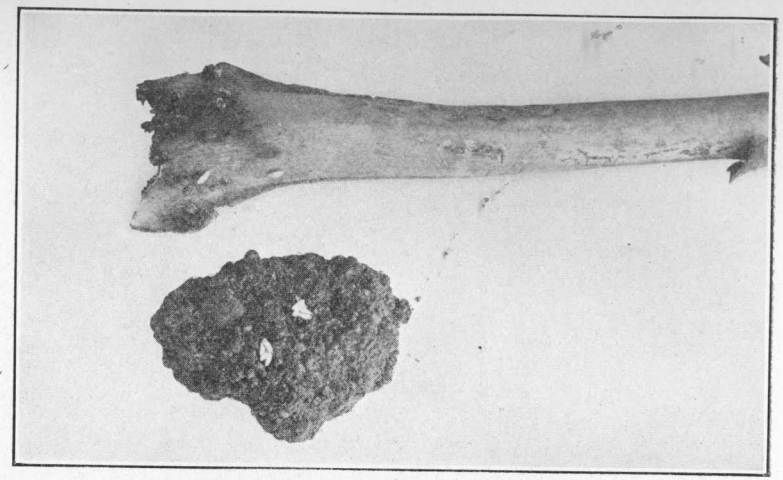


a. Turnips Injured by Maggot.

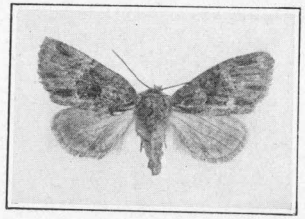


b. Tool and Device for Cutting Disks.

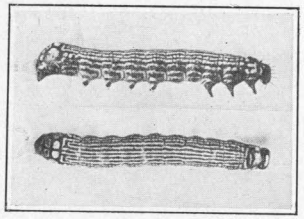
THE CABBAGE MAGGOT.



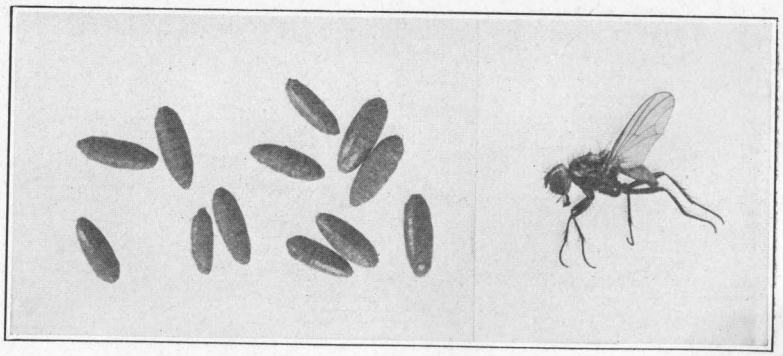
a. Eggs of the Cabbage Maggot. Twice natural size.



c. *Hadena turbulenta* Hubn. Natural size.

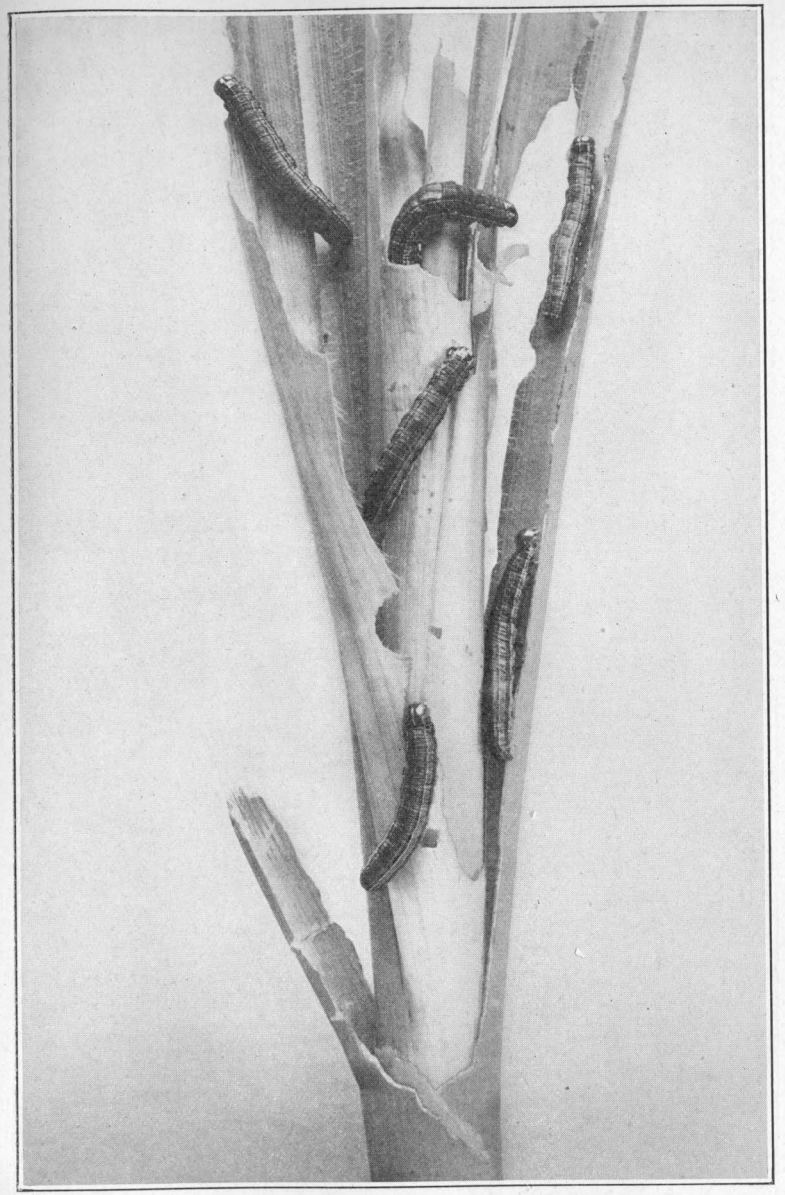


d. Larvæ of *Hadena turbulenta* Hubn. Natural size.



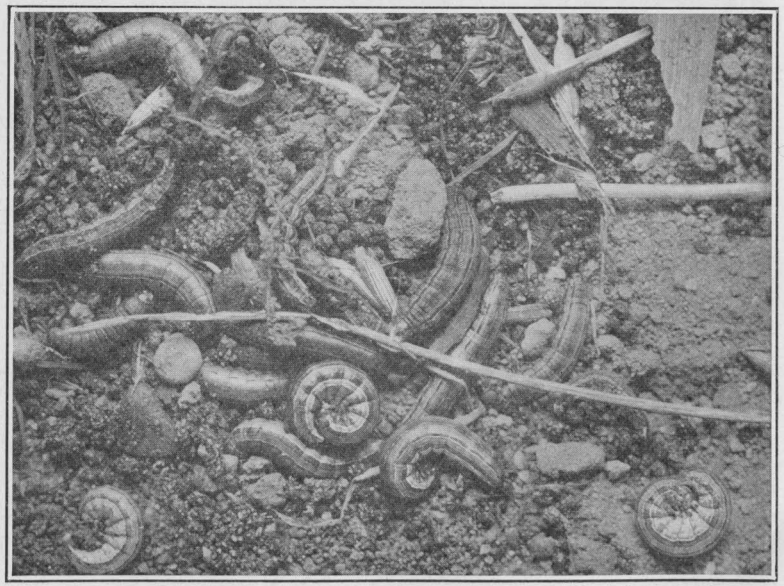
b. Puparia and Adult of the Cabbage Maggot. Enlarged.

THE CABBAGE MAGGOT AND *HADENA TURBULENTA* HUBN.



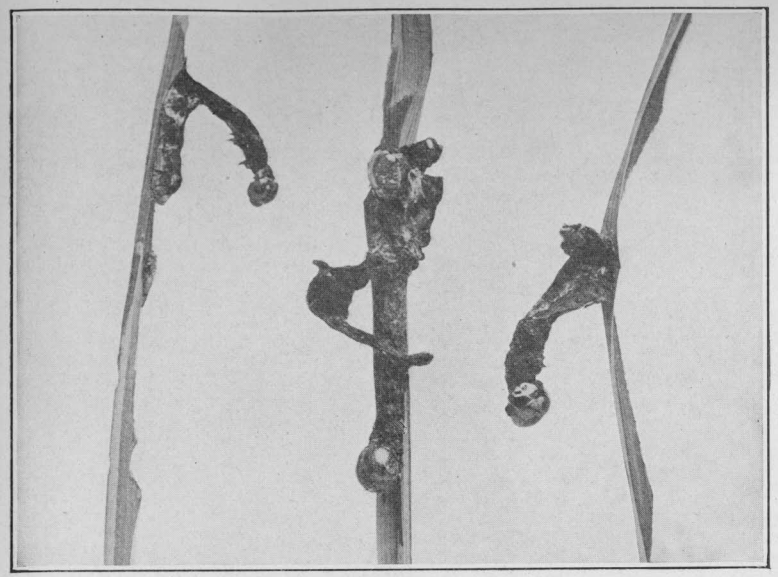
THE ARMY WORM.

a. Caterpillars Feeding on Grass.

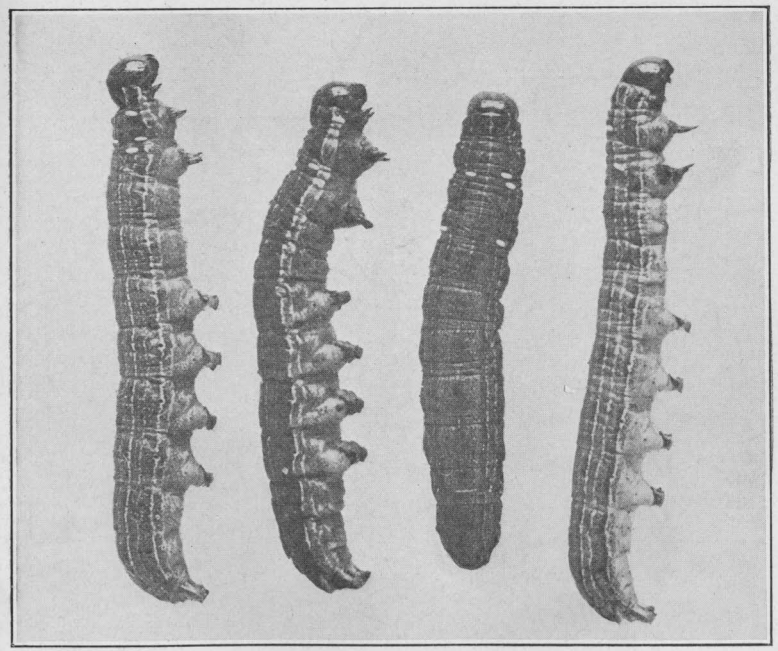


b. Caterpillars Coiled up under Straw.

THE ARMY WORM.

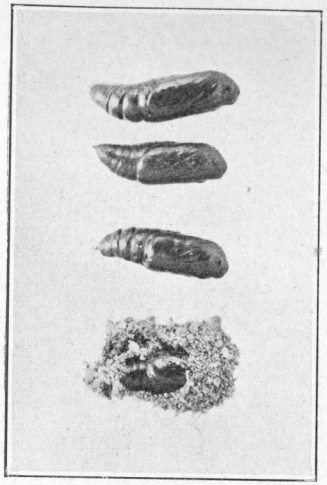


a. Caterpillars killed by Wilt Disease hanging on Grass Stalks and Leaves. Twice natural size.



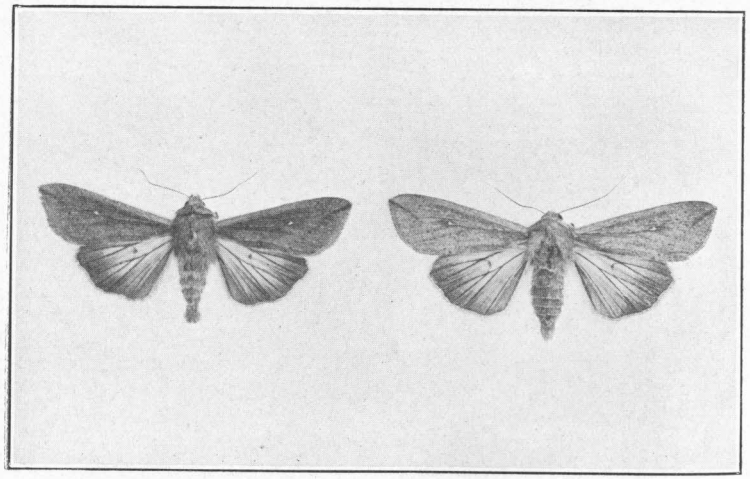
b. Caterpillars showing Tachinid Eggs. Twice natural size.

THE ARMY WORM.



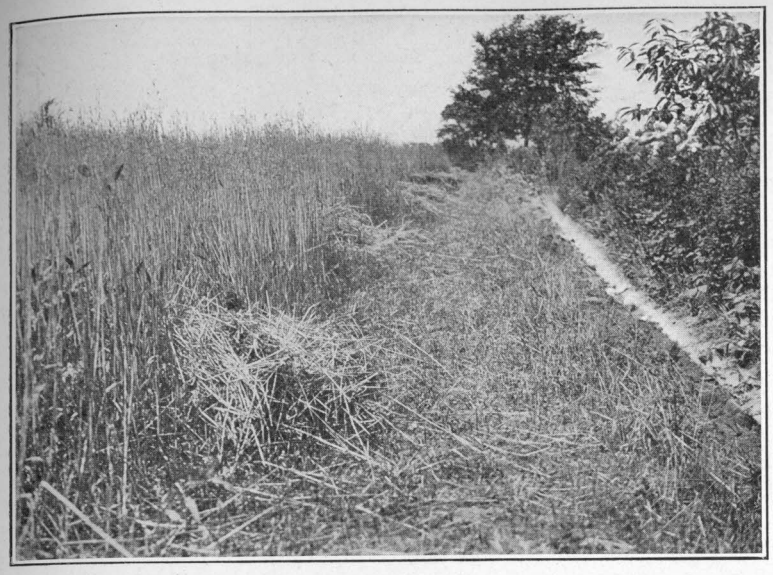
a. Pupæ. Natural size.

b. A Tachinid Fly
Winthemia quadri-pustulata Fabr.
Twice natural size.

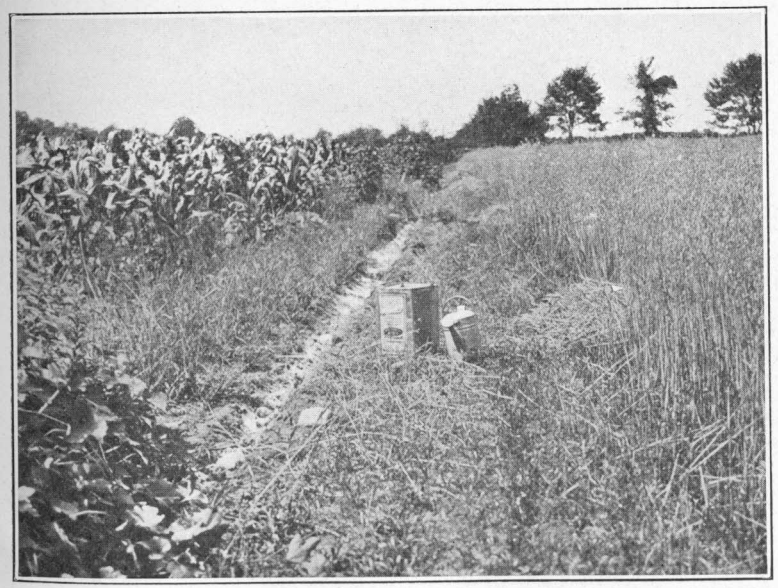


c. Army Worm Moths. Natural size.

THE ARMY WORM.



a. View in New Canaan showing Infested Oat Field, with a Swath Cut and a Furrow Plowed to check the Army Worms.



b. Another View showing Furrow Plowed between Oats and Corn.

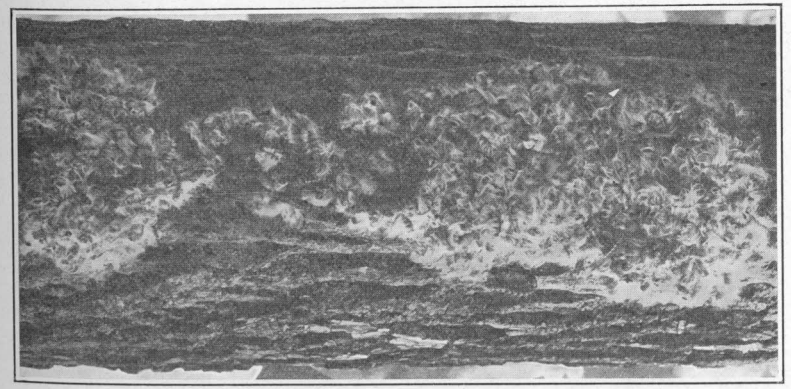
THE ARMY WORM.

a. Method of Collecting Weevils in White Pine Plantations.

b. Spraying Infested Plants in Greenhouses.

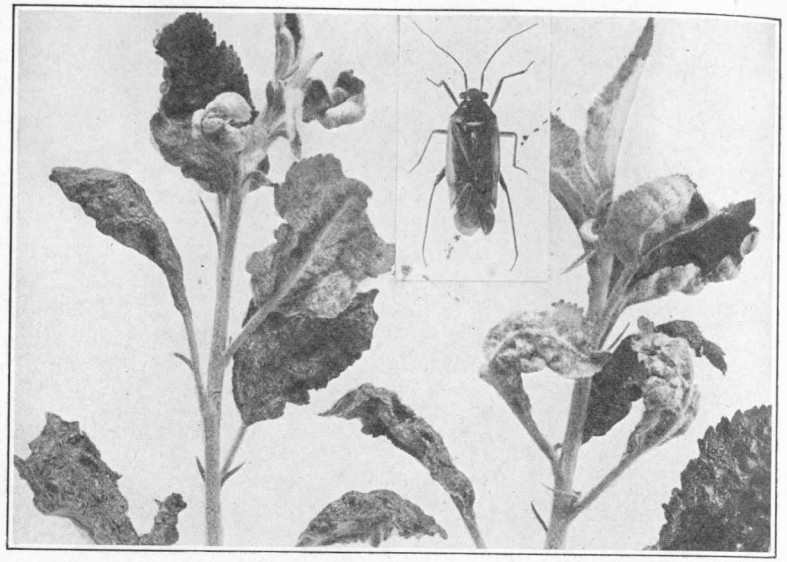
CONTROLLING THE WHITE PINE WEEVIL AND A MITE ON SNAPDRAGON PLANTS.

a. Shoot of Snapdragon Plant showing Leaves Curled by Mites and the Clean Growth after Treatment.

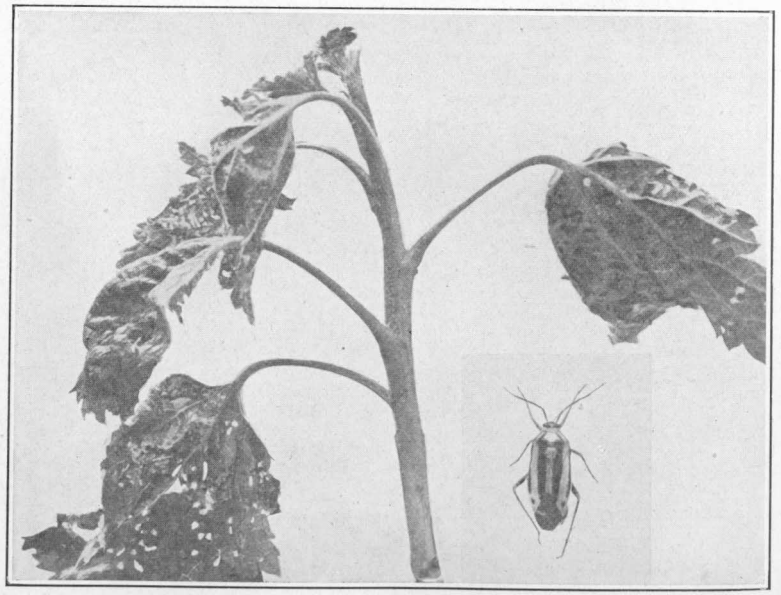


b. Walnut Caterpillars Clustered on Trunk of Tree.

MITE ON SNAPDRAGON PLANTS AND THE WALNUT CATERPILLAR.

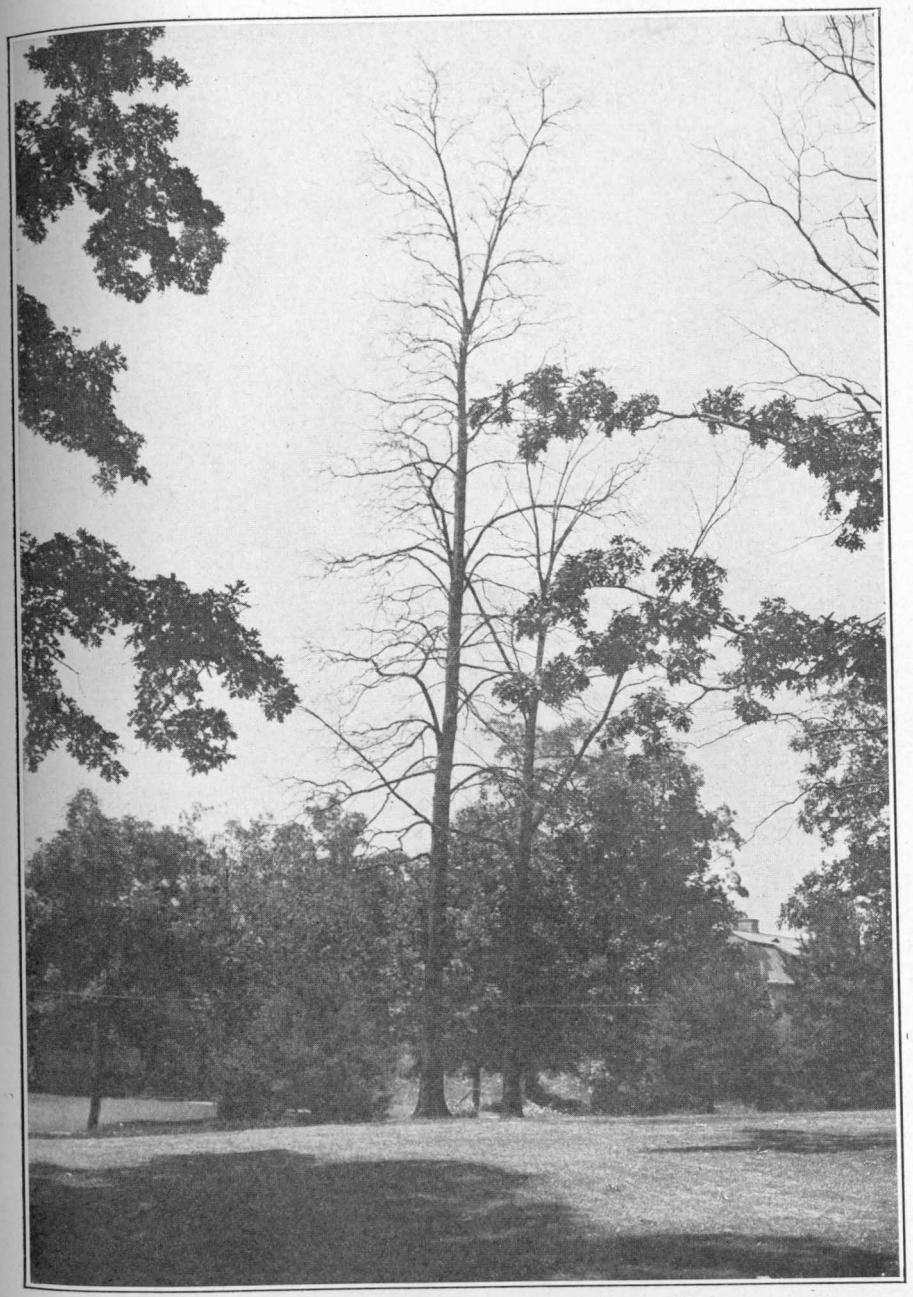


a. Apple Leaves Injured by the False Red Bug.
Leaves natural size, Bug nearly three times enlarged.

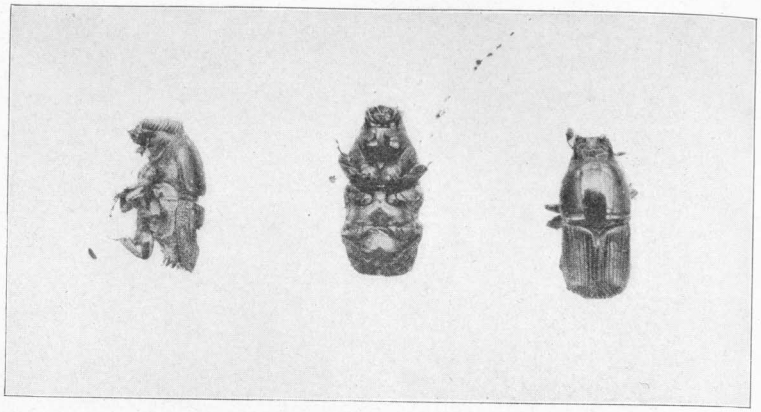


b. Currant Injured by the Four-Lined Leaf-bug.
Leaves natural size, Bug twice enlarged.

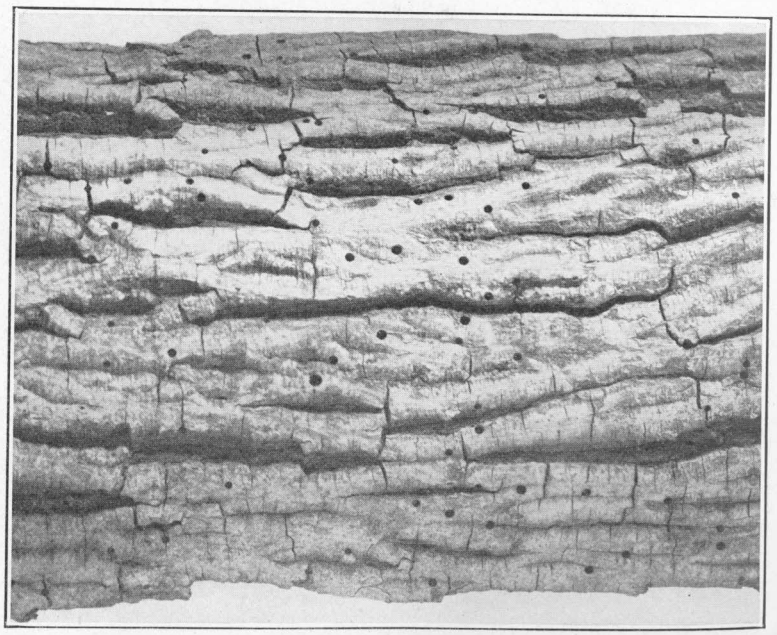
TWO DESTRUCTIVE BUGS.



Trees on Station Grounds Killed by the Hickory Bark Borer.

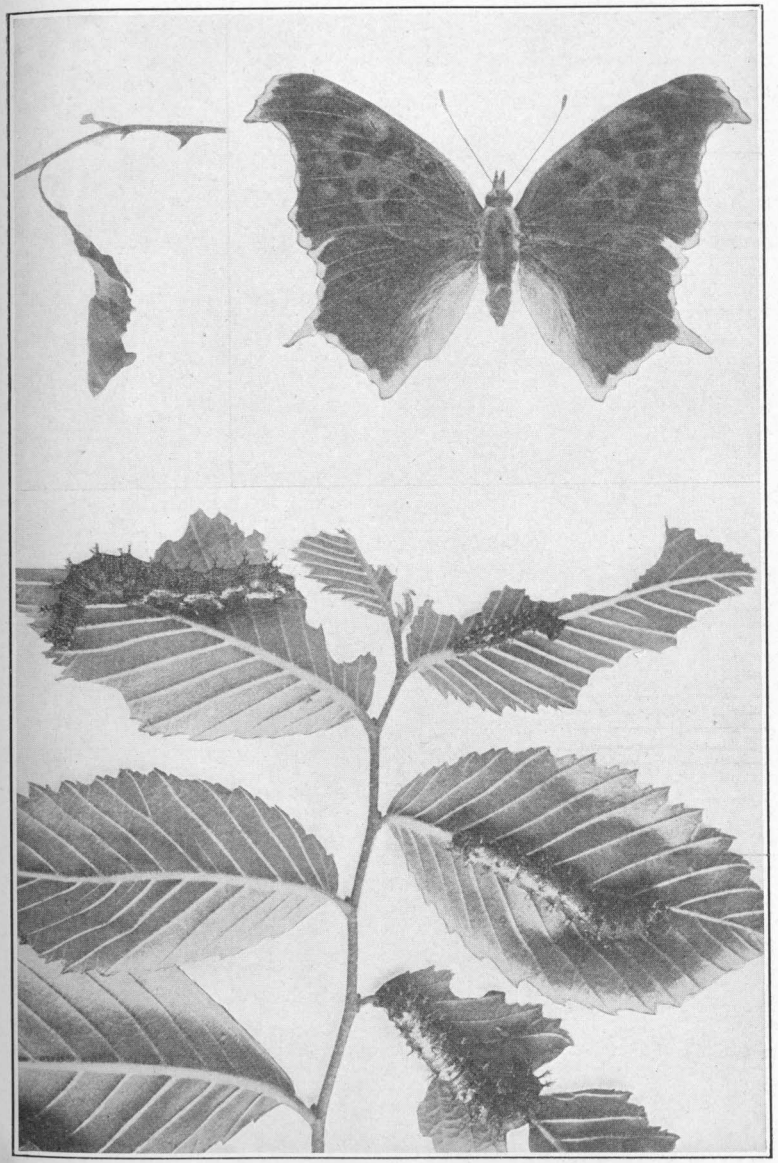


a. Beetles, much enlarged.

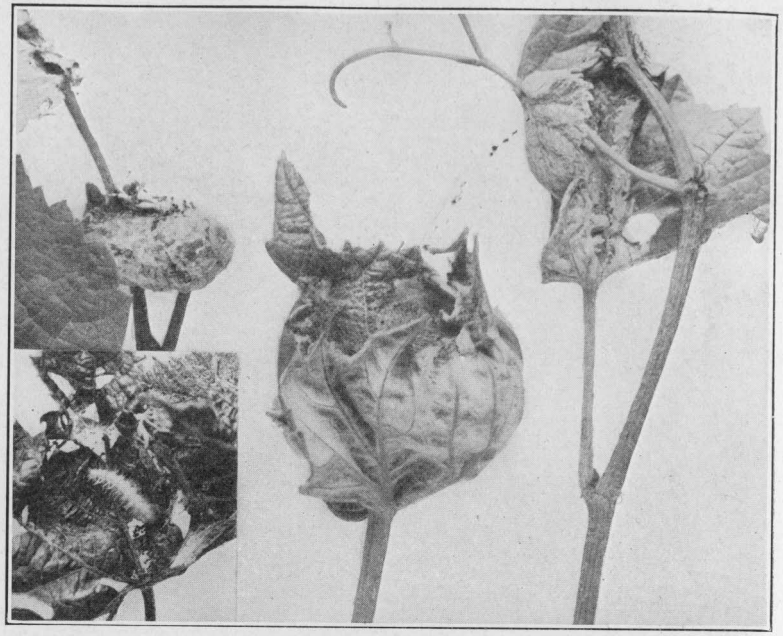


b. Holes in Bark, where Beetles Emerged.

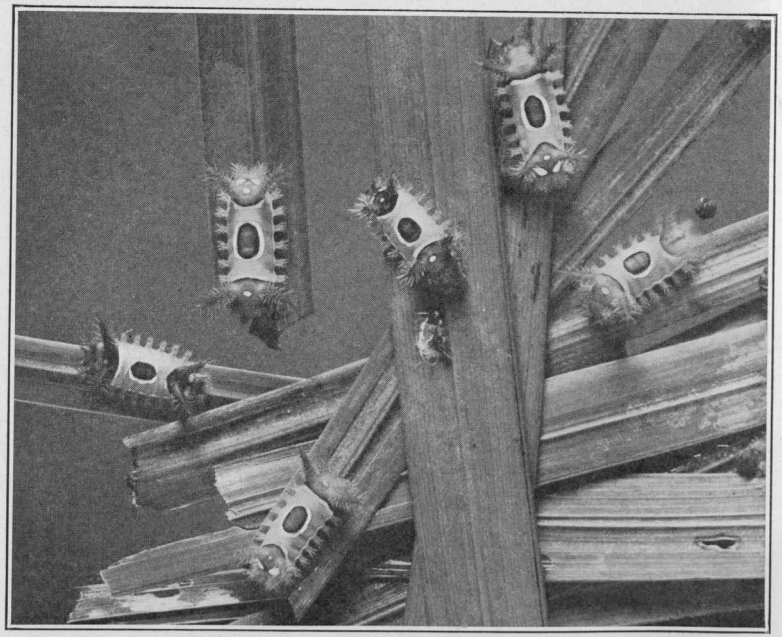
THE HICKORY BARK BORER.



Caterpillars, Cocoon and Adult of the Violet Tip Butterfly.



a. Folded Grape Leaves. Larva in Lower Left-hand Corner. All natural size.



b. Saddle-back Caterpillars Feeding upon Cat-tail Flag. Natural size.

THE GRAPE PLUME MOTH AND THE SADDLE-BACK CATERPILLAR.

PART IV.

COMMERCIAL FEEDING STUFFS.

By John Phillips Street.*

Under the Connecticut statutes the term "concentrated commercial feeding stuff" covers pratically all feeds excepting hay and straw, whole seeds, unmixed meal made directly from any of the cereals or from buckwheat, and feed ground from whole grain and sold directly from manufacturer to consumer.

Section 4592 requires that every package of concentrated commercial feeding stuff shall bear a statement giving the name and address of manufacturer or importer, the number of net pounds in the package, the name of the article and the percentages of protein and fat contained in it.

No registration of feeds or payment of analysis or license fees is required.

The penalty for violation of the statue is not more than $100 for the first offense and not more than $200 for each subsequent offense.

The law authorizes this station to take samples from any manufacturer, or dealer, in a prescribed manner, and requires the station to analyze annually at least one sample of each brand which it has collected and to publish these analyses "together with such additional information in relation to the character, composition and use thereof as may be of importance."

Inspection of 1914.

In compliance with the above requirements the following report has been prepared. During the fall of 1914 the station sampling agent visited 46 towns and villages of this state and collected 166 samples of feeds. The results of the examination of these samples are here discussed and the chemical analyses are given in Table III.

The analyses of 48 samples sent by individuals are also separately reported, as well as 59 samples of ensilage corn, soy bean fodder and soy beans grown in connection with experimental work.

* The chemical analyses here reported were made by C. H. Shepard and G. L. Davis.

The official samples may be grouped as follows:

No.		No.	
22	Cotton seed meal	1	Malt sprouts
2	Linseed meal, new process	5	Dried brewers' grains
8	Linseed meal, old process	5	Dried distillers' grains
1	Wheat bran	7	Dried beet pulp
1	Wheat middlings	10	Corn and oat feeds
1	Rye feed	3	Wheat and corn cob feeds
1	Corn gluten meal	2	Horse feeds
13	Corn gluten feed	22	Dairy and stock feeds
20	Hominy feed	19	Molasses feeds
1	Corn	20	Poultry feeds
1	Buckwheat middlings	1	Fish scrap
		166	total

Comments on Analyses.

Of the 166 official samples, 16 did not meet their guaranties in some particular; 2 in protein, 12 in fat, and 2 in both protein and fat. The number of deficient samples is considerably less than for a number of years past. Table I shows the individual brands which failed to satisfy their guaranties.

Table I.—Feeds Below Guaranty.

Station No.		* Deficiency in	
		Protein.	Fat.
4926	Pilgrim Brand Cotton Seed Meal	2.50	....
4980	Cream of Corn Gluten Feed	....	0.72
4959	Wirthmore Hominy Feed	....	1.38
4970	" " "	....	0.77
5030	Quinebaug Buckwheat Middlings	4.06	1.04
4991	American Malting Co.'s Malt Sprouts	....	0.70
4901	Continental Gluten Feed	....	2.13
5002	" " "	....	2.41
4924	Biles Ready Ration, Union Grains	....	1.29
4969	V-B Stock Feed	....	0.78
4967	Clover Leaf Dairy Feed	1.00	....
4917	H. and S. Alfalfa Feed	....	0.46
4893	Wirthmore Growing Feed	....	1.25
4892	Wirthmore Poultry Feed	....	0.76
4872	Park and Pollard's Fattening Feed	....	0.49
4954	Red Star Fish Scrap	6.14	0.34

Cotton Seed Meal averaged one-half per cent. more protein than last year with a price $2.50 per ton lower.

*A deficiency of less than 1 per cent of protein and 0.25 per cent. of fat is not noted.

Linseed Meal, New Process, averaged one per cent. more protein than in 1913, but the price per ton was $3.50 higher. *Linseed Meal, Old Process* likewise averaged one per cent. more protein than last year with practically no increase in price.

Corn Gluten Meal. The single sample was well above guaranty containing four times as much fat as claimed. A guaranty of one per cent. fat for this product conveys little useful information to the intending purchaser.

Corn Gluten Feed. The thirteen samples ranged in protein from 22.75 to 31.25 per cent., the two extreme samples strangely enough selling for the same price. The ash in the samples ranged from 1.35 to 5.48 per cent. These differences are probably due in large part to the use or exclusion of the "steep liquor," a by-product of glucose manufacture. In the *Buffalo* and *Globe* brands the guaranty of 23 per cent. protein and 1 per cent. fat has little relation to the true composition, the samples showing on the average 28.55 and 2.94 per cent., respectively.

Hominy Feed. Contained about the same amount of protein as last year and cost on the average 58 cents per ton less. Samples **4970** and **5018** bore no guaranties at the time of sampling, although both proved to be of standard quality.

Buckwheat Middlings. This sample was far below both its protein and fat guaranty, but the product was of much better quality than the sample secured from the same mill in 1913.

Malt Sprouts. The single sample was very similar both in composition and price to that examined last year. This material is very commonly guaranteed too high for fat.

Dried Brewers' Grains. The five samples were of excellent quality. They averaged 2.50 per cent. more protein than in 1913 with an increased price of one dollar per ton. The protein guaranty for this class of feeds is generally too low. A guaranty of 25 per cent. for a product containing 35 per cent protein is of very little use to the careful feeder. The five samples on the average exceeded their protein guaranty by nearly 5 per cent.

Dried Distillers' Grains. The five samples were all high grade grains, although the guaranty of *Continental Gluten Feed* is somewhat too high. Compared with 1913 the samples show 2.35 per cent. less protein at an increased cost of $1.20 per ton.

Dried Beet Pulp. The seven samples were very similar both as regards composition and cost to those examined last year.

Provender and Corn and Oat Feeds. The samples were of normal composition, the higher amounts of fiber in most of the chop feeds indicating the probable use of low-grade oats or excessive oat hulls. These products show the usual relatively high price when compared with high-grade feeds.

Wheat and Corn Cob Feeds show a slightly higher content of protein than last year at a cost of $1.50 per ton higher. It happens that the average price of these feeds is the same as that of our single sample of wheat bran, although the latter contains 5 per cent. more protein.

Proprietary Horse, Dairy and Stock Feeds. These require no special comment further than to all attention to the fact that while high-grade materials are used in the compounding of certain brands, many of them consist of relatively inferior materials sold at an excessively high price. Among the dairy and stock feeds we find brands containing from 9 to 11 per cent. protein selling for $29 to $30 per ton, some containing from 9 to 26 per cent. for $32 to $34, and others containing 11 to 28 per cent. for $35 to $37. In other words, as often pointed out by us, the selling price as a rule bears no relation to the feeding value of the feed. With a very few exceptions feeds of this class are an expensive luxury to the feeder.

Proprietary Poultry Feeds. Sample **4973** did not bear the guaranty required by law. The guaranty of *M. and S. Dry Mash* bears no relation to the feed's composition, an excess of 8.75 per cent. protein and 2.53 per cent. fat being shown. The single sample of *Fish Scrap* showed a protein deficiency of 6.14 per cent.

Molasses Feeds. Nineteen samples of this class of feeds were examined. They are compounded from a variety of materials, including corn, oats, wheat bran, alfalfa, dried brewers's grains, dried distillers' grains, cotton seed meal and dried beet pulp. In one brand peat, and in another sphagnum moss, was substituted for feed. The ether extract in all of these samples was determined by the regular official method and by the modified method described in our report of last year. In general the modified method gives higher percentages of fat, but in certain samples, notably the beet pulp feeds, somewhat more fat was obtained by the official method. The results given in our general tables were secured by the modified method. In the table which follows the results obtained by both methods are given, as well as the amount of water-soluble material found in these feeds. This latter figure indicates roughly

the maximum amount of molasses or sugar present. Our results last year showed that considerable of the protein in these feeds was soluble in cold water, so that the percentages reported in Table II for water extract in most cases are doubtless somewhat higher than the actual amount of molasses or sugar solids present.

TABLE II.—MOLASSES FEEDS.

Station No.	Brand.	Soluble in Cold Water	Fat.	
			In Original Material	In Water-Extracted Material
4966	Sucrene Dairy Feed	25.48	6.34	6.10
4967	Clover Leaf Dairy Feed	24.60	4.47	4.17
4985	Anchor Horse Feed	14.00	4.44	3.84
4917	H. and S. Alfalfa Feed	36.44	2.23	3.04
5033	H. and S. Alfalfa Feed for Milch Cows	31.72	3.21	4.13
4897	Badger Dairy Feed	30.96	4.10	3.83
4899	Badger Horse Feed	23.88	2.37	2.31
4953	Dried Beet Pulp and Molasses	11.80	1.08	0.35
5012	" " " " "	10.32	0.73	0.31
4933	" " " " "	15.32	0.94	0.40
4956	Molassine Meal	61.08	0.43	0.80
4883	Peter's King Corn Sugar Feed	27.00	1.76	2.65
4908	Purina Dairy Feed	26.04	4.48	4.45
4910	Purina Feed with Molasses	21.52	2.73	2.38
4968	Blue Ribbon Dairy Feed	24.44	5.53	5.39
4958	Quaker Dairy Feed with Molasses	24.28	4.75	4.45
4971	Arab Balanced Horse Ration	26.88	2.19	2.52
4974	Prize Horse Feed	33.76	1.26	1.87
4930	Xtra-Vim Feed	63.68	0.48	0.80

UNOFFICIAL SAMPLES.

Forty-eight samples sent in by individuals have also been analyzed. The station is responsible for the accuracy of the analysis, but not for the sampling, of these samples.

COTTON SEED MEAL. Four samples of *Dixie Brand*, Humphreys Godwin Co., Memphis, Ten., were guaranteed 41 per cent. protein; **3850**, **5191** and **5235**, sent by The Coles Co., Middletown, contained 38.13, 42.63 and 41.69 per cent, respectively; **5189**, sent by H. B. Coger, Newtown, contained 42.50 per cent. Two other samples of the same brand, but guaranteed 38.62 per cent. protein, **5138**, sent by The E. W. Spurr Co., Lakeville and **4683**, sent by W. C. Everett, Bloomfield, contained 38.81 and 40.94 per cent. respectively. Still another sample of the same brand without

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

SAMPLED IN 1914.

Station. No.	Brand.	Retail Dealer.
	OIL SEED PRODUCTS.	
	Cotton Seed Meal.	
5006	*Farmer Brand. J. E. Bartlett Co., Jackson, Mich	*Winsted:* E. Manchester & Sons
4978	Owl Brand. F. W. Brode & Co., Memphis, Tenn.	*Stamford:* W. L. Crabb
4885	" " " " "	*Shelton:* Ansonia Flour & Grain Co
4982	Buckeye. Buckeye Cotton Oil Co., Cincinnati, O.	*Bethel:* Morrison & Dunham
4902	" " " " "	*Hazardville:* A. D. Bridge's Sons
5017	Good Luck Brand. S. P. Davis, Little Rock, Ark	*Rockville:* Rockville Milling Co
4878	Dixie Brand. Humphreys, Godwin Co., Memphis, Tenn	*East Haven:* F. A. Forbes
4880	Dixie Brand. Humphreys, Godwin Co., Memphis, Tenn	*Guilford:* Morse & Landon
4921	Dixie Brand. Humphreys, Godwin Co, Memphis, Tenn	*Hartford:* Smith, Northam Co.
4952	Dixie Brand. Humphreys, Godwin Co., Memphis, Tenn	*Yantic:* A. R. Manning
5072	Dixie Brand. Humphreys, Godwin Co., Memphis, Tenn	*New Haven:* Crittenden-Benham Co
4931	Forfat Brand. Humphreys, Godwin Co., Memphis, Tenn	*Westerly:* C. W. Campbell Co.
5015	Forfat Brand. Humphreys, Godwin Co., Memphis, Tenn	*Manchester:* Little & McKinney
4940	Canary Brand. C. L. Montgomery & Co., Memphis, Tenn	*Norwich:* Norwich Grain Co.
5028	Robin Brand. G. B. Robinson, Jr., New York	*Danielson:* Young Bros. Co.
4898	Pilgrim Brand. J. E. Soper Co., Boston	*Meriden:* A. Grulich
4926	" " " "	*Westerly:* C. W. Campbell Co.
4946	" " " "	*Norwich:* C. Slosberg
4941	Pioneer " " "	*Norwich:* Norwich Grain Co.
4965	" " " "	*Bristol:* Goodsell Bros
5023	" " " "	*Willimantic:* E. A. Buck
5035	Durjan Brand. Union Brok. & Com. Co., New Orleans, La	*New Haven:* Crittenden-Benham Co
		Average guaranty
		Average of these 22 analyses
		Average digestible
	Linseed Meal, New Process.	
4904	American Linseed Co., Chicago	*Thompsonville:* Geo. S. Phelps & Co
5031	Hypro. American Linseed Co., New York	*New Haven:* R. G. Davis & Son
		Average guaranty
		Average of these 2 analyses
		Average digestible

* Statement of dealer.

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
5006	8.13	5.93	42.75	10.23	22.62	10.34	$33.00
4978	8.22	6.28	43.88	7.73	27.15	6.74	35.00
4885	8.61	6.73	42.19	9.90	24.39	8.18	35.00
4982	7.01	5.95	38.69	12.00	30.31	6.04	35.00
4902	6.05	5.75	38.00	12.45	30.84	6.91	31.00
5017	7.90	6.30	43.44	8.33	26.03	8.00	31.00
4878	7.87	5.70	39.56	11.05	28.53	7.29	32.00
4880	7.50	5.68	38.56	11.45	29.84	6.97	33.00
4921	7.91	5.68	42.06	9.00	27.71	7.64	34.00
4952	7.65	5.88	38.00	12.38	29.82	6.27	34.00
5072	8.35	5.83	38.11	10.13	29.24	8.34	.....
4931	7.48	7.20	40.94	9.50	27.39	7.49	31.00
5015	8.67	5.95	40.31	9.03	28.97	7.07	34.00
4940	7.74	7.80	42.50	7.23	25.82	8.91	33.00
5028	7.54	6.25	40.19	9.30	29.55	7.17	30.00
4898	7.74	6.48	40.19	9.18	28.79	7.62	32.00
4926	7.89	5.45	36.00	12.60	28.79	9.27	31.00
4946	7.53	6.20	39.81	9.85	28.74	7.87	31.00
4941	7.64	6.13	41.13	8.75	28.67	7.68	33.00
4965	7.66	5.80	40.75	9.40	28.92	7.47	34.00
5023	7.02	6.30	40.44	8.20	30.20	7.84	34.00
5035	9.30	7.13	43.13	6.40	25.21	8.83	33.00
....	....	....	**39.53**	....	.....	**6.12**	.....
....	**7.79**	**6.20**	**40.48**	**9.73**	**28.07**	**7.73**	**32.81**
....	....	....	**34.00**	**3.4**	**21.9**	**7.3**	.....
4904	7.83	5.70	36.00	8.95	38.45	3.07	37.00
5031	9.08	5.68	37.88	8.18	35.48	3.70	39.00
....	....	....	**34.50**	....	.....	**2.00**	.....
....	**8.45**	**5.69**	**36.94**	**8.56**	**36.97**	**3.39**	**38.00**
....	....	....	**31.00**	**6.3**	**29.6**	**3.0**	.....

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	OIL SEED PRODUCTS.—*Continued.*	
	Linseed Meal, Old Process.	
4877	American Linseed Co., Buffalo, N. Y.	*East Haven:* F. A. Forbes.
5011	" " " " "	*Torrington:* F. U. Wadhams.
4948	Amco. American Milling Co., Peoria, Ill.	*Norwich:* C. Slosberg
4998	" " " " "	*Middletown:* Meech & Stoddard, Inc.
4927	Kelloggs & Miller, Amsterdam, N. Y.	*Westerly:* C. W. Campbell Co.
5000	Mann Bros. Co., Buffalo, N. Y.	*New Britain:* C. W. Lines
4888	Midland Linseed Prod. Co., Minneapolis, Minn.	*Wallingford:* E. E. Hall
4957	" " " " " "	*Hamden:* I. W. Beers
		Average guaranty
		Average of these 8 analyses
		Average digestible
	WHEAT PRODUCTS.	
4943	Bran. Yellowstone Valley Mills, Fairview, Mont.	*Norwich:* Norwich Grain Co.
		Digestible
5024	Winona Middlings. Bay State Mill. Co., Winona, Minn.	*Storrs:* College
		Digestible
	RYE PRODUCTS.	
4881	Feed. Boutwell Mill. & Grain Co., Troy, N. Y.	*Ansonia:* Ansonia Flour & Grain Co.
		Digestible
	MAIZE PRODUCTS.	
	Corn Gluten Meal.	
4929	Diamond. Corn Products Ref. Co., New York.	*Westerly:* C. W. Campbell Co.
		Guaranty
		Digestible
	Corn Gluten Feed.	
4906	Buffalo. Corn Products Ref. Co., New York.	*Thompsonville:* Geo. S. Phelps & Co.
4920	" " " "	*Hartford:* Smith, Northam & Co.
5001	" " " "	*New Britain:* C. W. Lines
		Average guaranty
		Average of these 3 analyses
		Average digestible
4980	Cream of Corn. American Maize Prod. Co., New York.	*Bethel:* Morrison & Dunham.
5003	Cream of Corn. American Maize Prod. Co., New York.	*Winsted:* E. Manchester & Sons
		Average guaranty
		Average of these 2 analyses
		Average digestible
5020	Clinton. Clinton Sugar Ref. Co., Clinton, Ia.	*Stafford Springs:* G. L. Dennis
		Guaranty
		Digestible

SAMPLED IN 1914—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
4877	9.30	5.20	35.13	8.18	36.67	5.52	$36.00
5011	9.76	5.28	35.44	7.75	36.25	5.52	40.00
4948	9.90	5.70	30.31	7.83	39.62	6.64	35.00
4998	9.45	5.73	30.38	9.15	38.03	7.26	35.50
4927	9.61	5.20	35.50	7.78	35.84	6.07	37.00
5000	9.57	5.03	35.69	7.35	34.70	7.66	39.00
4888	8.73	5.00	35.19	7.75	35.14	8.19	36.00
4957	9.88	5.10	34.00	7.33	35.75	7.94	38.00
....	....	....	**32.25**	....	.....	**5.00**	.....
....	**9.52**	**5.28**	**33.96**	**7.89**	**36.50**	**6.85**	**37.06**
....	....	....	**30.2**	**4.5**	**28.5**	**6.1**	.....
4943	9.12	5.85	16.13	11.08	52.87	4.95	28.00
....	....	....	**12.4**	**4.3**	**37.5**	**3.1**	.....
5024	10.80	4.98	17.31	7.23	54.44	5.24	.....
....	....	....	**13.3**	**2.2**	**42.5**	**4.6**	.....
4881	9.66	3.42	15.75	4.98	62.86	3.33	33.00
....	....	....	**12.6**	....	**55.3**	**3.0**	.....
4929	6.72	1.48	40.50	1.33	45.92	4.05	38.00
....	....	....	**40.00**	....	.....	**1.00**	.....
....	....	....	**35.6**	....	**40.4**	**3.8**	.....
4906	9.38	4.33	29.81	6.30	46.67	3.51	35.00
4920	9.63	4.40	28.00	6.68	47.99	3.30	34.00
5001	9.46	4.73	26.81	6.52	48.78	3.70	36.00
....	....	....	**23.00**	....	.....	**1.00**	.....
....	**9.49**	**4.49**	**28.21**	**6.50**	**47.81**	**3.50**	**35.00**
....	....	....	**24.0**	**5.7**	**43.0**	**2.8**	.....
4980	9.45	3.00	25.44	6.08	54.25	1.78	33.00
5003	12.25	2.65	24.50	5.98	51.70	2.92	34.00
....	....	....	**23.00**	....	.....	**2.50**	.....
....	**10.85**	**2.82**	**24.97**	**6.03**	**52.98**	**2.35**	**33.50**
....	....	....	**21.2**	**5.2**	**47.7**	**1.9**	.....
5020	9.00	2.05	26.94	6.40	52.57	3.04	32.00
....	....	....	**23.00**	....	.....	**3.00**	.....
....	....	....	**22.9**	**5.6**	**47.3**	**2.5**	.....

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	MAIZE PRODUCTS.—*Continued.*	
	Corn Gluten Feed.—Continued.	
4935	Douglas. Douglas Co., Cedar Rapids, Ia.....	*New London:* P. Schwartz Co.
4987	" " " "	*New Milford:* G. E. Ackley Co.
		Average guaranty.....
		Average of these 2 analyses...
		Average digestible.....
4882	Globe. Corn Products Ref. Co., New York....	*Ansonia:* Ansonia Flour & Grain Co.....
4887	" " " " "	*North Haven:* Co-öperative Feed Co.....
		Average guaranty.....
		Average of these 2 analyses...
		Average digestible.....
4879	K. K. K. J. C. Hubinger Bros. Co., Keokuk, Ia.	*Guilford:* Morse & Landon...
4994	" " " "	*New Haven:* Crittenden-Benham Co.....
		Average guaranty.....
		Average of these 2 analyses...
		Average digestible.....
5008	Staley's. A. E. Staley Mfg. Co., Decatur, Ill...	*Winsted:* M. D. Leonard & Co.
		Guaranty.....
		Digestible.....
	Hominy Feed.	
5029	Homco. American Hominy Co., Indianapolis, Ind.....	*Danielson:* Quinebaug Mills..
		Guaranty.....
4894	Bufceco. Buffalo Cereal Co., Buffalo, N. Y....	*Meriden:* Meriden Grain & Feed Co.....
4976	" " " " ...	*Stamford:* W. L. Crabb.....
4942	* " " " " ...	*Norwich:* Norwich Grain Co..
		Average guaranty.....
4959	Wirthmore. Chas. M. Cox Co., Boston.....	*Hamden:* I. W. Beers.....
4970	* " " " "	*Norwalk:* Holmes, Keeler & Kent Co.....
		Average guaranty.....
4874	Evans. Evans Milling Co., Indianapolis, Ind..	*Branford:* S. V. Osborn.....
		Guaranty.....
4915	Badger. Chas. A. Krause Mill. Co., Milwaukee, Wis.....	*East Hartford:* G. M. White & Co.....
		Guaranty .....
4909	Steam Cooked. Miner-Hillard Mill. Co., Wilkesbarre, Pa.....	*Suffield:* Spencer Bros.....
4922	Steam Cooked. Miner-Hillard Mill. Co., Wilkesbarre, Pa.....	*Hartford:* Smith, Northam & Co.....
5013	Steam Cooked. Miner-Hillard Mill. Co., Wilkesbarre, Pa.....	*Torrington:* D. L. Talcott....
		Average guaranty.....

* Statement of dealer.

SAMPLED IN 1914—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
4935	9.52	4.85	26.44	5.75	51.03	2.41	$34.00
4987	9.27	2.73	22.88	5.90	56.67	2.55	33.00
....	....	....	**20.00**	....	.....	**2.00**	.....
....	**9.39**	**3.79**	**24.66**	**5.83**	**53.85**	**2.48**	**33.50**
....	....	....	**21.0**	**5.0**	**48.2**	**2.0**	.....
4882	7.93	4.05	31.25	4.13	49.82	2.82	34.00
4887	6.17	4.50	26.88	6.30	54.80	1.35	31.00
....	....	....	**23.00**	....	.....	**1.00**	.....
....	**7.05**	**4.27**	**29.07**	**5.21**	**52.31**	**2.09**	**32.50**
....	....	....	**24.7**	**4.5**	**47.1**	**1.7**	.....
4879	7.86	1.63	26.13	6.15	53.95	4.28	32.00
4994	7.90	1.80	22.75	7.10	54.97	5.48	34.00
....	....	....	**23.00**	....	.....	**2.40**	.....
....	**7.88**	**1.72**	**24.44**	**6.62**	**54.46**	**4.88**	**33.00**
....	....	....	**20.8**	**5.8**	**49.0**	**4.0**	.....
5008	8.13	4.43	26.00	6.20	52.54	2.70	34.00
....	....	....	**23.00**	....	.....	**2.50**	.....
....	....	....	**22.1**	**5.4**	**47.3**	**2.2**	.....
5029	9.25	2.70	11.31	4.00	63.42	9.32	31.00
....	....	....	**9.50**	....	.....	**7.00**	.....
4894	8.78	2.88	11.31	4.45	66.78	5.80	31.00
4976	10.14	2.68	11.25	3.73	64.71	7.49	30.00
4942	10.16	2.68	11.31	5.18	64.24	6.43	31.00
....	....	....	**10.00**	....	.....	**6.00**	.....
4959	9.79	2.63	11.44	4.68	65.34	6.12	31.00
4970	8.16	2.85	12.00	4.88	65.38	6.73	35.00
....	....	....	**9.50**	....	.....	**7.50**	.....
4874	8.14	2.68	11.44	5.40	64.05	8.29	32.00
....	....	....	**10.00**	....	.....	**7.50**	.....
4915	9.08	2.45	10.94	4.43	67.01	6.09	33.00
....	....	....	**10.00**	....	.....	**6.00**	.....
4909	10.38	2.83	11.38	4.23	64.26	6.92	30.00
4922	8.98	2.90	11.63	3.40	65.93	7.16	34.00
5013	10.14	2.98	12.13	3.53	63.88	7.34	33.00
....	....	....	**10.00**	....	.....	**5.00**	.....

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	MAIZE PRODUCTS.—*Continued.*	
	Hominy Feed.—Continued.	
4916	Mystic Milling Co., Sioux City, Ia.	*East Hartford:* G. M. White & Co.
4949	" " " "	*Yantic:* A. R. Manning.
		Average guaranty
4937	Patent Cereals Co., Geneva, N. Y.	*New London:* J. N. Bragaw.
4990	" " " "	*Danbury:* F. C. Benjamin.
		Average guaranty
5014	Yellow. Quaker Oats Co., Chicago	*Manchester:* Little & McKinney
5018	*Simpson, Hendee Co., New York	*Rockville:* E. White
4947	Blue Ribbon. J. E. Soper Co., Boston	*Norwich:* C. Slosberg
4993	" " " " "	*New Haven:* Crittenden-Benham Co
		Average guaranty
4886	Frumentum. U. S. Frumentum Co., Detroit, Mich.	*North Haven:* Coöperative Feed Co.
		Guaranty
		Average guaranty of all
		Average of these 20 analyses
		Average digestible
	Corn.	
5036	Argentine Corn	*New Haven:* Crittenden-Benham Co
	BUCKWHEAT PRODUCTS.	
5030	Middlings. Quinebaug Grist Mill, Danielson	*Danielson:*
		Guaranty
	BREWERY AND DISTILLERY PRODUCTS.	
	Malt Sprouts.	
4991	Standard. American Malting Co., New York	*New Haven:* Crittenden-Benham Co
		Guaranty
		Digestible
	Dried Brewers' Grains.	
4876	Bull Brand. Farmers Feed Co., New York	*East Haven:* F. A. Forbes
5022	" " " " " "	
		Average guaranty
4875	Providence Brewing Co., Providence, R. I.	*Branford:* S. V. Osborn
		Guaranty
4907	Pilsner. Rosekans-Snyder Co., Philadelphia	*Suffield:* Spencer Bros.
		Guaranty
4950	Western Grains & Feed Co., Chicago	*Yantic:* A. R. Manning
		Guaranty
		Average of these 5 samples
		Average digestible

* Statement of dealer.

SAMPLED IN 1914—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
4916	9.60	2.28	10.94	4.03	66.16	6.99	$33.00
4949	10.85	2.18	11.06	4.15	64.65	7.11	33.00
....	....	....	**11.00**	....	.....	**6.25**	.....
4937	10.41	2.80	11.69	4.85	63.53	6.72	31.00
4990	9.60	2.53	11.31	4.95	64.93	6.68	34.00
....	....	....	**10.00**	....	.....	**6.00**	.....
5014	11.04	2.03	10.44	2.83	67.37	6.29	35.00
....	....	....	**9.00**	....	.....	**4.00**	.....
5018	9.76	2.95	11.69	4.95	63.68	6.97	34.00
4947	9.29	2.88	11.63	5.53	64.28	6.39	32.00
4993	8.98	3.13	11.94	4.50	64.15	7.30	31.00
....	....	....	**10.00**	....	.....	**6.00**	.....
4886	6.86	2.75	11.94	5.05	64.26	9.14	30.00
....	....	....	**9.50**	....	.....	**7.30**	.....
....	....	....	**9.95**	....	.....	**6.12**	.....
....	**9.47**	**2.69**	**11.44**	**4.44**	**64.90**	**7.06**	**32.20**
....	....	....	**7.4**	**3.0**	**57.8**	**6.5**	.....
5036	11.68	1.53	9.25	1.58	71.21	4.75	31.00
5030	10.17	4.55	25.69	15.30	37.83	6.46	32.00
....	....	....	**29.75**	....	.....	**7.50**	.....
4991	5.77	5.53	26.94	12.88	47.82	1.06	27.00
....	....	....	**19.12**	....	.....	**1.76**	.....
....	....	....	**21.6**	**4.4**	**33.0**	**1.1**	.....
4876	5.68	3.20	30.56	13.23	39.77	7.56	28.00
5022	5.29	3.63	26.31	14.70	43.00	7.07	28.00
....	....	....	**27.20**	....	.....	**6.30**	.....
4875	6.91	3.50	28.81	13.93	40.42	6.43	30.00
....	....	....	**25.00**	....	.....	**5.00**	.....
4907	6.51	2.48	35.13	10.10	39.33	6.45	32.00
....	....	....	**25.00**	....	.....	**5.00**	.....
4950	7.63	3.88	30.44	13.13	38.28	6.64	30.00
....	....	....	**25.00**	....	.....	**5.00**	.....
....	**6.40**	**3.34**	**30.25**	**13.02**	**40.16**	**6.83**	**29.60**
....	....	....	**24.5**	**6.4**	**22.9**	**6.1**	.....

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station. No.	Brand.	Retail Dealer.
	BREWERY AND DISTILLERY PRODUCTS.—*Cont'd.*	
	Dried Distillers' Grains.	
4989	Ajax Flakes. Ajax Mill. & Feed Co., Hammond, Ind.	*New Milford:* G. T. Soule....
		Guaranty.....
		Digestible.....
4901	Continental Gluten Feed. Continental Cereal Co., Peoria, Ill.	*Hazardville:* A. D. Bridge's Sons.....
5002	Continental Gluten Feed. Continental Cereal Co., Peoria, Ill.	*Winsted:* E. Manchester & Sons.....
		Average guaranty.....
		Average of these 2 analyses..
		Average digestible.....
4963	Corn 3 D Grains. The Dewey Bros. Co., Blanchester, O.	*Plainville:* Eaton Bros.....
5019	Corn 3 D Grains. The Dewey Bros. Co., Blanchester, O.	*Rockville:* E. White.....
		Average guaranty.....
		Average of these 2 analyses...
		Average digestible.....
	MISCELLANEOUS FEEDS.	
	**Dried Beet Pulp.*	
4999	Menominee River Sugar Co., Menominee, Mich.	*New Britain:* C. W. Lines...
4961	Michigan Sugar Co., Sebewaing, Mich.	*West Cheshire:* G. W. Thorpe.
5010	Mt. Clemens Sugar Co., Mt. Clemens, Mich...	*Torrington:* F. U. Wadhams..
4889	Owasso Sugar Co., Lansing, Mich.	*Wallingford:* E. E. Hall.....
4919	Charles Pope, Riverdale, Ill.	*Hartford:* Smith, Northam Co.
5005	Toledo Sugar Co., Toledo, O.	*Winsted:* E. Manchester & Sons.....
4934	West Bay City Sugar Co., Bay City, Mich....	*Mystic:* Mystic Grain Co....
		Average guaranty.....
		Average of these 7 analyses...
		Average digestible.....
	PROPRIETARY MIXED FEEDS.	
	Corn and Oat Feeds, and Chop Feeds.	
4939	Caulkins' Provender. Arnold Rudd Co., New London.	*New London:*.....
4884	Bufceco Chop Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Shelton:* Ansonia Flour & Grain Co.....
		Guaranty.....
4925	Provender. C. W. Campbell Co., Westerly....	*Westerly:*.....
		Guaranty.....
4984	Corn and Oats. Globe Elevator Co., Buffalo, N. Y.	*New Milford:* G. E. Ackley Co.
4988	No. 1 Chop Feed. Globe Elevator Co., Buffalo, N. Y.	*New Milford:* G. T. Soule....
		Guaranty.....
4945	Haskell Stock Feed. W. H. Haskell & Co., Toledo, O.	*Norwich:* C. Slosberg.....
		Guaranty.....
5004	Provender. E. Manchester & Sons, Winsted...	*Winsted:*.....

* See also Molasses Feeds, page 216.

SAMPLED IN 1914—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
4989	6.11	2.83	31.25	11.13	36.52	12.16	$35.00
....	....	....	**30.00**	....	.....	**11.00**	.....
....	....	....	**22.8**	**10.6**	**29.6**	**11.6**	.....
4901	9.20	4.33	28.13	6.53	43.44	8.37	35.00
5002	8.57	4.10	28.13	6.70	44.41	8.09	36.00
....	....	....	**29.00**	....	.....	**10.50**	.....
....	**8.88**	**4.22**	**28.13**	**6.61**	**43.93**	**8.23**	**35.50**
....	....	....	**20.5**	**6.3**	**35.6**	**7.8**	.....
4963	6.77	4.45	29.00	8.38	40.09	11.31	36.00
5019	7.38	4.53	27.94	8.45	41.00	10.70	36.00
....	....	....	**26.00**	....	.....	**9.00**	.....
....	**7.07**	**4.49**	**28.47**	**8.41**	**40.55**	**11.01**	**36.00**
....	....	....	**20.8**	**8.0**	**32.8**	**10.5**	.....
4999	7.90	2.45	8.38	19.65	60.55	1.07	30.00
4961	8.77	3.08	7.63	19.08	60.81	0.63	30.00
5010	5.09	3.18	9.19	20.53	61.47	0.54	30.00
4889	6.92	2.85	8.69	20.75	59.94	0.85	27.00
4919	7.64	3.13	8.69	18.88	60.35	1.31	30.00
5005	9.39	3.95	9.19	19.50	57.28	0.69	30.00
4934	8.14	3.20	8.44	19.93	59.59	0.70	31.00
....	....	....	**8.00**	....	.....	**0.50**	.....
....	**7.69**	**3.12**	**8.60**	**19.76**	**60.00**	**0.83**	**29.71**
....	....	....	**5.5**	**16.6**	**54.6**	.....	.....
4939	11.53	2.38	10.31	4.83	66.98	3.97	34.00
4884	8.71	3.70	10.00	10.65	61.60	5.34	35.00
....	....	....	**7.00**	....	.....	**3.00**	.....
4925	11.18	2.40	10.75	6.60	64.70	4.37	37.00
....	....	....	**8.00**	....	.....	**3.00**	.....
4984	10 55	2.95	10.88	7.13	63.37	5.12	38.00
4988	9.12	4.25	7.63	10.60	64.55	3.85	33.00
....	....	....	**7.00**	....	.....	**3.00**	.....
4945	7.99	3.50	10.19	9.83	61.67	6.82	32.00
....	....	....	**9.00**	....	.....	**4.00**	.....
5004	10.04	2.98	11.50	6.55	62.25	6.68	36.00

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS.—*Continued.*	
	Corn and Oat Feeds, and Chop Feeds.—Continued.	
4996	Korn-Oato Feed. Meech & Stoddard, Inc., Middletown	*Middletown:* Guaranty
5037	Boss Feed. Quaker Oats Co., Chicago	*New Haven:* Crittenden-Benham Co Guaranty
5032	Victor Feed. Quaker Oats Co., Chicago	*New Haven:* R. G. Davis & Sons Guaranty
	Wheat and Corn Cob Feeds.	
5007	Holstein Feed. Indiana Mill. Co., Terre Haute, Ind	*Winsted:* Platt & Coe Guaranty
4992	Sterling Feed. Indiana Mill. Co., Terre Haute, Ind	*New Haven:* Crittenden-Benham Co Guaranty
4900	Kennebec Feed. J. E. Soper Co., Boston	*Meriden:* A. Grulich Guaranty Average of these 3 analyses Average digestible
	* *Horse Feeds.*	
4914	Bufceco Horse Feed. Buffalo Cereal Co., Buffalo, N. Y	*East Hartford:* G. M. White & Co Guaranty
4932	Algrane Horse Feed. H. O. Co.'s Mills, Buffalo, N. Y	*Westerly:* C. W. Campbell Co. Guaranty
	* *Dairy and Stock Feeds.*	
4912	Blatchford's Calf Meal. Blatchford, C. M., Factory, Waukegan, Ill	*East Hartford:* G. M. White & Co Guaranty
4928	Dairy Ration. C. W. Campbell Co., Westerly	*Westerly:* Guaranty
4962	Unicorn Dairy Ration. Chapin & Co., Hammond, Ind	*West Cheshire:* G. W. Thorpe.
5038	Unicorn Dairy Ration. Chapin & Co., Hammond, Ind	*Middlefield:* C. U. Burnham Average guaranty Average of these 2 analyses
4911	Wirthmore Stock Feed. Chas. M. Cox Co., Boston	*Suffield:* Arthur Sikes Guaranty
5021	Dewey's Ready Ration. Dewey Bros. Co., Blanchester, O	*Willimantic:* H. A. Bugbee Guaranty
4918	White Cross Stock Feed. Albert Dickinson Co., Chicago	*Hartford:* Smith, Northam & Co Guaranty
4896	Grandin's Stock Feed. D. H. Grandin Mill. Co., Jamestown, N. Y	*Meriden:* A. Grulich

* See also Molasses Feeds, page 216.

SAMPLED IN 1914—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
4996	9.93	2.73	8.38	10.33	65.42	3.21	$27.50
....	....	....	**7.00**	....	.....	**3.00**	.....
5037	8.84	4.18	11.38	10.30	60.56	4.74	32.00
....	....	....	**8.00**	....	.....	**3.00**	.....
5032	8.80	3.70	9.56	9.03	64.42	4.49	32.00
....	....	....	**8.00**	....	.....	**3.00**	.....
5007	9.77	4.93	11.88	17.98	51.95	3.49	30.00
....	....	....	**11.00**	....	.....	**3.00**	.....
4992	8.92	4.43	10.69	14.63	58.03	3.30	27.00
....	....	....	**10.00**	....	.....	**3.00**	.....
4900	8.51	4.20	10.56	17.10	56.50	3.13	27.00
....	....	....	**9.80**	....	.....	**2.75**	.....
....	**9.07**	**4.52**	**11.04**	**16.57**	**55.49**	**3.31**	**28.00**
....	....	....	**7.0**	**4.6**	**39.4**	**3.0**	.....
4914	8.07	3.58	12.38	10.18	60.94	4.85	34.00
....	....	....	**10.00**	....	.....	**4.00**	.....
4932	9.27	5.13	11.50	11.20	58.81	4.09	33.00
....	....	....	**11.00**	....	.....	**4.00**	.....
4912	10.05	5.35	24.75	6.63	47.80	5.42	70.00
....	....	....	**24.00**	....	.....	**5.00**	.....
4928	8.93	4.15	23.19	8.68	49.06	5.99	32.00
....	....	....	20.00	....	.....	**5.50**	.....
4962	7.61	5.00	27.13	11.08	42.20	6.98	35.00
5038	8.16	6.90	25.88	9.83	41.85	7.38	33.50
....	....	....	**26.00**	....	.....	**5.50**	.....
....	**7.88**	**5.95**	**26.51**	**10.45**	**42.03**	**7.18**	**34.25**
4911	8.67	3.45	10.81	9.33	61.22	6.52	35.00
....	....	....	**9.00**	....	.....	**4.00**	.....
5021	8.07	4.60	28.25	10.30	41.15	7.63	35.00
....	....	....	**25.00**	....	.....	**7.00**	.....
4918	10.24	2.85	10.69	5.43	66.69	4.10	37.00
....	....	....	**10.00**	....	.....	**3.50**	.....
4896	7.64	4.00	10.38	10.78	59.91	7.29	33.00

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS.—*Continued.*	
	* *Dairy and Stock Feeds.—Continued.*	
4955	Grandin's Stock Feed. D. H. Grandin Mill. Co., Jamestown, N. Y.	*Jewett City:* Jewett City Grain Co.
		Average guaranty
		Average of these 2 analyses
4936	Algrane Milk Feed. H. O. Co.'s Mills, Buffalo, N. Y.	*New London:* P. Schwartz Co.
4979	Algrane Milk Feed. H. O. Co.'s Mills, Buffalo, N. Y.	*South Norwalk:* S. Roodner.
		Average guaranty
		Average of these 2 analyses
4986	New England Stock Feed. H. O. Co.'s Mills, Buffalo, N. Y.	*New Milford:* G. E. Ackley Co.
		Guaranty
4895	Badger Stock Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*Meriden:* A. Grulich
		Guaranty
4890	Larro-Feed for Dairy Cows. Larrowe Mill. Co., Detroit, Mich.	*Meriden:* Meriden Grain & Feed Co.
4905	Larro-Feed for Dairy Cows. Larrowe Mill. Co., Detroit, Mich.	*Thompsonville:* Geo. S. Phelps & Co.
		Average guaranty
		Average of these 2 analyses
4997	M. & S. Stock Feed. Meech & Stoddard, Middletown.	*Middletown:*
		Guaranty
5027	Sugarota Calf Meal. North West Mills Co., Winona, Minn.	*Putnam:* Bosworth Bros.
		Guaranty
4951	Schumacher's Calf Meal. Quaker Oats Co., Chicago	*Yantic:* A. R. Manning
		Guaranty
4903	Schumacher's Stock Feed. Quaker Oats Co., Chicago	*Hazardville:* A. D. Bridge's Sons
		Guaranty
4983	Winner Feed. David Stott, Detroit, Mich.	*Danbury:* Keeler Grain Co.
		Guaranty
4924	Biles Ready Ration (Union Grains). Ubiko Milling Co., Cincinnati, O.	*Hartford:* C. A. Pease & Co.
		Guaranty
4969	V-B Stock Feed. Vincent Bros., Bridgeport.	*Bridgeport:*
		Guaranty
	Molasses Feeds.	
4966	Sucrene Dairy Feed. American Milling Co., Peoria, Ill.	*Milford:* E. L. Oviatt
		Guaranty
4967	Clover Leaf Dairy Feed. Clover Leaf Mill. Co., Buffalo, N. Y.	*Milford:* E. L. Oviatt
		Guaranty
4985	Anchor Horse Feed. Glove Elevator Co., Buffalo, N. Y.	*New Milford:* G. E. Ackley Co.
		Guaranty
4917	H. & S. Alfalfa Feed. Dwight E. Hamlin & Co., Pittsburgh, Pa.	*East Hartford:* G. M. White & Co.
		Guaranty

* See also Molasses Feeds, below.

SAMPLED IN 1914—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
4955	8.80	3.80	10.25	9.28	60.59	7.28	$29.00
....	....	....	**8.50**	....	.....	**3.50**	.....
....	**8.22**	**3.90**	**10.32**	**10.03**	**60.25**	**7.28**	**31.00**
4936	8.10	5.18	15.50	12.35	54.01	4.86	36.00
4979	8.06	5.83	15.88	11.78	53.75	4.70	34.00
....	....	....	**14.00**	....	.....	**4.00**	.....
....	**8.08**	**5.51**	**15.69**	**12.06**	**53.88**	**4.78**	**35.00**
4986	9.01	4.73	9.44	10.55	62.20	4.07	34.00
....	....	....	**9.00**	....	.....	**4.00**	.....
4895	8.81	4.45	10.19	10.45	60.39	5.71	30.00
....	....	....	**10.00**	....	.....	**4.00**	.....
4890	8.06	4.70	21.50	12.28	49.65	3.81	36.00
4905	8.46	5.33	21.75	12.00	48.06	4.40	34.00
....	....	....	**19.00**	....	.....	**3.00**	.....
....	**8.26**	**5.01**	**21.63**	**12.14**	**48.85**	**4.11**	**35.00**
4997	9.27	3.23	9.81	8.68	63.44	5.57	29.00
....	....	....	**9.00**	....	.....	**3.00**	.....
5027	10.02	3.95	25.69	4.95	50.04	5.35	62.00
....	....	....	**14.00**	....	.....	**5.00**	.....
4951	9.26	3.63	18.94	1.83	58.04	8.30	68.00
....	....	....	**19.00**	....	.....	**8.00**	.....
4903	9.19	3.15	11.25	9.80	63.35	3.26	35.00
....	....	....	**10.00**	....	.....	**3.25**	.....
4983	9.29	3.40	8.94	9.50	63.74	5.13	30.00
....	....	....	**9.00**	....	.....	**5.00**	.....
4924	7.44	6.58	24.81	9.95	45.51	5.71	35.00
....	....	....	**24.00**	....	.....	**7.00**	.....
4969	7.35	4.98	11.38	18.25	54.22	3.82	29.00
....	....	....	**9.63**	....	.....	**4.60**	.....
4966	10.36	8.35	16.50	13.30	45.39	6.10	30.00
....	....	....	**16.50**	....	.....	**3.50**	.....
4967	9.89	9.75	15.50	13.38	47.31	4.17	30.00
....	....	....	**16.50**	....	.....	**3.50**	.....
4985	11.03	3.03	10.81	7.40	63.89	3.84	40.00
....	....	....	**9.00**	....	.....	**3.00**	.....
4917	8.44	7.40	16.44	14.05	50.63	3.04	32.00
....	....	....	**14.00**	....	.....	**3.50**	.....

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station. No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS.—*Continued.*	
	Molasses Feeds.—Continued.	
5033	H. & S. Alfalfa Feed for Milch Cows. Dwight E. Hamlin, Pittsburgh, Pa	*New Haven:* R. G. Davis & Sons
		Guaranty
4897	Badger Dairy Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis	*Meriden:* A. Grulich
		Guaranty
4899	Badger Horse Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis	*Meriden:* A. Grulich
		Guaranty
4953	Dried Beet Pulp and Molasses. Michigan Sugar Co., Bay City, Mich	*Jewett City:* Jewett City Grain Co
5012	Dried Beet Pulp and Molasses. Michigan Sugar Co., Bay City, Mich	*Torrington:* D. L. Talcott
4933	Dried Beet Pulp and Molasses. Michigan Sugar Co., Bay City, Mich	*Westerly:* C. W. Campbell Co.
		Average guaranty
		Average of these 3 analyses
4956	Molassine Meal. The Molassine Co., Boston	*Hamden:* I. W. Beers
		Guaranty
4883	Peters' King Corn. M. C. Peters Mill. Co., Omaha, Neb	*Ansonia:* Ansonia Flour & Grain Co
		Guaranty
4908	Purina Dairy Feed. Purina Mills, St. Louis	*Suffield:* Spencer Bros
		Guaranty
4910	Purina Feed with Molasses. Purina Mills, St. Louis	*Suffield:* Spencer Bros
		Guaranty
4968	Blue Ribbon Dairy Feed. Quaker Oats Co., Chicago	*Milford:* E. L. Oviatt
		Guaranty
4958	Quaker Dairy Feed with Molasses. Quaker Oats Co., Chicago	*Hamden:* I. W. Beers
		Guaranty
4971	Arab Balanced Horse Ration. G. E. Rarig, New York	*Norwalk:* Holmes, Keeler & Kent Co
		Guaranty
4974	Prize Horse Feed. J. C. Smith & Wallace Co., Newark, N. J	*Greenwich:* J. P. Johnson
		Guaranty
4930	Xtra-Vim Feed. Xtra-Vim Molasses Feed Co., Boston	*Westerly:* C. W. Campbell Co.
		Guaranty
	Poultry Feeds.	
4938	Bufceco Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y	*New London:* The Arnold Rudd Co
4977	Bufceco Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y	*Stamford:* W. L. Crabb
		Average guaranty
		Average of these 2 analyses
4893	Wirthmore Growing Feed. Chas. M. Cox Co., Boston	*Meriden:* Meriden Grain & Feed Co
		Guaranty
4891	Wirthmore Poultry Mash, All Grain. Chas. M. Cox Co., Boston	*Meriden:* Meriden Grain & Feed Co
		Guaranty

SAMPLED IN 1914—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
5033	9.43	6.20	21.94	12.38	45.92	4.13	$36.00
....	....	....	**20.00**	....	.....	**3.50**	.....
4897	10.96	11.40	16.13	11.28	46.40	3.83	30.00
....	....	....	**16.00**	....	.....	**2.00**	.....
4899	10.08	8.50	10.19	10.53	58.39	2.31	35.00
....	....	....	**10.00**	....	.....	**2.00**	.....
4953	9.10	3.53	8.63	17.53	60.86	0.35	26.50
5012	7.35	3.65	8.50	19.95	60.24	0.31	29.00
4933	8.71	3.78	9.13	17.80	60.18	0.40	29.00
....	....	....	**9.00**	....	.....	**0.50**	.....
....	**8.39**	**3.65**	**8.75**	**18.43**	**60.43**	**0.35**	**28.17**
4956	16.33	7.78	9.31	6.83	58.95	0.80	42.00
....	....	....	**7.00**	....	.....	**0.50**	.....
4883	10.30	5.10	9.63	9.95	62.37	2.65	38.00
....	....	....	**9.00**	....	.....	**1.50**	.....
4908	9.61	7.50	22.13	14.98	41.33	4.45	32.00
....	....	....	**19.00**	....	.....	**3.50**	.....
4910	10.12	6.35	11.56	13.00	56.59	2.38	38.00
....	....	....	**9.30**	....	.....	**1.70**	.....
4968	9.34	6.80	26.75	11.98	39.74	5.39	34.00
....	....	....	**25.00**	....	.....	.....	.....
4958	10.64	7.08	17.63	12.25	47.95	4.45	27.00
....	....	....	**16.00**	....	.....	**4.00**	.....
4971	9.89	5.25	10.63	10.33	61.38	2.52	39.00
....	....	....	.....	....	.....	.....	.....
4974	10.65	6.83	12.00	10.15	58.50	1.87	38.00
....	....	....	**10.00**	....	.....	**2.00**	.....
4930	15.32	7.93	5.31	5.90	64.74	0.80	36.00
....	....	....	**4.61**	....	.....	**0.81**	.....
4938	9.68	3.15	16.38	5.50	60.15	5.14	37.00
4977	10.15	3.98	17.88	5.73	55.89	6.37	39.00
....	....	....	**15.00**	....	.....	**4.00**	.....
....	**9.91**	**3.57**	**17.13**	**5.61**	**58.02**	**5.76**	**38.00**
4893	10.21	2.00	11.44	3.43	70.17	2.75	40.00
....	....	....	**12.00**	....	.....	**4.00**	.....
4891	9.22	5.05	16.69	7.63	58.13	3.28	40.00
....	....	....	**12.00**	....	.....	**3.00**	.....

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS.—*Concluded.*	
	Poultry Feeds.—Concluded.	
4892	Wirthmore Poultry Mash, Fish & Scrap. Chas. M. Cox Co., Boston	*Meriden:* Meriden Grain & Feed Co
		Guaranty
5034	Globe Egg Mash. Albert Dickinson Co., Chicago	*New Haven:* R. G. Davis & Sons
		Guaranty
4923	Queen Dry Mash. Albert Dickinson Co., Chicago	*Hartford:* Smith, Northam & Co
		Guaranty
4973	Dry Mash. Edward R. Donovan, New York	*Greenwich:* J. P. Johnson
4960	Blue Ribbon Laying Mash. Globe Elevator Co., Buffalo, N. Y	*West Cheshire:* G. W. Thorpe.
		Guaranty
5025	Meat Mash for Poultry. Greene's Chicken Feed Co., Marblehead, Mass	Putnam: F. M. Cole
		Guaranty
5026	Purity Poultry Mash. Wm. S. Hills Co., Boston	*Putnam:* Bosworth Bros
		Guaranty
4964	H. O. Poultry Feed. The H. O. Mills, Buffalo, N. Y	*Bristol:* Goodsell Bros
		Guaranty
4995	M. & S. Dry Mash. Meech & Stoddard, Middletown	*Middletown:*
		Guaranty
4944	Mystic Laying Mash. Mystic Mill. & Feed Co., Rochester, N. Y	*Norwich:* Chas. Slosberg
		Guaranty
4972	Fattening Feed. Park & Pollard, Boston	*Norwalk:* Holmes, Keeler & Kent Co
		Guaranty
4913	"Lay or Bust" Dry Mash. Park & Pollard, Boston	*East Hartford:* G. M. White & Co
		Guaranty
4975	Purina Chicken Chowder. Purina Mills, St. Louis	*South Norwalk:* S. Roodner
		Guaranty
4981	American Poultry Feed. Quaker Oats Co., Chicago	*Bethel:* Morrison & Dunham.
		Guaranty
5016	Quaker Poultry Mash. Quaker Oats Co., Chicago	*Manchester:* Little & McKinney
		Guaranty
5009	V-B Mash for Laying Hens. Vincent Bros., Bridgeport	*Torrington:* F. U. Wadhams
		Guaranty
	Fish Scrap.	
4954	Red Star Brand. International Glue Co., Boston	*Jewett City:* Jewett City Grain Co
		Guaranty

SAMPLED IN 1914—*Concluded.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
4892	9.09	7.30	19.44	6.80	54.13	3.24	$40.00
	....	....	**17.00**	....	.....	**4.00**	.....
5034	10.01	5.70	17.19	6.85	55.78	4.47	42.00
	....	....	**15.00**	....	.....	**3.00**	.....
4923	10.08	2.68	10.63	5.50	67.02	4.09	43.00
	....	....	**11.00**	....	.....	**2.50**	.....
4973	10.68	3.98	13.13	6.68	60.70	4.83	39.00
4960	9.71	8.65	20.81	8.65	46.52	5.66	40.00
	....	....	**20.00**	....	.....	**3.00**	.....
5025	9.23	19.33	14.50	6.93	44.90	5.11	44.00
	....	....	**12.00**	....	.....	**3.00**	.....
5026	8.67	10.68	19.81	6.43	48.36	6.05	43.00
	....	....	**18.00**	....	.....	**4.00**	.....
4964	9.31	3.40	16.63	8.23	57.37	5.06	40.00
	....	....	**17.00**	....	.....	**4.50**	.....
4995	9.48	8.48	20.75	6.90	48.87	5.52	38.00
	....	....	**12.00**	....	.....	**3.00**	.....
4994	10.08	7.60	23.00	6.83	47.80	4.69	41.00
	....	....	**23.00**	....	.....	**4.00**	.....
4972	10.63	4.53	9.94	4.53	67.36	3.01	45.00
	....	....	**10.00**	....	.....	**3.50**	.....
4913	9.75	11.73	18.19	7.25	49.03	4.05	45.00
	....	....	**18.00**	....	.....	**3.50**	.....
4975	9.24	7.30	19.69	8.50	50.51	4.76	44.00
	....	....	**17.00**	....	.....	**3.00**	.....
4981	10.51	3.50	13.81	4.48	62.49	5.21	40.00
	....	....	**12.00**	....	.....	**3.50**	.....
5016	9.11	5.70	19.13	7.55	52.62	5.89	40.00
	....	....	**17.00**	....	.....	**4.00**	.....
5009	9.35	8.40	20.63	10.45	46.23	4.94	42.00
	....	....	**21.50**	....	.....	**4.00**	.....
4954	7.50	49.70	38.86	2.28	.....	1.66	50.00
	....	....	**45.00**	....	.....	**2.00**	.....

guaranty, **3698**, sent by S. J. Orr, West Suffield contained 40.75 per cent. protein.

Six other samples credited to Humphreys Godwin Co. were analyzed. **3652, 4691** and **3741,** sent by The Coles Co., Middletown, without guaranty, **5127,** sent by E. F. Miller, Ellington, without guaranty, **3578,** sent by J. L. Blackmar, West Redding, guaranteed 41 per cent. protein, and **3616,** sent by F. C. Benjamin and Co., Danbury, guaranteed 36 per cent. protein, contained 37.44, 39.38, 39.38, 39.31, 42.63 and 37.19 per cent., respectively.

3579, *Buckeye Brand,* sold by Buckeye Cotton Oil Co., Cincinnati, O., guaranteed 38.62 per cent protein, and sent by H. E. Meeker, Danbury, contained 38.81 per cent.

3717 and **3676,** *Good Luck Brand,* sold by S. P. Davis, Little Rock, Ark., guaranteed 41 per cent protein, and both sent by G. T. Soule, New Milford, contained 41.38 and 40.44 per cent. respectively.

3650 and **3651,** *Owl Brand,* sold by F. W. Brode and Co., Memphis, Tenn., guaranteed 43.70 per cent. protein, and sent by G. T. Soule, New Milford, contained 45.19 and 45.50 per cent, respectively; **3649**, also sent by Mr. Soule, guaranteed 41 per cent., contained 37.25 per cent; **5128**, same brand, sold by R. J. Hardy and Sons, Boston, and sent by E. H. Rollins, Granby, without guaranty, contained 41.63 per cent. protein.

4666, *Bonita Brand,* sold by Southern Cotton Oil Co., guaranteed 38.62 per cent. protein, and sent by Apothecaries Hall Co., Waterbury, contained 38.25 per cent.

5123, *Canary Brand,* sold by C. L. Montgomery and Co., Memphis, Tenn., guaranteed 38.5 per cent. protein, and sent by The Coles Co., Middletown, contained 37.31 per cent.

5124, *Pilgrim Brand,* sold by Southern Cotton Oil Co., Memphis, Tenn., guaranteed 38.5 per cent. protein, and sent by The Coles Co., Middletown, contained 38.13 per cent.

5232, *Pioneer Brand,* sold by J. E. Soper Co., Boston, guaranteed 41 per cent. protein, and sent by T. F. Connor, Poquonock, contained 52.46 per cent.

4684, sold by J. E. Soper Co., Boston, guaranteed 41 per cent. protein, and sent by Wheeler and Co., Bridgeport, contained 41.38 per cent. **5234**, sold by Alpine, McLean Co., Boston, guaranteed 38.5 per cent. protein, and sent by The Coles Co., Middletown contained 40.19 per cent.

Wheat Products. **3660**, *H. Middlings,* Hecker-Jones-Jewell Milling Co., New York, guaranteed 17.36 per cent. protein, and sent by O. G. Beard, Shelton, contained 17.13 per cent. The sample contained 8010 weed seeds to the pound, the chief of which which were mustard (3762), hare's ear mustard (1332) and green foxtail (1134). Knot weed, pigweed, catchfly and Russian thistle seeds were also present at the rate of from 200 to 600 per pound. The six varities of seeds present in largest quantity showed a germination power of from 11.4 to 100 per cent.

3594, *Middlings,* sent by M. Strochansky, East Haven, contained considerable stinking smut.

Corn Products. **3592,** *Gluten Feed,* sent by M. Strochansky, East Haven, contained 26.38 per cent. protein. **3593**, *Corn Meal,* sent by the same person, contained 9.69 per cent protein; **4152**, *Gluten Feed,* sent by Thomas Holt, Southington, contained 24.69 per cent protein. None of these three samples showed any abnormality.

Dried Beet Pulp, **3603**, sent by W. A. Hyde, Kensington, contained 8.63 per cent. protein.

Dried Brewers' Grains, **4685,** sent by Mrs. C. E. Herold, New Canaan, contained 28.44 per cent protein.

Provender, **3762,** sent by R S. Wells, Hazardville, with the complaint that it made his horses sick; no impurity, other than a trace of mold, was found in the sample.

Stock Feeds. **3677**, *Unicorn Dairy Feed,* sent by S. R. Scoville, West Cornwall, contained 28.25 per cent. protein.

3833, *Purina Dairy Feed,* guaranteed 19 per cent. protein, and sent by A. Greenbacker, Meriden, contained 19.50 per cent.

3877, *Xtra-Vim Molasses Feed,* guaranteed 4.61 per cent. protein, and sent by R. H. Ensign, Simsbury, contained 4.38 per cent. protein.

4061, *Feed,* said to consist of corn hulls and a little meal, sent by M. D. Lincoln, Norwich, contained 5.63 per cent. protein.

Poultry Feeds. **4555,** *Poultry Mash,* sent by D. W. Meeker, West Cheshire, contained 19.69 per cent. protein. **3878,** *Dry Poultry Mash,* sent by R. H. Ensign, Simsbury, contained 15.63 per cent. protein. **5233**, feed for mixing in mash for hens, sent by Mrs. W. E. Waller, Bridgeport, contained 12.69 per cent. protein.

Alfalfa Feeds. **3834,** *Pure Dustless Alfalfa Meal,* Otto Weiss Alfalfa Stock Food Co., Wichita, Kan., guaranteed 14 per cent.

protein, and sent by A. Greenbacker, Meriden, contained 14.88 per cent. **3629,** *Shredded Alfalfa,* sold by Hartford Hay and Grain Co., Hartford, and sent by T. A. Stanley, New Britain, contained

Water	6.22	Fiber	31.32
Ash	9.74	Nitrogen-free extract	36.66
Protein	14.31	Fat	1.75

Cocoa Shells. **4721** sent by A. A. Cobb, Guilford, contained

Water	8.97	Fiber	17.15
Ash	6.93	Nitrogen-free extract	46.07
Protein	15.00	Fat	5.88

Condimental Stock Feeds. **5192,** *Savage's Three Feeds for a Cent,* sent by F. S. Smith, Beacon Falls, consisted largely of mineral matter and charcoal. It contained 66.70 per cent. ash, showing much chlorine, considerable lime, phosphates and sulphates, and distinct amounts of magnesia, carbonates and sand. **5193**, *Anglo-American Horse and Cattle Food,* sent by Judd Bros., New Milford, consisted largely of wheat with probably some buckwheat. It contained 10.84 per cent. ash, in which much phosphate was present, and considerable chlorides and magnesia, with some sulphates and alumina, and a trace of lime.

Bakery Refuse. **5248**, sent by C. M. Jarvis, Berlin, contained

Water	4.99	Fiber	0.27
Ash	7.23	Nitrogen-free extract	69.26
Protein	10.06	Fat	8.19

Ensilage Corn, Soy Bean Fodder and Soy Beans. Below will be found the analyses of nineteen samples of various varieties of ensilage corn grown at the Station farm at Mt. Carmel and at Granby, which are published here merely as a matter of record. Also the analyses of twenty samples of soy bean fodder and nineteen samples of soy beans.

Soy Beans.

No.	Variety.	Water	Ash.	Protein.	Fiber.	Nitrogen-free Extract.	Fat.
4730	Ito San	13.35	4.72	37.83	3.76	25.65	14.69
4725	Ito San	15.01	4.50	37.70	3.64	24.27	14.88
4727	Quebec 92	11.44	5.18	37.63	3.52	25.43	16.80
4737	Quebec 537	12.43	5.49	39.37	3.58	24.21	14.92
4724	Kentucky	14.60	5.26	34 68	4.15	25.44	15.87
4729	Medium Yellow	17.09	4.31	37.76	3.49	23.28	14.07
4723	Manhattan	14.02	7.42	38.85	3.51	22.52	13.68
4733	Ebony	13.94	4.94	38.85	4.99	23.82	13.46
4728	Peking	25.62	5.20	31.16	4.85	22.40	10.77
4868	Medium Green	12.49	4.72	39.54	3.99	23.86	15.40
4726	Okute	13.54	5.60	37.05	4.54	24.04	15.23
4736	Wilson	18.54	4.61	33.83	5.23	24.94	12.85
4735	Arlington	16.01	4.84	32.70	5.41	27.63	13.41
4732	Swan	40.69	4.53	25.80	3.06	17.33	8.59
4869	Morse	15.78	4.37	35.32	4.66	26.60	13.27
4731	Cloud	25.54	4.67	30.80	4.49	23.98	10.52
4722	Mikado	37.45	3.71	23.05	3.50	20.54	11.75
4734	Wing's Mongol	19.12	5.37	31.98	4.91	24.25	14.37
4870	Jenkins' Hollybrook	17.77	5.24	35.19	3.91	25.95	11.94

Soy Bean Fodder.

No.	Variety.	Water	Ash.	Protein.	Fiber.	Nitrogen-free Extract.	Fat.
4652	Ito San	72.71	2.30	4.98	7.53	10.52	1.96
4621	Ito San	70.34	2.62	4.97	7.78	12.28	2.01
4619	Quebec	78.31	1.98	4.13	4.96	8.72	1.90
4620	Quebec	72.51	2.37	5.13	7.03	11.04	1.92
4625	Kentucky	71.93	2.40	4.97	7.05	11.84	1.81
4622	Medium Yellow	73.88	2.61	4.97	6.49	10.40	1.65
4624	Manhattan	70.40	2.50	5.49	7.56	11.94	2.11
4623	Ebony	69.81	2.61	5.63	8.36	11.88	1.71
4661	Arlington	68.12	2.36	3.87	11.41	12.93	1.31
4660	Hollybrook	71.91	2.82	3.73	8.58	12.23	0.73
4659	Wilson	61.88	3.15	7.06	11.96	14.16	1.79
4658	Wing's Mikado	76.83	1.91	2.74	7.27	10.10	1.15
4657	Okute	75.96	1.98	4.48	7.25	8.89	1.44
4656	Cloud	64.96	3.26	4.86	12.30	13.74	0.88
4655	Medium Green	59.74	3.29	6.85	11.98	15.51	2.63
4654	Morse	73.71	2.65	4.95	7.35	10.25	1.09
4653	Swan	75.82	2.11	4.36	7.46	9.24	1.01
4678	Wing's Mongol	69.30	2.61	3.31	11.23	12.37	1.18
4677	Peking	65.45	3.06	5.22	11.92	13.15	1.20
4679	Plot 37	67.75	2.59	4.40	8.25	15.68	1.33

ENSILAGE CORN.

No.	Variety.	Water	Ash.	Protein.	Fiber.	Nitrogen-free Extract.	Fat.
	GROWN AT MT. CARMEL.						
4646	Brewer's Dent x King Philip	67.80	1.48	2.06	5.94	21.73	0.99
4647	Brewer's Dent	70.32	1.64	2.20	6.43	18.67	0.74
4648	Howe's Dibble's Dent	70.91	1.32	2.30	5.98	18.59	0.90
4676	Dibble's Dent	60.96	1.44	2.94	7.15	26.30	1.21
4633	Rustless White Dent	78.11	1.13	1.80	4.86	13.57	0.53
4650	Gelston's Selected, 12 in	75.22	1.41	1.64	6.03	15.09	0.61
4651	" " 6 in	74.46	1.44	1.49	6.03	16.18	0.40
4649	Funk's 90 Day	75.76	1.22	1.77	5.48	15.14	0.63
4634	Early Mastodon	76.25	1.23	2.11	5.55	14.27	0.59
4674	Eureka 6 in	75.29	1.32	1.63	6.74	14.66	0.36
4675	" 12 in	75.93	1.30	1.81	6.14	14.51	0.31
5673	" 12 in	76.84	1.32	1.95	6.10	13.48	0.31
	GROWN AT GRANBY.						
4627	Gelston's Selected	77.98	1.19	1.30	5.11	14.02	0.40
4628	Dibble's Dent	77.46	1.13	1.64	5.50	13.77	0.50
4630	Brewer's Dent x King Philip	78.44	1.00	1.32	5.15	13.64	0.45
4631	Brewer's Dent	79.30	0.99	1.27	5.24	12.83	0.37
4626	Eureka	87.87	1.06	1.24	4.55	8.02	0.26
4632	Funk's Silver King	82.56	0.97	0.93	5.05	10.26	0.23
4629	Funk's 90 Day	78.01	0.95	1.41	5.61	13.65	0.37

PART V.

NINETEENTH REPORT ON FOOD PRODUCTS AND SEVENTH REPORT ON DRUG PRODUCTS, 1914.

By JOHN PHILLIPS STREET.*

Of the 392 samples collector by the station agent 52 were adulterated, misbranded or below standard, exclusive of the 130 samples of proprietary medicines, of which possibly 20 might be passed as possessing some merit. The Dairy and Food Commissioner submitted to this laboratory 1251 samples, chiefly eggs, milk, vinegar, temperance drinks and drug tinctures. Of these 460 were adulterated, misbranded or below standard, and 30 were legally labeled compounds. Besides the above, 275 samples have been examined for city and health officials and other individuals. In all 1918 samples were analyzed of which 624 were adulterated, misbranded or below standard (exclusive of the proprietary medicines).

I. FOOD PRODUCTS.

BISCUITS AND CRACKERS.

Eighty-eight samples of biscuits and crackers were examined not with the expectation of finding adulteration, but rather to secure data to enable us to answer the frequent requests as to the composition of certain brands of biscuits, and also to determine whether or not the manufacturers were complying with the net weight law. Many of these biscuits are more strictly confections than foods, and this must kept in mind in connection with their high cost. From the food standpoint many of them the consumer would not be justified in purchasing; on the other hand, judged as confections, their daintiness, tastiness, general attractiveness and cleanliness might justify such high prices as from 60 cents to $1.50 per pound. Furthermore, it is only just to say that in many

* The analytical work herein reported was done by E. M. Bailey, C. B. Morison, C. E. Shepard and G. L. Davis.

TABLE I:—BISCUITS, CRACKERS, ETC.

Station No.	Manufacturer and Brand.	No. of Pieces		Net Weight.		Cost.		Calculated Calories per 100 gms.	Water.	Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free Extract.	Ether Extract.
		Claimed.	Found.	Claimed.	Found.	Per Package.	Per Pound.							
				oz.	oz.	cts.	cts.							
	Huntley and Palmer, Reading, Eng.													
4400	Acorn Biscuit	..	42	..	5.0	38	122	592	4.29	1.22	8.75	0.54	41.99	43.21
3537	Breakfast Biscuit	..	15	4	4.4	10	36	403	8.37	1.41	9.13	0.16	72.40	8.53
4399	Carmencita, Assorted	..	42	4	5.2	40	123	529	3.60	0.56	2.31	0.13	64.09	29.31
4401	Cinderella Biscuits	..	24	..	6.3	35	89	474	6.95	0.52	6.44	0.18	64.99	20.92
4398	Philippine Biscuit	..	47	4	5.0	38	122	536	3.79	1.53	9.94	0.65	52.08	32.01
4402	Reading Shortbread	..	22	6	7.7	28	28	497	5.37	0.60	4.50	0.11	65.21	24.21
4403	Sugar Wafers, Lemon Flavored	..	36	..	4.4	35	127	377	6.22	0.66	8.38	0.10	83.61	1.03
	Johnson Educator Food Co., Boston, Mass.													
4391	Barley Educator Crackers	52	52	8	12.3	25	33	403	8.48	4.86	9.13	0.48	65.39	11.66
4419	Educator Original Water Cracker	72	84	12	17.2	25	23	362	7.99	0.75	10.50	0.38	79.87	0.51
4464	The Suffragette	43	42	7	7.5	10	21	413	8.05	1.40	9.00	0.15	71.08	10.32
	Loose-Wiles Biscuit Co., Boston, Mass.													
4460	Chocolate London Biscuits	46	44	7½	8.2	25	49	423	6.62	1.33	7.25	0.53	72.89	11.38
4415	Hydrox Chocolate Biscuits	16	16	7¾	8.0	30	60	460	5.45	1.00	5.63	0.43	70.08	17.41
4409	Sunshine Brandywine	20	20	5¾	6.0	25	67	497	2.24	0.69	3.69	0.28	71.03	22.07
3541	" Butter Thin	44	56	6½	7.4	10	22	427	7.33	1.76	9.00	0.14	68.91	12.86
4408	" Champagne Wafers	28	30	3¾	4.1	15	59	486	3.20	0.64	4.50	0.10	71.27	20.29
4406	" Clover Leaves	32	32	3¾	4.1	15	59	493	3.24	0.58	4.00	0.05	70.44	21.69
4417	" Dessert Wafers	43	39	9	9.0	25	44	410	7.59	1.05	6.25	0.16	75.89	9.06
3547	" Matinee Biscuit	36	44	5¾	7.1	10	23	415	8.29	1.27	7.25	0.16	72.19	10.84
3548	" O. So. Fine Lunch Biscuit	25	23	4½	5.0	5	16	422	8.61	1.31	9.00	0.16	68.52	12.40
4410	" Perfetto Sugar Wafers, Lemon	36	36	6¼	7.2	25	56	499	3.18	0.58	4.38	0.20	68.71	22.95
4416	" Philopena Sugar Almonds	60	60	5½	5.7	25	70	519	3.76	0.53	2.63	0.17	65.54	27.37
3534	" Pretzelettes	30	60	6½	9.0	15	27	354	9.46	5.05	10.00	0.21	72.67	2.61
3549	" Saltines	44	46	5¼	5.7	25	70	418	8.74	2.72	8.94	0.17	66.56	12.87
4411	" Tan-San	10	10	2½	2.6	10	62	510	3.31	0.91	4.19	0.10	65.94	25.55
4407	" Veroniques	..	51	6	6.3	25	63	511	2.96	0.58	3.75	0.09	67.49	25.13
4405	" Vienna Sugar Fingers	40	41	6½	7.3	25	55	418	6.51	1.45	6.81	0.12	75.08	10.03
4462	" Zephyrettes	..	84	...	10.7	23	34	419	9.09	1.70	9.38	0.14	67.20	12.49
4412	Takhoma Biscuit	22	24	4¾	5.2	5	15	405	8.07	1.96	10.06	0.16	70.48	9.27
4451	Tom Thumb Biscuits	117	117	7	8.8	25	45	403	8.14	1.19	6.00	0.12	76.45	8.10
	Meyer and Lange (Dist.), New York City.													
4397	Peterson's Eatsum Swedish Style Milk Wafer	..	12	2¼	2.6	25	154	365	7.72	1 75	12 69	0.14	77.08	0.62

TABLE I:—BISCUITS, CRACKERS, ETC.

Station No.	Manufacturer and Brand.	No. of Pieces.		Net Weight.		Cost.		Calculated Calories per 100 gms.	Water.	Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free Extract.	Ether Extract.
		Claimed.	Found.	Claimed.	Found.	Per Package.	Per Pound.							
				oz.	oz.	cts.	cts.							
	National Biscuit Co., New York City.													
4420	Albert Biscuit	75	81	15	16.3	25	25	445	4.67	1.09	7.25	0.13	73.09	13.77
4441	Arrowroot Biscuit	32	34	6¼	6.6	10	24	424	6.28	1.13	7.69	0.15	74.00	10.75
4449	Baronet Biscuit	44	46	6½	7.1	10	23	429	7.51	1.51	8.31	0.13	69.36	13.18
4434	Bent's Home Made Water Crackers (Milton, Mass.)	18	20	15	17.5	30	27	369	8.07	0.53	10.44	0.15	79.90	0.91
4438	Champagne Wafers	30	30	5	4.6	25	87	478	3.56	0.83	5.38	0.21	70.82	19.20
4456	Chocolate Tokens	16	16	6	6.1	25	66	555	1.71	1.03	4.63	0.63	58.33	33.67
4423	Dinner Biscuit	120	153	6	7.9	15	30	406	8.10	1.99	11.25	0.17	68.98	9.51
4422	Festino Almonds	55	55	4½	4.2	25	95	504	5.51	1.04	7.50	0.41	59.15	26.39
4429	Five O'Clock Tea Biscuit (Vanilla and Chocolate)	34	36	6	6.7	10	24	422	6.72	1.53	7.69	0.34	72.50	11.22
4428	Lemon Snaps	27	28	4	4.2	5	19	408	7.65	1.42	6.25	0.15	75.51	9.02
4433	Merrimac Biscuit	25	27	11	12.8	10	13	397	8.30	1.81	10.19	0.17	71.91	7.62
4437	Minaret Wafers	40	40	4¼	4.5	10	36	427	5.90	2.31	6.44	0.14	73.11	12.10
4421	Nabisco, Vanilla Flavor	29	28	2⅝	3.0	10	53	498	3.26	0.56	4.38	0.08	68.97	22.75
4468	Oreo Biscuit	18	18	8¼	8.1	25	49	463	4.90	1.18	5.69	0.37	70.02	17.84
4431	Oswego Biscuit	60	67	12	12.3	25	33	422	5.41	1.08	7.50	0.11	76.35	9.55
4444	Oysterettes	140	152	4¾	5.5	5	15	394	8.94	2.75	10.38	0.19	69.50	8.24
4463	Pretzelettes, Hand Made	35	40	7	8.4	9	17	359	9.38	3.45	10.56	0.20	74.30	2.11
4450	Saltine Biscuit	44	46	5¼	6.5	10	25	401	9.52	5.53	8.88	0.16	63.44	12.47
3543	Saratoga Chips	130	135	11¼	11.7	25	34	426	8.21	1.63	9.00	0.11	67.94	13.11
4459	Saratoga Flakes, Salted	100	108	12	14.3	25	28	416	7.36	4.13	8.63	0.13	67.34	12.41
4426	Social Tea Biscuit	37	40	6¼	6.4	10	25	419	6.74	1.27	7.75	0.13	73.92	10.19
4442	Soda Crackers	36	36	9¼	9.7	10	16	403	9.19	1.83	9.31	0.14	70.02	9.51
4424	Uneeda Biscuit	22	22	4¾	5.0	5	16	399	8.93	2.05	10.13	0.16	69.96	8.77
4445	Uneeda Lunch Biscuit	25	26	4½	5.0	5	16	425	8.26	1.20	8.06	0.16	69.71	12.61
4432	Vanilla Wafers	30	34	5½	6.5	10	25	438	7.59	1.44	6.25	0.07	69.90	14.75
4430	Water Thin Biscuit	87	98	13	14.0	25	29	397	5.78	1.55	9.69	0.13	77.48	5.37
4435	Zephyrette	104	106	12	13.5	25	30	429	7.51	1.71	8.88	0.13	68.52	13.25
	The Quaker Oats Co., Chicago, Ill.													
3540	Quaker Breakfast Biscuit	..	12	12	12.8	10	13	350	9.74	2.86	17.13	0.40	69.43	0.44
	Graham Crackers.													
4382	Battle Creek San. Co.'s Sweetened Graham Crackers	..	33	14	15.0	15	16	401	7.00	1.70	8.81	0.73	74.07	7.69
4392	Johnson's Educator Graham Crackers	50	64	10	13.8	25	22	410	6.55	2.88	10.25	1.19	69.07	10.06
4395	" " Sweet Graham Crackers	28	32	8	9.8	25	41	394	8.54	2.95	8.50	1.30	69.60	9.11
3542	Sunshine Graham Crackers (L.-W. Bisc. Co.)	32	30	3	3.2	5	25	409	8.40	2.36	8.25	0.43	69.90	10.66
4440	Nat. Bisc. Co.'s Graham Crackers	30	28	8½	9.0	10	18	415	6.61	2.03	8.31	0.38	72.46	10.21
4389	" " " " Wafers	45	43	11	9.9	25	40	422	5.36	1.97	8.38	0.28	73.53	10.48

TABLE I:—BISCUITS,

Station No.	Manufacturer and Brand.	No. of Pieces. Claimed.	No. of Pieces. Found.
	Oatmeal Crackers.		
4383	Battle Creek San. Co.'s Oatmeal Wafers	..	28
4390	Johnson's Educator Oatmeal Crackers	38	44
3539	Sunshine Oatmeals (L.-W. Bisc. Co.)	27	31
4439	Nat. Bisc. Co.'s Oatmeal Crackers	30	29
	Ginger Wafers.		
4413	Sunshine New England Ginger Wafers (L.-W. Bisc. Co.)	55	60
4452	" Yum-Yum Ginger Snaps (L.-W. Bisc. Co.)	27	31
4436	Nat. Bisc. Co.'s Famous Ginger Wafers	38	40
4447	" " " Ginger Snaps	32	35
4446	" " " Uneeda Jinjer Wayfer	43	44
4427	" " " Zu Zu Ginger Snaps	27	27
	Cheese Wafers.		
4404	Huntley & Palmer's Cheese Straws Biscuits	..	168
4414	Sunshine Cheese Sticks (L.-W. Bisc. Co.)	100	104
4453	" Cheese Wafers (L.-W. Bisc. Co.)	26	31
4443	Nat. Bisc. Co.'s Al Fresco Cheese Wafers	60	62
4448	" " " Cheese Sandwich	38	41
4425	" " " Cheese Tid-Bit	325	..
	Whole Wheat Preparations.		
4380	Crystal Wheat. Battle Creek San. Co., Battle Creek, Mich.	..	..
4384	Whole Wheat Cream Sticks. Battle Creek San. Co., Battle Creek, Mich	..	127
4458	Wheatsworth Biscuit. F. H. Bennett Bisc. Co., New York City	..	35
4387	Wheat Meal Biscuit. Huntley & Palmer, Reading, Eng.	..	15
4393	Educator Toasterettes. Johnson Educator Food Co., Boston, Mass	40	43
4394	Educator Wafers. Johnson Educator Food Co., Boston, Mass	40	41
4381	Granose Biscuit. Kellogg Food Co., Battle Creek, Mich.	..	11
4388	Sunshine Whole Wheat Wafers. Loose-Wiles Bisc. Co., Boston, Mass	112	140

CRACKERS, ETC.

Net Weight. Claimed.	Net Weight. Found.	Cost. Per Package.	Cost. Per Pound.	Calculated Calories per 100 gms.	Water.	Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free Extract.	Ether Extract.
oz.	oz.	cts.	cts.							
11	13.1	15	18	418	7.46	1.74	7.94	0.27	71.35	11.24
10	14.8	25	27	414	7.14	1.88	9.63	0.38	70.71	10.26
9	9.2	15	26	412	7.79	1.90	8.63	0.27	70.99	10.42
9	9.1	10	18	408	7.84	1.67	8.50	0.19	72.33	9.47
13	13.9	25	22	442	4.22	2.60	6.00	0.19	73.05	13.94
4	4.8	5	17	405	7.77	2.82	6.25	0.20	73.43	9.53
14	14.7	..	..	432	4.09	2.33	6.19	0.11	75.61	11.67
8	8.8	10	18	410	7.29	2.10	5.56	0.17	75.34	9.54
7¾	8.4	10	19	410	7.87	2.28	5.94	0.14	73.54	10.23
4	4.4	5	18	404	7.55	2.64	6.75	0.22	73.70	9.14
6	7.8	35	72	491	6.67	3.37	13.56	0.10	50.11	26.19
6¾	8.0	15	30	406	8.78	2.68	13.38	0.19	64.40	10.57
6¾	6.0	10	27	406	8.39	2.38	13.44	0.19	63.99	10.71
4	4.3	10	37	400	8.22	4.80	16.50	0.14	59.87	10.47
4¼	5.0	10	32	418	8.59	3.13	14.06	0.14	61.03	13.05
4	4.5	10	36	403	8.41	5.12	16.13	0.12	58.67	11.55
20	23.7	15	10	357	9.53	1.85	11.25	1.73	73.69	1.95
14	16.0	15	15	400	9.09	1.92	9.19	0.30	70.40	9.10
7	7.3	10	22	404	6.28	2.38	8.13	1.24	73.25	8.72
...	8.5	18	34	431	7.40	1.71	8.13	1.32	66.80	14.64
4	4.0	10	40	398	7.38	1.65	10.06	0.38	73.35	7.18
3	4.2	10	38	363	8.96	0.82	10.38	0.42	78.83	0.59
6	5.2	15	46	340	11.32	3.94	10.25	1.83	71.03	1.63
9½	12.8	25	31	419	5.27	2.33	9.25	0.42	72.54	10.19

ages, thus permitting a considerable saving in cost, with a possible loss as to freshness and cleanliness.

The samples were of such a miscellaneous character as not to permit a very detailed classification. The graham, oatmeal, ginger, cheese and whole wheat biscuits are grouped separately; the others are classified simply according to their manufacturer.

One brand of *Sunshine* biscuits and four of *Huntley and Palmer's* bore no statement of net weight as required by law. The claims for the other samples both as to count and weight were met very satisfactorily, in general the amount found being considerably in excess of that claimed.

The miscellaneous biscuits require no special comment other than to call attention to their very wide range in composition and cost. The maxima and minima of the important constituents and the upper and lower limits of price per pound are shown in the following tabulation:

Miscellaneous Biscuits.

	Max.	*Min.*
Protein	17.13	2.31
Ash	5.53	0.52
Nitrogen—free extract	83.61	41.99
Ether extract	43.21	0.44
Cost per pound	$1.54	$0.13
Calories per 100 gms.	592	350

It is impossible to generalize with such diverse preparations. The high percentages of fat are chiefly due to the addition of chocolate, nut pastes, or butter; the high ash figures are generally due to common salt; the variations in nitrogen-free extract depend upon whether or not the biscuits are sweetened. It is interesting to note that the two brands selling at the highest prices per pound are among the lowest in calorific value.

Graham Crackers.

Graham crackers, to be entitled to the name, should be made from graham flour, "unbolted wheat meal." Graham flour is characterized by a higher ash and fiber content than ordinary wheat flour. With the exception of the two *Johnson* samples the fiber is low and in the *Battle Creek* samples the ash is likewise low. Fibers as low as from 0.28 to 0.73 per cent. do not suggest

cases the biscuits may be bought in bulk as well as in small packthe use of any considerable quantity of unbolted wheat meal. In cost they ranged from 18 to 40 cents per pound.

Oatmeal Crackers.

The four samples were fairly uniform in composition and appeared to be true to name. They cost from 18 to 27 cents per pound.

Ginger Wafers.

The six samples were quite uniform except in the amount of ether extract which ranged from 9.14 to 13.94 per cent. They require no special comment.

Cheese Wafers.

The samples varied considerably in composition, especially in ether extract, No. 4404 containing twice as much as any of the other samples. These variations are due chiefly to the amount and quality of cheese used. They cost from 27 to 72 cents per pound.

Whole Wheat Preparations.

"Entire wheat" flour is a name for flour produced in a special manner, and contains all the ingredients of the wheat grain except those found in the outer branny covering. It would naturally, therefore, contain somewhat less fiber and ash than graham flour. By reference to Table I it will be seen that the whole wheat biscuits in general contained more protein and fiber and less ash than the graham crackers. Certainly all cannot be straight whole wheat preparations, with the ash ranging from 0.82 to 3.94 per cent., and the fiber from 0.30 to 1.83 per cent. Likewise the fat shows a range from 0.59 to 14.64 per cent.

BRAN BISCUITS AND LAXATIVE PREPARATIONS.

Twelve of these preparations were analyzed. With two exceptions their alleged laxative qualities would seem to depend on the wheat bran, which is more or less directly claimed to have been incorporated in the biscuit. *Colax* claims to be cellulose prepared from Ceylon moss, while *Mansfield Agar Agar Wafers* claim agar agar to be present.

TABLE II:—BRAN BISCUIT AND

Station No.	Manufacturer and Brand.	No. of Pieces. Claimed.	No. of Pieces. Found.
3568	Christian's Laxative Bread. Christian's Natural Food Corp., N. Y. City	..	29
3569	Dietetic Bran Biscuit. The Dietetic Food Co., Baltimore, Md.	30	30
3571	Bran Biskue. The Health Food Co., N. Y. City	..	33
3570	Health Food Wafers. The Health Food Co., N. Y. City	..	29
4386	Oval Digestive Biscuit. Huntley & Palmer, Reading, Eng	..	17
4396	Educator Bran Cookies. Johnson Educator Food Co., Boston	30	36
4473	Educator Bran Meal. Johnson Educator Food Co., Boston	..	..
3564	Brose Good Health Breakfast Food. Kellogg Food Co., Battle Creek, Mich.	..	..
3565	Good Health Biscuit. Kellogg Food Co., Battle Creek, Mich.	..	14
3563	Laxative Biscuit. Kellogg Food Co., Battle Creek, Mich.	..	8
3566	Colax. Kellogg Food Co., Battle Creek, Mich.	..	21
3696	Mansfield Agar Agar Wafers. Mansfield Laboratories, Mansfield, Mass.	60	62

Agar agar, Ceylon moss and similar preparations contain galactan; this was determined in all the samples by the official mucic acid method (*U. S. Dept. Agr., Bur. of Chem., Bull.* 107, *p.* 55). Patten and Hart have shown that a considerable part of the phosphoric acid of wheat bran exists in organic form as phytin. The amount of phytin phosphoric acid present would measure, therefore, in some degree the proportion of wheat bran present. This was determined by Patten and Hart's method (*New York Agr. Expt. Stat., Tech. Bull.* 22, 1912).

Wheat bran itself contains about 0.40 per cent. of galactan. A figure much in excess of this would suggest the use of some other galacten-yielding material, such as agar agar, Ceylon moss or the various seaweed preparations. No such addition is indicated with certainty in any of the samples, except in Colax, which claimed Ceylon moss, a claim which we find to be correct. On the other hand the *Mansfield Agar Agar Wafers,* which claim agar agar, shown only 0.13 per cent. galactan, indicating that no large amount, certainly not over one per cent., of agar is present. Some of the other brands may contain small amounts of agar, but no large quantity is present.

The other ten brands all show some phytin phosphoric acid,

LAXATIVE PREPARATIONS.

Net Weight. Claimed.	Net Weight. Found.	Cost. Per Package.	Cost. Per Pound.	Calculated Calories per 100 gms.	Water.	Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free Extract.	Ether Extract.	Galactan.	Phytin Phosphoric Acid.
oz.	oz.	cts.	cts.									
..	13.2	25	30	351	9.93	2.78	10.00	1.33	74.58	1.38	0.24	0.36
10½	12.2	25	33	361	9.28	*4.95	9.94	1.68	69.20	4.95	0.12	0.78
..	15.7	15	15	410	8.50	3.08	12.06	2.23	61.05	13.08	0.22	0.57
..	13.5	15	18	374	9.70	†5.28	10.00	1.40	65.77	7.85	0.24	0.65
8	8.1	15	30	437	8.80	2.07	7.75	0.45	64.61	16.32	0.09	0.31
8	10.3	25	39	425	7.12	3.27	8.88	1.50	64.75	14.48	0.09	0.41
..	41.9	20	8	340	11.78	2.88	12.25	3.84	66.49	2.76	0.54	1.15
16	18.1	15	13	358	10.13	2.63	14.44	3.13	65.37	4.30	0.68	0.73
6	7.1	15	34	340	10.90	‡4.18	7.69	1.48	74.57	1.18	0.18	0.00
..	2.8	..	..	395	9.35	2.95	16.69	2.43	57.78	10.80	0.34	0.33
..	5.8	100	276	...	13.08	2.08	1.13	0.13	82.80	0.78	13.18	....
5	6.1	23	60	416	7.93	2.33	7.13	0.75	69.86	12.00	0.13	....

*Contains 1.21 phosphoric acid, 0.58 sulphuric anhydride, 0.11 magnesium oxide.
†Contains 0.96 phosphoric acid, 0.17 sulphuric anhydride, 0.14 magnesium oxide.
‡Contains 0.52 phosphoric acid, no sulphuric anhydride, 0.14 magnesium oxide.

except *Kellogg's Good Health Biscuit.* The amounts range from 0.31 to 1.15 per cent. Apparently bran is present in nine of the preparations in varying quantities.

In the three samples showing the highest percentages of ash, tests were made for mineral drugs. While two of them contained both sulphuric anhydride and magnesium oxide, the percentages were small, and it does not appear that any mineral laxative, such as Epsom salts, was present in an important amount. It would appear that in five cases at least, *Oval Digestive Biscuit, Educator Bran Cookies, Bran Biskue, Kellogg's Laxative Biscuit* and *Mansfield Agar Agar Wafers,* the laxative properties may depend to some extent on the oil or fat present. The ether extract in these ranges from 10.8 to 16.42 per cent., but no attempt was made to identify its source.

Kellogg's Brose Good Health Breakfast Food claims that "it contains 50 per cent. more bone-and nerve-building 'salts' and cellulose than any other food," a claim that is not sustained by the analysis. Likewise *Kellogg's Good Health Biscuit* claims to contain "more blood and bone making elements than any other food,"

a claim similarly untrue. Strange to say this latter brand is the only one of the ten tested which showed no phytin phosphoric acid.

Christian's Laxative Bread, Bran Biskue, Health Food Wafers, Educator Bran Meal, Kellogg's Laxative Biscuit (a sample package) and *Colax* bore no statement of net weight as required by law. The brands which did state net weight satisfied their claims in every case.

The cost of these preparations is extremely variable, ranging from 8 cents to $2.76 per pound. It would seem that Ceylon moss might be bought in some cheaper form than *Colax*.

CONDENSED SOUPS.

1933. *Knorr's Consomme.* Price 30 cents per box of 12 cubes, weighing 1.83 oz.

1939. *Liebig Company's OXO Bouillon Cubes,* Corneille David and Co., New York, Agts. Price 25 cents per box of 10 cubes, weighing 1.48 oz.

The samples showed the following analysis:

	1933	1939
Water	4.32	4.75
Ether extract	5.43	3.58
Ash	66.51	67.46
Sodium chloride	61.46	62.70
Nitrogen	3.18	3.28

These samples are very much alike in composition. They are essentially concentrated meat or yeast extracts, with considerable fat and nitrogenous matter (mostly meat bases) and very much common salt. At the price charged per box one pound of the cubes would cost $2.61 and $2.70, respectively. As the six-tenths of a pound of salt contained in a pound of the cubes is worth about one cent, it is evident that, although the cubes may offer many conveniences in their use, they are a very expensive form of food. The *OXO* booklet represents each cube to constitute a meal. Each cube of this brand contains 0.15 gm. of fat, 0.14 gm. of nitrogen and 2.64 gms. of common salt, certainly an extremely light meal.

DIABETIC FOODS.

This Station is endeavoring to keep its analyses of "diabetic" foods up-to-date, and in line with this policy is glad to analyze authentic samples of new brands. Seventy-two samples of this class, including both new brands and brands which have been on the market for a number of years, have been analyzed during the past year. The samples of the Health Food Co., the Pure Gluten Food Co. and Loeb's Diabetic Food Bakery were sent by the manufacturers in original packages; the other samples were bought in the open market. These new analyses in connection with those published last year (*Conn. Agr. Expt. Stat., Rept.* 1913, *pts. I and IV*) give a very complete record of the special diabetic foods sold in this country. The present European war will doubtless interfere with the importation of many of these foods, especially those made in France and Germany. While this interference will remove, at least temporarily, some excellent brands from our markets it will, on the other hand, encourage the use of the American foods, and should stimulate American manufacturers to improve their products still further.

In using the tables which follow, as well as those published in the report for 1913, certain points should be kept constantly in mind. The percentages in the protein column are uniformly calculated from the nitrogen found, using the conventional factor 6.25. It is well known by us that with pure wheat products the factor 5.7 gives more accurate results, and strictly speaking the latter factor should be used for gluten flours and other gluten products. In baked products where the protein may be derived from other sources than wheat, such as soy beans, cotton seed, nuts, etc., it is impracticable to vary the factor with each particular food without causing endless confusion. Similarly it has seemed to us best to retain for the flours the old factor for the sake of uniformity. In the high-grade ground glutens, containing as much as 13.7 per cent. of nitrogen, the use of the proper factor would reduce the protein by about 7.5 per cent. and the nitrogen-free extract would be increased in the same proportion. The values given for starch, however, are absolute, being direct determinations and having no connection with the protein factor used.

The user of diabetic foods should also remember that such foods may serve two distinct purposes, first as an aid in determining the diabetic's tolerance for carbohydrates, and second, when such a

tolerance is determined as a source of supply of food containing reduced amounts of carbohydrates and suited to the individual patient's use. Diabetic foods of the first class should be as near carbohydrate-free as possible; foods of the second class may contain considerable amounts of carbohydrates and still be useful for the diabetic. It is apparent, however, that it is the province of the physician not of the patient to determine this tolerance, and furthermore it is evident from our analyses that the mere calling a product a "diabetic food" by no means establishes its right to such a name or its usefulness to the diabetic. In our judgment a food to have any just claim to the name "diabetic" should not contain more than half the carbohydrates usually found in a normal food of the same class. Foods containing 60 or 70 per cent. of carbohydrates are no more "diabetic" foods than potatoes, rice or oat meal, and are no more entitled to that name.

The samples examined this year illustrate these classes very clearly. For instance we have *No. 1 Proto Puffs* and *No. 2 Proto Puffs* with 9.23 and 20.70 per cent. of starch respectively, the former being intended for use in a strict diet, the latter in a diet where a greater starch tolerance is indicated. In the same way *No. 1 Dainty Fluffs* with 10.74 per cent. starch is intended for the strict diet, while *No. 2 Dainty Fluffs* with 21.85 per cent. is suitable where more starch is permissible.

Of the brands examined by us this year for the first time, *Heudebert's Pain d'Aleurone, Heudebert's Pain de Gluten, Health Food Gluten Flour No. 1, Loeb's Diabetic Almond Macaroons, Diabetic Lady Fingers* and *Diabetic Sponge Cookies*, and *Hoyt's Gum Gluten Special Flour* are notable for their low carbohydrate content.

Health Food Pure Washed Gluten, Battle Creek Sanitarium Co.'s 80 per cent. Gluten Meal and *Hoyt's Gum Gluten Special Flour* are all very high-grade products from the standpoint of high protein and low carbohydrates. *Glutosac Gluten Four, Protosac Gluten Flour, Hoyt's Gum Gluten Flour 50 per cent.* and *Hoyt's Gum Gluten Flour Ground* are gluten flours well above the government standard, containing from 38 to 50 per cent. of protein and from 31.5 to 42.5 per cent. of starch.

Of the *Health Food Co's* products the following showed an improvement over our previous analyses as regards increased protein and decreased carbohydrates *Diabetic Biscuit, Glutosac*

Butter Wafers, Glutosac Rusks, Glutosac Wafers Plain, Glutosac Zwieback and Manana. On the other hand *Protosoy Diabetic Wafers* and *Salvia Almond Sticks* showed a less satisfactory analysis than when last examined. The latter claim to be "practically free from starch," although we find 28 per cent. We are advised by the company that this claim will no longer be made. Of the *Pure Gluten Food Co.'s* products the *Gum Gluten Biscuit Crisps* showed an improvement, while *Gum Gluten Granules* and *No. 1 Dainty Fluffs* contained less protein and more starch than before.

During the last eighteen months we have analyzed three samples of *Loeb's Gluten Luft Bread.* This product has shown a constant improvement with each analysis, the protein increasing from 27.9 to 52.4 per cent. and the starch decreasing from 44.1 to 22.9 per cent.

Seven of the *Goldscheider* brands made a definite claim as to the amount of carbohydrates present, and, as is usually the case, the actual amounts found far exceeded those claimed, as will be noted in the following tabulation:

	Carbohydrates	
	Claimed.	Found.
Cocosnuss-Biskuits	3.6	13.86
Vanille-Biskuits	3.6	16.75
Hönigküchen	3.6	13.91
Dessert-Schokolade	9.98	25.42
Mocca-Schokolade	10.26	23.49
Nuss-Schokolade	11.32	23.30
Orange-Schokolade	9.98	24.91

All of the above samples, however, are low in starch, the first three containing none at all, the last four from 4 to 7 per cent. On the other hand *Goldscheider's Butter-Brezeln* and *Zwieback* with 67.57 and 65.30 per cent. of carbohydrates have nothing to recommend than as special "diabetic" foods.

The *Dieto* Foods have been examined by us this year for the first time. The following quotation from their booklet "Correct Diet in Diabetes" shows the general claim made for these products.

"The vitality and health-giving properties of wheat and barley in their entirety rank high in the cereal world. Diabetics and persons of weak digestion need a food composed of either one or both of these grains, chiefly wheat; we therefore make it our principle to manufacture "Dieto" foods with wheat and barley for the basis. The basis of "Dieto" Flour is wheat. It is in its entirety, just as Nature gave it to man. It undergoes a process of treatment in

which the elements of the wheat are subjected to a fermentation. By this process a structural change is effected in the molecules. This change is slight, and is noticeable only under the microscope; the starch cells in this starch-changed wheat are swollen and burst —starch cells in their natural state are unbroken, not swollen and burst. It is a preliminary change that is effected, and assists the digestive organs in performing their functions. Food treated under the "Dieto" system is not predigested, for if it were, the course of Nature would be arrested and there would be no work for the digestive organs."

A microscopical examination of the *Dieto Flour* showed only an occasional "burst" starch grain; the starch was mostly unaltered and apparently would be just as objectionable to the diabetic as the starch of ordinary wheat flour which had not been subjected to the mysteries of the "Dieto" system. The flour contained over 62 per cent. of unaltered starch.

Aside from the *Dieto Pine Nuts*, a natural product containing no starch, these products from the diabetic' standpoint have nothing to commend them. The *Pine Nuts* are claimed to be treated by the "Dieto" system, but as there is no starch in these nuts for the system to act upon, the reason for the alleged treatment is not apparent.

Dieto Barley Coffee is not entitled to the name "coffee" as it is "made of the choicest raw barley combined with a small percentage of chicory." *Dieto Bread* contains about two-thirds as much starch as ordinary wheat bread. *Dieto Cocoa* is "specially prepared for diabetics," although barley is added, and the carbohydrates are no less than in ordinary cocoa. *Dieto Crackers* are recommended "for those restricted to a rigid diet" and are claimed to "supply (sic) the craving for those foods diabetics are not permitted to eat," and yet they contain nearly 55 per cent. of starch, more than ordinary bread. *Dieto Rusks*, although "made of Dieto Flour, which is scientifically prepared for diabetics," likewise contains over 52 per cent. of starch. *Dieto Wheat and Barley Cereal* contains over 61 per cent. of starch, and *Dieto Macaroni*, which is similar to ordinary macaroni, contains nearly 58 per cent.

In the company's booklet "Correct Diet in Diabetes" we read "Diet is of primary importance, inasmuch as it has been proved beyond question that certain kinds of foods have a powerful influence in aggravating the disease, more particularly those consisting largely of saccharin and starchy matter."

The company in these words offers the strongest possible condemnation of its own products for the purpose for which they are recommended.

Phospho D. and D. Special claims to be "a palatable, non-sugaring glutinous wheat flour for diabetics." It contains 58.57 per cent. of starch, with 72.92 per cent. of total carbohydrates, and is totally unsuited for use as a "diabetic" food.

For analyses of diabetic foods, see pages 244 and 246.

WHEAT BRAN

Five samples were examined, and these show the usual variations to be expected in this product. All the samples were clean and well suited for human food. In recent years wheat bran has found considerable use as a means of preventing constipation. The fiber and the organic phosphorus are the chief ingredients which give bran this property. In the samples analyzed it is seen that the ash ranges from 4.48 to 6.09 and the fiber from 5.56 to 8.54. Other things being equal it would seem that the samples showing the highest percentages of these ingredients would be the most effective in preventing constipation.

On the other hand the question of cost is worthy of consideration. The samples sold at the rate of from 6.5 to 20.5 cents per pound, or from $130 to $410 per ton. When it is considered that wheat bran as a cattle feed sells for from $25 to $28 per ton retail, it is evident how profitable is the practice of cleaning the crude bran for human use. The last two brands in the table are very much alike in composition, yet one costs more than twice as much as the other.

TABLE III:—WHEAT BRAN.

Station No.	Brand.	Net Weight.		Cost.		Water.	Ash.	Protein (N×6.25)	Fiber.	Nitrogen—free extract.	Ether Extract.
		Claimed	Found.	Per package.	Per pound.						
		oz.	oz.	cts	cts.						
4465	Ballard's	42	43.7	25	9.2	11.45	4.48	17.31	5.56	55.78	5.43
4461	Health Food Co.	13	12.8	10	12.5	11.57	5.58	14.25	8.19	56.28	4.13
3567	Jireh	24	24.7	10	6.5	11.08	4.30	16.81	6.33	56.68	4.80
3550	Educator	20	25.2	15	9.5	11.64	6.09	15.38	7.81	54.43	4.65
4385	Kellogg's	17	19.5	25	20.5	9.63	6.03	16.25	8.54	54.31	5.24

TABLE IV:—

DIABETIC FOODS.

Station No.	Manufacturer and Brand.	No. of Pieces.	Net Weight of Package.	Cost per Package.	Cost per Pound.	Water.	Ash.	Protein (N x 6.25.)	Fiber.	Nitrogen-free Extract.	Fat (Ether Extract.)	Starch.	Weight supplying same amt. of carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms.
			oz.	cts.	cts.									
	The Dieto Food Co., New York City.											12.94	....	...
5169	Dieto Baking Powder	..	8.1	35	70	....	...	....	...	....	....			
5168	" Barley Coffee	..	14.0	30	34	3.42	3.08	13.19	9.14	63.87	7.30	17.72	8	374
5175	" Bread, Pure Whole Wheat	1	15.1	12	13	40.42	1.69	9.67	0.71	47.15	0.36	36.57	11	231
5171	" Cocoa	..	7.3	30	66	4.29	5.40	23.56	4.87	¶38.95	22.93	12.38	14	456
5166	" Crackers	42	10.4	30	46	6.59	1.75	13.38	0.98	68.06	9.24	54.84	8	409
5174	" Flour, Pure Whole Wheat	..	79.0	60	12	7.85	1.15	14.75	1.01	73.13	2.11	62.44	7	371
5167	" Nut Cereal	..	14.3	30	34	5.00	1.95	21.63	1.22	51.82	18.38	39.54	10	459
5170	" Pine Nuts	..	7.9	40	81	2.23	4.55	39.69	0.75	2.76	50.02	0.00	193	620
5173	" Rusks	47	12.7	60	76	6.43	1.50	15.94	0.98	66.04	9.11	52.09	8	410
5165	" Wheat and Barley Cereal	..	36.3	30	13	6.77	1.68	11.63	2.00	75.77	2.15	61.42	7	359
5172	" Whole Wheat Brand Macaroni	..	13.4	30	36	9.81	0.90	13.88	0.57	73.70	1.14	58.72	7	361
	Fromm & Co., Dresden.													
3502	Conglutin Drops	..	...	..	..	6.49	5.23	50.81	0.23	36.13	1.11	29.19	15	358
3503	Conglutin-Zwieback	..	...	..	..	4.48	2.00	14.25	0.40	57.62	21.25	29.70	9	479
	Karl Goldscheider, Karlsbad.													
3500	Aleuronat-Conglutin Cakes	..	...	..	..	5.17	1.25	26.63	0.08	51.30	15.57	31.67	10	452
3499	Butter-Brezeln	..	...	..	..	5.16	1.83	10.50	0.08	67.57	14.86	43.93	8	446
3506	Feinste Cocosnuss-Biskuits für Diabetiker. "3.6% carbohydrates."	..	...	..	..	2.71	2.73	34.44	0.88	13.86	‡45.38	None	38(?)	...
3507	Feinste Vanille-Biskuits für Diabetiker. " "	..	...	..	..	3.14	2.85	46.38	0.55	16.75	‡30.33	None	32(?)	...
3505	Hönigküchen für Diabetiker. " "	..	...	..	..	2.98	3.05	40.31	1.00	13.91	‡38.75	None	38(?)	...
3498	Saccharin-Oblaten ohne Zucker	..	...	..	..	5.42	2.43	16.50	1.95	51.10	22.60	33.47	10	474
3501	Tee-Gebäck	..	...	..	..	3.44	1.28	7.00	0.23	60.79	27.26	18.00	9	517
3493	Zwieback	..	...	..	..	6.85	2.70	21.31	0.23	65.30	3.61	51.69	8	379
3497	Feinste Dessert-Schokolade für Diabetiker. "9.98% carbohydrates."	..	...	..	..	2.17	1.80	11.38	1.68	†25.42	57.55	4.98	21	665
3494	Feinste Mocca-Schokolade für Diabetiker. "10.26% carbohydrates."	..	...	..	..	2.20	2.25	10.19	1.65	†23.49	60.22	4.11	23	677
3495	Feinste Nuss-Schokolade für Diabetiker. "11.32% carbohydrates."	..	...	..	..	3.37	2.65	14.63	1.70	†23.30	54.35	6.86	23	641
3496	Feinste Orange-Schokolade für Diabetiker. "9.98% carbohydrates."	..	...	..	..	2.38	2.20	11.44	1.43	†24.91	57.64	4.98	21	664
	The Health Food Co., New York City.													
5365	Almond Meal	..	...	..	100	7.16	5.48	49.13	0.48	15.91	21.84	0.00	33	457
5376	Alpha Best Diabetic Wafer	23	3.6	50	222	7.61	5.03	67.06	0.16	11.73	8.41	1.26	45	391
5372	Diabetic Biscuit	26	9.6	25	42	5.80	2.55	35.94	0.35	46.53	8.83	39.77	11	409
5361	Gluten Flour No. 1	..	...	..	60	7.65	2.78	75.69	0.21	12.79	0.88	7.09	41	362
5373	Gluten Nuggets	..	11.9	35	47	5.32	2.75	31.69	0.27	45.67	14.30	34.93	12	438
5358	Glutosac Bread	1	10.4	15	23	37.20	1.64	27.16	0.82	31.08	2.10	22.17	17	252
5370	" Butter Wafers	24	8.8	30	55	5.44	2.10	31.13	0.38	47.01	13.94	38.93	11	438
5362	" Gluten Flour	..	32.3	37	18	8.18	1.20	38.00	0.48	50.45	1.69	41.96	10	369
5367	" Rusks	14	3.9	15	62	6.66	2.50	39.31	1.13	46.96	3.44	33.64	11	376
5369	" Wafers, Plain	100	6.0	15	40	7.24	2.55	42.63	1.58	44.26	1.74	29.55	12	363
5371	" Zwieback	22	6.4	20	50	5.92	2.50	36.38	0.85	46.64	7.71	32.46	11	401
5366	Manana Gluten Breakfast Food	..	10.1	25	40	7.56	2.53	42.63	1.73	43.56	1.99	29.87	12	363
5356	No. 1 Proto Puffs	8	4.4	35	127	8.71	2.80	72.25	0.40	13.02	2.82	9.23	40	366
5357	No. 2 Proto Puffs	8	5.3	25	75	9.16	2.60	58.75	0.40	27.00	2.09	20.70	20	362
5359	Protosac Bread	1	9.8	20	33	30.70	2.11	29.82	0.38	35.19	1.80	27.66	12	276
5363	" Gluten Flour	..	30.2	40	21	8.16	1.30	45.94	0.38	42.26	1.96	31.50	13	370

TABLE IV:—

DIABETIC FOODS.—*Continued.*

Station No.	Manufacturer and Brand.	No. of Pieces.	Net Weight of Package.	Cost per Package.	Cost per Pound.	Water.	Ash.	Protein (N x 6.25.)	Fiber.	Nitrogen-free Extract.	Fat (Ether Extract.)	Starch.	Weight supplying same amt. of carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms.
			oz.	cts.	cts.									
5368	Protosac Rusks	10	3.0	15	80	7.21	2.93	39.69	0.48	46.69	3.00	35.89	11	373
5375	Protosoy Diabetic Wafers	29	5.7	40	112	4.76	3.50	37.07	1.80	29.34	23.53	14.40	18	477
5364	" Soy Flour	..	...	..	50	3.86	5.30	42.88	2.75	26.03	19.18	1.86	20	448
5360	Pure Washed Gluten	..	...	..	25	7.03	0.58	85.63	0.40	5.35	1.01	2.81	99	373
5374	Salvia Almond Sticks	77	15.6	75	77	2.63	3.38	22.31	0.70	41.04	29.94	28.29	13	523
	Ch. Heudebert, Paris.													
4379	*Pain d'Aleurone pour Diabétiques. "5% carbohydrates."	60	10.2	90	141	8.18	4.43	76.06	0.71	9.17	1.45	4.22	58	354
4377	*Pain "Essentiel" en Biscottes	50	16.6	80	77	7.67	2.33	26.38	0.20	62.22	1.20	49.89	8	365
4378	*Pain de Gluten pour Diabétiques	21	14.3	110	123	7.85	3.96	80.65	0.16	6.54	0.84	3.38	81	356
	J. Heinbockel & Co., Baltimore, Md.													
5249	Diabeto Bread for Diabetes	..	...	..	..	33.47	3.22	8.55	1.15	52.12	1.49	40.39	10	256
	Loeb's Diabetic Food Bakery, New York City.													
5389	Chocolate Almond Bars	4	2.6	25	154	2.88	3.77	16.25	4.32	**31.78	41.00	5.74	17	561
5387	Diabetic Almond Macaroons	49	4.4	40	145	3.22	2.98	46.50	1.53	8.00	37.77	0.64	66	558
5388	" Bread Sticks	10	2.9	15	83	8.72	2.28	50.44	0.60	34.52	3.44	24.64	15	371
5390	" Chocolates	4	2.6	25	154	1.98	3.85	14.88	4.90	**22.97	51.42	6.92	23	614
5385	" Lady Fingers	25	1.4	25	286	6.01	2.75	56.56	0.35	6.04	28.29	1.81	88	505
5386	" Sponge Cookies	32	1.6	25	250	6.92	2.75	54.69	0.55	4.98	30.11	1.24	106	510
5391	Gluten Luft Bread	12	14.4	85	94	5.68	2.05	52.38	0.63	26.02	13.24	22.89	20	433
5392	P. & L. Genuine Glubetic Bread	1	11.9	15	20	30.07	1.06	38.77	0.36	25.69	4.05	19.15	21	294
	Mansfield Laboratories, Mansfield, Mass.													
4374	No Name (square)	..	...	..	..	9.34	5.53	29.50	0.43	47.79	7.41	§34.26	11	376
4375	No Name (hexagonal)	..	...	..	..	8.65	4.84	25.38	0.47	45.49	15.17	§31.16	12	358
	The Pure Gluten Food Co., New York City.													
5379	Hoyt's Gum Gluten Biscuit Crisps	20	3.8	25	105	5.97	1.70	52.69	1.08	38.04	0.52	31.22	14	368
5397	" " " Breakfast Food	..	16.5	20	19	6.48	0.60	45.38	0.28	46.40	0.86	39.21	11	375
5399	" " " Flour, 50%	..	...	..	..	6.61	0.70	49.69	0.33	41.52	1.15	37.07	13	375
5398	" " " " Ground	..	16.0	18	18	8.21	0.60	41.94	0.18	48.14	0.93	42.61	11	369
5394	" " " Granules	..	16.5	20	19	6.64	0.73	42.69	0.45	48.80	0.69	41.93	11	372
5393	" " " Noodles	..	4.0	15	60	8.21	0.65	40.50	0.33	49.08	1.23	41.82	11	369
5396	" " " Self Raising Flour	..	16.1	18	18	7.30	3.88	42.69	0.40	44.98	0.75	38.98	12	357
5395	" " " Special Flour	..	16.3	30	29	5.63	0.93	90.69	0.35	1.68	0.72	2.17	315	376
5377	No. 1 Dainty Fluffs	19	2.6	40	246	7.04	0.75	79.94	0.45	11.28	0.54	10.74	47	370
5378	No. 2 " "	18	2.4	25	167	7.45	0.68	66.25	0.28	24.87	0.47	21.85	21	369
	Battle Creek Sanitarium Co., Battle Creek, Mich.													
5400	80% Gluten Meal	..	14.4	..	..	6.83	...	84.00	...	....	....	5.77	...	...
	Phospho Food Co., Los Angeles, Cal.													
5555	Phospho D. & D. Special	..	...	..	..	8.74	1.22	13.69	1.24	72.92	2.19	58.57	7	366

* Sold by A. Beauvais & Co., New York City, and John Gilbert & Son, New Haven.

† 3497 contains 10.95% as invert sugar, 3494, 10%, 3495, 7.25%, and 3496 11.15%. ‡ In part glyceral. § Possibly in part due to the copper-reducing power of the agar-agar present. ¶ Polarization at 20° C. direct + 1.5°, after inversion ± 0.0°. ** Polarization at 20° C. direct + 2.1°, after inversion ± 0.0.

II. DRUG PRODUCTS.

BAY RUM

Bay Rum, prepared according to the National Formulary, should contain about 58 per cent. of ethyl alcohol. This amount was found in none of the forty-three samples examined although three of the Bridgeport samples and one from New Haven almost reached it. Eight samples claimed a definite percentage of alcohol; only one of these, No. **3443,** showed any marked deficiency, 48.64 per cent. being found compared with the claimed 58 per cent. The alcohol percentages ranged from zero to 57.88 per cent. These may be summarized as follows:—

Zero to 15 per cent.....	3	42 to 50 per cent.....	20
30 to 40 " "	1	Over 50 " "	19

The three samples bought at "5 and 10 Cent" stores contained none, 11.96 and 15.16 per cent. of alcohol. The useful ingredient in bay rum is the alcohol, and the purchaser paying 21 cents for a pint of weakly perfumed water is certainly defrauded. Of the samples purchased from druggists, No. **3442,** bought in Bridgeport, showed the greatest deficiency in alcohol, containing only 32.32 per cent.

None of the samples contained wood alcohol.

Calculated to the same basis the samples cost from 21 cents to $1.15 per pint. Four-ounce samples cost from 10 to 28 cents, eight-ounce samples from 10 to 35 cents.

BELLADONNA PLASTERS.

(*Emplastrum Belladonnæ.*)

The U. S. Pharmacopoeia requires that belladonna plasters made with a rubber base should yield not less than 0.38 per cent. nor more than 0.42 per cent. of mydriatic alkaloids.

Seven samples were analyzed, ranging from 0.32 to 0.44 per cent; three of these were somewhat below the minimum U. S. P. standard. (See page 251 for analyses.)

BLACKBERRY BRANDY AND CORDIAL.

For many years blackberry brandy has been sold under false representations. Blackberry juice has obtained a reputation for certain medicinal qualities, and the public has come to believe that "color, aroma and so-called 'body' are criteria of purity, hence

TABLE V:—BAY RUM.

Station No.	Brand, or Place of Sampling.	Volume of Sample.	Cost. Sample.	Cost. Pint of Material.	Specific Gravity @ 15.5°C.	Alcohol by Volume.
		oz.	cts.	cts.		%
3225	American Druggists Syndicate, Long Island City, N. Y.	4.2	20	76	.93265	50.64[1]
3446	American Druggists Syndicate, Long Island City, N. Y.	4.4	25	90	.93386	49.88[1]
3433	Hendricksen & Co., St. Thomas, W. I.	7.7	10	21	.99990	0.
3435	Moorac, Holman, Chicago.	4.6	10	35	.98495	11.96[2]
3206	Jaynes Drug Co., Boston.	8.2	25	50	.93896	47.62[3]
3434	Joubet et Cie.	3.7	10	43	.98171	15.16
3447	H. Michelsen, St. Thomas, W. I.	4.0	25	100	.93456	50.52[4]
3224	" " " " "	5.7	35	98	.93481	50.48[4]
3445	Park & Tilford, New York.	7.1	35	79	.93677	48.56[5]
3441	Bridgeport.	4.2	15	57	.91963	57.88
3440	"	3.9	20	84	.91789	57.20
3437	"	5.8	25	70	.92072	55.88
3438	"	4.1	25	98	.92900	52.32
3436	"	8.8	35	64	.93325	50.04
3444	"	6.7	25	60	.93557	49.12
3443	"	4.1	20	78	.93661	48.64[6]
3439	"	6.3	25	63	.93699	48.36
3442	"	7.8	25	51	.96289	32.32
3461	Hartford.	4.1	25	98	.92727	53.92
3474	"	7.5	25	53	.93119	51.32
3459	"	4.1	20	78	.93200	50.72
3471	"	3.9	15	62	.93324	50.48
3472	"	3.9	15	62	.93535	50.04
3469	"	4.2	17	65	.93454	49.76
3473	"	3.9	20	82	.94016	46.64
3460	"	4.2	15	57	.94385	44.64
3462	"	3.8	15	63	.94376	44.00
3470	"	3.4	15	71	.94690	42.96
3475	"	7.5	25	53	.94857	41.80
3415	New Haven.	3.9	15	62	.92022	56.52
3428	" "	4.2	15	57	.92789	52.48
3429	" "	6.6	25	60	.93109	51.72
3417	" "	4.0	15	60	.93095	51.12
3412	" "	4.3	20	74	.93421	50.32
3418	" "	4.0	20	80	.93402	50.00
3226	" "	6.1	25	65	.93579	48.96
3419	" "	4.0	15	60	.93565	48.88
3204	" "	3.8	20	84	.93940	47.92
3410	" "	3.8	15	63	.93860	47.72
3424	" "	4.0	20	80	.93993	47.40
3413	" "	3.9	25	103	.94106	46.12
3414	" "	4.0	15	60	.94334	44.56
3416	" "	3.9	28	115	.94433	43.46

[1] Claimed 48% alcohol. [2] Claimed 12% alcohol. [3] Claimed 47% alcohol. [4] Claimed 51% alcohol. [5] Claimed 100° proof. [6] Claimed 58% alcohol.

TABLE VI:—BLACKBERRY BRANDY AND CORDIAL.

Station No.	Brand.	Price Per Bottle.	Volume of Bottle.	Specific Gravity @ 15.6°C.	Alcohol by Volume.	Grams per 100cc. Extract.	Sucrose.	Reducing Sugar as Invert.	Ash.	Water-Soluble Ash.	Acidity, cc. $\frac{n}{10}$ Na OH per 100cc.	Alkalinity of Soluble Ash. cc. $\frac{n}{10}$ Acid. Per 100cc.	Polarization @ 19°C. Direct °V.	Polarization @ 19°C. Invert °V.	Preservatives.	Coal-Tar Color.
		cts.	fl. oz.													
1614	Blackberry Cordial, Acker, Merrall & Condit Co., New York	20	8.0	1.0632	19.29	22.46	0	20.06	0.148	0.136	56.0	11.0	−4.8	−5.4	None.	None.
1609	Blackberry Cordial, A. F. Beckman & Co., So. Norwalk.	25	6.9	1.1065	18.16	33.60	0	30.05	0.211	0.170	73.6	13.5	−7.2	−7.7	None.	None.
1636	Blackberry Brandy, Brown Drug Store, Waterbury...	58	7.7	1.0337	32.55	18.53	1.69	14.12	0.115	0.113	71.6	8.5	−2.0	−4.6	None.	None.
1755	Blackberry Cordial, Wm. Donaghue & Co., Hartford..	50	15.3	1.0653	14.54	21.75	0	19.43	0.147	0.140	77.0	16.5	−6.0	−6.6	None.	None.
1721	Old North State Blackberry, Simon Pure Juice, Garrett & Co., Norfolk, Va.	63	16.3	1.1649	10.53	47.00	0.43	42.21	0.218	0.210	90.2	25.0	−10.8	−11.7	None.	None.
1099	Blackberry Brandy, E. E. Hall & Son, New Haven.	35	7.8	1.1031	20.72	33.36	0	25.95	0.318	0.298	98.4	27.0	7.4	*7.2	Salicylates.	None.
1759	" " " " " " " " "	35	7.7	1.1031	21.00	.....	....	.....	.....	.....	.....	....	7.4	*7.1	Salicylates.	None.
1720	Superior Blackberry Brandy, A. Leverone, New London.	50	26.1	1.0950	20.63	31.21	0	26.07	0.213	0.207	96.4	20.5	−4.0	−4.2	None.	None.
1098	Blackberry Brandy, J. A. Notkin & Bros., New Haven.	25	7.9	1.0576	11.63	18.90	0	15.21	0.290	0.268	71.6	12.0	−2.6	−3.2	None.	None.
1094	Shafer's Medicinal Blackberry, I. Calvin Shafer Co., New York	50	8.8	1.0577	23.50	22.15	4.15	15.14	0.130	0.118	87.0	11.0	−0.2	−4.8	None.	None.

* Polarized 11.44 @ 87° C.

that a blackberry brandy, in order to be regarded as genuine, should be dark colored, highly flavored and even sweetened. Almost universally the purchaser has been supplied either with a product made by pouring distilled spirit over dried blackberries and containing added coloring and flavoring, or with a wholly artificial product containing nothing derived from the blackberry, but made from apple or other fruit cider, and highly colored and flavored. * * * * Blackberry brandy is a liquor distilled from the fermented juice of the blackberry. The product is colorless or nearly so, the color depending on the time or storage, resembles whiskey in appearance and flavor, and contains about 50 per cent. of alcohol, together with fusel oil, aldehydes, esters, acids, etc., much as they exist in other spirits obtained by the process of distillation". (*Minn. Dairy and Food Dept., Rept. of Chemist, 1909, p. 4.*)

On the other hand the term "cordial" is usually applied "to a product the alcohol content of which is some type of a distilled spirit, commonly neutral spirits or brandy. To this is added sugar and some type of flavor. The flavor is sometimes derived directly

TABLE VII:—BELLADONNA PLASTERS.

Station No.	Manufacturer.	Cost.	Weight. Total.	Weight. Dried Cloth.	Weight. Plaster Mass.	Mydriatic Alkaloids in Plaster Mass. Weight.	Mydriatic Alkaloids in Plaster Mass. Per cent.
		cts.	gms.	gms.	gms.	gms.	
1050	Bauer & Black, Chicago	25	10.8588	3.7571	7.1017	.0235	.331
1115	" " " "	15	11.1550	3.5473	7.6077	.0313	.412
1049	The Jaynes Drug Co., N. Y. City..	10	9.4299	3.3476	6.0823	.0217	.357
1093	Johnson & Johnson, New Brunswick, N. J.	20	11.3990	4.1948	7.2042	.0311	.432
1051	Seabury & Johnson, New York City	15	10.6390	3.3087	7.3303	.0292	.399
1052*	" " " " " "	13	11.2700	3.3697	7.9003	.0250	.317
1053	Seabury Pharmacal Laboratories, East Orange, N. J.	15	10.9370	3.0077	7.9293	.0346	.436

*Prepared for Hull's Corner Drug Store, New Haven.

by the addition of essential oils, again by the use of synthetic flavors, and also by the treatment of some vegetable product with the alcoholic spirit to extract the flavoring ingredients. It is likewise the general custom to color cordials." (*U. S. Dept. Agr. F. I. D., 125*).

In view of the above considerations it is apparent that all of our ten samples are either cordials or juices fortified with alcohol, although five of them were distinctly labeled as "brandy". That they are of most diverse character is shown by the following tabulation, which gives the maxima and minima for the various ingredients:—

	Max.	Min.
Alcohol	32.55	10.53
Extract	47.00	18.53
Sucrose	4.15	None
Invert Sugar	42.21	14.12
Ash	0.318	0.115
Ash, water-soluble	0.298	0.113
Acidity (cc. $\frac{n}{10}$ alkali per 100cc.)	98.4	56.0
Alkalinity of sol. ash (cc. $\frac{n}{10}$ acid per 100 cc.)	27.0	8.5

Not only were none of the brandies genuine, but the two samples from *E. E. Hall and Son, New Haven*, were also adulterated, containing salicylates and glucose. No coal-tar color was detected in any of the samples.

MALT EXTRACT.

Under the name "malt extract" two entirely different preparations are found on the market, one being a strong beer, the other an extract prepared from malt and composed chiefly of dextrin and maltose with some albumen and phosphates. A genuine malt extract, in the U. S. P. sense, should contain all the soluble principles of malt in a permanent form. It is made by extracting and digesting coarsely powered malt with water and evaporating the strained liquor at low temperature to the consistency of thick honey. Such an extract contains from 48 to 70 per cent. maltose, 2 to 16 per cent. dextrin, and, according to Jungk should, "when properly prepared, contain diastase sufficient to convert its own weight of starch into dextrose at 100° F. in 10 minutes".

Twenty-three samples of "malt extract" were analyzed. Only two of these, *Maltine and Trommer Diastatic Malt Extract*, have any claim whatever to the name, and both of these contain some alcohol. These preparations are quite similar in composition except that the latter contains about 5 per cent. more glycerin.

The separation of the sugars in malt extract is a matter of great difficulty. Direct reduction will give the reducing matters, viz.: maltose, dextrose and malto-dextrins. The specific reducing powers of the latter are not uniform or are unknown. The reducing matters after hydrolysis will be due to hydrolyzed maltose, the original dextrose, the converted dextrins, cane sugar, and soluble starch, if present. Roughly we may say that the direct reduction gives maltose and dextrose, and that the increase after hydrolysis is due to converted dextrin. The difficulty lies in not knowing how much of the direct reduction is due to maltose and how much to dextrose. Since the specific reducing power of maltose is only 62 per cent. of that of dextrose, it is evident that to calculate all as dextrose will give results which are too low, and to calculate all as maltose will give figures much too high.

On account of these difficulties we have determined the direct reducing power of the extracts and expressed it as dextrose recognizing that it is due chiefly to maltose and dextrose, and that maltose predominates. This difficulty is emphasized in the "*Maltine* and *Trommer* samples, where the sum of the maltose (as calculated in the table) and the dextrin fails to equal the total sugar solids by 11.52 and 9.35 per cent.

Diastatic power. 0.2 gm. of *Maltine* digested 0.2 gm. of soluble starch in 20 minutes at 55° C. The conversion was apparently complete judged by the iodine reaction. At the end of 10 minutes the starch reaction was negative and the test for achroodextrin (red color with iodine) was also negative. 0.2 gm. of the *Trommer* extract digested soluble starch in a similar manner, although at the end of 10 minutes the test for achroodextrin was positive and remained so at the end of one hour. With 0.5 gm. of sample and 0.2 gm. of soluble starch this test was negative at the end of one hour.

The diastatic power of the beer preparations is of course negligible.

These other samples are more or less concentrated beers, or

TABLE VIII:—

Station No.	Brand.
1603	A. D. S. Malt Extract, American Druggists Syndicate, New York
1747	Ballantine's Ideal Malt Extract, P. Ballantine & Sons, Newark, N. J.
1035	Berkshire Pure Malt Extract, Berkshire Brewing Assn., Pittsfield, Mass.
1108	Long Island Bottling Co.'s Braunschweiger Mumme Compound of Malt and Hops, F. M. Doyle & Co., Boston
1617	Long Island Bottling Co.'s Braunschweiger Mumme Compound of Malt and Hops, F. M. Doyle & Co., Boston
1728	Malt Extract, distilled by John A. Dunn, Norwich.
1601	Malt Stout, James M. Harriman, New Haven
1037	Malt Extract, Albert Harris, New York
1034	Johann Hoff'sches. Malt-Extract, Johann Hoff, Berlin, etc
1627	Johann Hoff's Extract, Johann Hoff, Berlin, etc
1707	Leopold Hoff's Malt, The Leopold Hoff Malt Co., Hamburg, Germany
1033	Jaynes Improved Liquid Extract of Malt, Jaynes Drug Co.
1746	Gold Rock Malt Extract, The Lathrop Co., Hartford
1100	Liebig's Malt Tonic, Liebig Malt Extract Co., Jersey City, N. J.
1121	Liebig's Malt Extract, Liebig Malt Extract Co., New York
1625	Maltine, Plain, Maltine Mfg. Co., New York
1036	Pabst Extract, Pabst Brewing Co., Milwaukee, Wis
1729	Malt Extract, The Pioneer Malt Extract Co., New York
1626	King's Pure Malt, Pure Malt Department, Boston
1620	Pure Canada Malt Extract, The Quebec Malt Extract Mfg. Co., Montreal, Canada
1709	Trommer Diastatic Extract of Malt, The Trommer Co., Freemont, O.
1722	Wampole's Liquid Extract of Malt, Henry K. Wampole & Co., Philadelphia, Pa
1058	Wyeth's Liquid Malt Extract, John Wyeth & Bro., Philadelphia, Pa

diluted extracts. The maxima and minima of these twenty-one samples are as follows:—

	Max.	Min.
Alcohol	9.11	2.52
Extract	15.32	5.39
Ash	0.37	0.14
Protein	1.09	0.34
Sugar Solids	14.04	4.84
Maltose	11.17	1.41
Dextrin	5.80	2.03

All of the samples bore a guaranty for alcohol except *Harriman's Malt Stout*, which showed the highest percentage. Twelve of the twenty-three samples contained more alcohol than claimed.

MALT EXTRACTS.

Price per Bottle.	Specific Gravity @ 15.6°C.	Alcohol By Vol. Claimed.	Alcohol By Vol. Found.	Grams per 100cc. Extract.	Ash.	Protein.	Glycerin.	Sugar Solids.	*Maltose.	Dextrins.
cts.										
13	1.0179	4	5.56	6.57	0.21	0.56	....	5.80	1.71	4.09
15	1.0297	3.7	3.53	9.02	0.20	0.40	....	8.42	4.57	3.85
15	1.0283	−5	6.96	9.57	0.30	1.09	....	8.18	2.43	5.75
15	1.0203	−6	5.50	7.32	0.29	0.64	....	6.39	1.84	4.55
15	1.0204	−6	5.68	7.38	0.29	0.64	....	6.45	1.84	4.61
15	1.0301	−6	4.90	9.70	0.21	0.46	....	9.03	5.25	3.78
10	1.0122	0	9.11	6.31	0.37	0.76	....	5.18	1.65	3.53
10	1.0192	4.5	4.52	5.77	0.30	0.56	....	4.91	2.03	2.88
25	1.0231	4.15	5.45	7.48	0.23	0.69	....	6.56	1.41	5.15
25	1.0233	4.95	5.08	7.68	0.24	0.75	....	6.69	1.41	5.28
35	1.0178	3–4	5.00	6.36	0.27	0.58	....	5.51	2.48	3.03
15	1.0151	3–4	4.67	5.39	0.21	0.34	....	4.84	2.81	2.03
15	1.0182	4	4.25	6.31	0.19	0.41	....	5.71	2.22	3.49
15	1.0199	−6	5.14	6.78	0.27	0.84	....	5.67	2.36	3.31
10	1.0225	5	5.29	7.56	0.30	0.83	....	6.43	2.06	4.37
75	.....	3.88	3.10	73.85	1.15	7.25	1.40	64.05	*38.60	13.93
20	1.0433	−5	3.71	12.26	0.37	0.69	....	11.20	5.40	5.80
15	1.0208	−4.5	4.17	6.88	0.14	0.44	....	6.30	2.54	3.76
25	1.0201	−6	5.60	7.06	0.32	0.66	....	6.08	1.98	4.10
10	1.0188	3–4	4.43	6.39	0.18	0.49	....	5.72	2.59	3.13
100	.....	2.6	4.05	75.67	1.10	5.63	6.80	62.14	*33.48	19.31
30	1.0285	7	8.77	10.03	0.33	0.98	....	8.72	2.95	5.77
25	1.0552	2.5	2.52	15.32	0.30	0.98	....	14.04	11.17	2.87

* Maltose and dextrose, all calculated as dextrose. See page 253.

CLAIMS OF THE LABELS.

The labels of these preparations bear much false and misleading advertising matter. Their concentration, food value, and diastatic power are greatly over-emphasized, and inasmuch as they are commonly used by convalescents and by consumptives and others suffering from wasting diseases, the advertisements leading one to confuse these spurious extracts with the genuine U.S.P. extract, constitute a serious and dangerous abuse. The U. S. P. extract, it should be remembered, is a non-alcoholic preparation.

The *Harris* and *Gold Rock* brands claim to be "concentrated", and yet they are among the most dilute of all the preparations. The *Johann Hoff*, *Leopold Hoff*, *Liebig*, *Pioneer*, *Quebec* and *Wampole* brands are specially recommended as "remedies for consumption". The *A. D. S.* brand makes the equivocal claim that it affords great comfort to "those of a cold temperament".

PROPRIETARY MEDICINES.

We have analyzed 130 of these preparations this year. Many of them have been analyzed before in other laboratories, but the results of the analyses are not available to the citizens of this state. Furthermore, experience has also shown that it is unsafe to depend upon former analyses of many of these remedies, as the formulas are frequently changed, usually without any notice to the public. A comparison of our analyses with those made at the time of the passage of the Food and Drugs Act shows a gratifying change in many instances. Habit-forming and other dangerous drugs are far less common in these nostrums than they were ten years ago. The average sufferer, unless he be a drug habitué, generally takes alarm at the words "morphine", "opium", "heroin", "cocaine", and even "alcohol", and fears to use remedies whose labels bear these words. The manufacturer dare not withhold this information, and in many cases has made substitutions to allay the public distrust. The patient failing to obtain the customary effect of the active and dangerous drug discontinues the use of the medicine, so that we find certain of the most widely advertised of these nostrums gradually being withdrawn from public sale.

Patent or proprietary medicines as a rule fall into one of three quite well-defined classes; those which are out-and-out fakes; those which consist of simple well-known drugs of more or less efficacy but sold under a fancy name at an equally fanciful price; and those which contain habit-forming or other dangerous drugs. Generally speaking most of these remedies are more or less fakes, either because of the extravagant, if not actually dishonest, claims made for them, or because of their excessive cost.

Of our 130 samples 35 might be passed as possessing some merit, but even these are expensive; they are generally toilet preparations and in certain cases possibly the convenience of their use might justify their purchase even at the high prices.

Sixty-one samples are fakes; many of these can be of no possible

benefit to one suffering from most of the long list of diseases for which they are recommended; some may do great harm to the patient suffering from a disease incurable by medical treatment, like consumption, kidney diseases, cancer or epilepsy, by the delay they encourage; others are fakes in that they claim for such common drugs as ordinary salt, borax, Epsom salts, Rochelle salts, sugar, etc., curative powers contrary to all human experience.

The remaining 34 preparations all contain dangerous drugs; these may be summarized as follows (alcohol is omitted as it was present in most of the liquid preparations):—

3 Ammoniated mercury.	1 Paraphenylene diamine.
1 Arsenic oxide.	1 Pyramidon.
2 Barium sulphide.	10 Santonine.
2 Bromides.	1 Silver nitrate.
5 Corrosive sublimate.	2 Thryoid gland.
4 Lead acetate.	2 Wood alcohol.
1 Morphine.	

Most of these dangerous or poisonous drugs do not come within the group, whose presence the law requires to be stated on the label. Generally the purchaser receives no warning as to the dangerous nature of these medicines, and often he is lulled into a false sense of security by the lying phrase "Absolutely Harmless".

The responsibility for the wide use of these nostrums of course rests in a large measure on their makers, but even the most misguided manufacturer would not continue to make what he could not sell. The physician, the newspaper, the druggist and the consumer must share the responsibility for this menace to the health of our people. Some physicians make "patent medicines", some testify for a consideration as to their worth, some actually prescribe them, in spite of the fact that in many cases they must be uncertain as to the composition of the medicines they are prescribing; the responsibility of such physicians is great. The newspapers must likewise bear much of the responsibility as they for mere dollars continue to allow their advertising columns to be used for the exploitation of remedies whose worthlessness, fraudulence and dangerous character have been exposed over and over again; they give the nostrum maker his chief stock in trade, publicity, and totally disregard their obligation to supply their readers with honest advertisements as well as accurate news. The druggist, both

wholesaler and retailer, as the purveyor of these wares, is equally responsible. In spite of the frequent claim made by him that he would prefer not to handle "proprietaries", we find that his advertisements generally lay stress not on his ability to compound accurate and reliable prescriptions but that he sells patent nostrums at cut-price rates. Not only does he sell these proprietaries, but with hardly an exception each druggist makes his own little line of "just as good" preparations, thereby putting himself on the same basis as the general manufacturer. The mere fact that a group of 10,000 or 25,000, or 100,000 druggists makes a line of preparations widely acclaimed as "not patent medicines" in no wise removes them from the category of the nostrum makers.

And, lastly, the consumer. His responsibility is indeed great and he is the main sufferer. He has been encouraged to indulge in that dangerous luxury "self-medication"; sometimes he has felt benefitted, in his ignorance confusing stimulation or deadened pain with cure. It will take a long time to reform the manufacturer, the physician, the newspaper, and the druggist, but the consumer *can* reform himself. He can refuse to buy this stuff and by his example encourage others to imitate him.

The identification of vegetable drugs in complex mixtures is extremely difficult, and at times impossible. It is not claimed, therefore, that our analysis is complete in all of these remedies, especially those in pill form and those containing vegetable extractives. We have, however, in all cases determined the active drugs present in appreciable amount. Likewise in certain hair preparations, cantharidin, pilocarpin and resorcin are frequently used in extremely minute quantities, so minute that ordinary methods of detection fail, unless inordinate amounts of the preparation are used. When there has been the slightest doubt as to the presence of these drugs, we have given the manufacturer the benefit of the uncertainty.

The following preparations were analyzed, and are discussed on subsequent pages in the order given below:—

Alcoholism (page 260 to 261).
- Orrine.
- White Ribbon Remedy.

Anti-Fat (page 261 to 264).
- Parnotis.
- Clark's Thinning Salts.
- Phytoline.
- Phy-thy-rin.
- Marmola.

Antiseptics (page 264 to 267).
- Liquocide.
- Purogen.
- Vilane Powder.

Bitters (page 267 to 275).
- A. D. S. Iron Tonic Bitters.
- Atwood's Vegetable Physical Jaundice Bitters.
- Boker's Stomach Bitters.
- Bucklen's Electric Bitters.
- Burdock Blood Bitters.
- Hopkin's Celebrated Union Stomach Bitters.
- Hostetter's Celebrated Stomach Bitters.
- Kaufmann's Sulphur Bitters.
- Lash's Kidney and Liver Bitters.
- Nyal's Iron Tonic Bitters.
- Zadoc Porter's Medicated Stomach Bitters.
- Severa's Stomach Bitters.
- Thompson's Laxative Appetizing Bitters.
- Turf Club Bitters.
- Von Koster's Bitters.

Catarrh, Coughs and Colds (page 275 to 278).
- Eckman's Alterative.
- Sage's Catarrh Remedy.
- Munyon's Catarrh Tablets.
- Bull's Cough Syrup.
- Hale's Honey of Horehound and Tar.

Deodorants (page 278 and 279).
- Amolin Deodorant Powder.
- Mum.

Depilatories (page 279 and 280).
- Del-A-Tone.
- Fluvol Powder.

Hair and Scalp (page 281 to 292).
- A. D. S. Hair Reviver.
- Allen's World's Hair Color Restorer.
- Ayer's Hair Vigor.
- Birt's Head Wash.
- Canthrox.
- Coke Dandruff Cure.
- Danderine.
- Germicidal Shampoo Powder.
- Goldman's Gray Hair Color Restorer.
- Hair Reviver.
- Hairwand.
- Liquid Arvon.
- Luxuriant Hair Tonic and Grower.
- Nyal's Hirsutone.
- Parisian Sage Compound.
- Parker's Hair Balsam.
- Penslar Hair Tonic.
- Plain Yellow Minyol.
- Potter's Walnut Tint Hair Stain.
- Stephan's Clescalp.
- Ther-Ox.
- Westphal's Auxiliator.
- Wyeth's Sage and Sulphur Hair Remedy.
- Yale's Excelsior Hair Tonic.

Kidneys and Liver (page 292 to 295).
- Carter's Little Liver Pills.
- Hood's Vegetable Pills.
- Doan's Kidney Pills.
- Kilmer's Swamp Root.

Skin and Complexion (page 295 to 307).
- Cadum.
- Champlin's Liquid Pearl.
- Citrox.
- D. D. D. Prescription.
- Derma-Royale.
- El-Gantis Beautifier.
- Epp-o-tone.
- Eptol.
- Hill's Freckle Lotion.
- Hind's Honey and Almond Cream.
- Holmes' Fragrant Frostilla.
- Kingsbery's Freckle Lotion.
- Kintho Beauty Cream.
- Kroy Wen Ointment.
- Luxor.
- May-A-Tone.
- McCorrison's Famous Diamond Lotion.
- Mercolized Wax.
- Othine.
- Perry's Moth and Freckle Lotion.
- Ruppert's World Renowned Face Bleach.

Sartoin.
Saxolite.
Saxon Salve.
Spurmax.
Zintone.

Soothing Syrups (page 307 to 309).
Kopp's Baby's Friend.
Nyal's Soothing Syrup.
Winslow's Soothing Syrup.

Stomach and Bowels (page 309 to 316).
Beecham's Pills.
Cardiol.
Edwards' Olive Tablets
Eno's Fruit Salt-Derivative.
Fruitola.
Mayr's Wonderful Stomach Remedy.
Munyon's Paw-Paw Pills Compound.
Pape's Diapepsin.
Mi-o-na.
Dilaxin Pills.
Para-Lax.

Tender Feet (page 316).
Calocide Compound.

Tonics (page 316 to 323).
Greene's Nervura.
Kardene.
Rexall Every Tay Tonic.
Tona Vita.
Vinol.
Waterbury's Compound, Plain.

Worm Syrups (page 323 to 325).
Adee-Co. Worm Syrup.
Dike's Worm Syrup.
Hand's Worm Elixir.
Hobson's Laxative Santonine Worm Syrup.
Manhattan Worm Syrup.
Notkin's Worm Syrup.
Nyal's Worm Syrup.
Penslar Worm Syrup.
Rexall Worm Syrup.
True's Elixir.
Wadewitz's Vegetable Worm Syrup.
Whitman Worm Syrup.

Miscellaneous (page 326 to 332).
Chi-Ches-ter's Diamond Brand Pills.
Hanford's Balsam of Myrrh.
Kosine.
Crystos.
Nurito.
Sargol.

REMEDIES FOR ALCOHOLISM

Orrine.

3222. *Orrine No. 1, Secret Remedy*, prepared for the Orrine Co., Washington, D. C. Price $1.00 per box of 12 powders, weighing 88.72 grains, or 0.185 oz. Powders of a slightly yellowish color, with a salty taste.

Reducing sugars (lactose).	84.48	Nitrogen, as ammonia.....	4.14
Chlorine.....	11.27	Gold (0.32) = gold chloride...	0.49

The material contains about 84.5 per cent. milk sugar, 15 per cent. ammonium chloride and 0.5 per cent. gold chloride. The papers containing the powders gave a distinct reaction for gold, showing that unless the patient consumed the papers as well as the powder he would fail to receive even the small amount of gold chloride originally in the remedy.

Gold chloride, the so-called "gold cure", according to leading authorities has no specific action on the alcohol habit.

White Ribbon Remedy.

3408. *White Ribbon Remedy for the Cure of Alcoholism*, Wm. R. Brown, Boston, Mass., manufactured expressly for Mrs. A. M. Townsend, Boston, Mass. Price $1.00 per box of 12 powders, weighing 92.43 grains, or 0. 193 oz. White powders with a salty taste.

Reducing sugars (lactose)..	94.68	Gold.....	none
Chlorine.....	3.95	Alkaloids.....	none
Nitrogen, as ammonia.....	1.51		

The material contains about 94.5 per cent. milk sugar and 5.5 per cent. ammonium chloride, an expectorant and mild stimulant.

The following extraordinary claims are made in the folder accompanying this mixture of milk sugar and ammonium chloride. (italics ours):

"In offering to the public White Ribbon Remedy for the treatment and *cure* of Intemperance (habitual or excessive indulgence in alcoholic liquors) Dr. William R. Brown does so with the knowledge that this *specific will cure* or destroy the diseased appetite for alcoholic stimulants. Whether the patient is a confirmed inebriate, or a 'tippler', a social drinker or a drunkard, White Ribbon Remedy will *cure*. *It is impossible for anyone to have an appetite for alcoholic liquors after using this specific.* Not only does the White Ribbon Remedy *extirpate the insatiable desire* for alcoholic stimulants, but *will neutralize the alcohol in the system, giving strength* to the nerve forces, and the determination to resist temptation. * * * Is the only reliable, safe, quick and *permanent* remedy for intemperance that can be given to the patients without their knowledge. * * * The price of the *specific* is so *low* that it is within the reach of all, and the small quantity that it takes to effect a *permanent cure* is as astonishing as it is effective. Requires from two to six boxes to make a *cure except in special cases when a special remedy will be prepared by Dr. Brown.*"

Even if the ammonium chloride had any virtue as a remedy for alcoholism, the patient would have to use eighteen powders to obtain the ordinary dose of 7.5 grains.

REMEDIES FOR REDUCING FLESH. (Anti-Fat).

Parnotis.

3520. *Parnotis*, for Making Flesh Reducing Remedy, H. S. Peterson & Co., Chicago. Price 50 cents for 3.7 oz. A cream-colored powder.

Sodium oxide	37.28	Carbon dioxide	much
Sulphuric anhydride	11.90		

The preparation appears to be a mixture of about 76 per cent. sodium bicarbonate (saleratus). and 24 per cent. impure sodium sulphate (Glauber's salts). The same amount of saleratus and Glauber's Salts would not cost more than two or three cents.

Clark's Thinning Salts.

3695. *The Famous French Clark's Thinning Salts, The Original Bath Powder*, See Amaigrissant Clark's Corp., New York. Price 25 cents for 7.5 oz.

Loss @ 100° C.	27.20	Sodium oxide	39.81
Boric acid, combined	9.27	Chlorine	trace
Carbon dioxide	much	Organic matter	small amount

The preparation appears to consist essentially of about 7.55 per cent. anhydrous borax and 64.03 per cent. crystalline sodium carbonate, with a small amount of organic matter (essential oil).

Phytoline.

3452. *Phytoline*, Walker Pharmacal Co., St. Louis., Mo. "A Powerful Anti-Fat and Anti-Rheumatic. A Remedy prepared from the Active Principle of the Berries of Phytolacca Decandra". "Alcohol 23.5 per cent". Price $1.50 for 2.17 fl. oz. A dark-brown liquid with a pleasant odor, suggesting a malted preparation.

Specific gravity @ 15.5° C.	1.0285			
Alcohol by volume	21.20			
Wood alcohol	none			
Solids	12.39	gms.	per	100 cc.
Ash	0.84	"	"	"
Reducing sugars, as dextrose	8.18	"	"	"
Salicylic acid	0.85	"	"	"
Undetermined organic matter	2.48	"	"	"
Iodine, alkaloids	none			

Poke root (*Phytolacca decandra*), which the manufacturer claims to be present, has emetic, purgative and somewhat narcotic properties. "It is not fit for use as an emetic" (U.S.D., p. 942), but it has been employed in the treatment of chronic rheumatism. It

appears to have no specific value as an anti-fat, any more than any other purgative. Furthermore its use is not unattended with danger.

No thryoid extract was present, and no alkaloids. It contained 12.39 gms of solids per 100 cc, of which about two-thirds was reducing sugar; the remaining solids consisted of 0.84 gm. ash, 0. 85 gm. salicylic acid and 2.48 gms. of an organic extract (possibly derived from poke berries).

"The introduction of this medicine has * * * brought a certain and positive treatment within the reach of all."

The manufacturer advises abundant exercise "to the extent of decided weariness several times a day", a strict diet, avoidance of alcoholic beverages, and moderate bathing. In referring to other methods of treating obesity the manufacturer states that they are "too expensive for any but a plethoric purse". This preparation costs $1.50 for about two fluid ounces, a quantity sufficient for about four days treatment according to the directions given.

Phy-thy-rin.

3690. *Phy-thy-rin Compound*, The Lesslie Co., Dayton, O. Price 75 cents for 54 yellow coated pills, weighing 34.67 grms., or 535 grs.

Loss @ 100° C.	3.14	Water-soluble	50.08
Ash	51.21	Alcohol-soluble	7.54
Ash insoluble in HCl	0.39	Iodine	0.0294
Calcium oxide	23.66	Carbon dioxide	much
Magnesium oxide	2.80	Na, So_3, Cl, $P_2 O_5$	trace
Sucrose	20.68	Unidentified alkaloid	trace

The coating of these pills is made up essentially of calcium and magnesium carbonates and sugar. The organic iodine indicates the presence of dried thyroid gland, and possibly other organic drugs are present. The danger from the use of thyroid preparations is referred to later under *Marmola* (see below).

Marmola.

3522. *Marmola Prescription Tablets*, The Marmola Co., Detroit, Mich. Price 75 cents for 36 brown uncoated tablets, weighing 21.70 gms., or 335 grs.

Loss @ 100° C.	2.43	Water-soluble	40.08
Ash	32.28	Alcohol-soluble	13.05
Ash insoluble in HCl	1.58	Iodine	0.030
Iron and aluminum phosphate	1.12	Phenolphthalein	present
Magnesium oxide	1.32	Carbon dioxide	much
Calcium oxide	15.32	SO_3, Cl, Na, K	traces
Sucrose	37.20		

The ash is made up chiefly of calcium and magnesium carbonates. The organic matter, 65.29 per cent., consists of sugar, phenolphthalein, dried thyroid gland and possibly powdered sea weed (bladder wrack). Thyroid gland extract is used to some extent in anti-fat remedies, and it is effectual in reducing flesh, but at the same time it reduces the user's strength as well. Such preparations in unskilled hands are dangerous to use, and by no means "a safe, scientific and effectual treatment for the reduction of fat".

The American Medical Association reports in *Nostrums and Quackery*, p. 389, an analysis made in 1911, showing that thyroid extract was no longer an ingredient of *Marmola*, and that the tablets consisted principally of phenolphthelein and cascara. Our sample may be of old stock, but it certainly contained iodine in organic combination. The Company's booklet accompanying the sample speaking of the *Marmola Prescription* says:

"These three ingredients are Peppermint Water, Extract Cascara Aromatic and Marmola. What Peppermint Water is everybody knows. That the Aromatic Cascara is a natural regulator of the digestive organs and liver, and is also well known. Likewise, as everybody knows Marmola is another pure product, that is most powerful in its influence over obesity, though always gentle and safe in its action."

These Statements regarding *Marmola* are not true.

A sample of *Dilaxin Pills* accompanied *Marmola*; and these are discussed on page 315.

ANTISEPTICS.

LIQUOCIDE.

3403. *Liquocide*, formerly called Liquozone, The Liquozone Co., Chicago. Price 50 cents for 7.5 fl. oz. A clear colorless liquid with the ordor of sulphurous acid.

Specific gravity @ 15.5° C.	1.0039	Residue on evaporation	0.549
Sulphuric anhydride	0.332	Residue on ignition	0.022
Sulphurous anhydride	0.312	Reaction	acid
Alcohol	none		

This preparation contains over 99 per cent. of water, with very small amounts of sulphuric and sulphurous acids. The residue on evaporation was black, carbonaceous, and strongly acid, and was characteristic of the result of the action of sulphuric acid on organic matter. On strong heating, fumes of sulphuric anhydride were given off. It is apparent, therefore, that *Liquocide* is possessed of acid rather than oxygenating properties as claimed.

Some of the claims made for this preparation are as follows:—

The great value of Liquocide lies in the fact that it is deadly to germs. It is a germicide so certain that for years we have published an offer of $1,000 to the physician or scientist who discovered a disease germ which Liquocide could not kill. Yet such a germ, so far as we know, has not yet been discovered."

"Impure air has been atomized with 1-125th the same volume of Liquocide. * * * Yet every germ in the air was destroyed. * * * "There is no disease germ, as far as is known, which can resist it." "Liquocide is unique in the fact that, while deadly to germs, it is harmless to bodily cells. It is this fact which gives to the product its enormous importance. Common germicides are poisons when taken internally. They destroy the tissues as well as the germs. That is why medicine has been so helpless in a germ disease. * * * Drugs that cannot kill germs are of little effect in a germ trouble. That has been the reason for perfecting this gas-made germicide. It is based on the fact that germs are of vegetable origin. And there are numerous gases which are deadly to vegetables, yet harmless to animals. * * * Thus Liquocide is deadly to vegetable matter, but helpful to animals. Put a vegetable into Liquocide and the tissues are gradually destroyed; but on meat Liquocide acts as a preservative."

The following are a few of the diseases for which Liquocide is recommended. The list covers almost the whole gamut of human ailments:—

"Abscess, Anaemia, Asthma, Blood Poison, Bowel Troubles, Bronchitis, Coughs, Colds, Cancer, Catarrh, Consumption, Contagious Diseases, Dysentery, Diarrhoea, Dyspepsia, Dandruff, Eczema, Erysipelas, Fevers, Gall Stones, Goitre, Gout, Gonorrhea, Gleet, Hay Fever, Influenza, La Grippe, Leucorrhea, Malaria, Neuralgia, Piles, Quinsy, Rheumatism, Scrofula, Syphilis, Skin Diseases, Throat Troubles, Tuberculosis, Tumors, Ulcers, also most forms of Kidney Diseases, Liver Troubles, Stomach Troubles and Women's Diseases."

"It should be understood that the very effectiveness of Liquocide may sometimes increase, for a little time, the symptoms which germs cause. Liquocide may lead to some temporary skin eruption, or to some other indication that Nature is getting rid of impurity. * * * Do not

attribute any such temporary discomfort to the belief that Liquocide is harming you * * * If skin eruptions appear, apply Liquocide to them and they will soon disappear."

The above quotations from the company's booklet have been given at considerable length to show the absurdity and falsity of the claims made for it. That an extremely dilute solution of sulphuric and sulphurous acids in water can serve as a "cure-all" is taxing one's credulity to the utmost. That the continued use of these active acids, even in small quantities, is entirely harmless is certainly open to question.

Purogen.

3525. *Purogen*, the Perfect Antiseptic, The Wilcox Co., Providence, R. I. "Composed of C.P. Boric Acid, Menthol, Eucalyptol, non-poisonous Phenols, and the antiseptic constituents of a number of essential oils". "Absolutely harmless". "Alcohol 25 per cent". Price 25 cents for 2.97 fl. oz. A colorless solution with the odor of menthol and eucalyptol.

Specific gravity @ 22° C.	0.9779	Volatile oils	0.30
Alcohol by volume	24.80	Non. volatile solids	0.14
Wood alcohol	none	Ash	0.08
Boric acid	2.15		

The preparation is a strongly alcoholic solution containing 2.15 per cent. of boric acid and small amounts of menthol, eucalyptol and possibly other volatile oils. Its rather simple and familar constituents can scarcely justify such claims as the following:—

"Purogen is the exemplification of the wonderful progress made in the production of antiseptics. It is in fact a crystallization of years of exhaustive effort in the field of chemistry, and embodies in rare degree all the essential features of a thoroughly reliable general antiseptic."

While the physiological action of boric acid is rather feeble, severe cases of poisoning from its use are on record, and it would seem that the manufacturers of this preparation rather overemphasize the claim that it is "absolutely harmless".

Vilane Powder.

3694. *Antiseptic Compound Vilane Powder*, The Blackburn Products Co., Dayton, O. Price 79 cents for 8 oz. A white powder with the odor of thymol.

Loss @ 100° C.	4.40	Chlorine	25.21
Loss on strong ignition	28.25	Sodium	present
Boric acid	16.62	Menthol, oil wintergreen	present
Carbonic acid	18.35	Thymol, eucalyptol probably	present
Salicylic acid	2.69		

From these data the powder appears to have approximately the following composition:—

Water and volatile matter (including menthol, oil wintergreen and probably thymol and eucalyptol)	4.40	Sodium chloride	41.60
		Borax, anhydrous	13.54
		Sodium salicylate	3.12
		Sodium carbonate and bicarbonate	37.34

BITTERS.

For the description, names of manufacturers and analyses of these preparations see Table IX, page 272.

A. D. S. Iron Tonic Bitters.

"Is a most useful remedy in cases of exhaustion and general debility following attacks of wasting diseases. It tends to improve the appetite, to increase the oxygenating power of the red blood-corpuscles, and to increase the general tone of the whole system."

These wonderful results are claimed for a solution containing 18 per cent. of alcohol and 11 per cent. of solids (a large portion of which is glycerine and sugar), with a trace of iron and a small amount of quinine. The "bracing" effect of this drink would seem to depend chiefly upon its high percentage of alcohol.

Atwood's Vegetable Physical Jaundice Bitters.

"Recommended for jaundice, headache, dyspepsia, worms, dizziness, loss of appetite, darting pains, colds and fevers. For cleansing the blood from humors and moistening the skin. It is also good for liver complaints, strangury, dropsy, croup and phthisic."

This "vegetable" medicine contains 2.18 per cent. of ash (mineral matter), of which 0.98 per cent. is potash and 0.23 per cent. lime; sulphates, chlorides and carbonates are present, with traces of iron, magnesia and phosphates. As noted for the previous preparation it would seem that its 13.5 per cent. of alcohol must be its really active ingredient.

Boker's Stomach Bitters.

"For sale by all prominent *grocers, wine merchants,* druggists, etc. * * * The most consummate harmony of palatable and invigorating ingredients and the only perfect stomach bitters * * * Being free of the taste and smell of the apothecary shop, but full and rich in flavor, are used in different ways and convenient proportions *in all the refined drinks of the bar.* * * * * * However, their *highest* and *most estimable value* must be found in their *Medicinal Properties.* * * * * Whoever feels irregularities in his digestive organs, or pains in the bowels, will find in them *invariable* and quick *relief.* They alleviate the most persistent cases of dyspepsia, and if judiciously used, they will *cure* them gradually but effectively. They have constantly proved a reliable *preventive* against fever and ague, and the dreaded attacks of the cholera; and these diseases may even be *cured,* if recourse be had to these Bitters at the appearance of the first symptoms" (italics ours.)

It is interesting to note that, in spite of their "estimable" value for quite an array of formidable diseases, the first emphasis is placed upon their being sold by grocers and wine merchants, and in their great value in concocting fancy mixed drinks. These "stomach bitters" contain 42.5 per cent. of alcohol (almost as much as whiskey), with 4.47 per cent. of solids, nearly half of which is sugar. In spite of this high alcoholic content we are told that "the weakened child and the delicate lady, the infirm and the convalescent" may use these bitters with safety.

Bucklen's Electric Bitters.

"The great Electric Remedy. Positively *cures all diseases of the stomach, liver and kidneys,* biliousness, general debility, fever and ague, and blood disorders" (italics ours).

These claims are made for an intoxicant containing 19 per cent. of alcohol, 1.12 per cent. of sugars and 0.93 per cent. of vegetable extractives. The claims are clearly false and fraudulent.

Burdock Blood Bitters.

"Has no *harmful* ingredients." "Has proven unfailing in relieving and *curing* diseases and afflictions caused by impure blood and irregularities or disorders of the *major organs* of the body.* * * * Primarily a blood medicine* * * * makes rich, red, life-giving blood* * * * Tones and stimulates the stomach and enables it to pour out *just the proper amount* of gastric or stomach fluids* * * * For *liver complaint in any form** * * *will be found *invaluable** * * * *In a way,* also,

Burdock Blood Bitters has an influence upon the kidneys, giving them tone and strength * * * * *Revitalizes and stimulates every function* * * * * Removes all blotches, eruptions and chronic sores, and makes the skin smooth and clear * * * * It can be used by young or old, weak or strong, *with perfect safety.*" (italics ours.)

This "safe" remedy contains over 19 per cent. of alcohol, with only 4.85 per cent. of solids (nearly half of which is sugar), and alkaloids possibly derived from hydrastis. The amount of vegetable extractives is small, certainly not enough to give the results claimed.

Dr. Hopkins' Celebrated Union Stomach Bitters.

"Sarsaparilla and other Roots and Barks compounded so as to act in concert, and assist nature in Eradicating Disease. * * * * A Pure Vegetable Medicine. * * * * Remedy for diseases of the Stomach and Nervous System, Dyspepsia, Liver Complaint and Consumption, and species of Indigestion, Loss of Appetite, etc., for Malarial Fevers, Chills and Ague * * * *For Piles."

This "consumption" remedy contains 15.54 per cent. of alcohol, a small amount of quinine, and 9.77 per cent. of solids, all but 0.81 per cent. of which is sugar. That this small amount of vegetable extractives will produce the results claimed is beyond credence. The efficiency of the medicine is illustrated by the directions to take from two to six bottles for fever and ague.

Hostetter's Celebrated Stomach Bitters.

This material contains nearly 25 per cent. of alcohol, a small amount of quinine, and only 4.57 per cent. of solids, all but 0.80 per cent. of which is sugar. Of course as in the other cases cited above, the alcohol is the main active ingredient, and the small amount of vegetable extractive present cannot possibly act as an efficient remedy for Dyspepsia, Liver Complaint, Costiveness, Indigestion, Intermittent Fever, Fever and Ague, Flux, Colic, Cholera, "mild and safe invigorant and corrobant for delicate females," an "anti-bilious alterative," "a powerful recuperant," "a depuretic of the blood and other fluids," as claimed.

Dr. Kaufmann's Sulphur Bitters.

"Recommended for Loss of Appetite, Dyspepsia, Indigestion, Dropsy, Nausea, That Tired and All-Gone Feeling, Gout, Habitual Costiveness, Pimples and Humor on Face and Body, Sick Headache, Scrofula, Colds,

Jaundice, Ulcers, Catarrh, Coughs, Colic, Piles, Kidney Complaint, Rheumatism, Female Weakness, Biliousness, Neuralgia, Tape, Pin and Other Worms, Dysentery, Faintness of the Stomach, Erysipelas, etc." In other parts of the company's literature it is recommended for Syphilitic Diseases, for Catarrh "the father of Consumption," Leucorrhoea, Painful Menstruation, Prolapsus Uteri, Sterility, Suppression of Menses, Urinary Troubles and all Uterine and Vaginal Ulcerations. In the company's pamphlet directions for the use of the medicine in special cases are given in German and French, *but not in English.* "De deux à cinq bouteilles pour faiblesse prématurée, et aider à recupérer le mâle vigeur diminuée ou affaiblie pour suite d'exces de jeunesse."

Translation—"Two to five bottles for premature weakness, and as an aid in restoring male vigor lessened or weakened by youthful excesses.)

The medicine contains over 22 per cent. of alcohol, or about half as much as ordinary whiskey. This quantity is far from being homeopathic and if the directions are followed the patient will assuredly acquire a pretty substantial taste for alcoholic stimulants.

The preparation contains little else besides the alcohol, only 2.32 per cent. of solids, one-third of which is sugar, some sulphur and a bitter principle, and less than one per cent. of vegetable extractives, "Gentianae Radix, Prunus Virginica, Aloe Socotrina, Eupatorium Tanacetum, Balmony, Podophyllum, Senna Indica and Calamus" being claimed.

The medicine is accompanied by a booklet of over one hundred pages entitled "Kaufmann on Disease," in which the symptoms are given for scores of diseases, always with the assurance that the Sulphur Bitters is the great and only remedy for the complaint. The most interesting section of the booklet, however, is a chapter of four pages on "Startling Facts and Figures of the Rum Traffic," concluding with this sentence:

"What man, what woman, what child would not vote to have that whole street" [where liquor is sold], "with its awful traffic in the infernal stuff, sunk to the lowest depths of perdition and covered ten thousand fathoms deep under the curses of the universe?"

And yet the author prescribes as much as twelve bottles of a concoction containing 22 per cent. of "the infernal stuff." Incidentally, the bitters are sold in a bottle quite similar to a whiskey flask.

Lash's Kidney and Liver Bitters.

"Is purely vegetable and contains no ingredients that can in any way be injurious* * * Recommended for Cure of Constipation, Biliousness, Malaria, Dyspepsia, Indigestion, Chills and Fever, Sick Headache, Sour Stomach and Affections of the Kidneys and Bladder"* * * *"Especially adapted for women and children."

This popular bar-room bitters (our sample was purchased in a saloon) contains 21.46 per cent. of alcohol and 7.83 per cent. of solids, with 2.42 per cent. of vegetable extractives of a more or less laxative nature. The suggestive pictures used to advertise these bitters show it better fitted for the bar-room than the sick-chamber.

Nyal's Iron Tonic Bitters.

"An Ideal Tonic. It Stimulates the Gastric Flow of the Stomach, thus Aiding Digestion and Increasing the Blood Supply. It is of Great Value in All Diseases connected with an Enfeebled State of the System or other Exhausting Conditions."

This preparation contains 18.32 per cent. of alcohol with 19.21 per cent. of solids, 12.91 per cent. of which is sugar. It contains 1.15 per cent. of ash, in which iron, chlorides, phosphates and sulphates were found, with a trace of magnesia; also about 5 per cent. of vegetable extractives, which give a reaction for unidentified alkaloids.

Mr. Zadoc Porter's Medicated Stomach Bitters.

We are told in the company's literature that "the great-great-grand uncle of Dr. Porter was among the early settlers of this country. When he left Europe, an aged Doctor, of high repute, gave him (Mr. Porter) the recipe for preparing these medicines * * * * Mr. Porter, being a man of generous feelings and considerable wealth, seeing much distress in the colony by sickness, had the liberality to furnish them without charge to all the inhabitants, by which great sufferings were relieved and health promoted over a large extent of country. Mr. Porter used no other medicines during his life, which was continued to 115 years, and died without suffering." "The present proprietor (Dr. Porter) * * * * regrets that he is unable to furnish them to the present generation on the same liberal terms that his esteemed and generous ancestor did, namely, *without charge*; but since he cannot, he will come as near to giving away as possible."

This remedy introduced by a philanthropist (?) is claimed to be

"A powerful corrector of the Stomach and all Nervous Affections * * * * Nausea of the Stomach, Weakness, General Languor, Dizzi-

TABLE IX.—

Station No.	Brand.	Volume.	Cost.	Alcohol guaranteed.	Specific Gravity @ 15.5° C.
		fl. oz.	cts.		
1107	A. D. S. Iron Tonic Bitters. American Druggists' Syndicate, Long Island City, N. Y.	10.7	79	20	1.0202
1104	Atwood's Vegetable Physical Jaundice Bitters. Manhattan Medicine Co., New York City	6.8	25	16.5	1.0722
1619	Boker's Stomach Bitters. L. Funke, Jr., N. Y. City.	11.3	65	42.1	0.9607
1106	Electric Bitters. H. E. Bucklen & Co., Chicago, Ill.	10.8	50	....	0.9846
1118	Burdock Blood Bitters. Foster-Milburn Co., Buffalo, N. Y.	9.8	90	22	0.9964
1635	Dr. Hopkins' Celebrated Union Stomach Bitters. F. S. Amidon, Hartford	20.2	125	15.5	1.0184
1105	Hostetter's Celebrated Stomach Bitters. The Hostetter Co., Pittsburg, Pa.	18.0	80	25	0.9873
1708	Dr. Kaufmann's Sulphur Bitters. A. P. Ordway & Co., New York City	10.3	100	22.3	0.9805
1711	Lash's Kidney and Liver Bitters. Lash's Bitters Co., New York City.	19.9	75	21	1.0083
1123	Nyal's Iron Tonic Bitters. New York & London Drug Co., New York City	15.0	100	20	1.0609
1122	Mr. Zadok Porter's Medicated Stomach Bitters. Hall & Ruckel, New York City	3.2	25	28.5	0.9774
1622	Severa's Stomach Bitters. W. F. Severa Co., Cedar Rapids, Ia.	8.9	50	25	0.9902
1716	Laxative Appetizing Bitters. E. W. Thompson & Co., New Britain	7.6	25	25	1.0084
1710	Turf Club Bitters. P. F. Bowe, Waterbury.	24.1	100	15	1.0286
1724	Von Koster's Bitters. Von Koster Bitters Co., Fairfield.	20.0	75	0	1.0408

ness, Loss of Appetite, Belching of Wind, Sourness of the Stomach, Indigestion, Agu , Diarrhoea, Summer Complaints, Teething of Children, Worms * * * * Heartburn, Waterbrash, Dyspepsia, Sick Headache Vomiting Food, Jaundice, etc." "Those who use Ardent Spirits will find the Stomach corrected in a most remarkable manner by this preparation."

BITTERS.

Alcohol by Volume.	Solids.	Sucrose.	Reducing Sugar.	Non-Sugar Solids.	Ash.	Alkaloids.	Oxymethylanthraquinones.	Remarks.
17.89	‡11.06	0	1.58	9.48	0.57	Yes	No	Iron (Fe_2O_3), 0.05; quinine and glycerine present.
13.55	19.69	0	11.59	8.10	2.18	Trace	Yes	Potash, 0.98; lime, 0.23; sulphates, chlorides and carbonates present; traces of iron, magnesia and phosphates.
42.56	4.47	0.87	0.98	2.62	0.05	None	*No	
19.13	2.05	0	1.12	0.93	0.11	None	Yes	
19.28	4.85	0	2.30	2.55	0.47	Yes	*No	
15.54	9.77	6.56	2.40	0.81	0.01	Yes	No	Quinine present.
24.82	4.57	2.13	1.64	0.80	0.08	Yes	No	Quinine present.
22.39	2.32	0	0.61	1.71	0.16	None	†Yes	Sulphur present.
21.46	7.83	0	4.94	2.89	0.47	None	*Yes	
18.32	19.21	0	12.91	6.30	1.15	Yes	No	Iron (Fe_2O_3), 0.16; chlorides, phosphates and sulphates present; trace of magnesia.
30.65	‡3.24	0.42	0	2.82	0.91	None	No	Soda, 0.43; potash, 0.12; traces of chlorides, sulphates, phosphates, lime, magnesia and iron; glycerine present.
24.48	‡6.04	0	0.42	5.62	0.08	Yes	*Yes	Emodin and glycerine present.
14.80	6.77	0	3.83	2.94	0.36	None	*Yes	
18.49	11.66	0	8.29	3.37	0.47	None	*Yes	
3.30	5.85	0	0.10	5.75	3.54	None	*Yes	Soda, 1.99; carbonates, much; traces of lime, iron and sulphates.

* A red-orange color was extracted from ethereal solution with ammonia water. † A pink color was extracted from ethereal solution with ammonia water; color was not strong and had a faint bluish fluorescence. ‡ Glycerine present.

The remedy contains over 30 per cent. of alcohol, with only 3.24 per cent. of solids, a considerable part of which is sugar, glycerine and mineral matter. Soda and potash are present with

traces of chlorides, sulphates, phosphates, lime, magnesia and iron. Such a strongly alcoholic concoction can hardly be considered a safe remedy for users of ardent spirits, nor is this intoxicant as cheap as many others of its class.

Severa's Stomach Bitters.

"A Reliable Remedy for Dyspepsia, every species of Indigestion, Intermittent Fever, and all kinds of Periodical Disorders."

The bitters contain 24.48 per cent. of alcohol, with 6.04 per cent. of solids, part of which is sugar and glycerine. Emodin is present with unidentified alkaloids.

Bowe's Turf Club Bitters.

"Advised for Constipation, Sick Headache and Nausea, Indigestion, Acid Stomach and Gases * * * * Recommended for Use in sickness following an alcoholic debauch and as constituent of cocktails and makes an excellent highball."

A strange remedy for alcoholism and yet excellent for cocktails and highballs. It contains 18.49 per cent. of alcohol and 11.66 per cent. of solids, over 8 per cent. of which is sugar. About 3 per cent. of vegetable extractives is present, which give the oxymethylanthraquinone reaction, showing the presence of cathartic drugs.

Von Koster's Bitters.

"Contains no narcotics or alcohol." "The Greatest of all Blood Purifiers." "Especially put up for hotels and cafes." Under "Directions" we read "take a teasponful of the Bitters in a glass of whiskey morning and evening. This will act as a laxative and keep the system in a healthy condition."

Contrary to the manufacturer's claim we find 3.30 per cent. of alcohol present, and even if it were non-alcoholic the express directions are to take it in whiskey twice a day. It contains 5.85 per cent. of solids, with 3.54 per cent. of ash, consisting chiefly of a sodium carbonate with traces of lime, iron and sulphates. An oxymethylanthraquinone is present.

Thompson's Laxative Appetizing Bitters.

"Recommended for Constipation, Biliousness, Dyspepsia, Indigestion, Loss of Appetite, Headaches, Jaundice and all disorders arising from a torpid liver.

It contains 14.80 per cent. of alcohol (25 per cent. claimed), and 6.77 per cent. of solids, one-half of which is sugar. A positive test for oxymethylanthraquinone was obtained, showing the presence of vegetable cathartics.

REMEDIES FOR CATARRH, COUGHS AND COLDS.

Eckman's Alterative.

3519. *Eckman's Alterative*, Eckman Mfg. Co., Philadelphia, Pa. "Does not contain Opium, Morphine, Codeine, Heroin, or other narcotics; nor any poisonous drugs". "Alcohol 14 per cent. "Alcohol used only as a solvent". Price $2 for 8.4 fl. oz. A brown liquid, containing some sediment, with the odor and taste of oil of cloves.

Specific gravity @ 15.5° C.	1.0176	Ash	4.04
Alcohol by volume	14.44	Calcium oxide	1.96
Wood alcohol	none	Chlorine	2.38
Solids	5.31	Insoluble residue	0.084
Glycerine	none	Alkaloids	none

The material contains 14.44 per cent. of alcohol with 5.31 per cent of solids, of which 3.88 per cent. is calcium chloride and 1.27 per cent. organic extractives. Calcium chloride has the property of increasing the coagulability of the blood and has, therefore, been used to a considerable extent for checking internal hemorrhage. If taken in the prescribed dose, a teaspoonful before each meal and before retiring, *Eckman's Alterative* would furnish about one-half the minimum dose of calcium chloride as laid down by the U. S. Dispensatory. The 14 per cent. of alcohol, however, would probably have the effect of making the patient *think* he felt better.

This preparation in its present labeling is recommended for "Tuberculosis (Consumption), Catarrhal Bronchitis, Bronchial Asthma and Stubborn Colds". The following well-guarded claims are made, showing the effect of the present law's insistence on honest labeling (italics ours):—

"After these changes occur and the system comes under the influence of the alterative, a gradual improvement *should* follow; the appetite *generally* increases, nausea, vomiting and indigestion *usually* cease; expectoration is *facilitated* and the sputum becomes a lighter yellow, thinner and *sometimes* frothy; the severity of the coughing spells *is expected to lessen*; fever *should lessen* and sleep become more restful; chest pains and night

sweats *usually* subside. *Generally*, as repair progresses, toxemic symptoms —anaemia, weakness, emaciation, etc.— are remedied and the mental condition *often* changes to one of interest and contentment. * * * * *Do not use spiritous or malt liquors.*"

In spite of the above cautious and colorless claims, the booklet issued by the company, and which does not accompany the medicine, throughout its pages constantly suggests the remedy as a "cure" for consumption. A patient who believed that calcium chloride in dilute solution might be of assistance to him, could secure the amount contained in this whole bottle for about one-half of a cent at any drug store.

The advice not to use spirituous or malt liquors comes with a medicine which contains more alcohol than any malt liquor contains, more than most wines, and over one-fourth that contained in gin, rum, whiskey or brandy.

Dr. Sage's Catarrh Remedy.

3397. *Dr. Sage's Catarrh Remedy*, World's Dispensary Medical Association, Buffalo, N. Y. Price 50 Cents for 0.42 oz. A greenish powder with a salty taste and an odor of camphor and phenol.

Loss @ 100° C.	1.65	Sulphates, phenol, resin	present
Ash	88.15	Blue pigment	present
Organic matter	10.20	Iron	trace
Sodium oxide	45.45	Alkaloids (hydrastis)	present
Chlorine	52.24		

The mixture consists of about 86 per cent. of common salt and 14 per cent. of volatile and organic matter. The matter other than salt consists chiefly of hydrastis and possibly other vegetable drugs, with resin and a phenolic compound; a blue pigment is also present.

The proprietor advertises this remedy as "beyond all comparison the best preparation ever invented. * * * * Its ingredients are simple and harmless, yet when scientifically and skillfully combined, in just the right proportions, they form a most wonderful and valuable healing medicine."

The treatment for catarrh as outlined in the company's circular is interesting. First the patient cleanses his system with *Pierce's Golden Medical Discovery*, then *Dr. Sage's Catarrh Remedy*; if that

fails he is to use, *Dr. Pierce's Fountain Nasal Injector* or *Douche*; a sort of "hit-or-miss" system; if the one does not do what the manufacturer claims, try one of the others for which equally positive claims are made.

Munyon's Catarrh Tablets.

3400. *Munyon's Catarrh Tablets*, Munyon Remedy Co., Philadelphia, Pa. Price 25 cents for 19 tablets weighing 6.72 grams.

Only a qualitative examination was made of these tablets. They were found to consist chiefly of sodium bicarbonate, borax, sodium chloride, and possibly a trace of carbolic acid. No alkaloids, heavy metals, sugars or starch were present.

The Munyon remedies, according to the company's literature, are sold specifically as "cures" for the various diseases. Under "Catarrh" we read as follows:—

"Catarrh Positively Cured—Are you a sufferer with catarrh? Have you taken all sorts of drugs and patent nostrums? Are you tired of paying big doctor bills without being cured? Are you willing to spend 50 cents for a cure that permanently cures catarrh by removing the cause of the disease? If so, ask your druggist for a 25-cent bottle of Munyon's Catarrh Cure and a 25-cent bottle of Catarrh Tablets. The Catarrh-Cure will eradicate the disease from the system and the Tablets will cleanse and heal the afflicted parts and restore them to a natural and healthful condition."

The freshness of our sample of the tablets is attested by the presence of a Spanish-American War (1898) revenue stamp.

Dr. Bull's Cough Syrup.

3219. *Dr. Bull's Celebrated Cough Syrup*, A. C. Meyer and Co., Baltimore, Md. "Contains 3 per cent. alcohol". Price 25 cents for 2.3 fl. oz.

Specific gravity @ 15.5° C.	1.2452
Alcohol by volume	5.00
Chloroform extract	0.071 grs. per fl. oz.
Ammonia	present
Chlorine =ammonium chloride	8.3 grs. per fl. oz.
Bromides	none

This sample was only analyzed in part, chiefly for the presence of habit-forming drugs. The medicine contained 5 per cent. of alcohol, and 8.3 grs. per fl. oz. of ammonium chloride. with 0.07

gr. per fl. oz. of chloroform extract. The latter gave the general reaction for morphine derivatives with sulphuric acid and formaldehyde but we hesitate to say such are present, as recent investigations in this laboratory show that certain emodin-containing drugs likewise give this reaction. The North Dakota department reports the medicine formerly to contain 3.72 per cent. alcohol, 55.54 per cent. solids, most of which was commercial glucose, and 0.48 gr., codeine per fl. oz.; sassafras and possibly wild cherry were also present (*Spec. Bull. 1, 1911, p. 401*).

The claims for this medicine have been considerably modified in recent years and the formula undoubtedly has been changed.

Hale's Honey of Horehound and Tar.

3215. *Hale's Honey of Horehound and Tar*, The Chas. N. Crittenton Co., New York City. "Alcohol 13 per cent." "For Coughs, Colds and Influenza and Affections of the Throat and Lungs". Price 25 cents for 1.5 fl. oz.

Specific gravity @ 15.5° C.	1.1258
Alcohol by volume	13.87
Chloroform extract	0.077 gr. per fl. oz.
Bromides	none

This sample likewise was examined only for habit-forming drugs. It contained 13.87 per cent. alcohol and 0.077 gr. per fl. oz. of chloroform extract. As already stated under *Dr. Bull's Cough Syrup*, this chloroform extract gave the reaction for morphine derivatives with sulphuric acid and formaldehyde, but for the reasons there given we do not feel justified in claiming that morphine or a morphine derivative is present. At one time this preparation contained $\frac{5}{13}$ gr. of opium per fl. oz. and later $\frac{1}{4}$ gr. of codeine per fl. oz. Apparently these and similar alkaloids are no longer present. The medicine is especially recommended for the use of children, in spite of its high alcoholic content.

DEODORANTS.

Amolin Deodorant Powder.

3482. *Amolin Antiseptic Deodorant Powder*, Amolin Chemical Co., New York City. "Contains no talcum or other insoluble ingredient. Relies chiefly upon a coal-tar derivative of the phenol hydro-carbon series, which differs from carbolic acid in being agreeable in odor." "Healthful and Absolutely Harmless". Price 15 cents for 1.48 oz.

It is a white powder, practically all boric acid, scented with thymol.

There is no question as to the value of boric acid as a dusting powder and antiseptic. However, calling it *Amolin Deodorant Powder* in no way enhances its value.

The harmlessness of this preparation is doubtful. While the physiological action of boric acid is rather feeble, still severe cases of poisoning are on record. Its use in foods, even in small quantities, is forbidden in many of the states. In view of the manufacturer's statement that "for all vaginal inflammations * * * Amolin Powder * * * may be used * * * as frequently as desired", the following from the *U. S. Dispensatory* is of interest:—"Fatal cases of boric acid poisoning have been produced by the immoderate use of its solution in washing out internal cavities. Two ounces of boric acid in the vagina produces violent poisoning."

Mum

3448. *Mum*, Mum Mfg. Co., Philadelphia, Pa. "A delicate deodorant indispensable for the toilet." Price 25 cents for 0.28 oz. A white ointment with the odor of rose.

Loss at 100° C.	7.12	Chloroform insoluble	14.85
Ether extract	76.13	Zinc oxide	14.30
Ether extract unsaponifiable	14.57	Benzoic acid	3.30
Ether extract saponifiable	61.56	Boric acid, salicylic acid, phenols, alumina, starch	None
Alcohol extract (hot 95%)	80.57		

This material consists essentially of 14.3 per cent. zinc oxide and 3.3 per cent. benzoic acid, possibly derived from benzoin, with an undetermined fatty base.

DEPILATORIES.

Del-A-Tone.

3524. *Del-A-Tone*, for Superfluous Hair, Sheffield Pharmacal Co., Chicago. Price one dollar for 1.9 oz. A fine, gray powder with the odor of hydrogen disulphide and nitrobenzene.

Starch	66.29	Sulphur, as sulphide	3.35
Barium, total	16.62	Insoluble in hydrochloric acid	1.77
Barium, as sulphide	15.69	Loss @ 100° C	7.85
Barium, as sulphate	0.96	Loss on ignition	76.60
Sulphur, total	3.67		
Sulphur, as sulphate	0.32		

The preparation is a mixture of about 19.35 per cent. barium sulphide, 1.63 per cent. barium sulphate, 66.29 per cent. starch, 7.85 per cent. water and volatile matter, with 4.88 per cent. undetermined matter.

Barium sulphide, although not an official drug, has been used to some extent as a depilatory. The barium salts are generally poisonous and are not safe remedies for careless or indiscriminate use.

Fluvol Powder.

3692. *Fluvol Powder*, for the Removal of Superfluous Hair on Face, Arms or Body, The Lesslie Co., Dayton, O. Price 69 cents for 1.1 oz.

Loss @ 100° C	3.17	Sulphur, as sulphate	1.90
Ash	63.89	Starch	24.05
Barium	20.11	Insoluble in hydrochloric acid	46.96
Sulphur, total	4.65		
Sulphur, as sulphide	2.75		

From the above data the following composition is indicated: Water and volatile matter 3.17, barium sulphide 14.69, barium sulphate 13.91, starch 24.05, and talc, by difference, 44.18 per cent. The preparation is somewhat similar to *Del-A-Tone*, already discussed. It is a stronger preparation, however, containing considerably more barium, and a part of the starch is replaced with a talc-like mineral. As already stated the barium salts are generally poisonous and are unsafe for careless or indiscriminate use.

The manufacturers apparently are not entirely sure of the efficacy of the remedy, for they tell us "Should the hair again grow use the powder as before."

HAIR AND SCALP PREPARATIONS.

A. D. S. Hair Reviver.

3423. *A. D. S. Hair Reviver*, American Druggists Syndicate, Long Island City, N. Y. "Alcohol 27 per cent." Price 50 cents for 6.0 fl. oz. A greenish liquid with the odor of menthol (?).

Specific gravity @ 15.5°C.	0.9704	Ash	0.04
Alcohol by volume	26.76	Quinine, pilocarpine and salicylates	present
Wood alcohol	none	Cantharidin	(?)
Solids	0.69	Heavy metals, boric acid	none
Glycerine	0.57		

The preparation is strongly alcoholic with a very small amount of solids (0.69 per cent.), most of which is glycerine. Quinine, pilocarpine and a salicylate are present in extremely small amounts, the first two of which are tonics and the last an antiseptic. Cantharidin may also be present in small quantity.

Mrs. S. A. Allen's World's Hair Color Restorer.

3431. *Mrs. S. A. Allen's World's Hair Color Restorer*, Mrs. S. A. Allen, New York City. Price one dollar for 8.7 fl. oz. A water-white liquid containing much sediment, with a cinnamon-like odor.

Specific gravity @ 15.5° C.	1.0795	Lead (1.57) = lead acetate	2.88
Alcohol	none	Acetates	present
Solids	24.94	Alkaloids, boric and salicylic acids	none
Glycerine	17.62	Reaction	neutral
Ash	2.13		
Sulphur	1.76		

This is a glycerine-water solution of lead acetate with considerable free sulphur.

"A Superior Dressing for the Hair. A Preparation for Beautifying and Dressing the Hair; rendering it soft, silky and glossy, and disposing it to remain in any desired position; quickly cleansing the scalp, and imparting a healthy and natural color to the hair. Youthful Color and Beauty Imparted to Gray Hair."

The use of any preparation, even externally, containing such a dangerous poison as lead acetate, must be deprecated.

Ayer's Hair Vigor.

3205. *Ayer's Hair Vigor*, Dr. J. C. Ayer and Co., Lowell, Mass. New improved formula; "Alcohol, 15 per cent., capsicum, sodium chlorid, sage, quinin, sulphur, glycerin, water and perfume." Price 85 cents for 7.2 fl. oz. A water-white liquid containing considerable sediment, with the odor of oils of lemon, neroli and lavender.

Specific gravity @ 15.5° C.	1.0366	Sulphur	1.48
Alcohol by volume	15.84	Quinine, capsicum, chlorides	present
Wood alcohol	none	Heavy metals, boric and salicylic acids	none
Solids	21.62	Reaction	neutral
Glycerine	17.29		
Ash	0.27		

This preparation formerly contained lead and its omission has certainly "improved" the formula. The present formula as given is essentially correct. It is an aqueous-alcohol-glycerine solution containing quinine, a very small amount of common salt and capsicum, with considerable free sulphur.

The following are some of the claims made for the medicine:

"Destroys dandruff, makes hair grow, stops falling hair. * * * * This new preparation certainly destroys the germs of dandruff and falling hair; supplies nourishment to the hair, etc., etc." "Ayer's Hair Vigor, new improved formula, is a regular hair food. It feeds, nourishes, builds up, strengthens. The principal ingredient which makes this possible is glycerin."

The tonic properties of quinine and capsicum are well known. On the other hand, this preparation is not a "hair food," for no such preparation exists, any more than skin foods, brain foods or nerve foods. Certainly glycerine has no such food value. Speaking of glycerine the *U. S. Dispensatory* says:

"All our physiological evidence goes to show that glycerine has, unless in very immoderate quantities, no distinct physiological or therapeutic properties other than those of a feeble laxative."

Birt's Head Wash.

3210. *Birt's Head Wash*, The Omega Chemical Co., New York City. "Is made of the following ingredients: Refined Soap, Cochin Cocoanut Oil, White of Eggs, Glycerine and Salicylic Acid." Price 25 cents for 1.83 oz. A pink paste with odor of rose water.

Loss @ 35–40° in vacuo	19.02	Ash (sodium carbonate from soap)	14.31
Glycerine	8.93	Heavy metals	none
Ether extract	16.56	Boric and salicylic acids	none
Nitrogen (0.04) = protein	0.25	Caustic alkali	none
Soap, by difference	55.24		

It is a mixture of soap, oil and glycerine with a very small amount of nitrogenous matter, possibly egg albumin. The ordinary tests failed to show any salicylic acid.

Canthrox.

3216. *Canthrox*, for Hair Shampoo, H. S. Peterson Co., Chicago. Price 45 cents for 3.7 oz. A white powder.

Soap (absolute alcohol extract)	33.42	Potassium oxide	0.38
Unsaponifiable matter	43.56	Boric acid	15.87
Ash, total	49.34	Loss at 100° C	21.48
Ash, from soap	8.66	Heavy metals, alkaloids, ether extract, salicylic acid, caustic alkali	none
Carbon dioxide	16.87		
Sodium oxide	26.99		

The above data may be summarized as follows:

Granulated soap	33.42
Sodium borate, anhydrous	12.93
Sodium bicarbonate, anhydrous	32.22
Loss at 100° C	21.48

This preparation is apparently of inconstant composition. The Kansas Board of Health found it to contain 75 per cent. of soap and 25 per cent. of potassium carbonate, while the Indiana Board of Health reports it to be granulated soap, both of which analyses are decidedly at variance with our own.

Coke Dandruff Cure.

3387. *Coke Dandruff Cure and Hair Tonic*, The Kells Co., Newburgh, N. Y., and Toronto, Can. Price 50 cents for 4.7 fl. oz. "For external use only." "Contains no grease, mineral or other

deleterious substances." A reddish-brown liquid with a greenish fluorescence, and the odor of rose water.

Specific gravity @ 15.5° C.	0.9861	Boron, capsicum, resorcin.	present
Alcohol by volume	13.36	Cantharidin	(?)
Wood alcohol	none	Salicylic acid, alkaloids, ether extract	none
Solids	1.29	Reaction	neutral
Glycerine	0.86		
Ash	0.08		

Inspections in North Dakota in 1905 and in New Hampshire in 1907 showed the presence of wood alcohol in this preparation. It is apparent from our analysis that the formula has been changed. The claims made for this material are entirely reasonable, barring the use of the word "cure." The total active solid ingredients, however, amount to not more than 0.43 per cent.

Danderine.

3202. *Danderine*, Knowlton Danderine Co., Chicago. Price 25 cents for 2.6 fl. oz. "The Great Hair Remedy and Scalp Invigorator, Alcohol 9 per cent." A yellowish-brown liquid with the odor of oil of bay.

Specific gravity @ 15.5° C	1.000	Boric acid, salicylic acid, resorcin, capsicum	present
Alcohol by volume	9.26	Cantharidin	(?)
Wood alcohol	none	Heavy metals, ether extract, alkaloids	none
Solids	5.16		
Glycerine	4.19		
Ash	0.08		

It is a dilute alcohol-glycerine solution containing small amounts of boric acid, salicylic acid, resorcin, capsicum and, possibly, cantharidin.

Germicidal Shampoo Powder.

3402. *Germicidal Shampoo Powder*, Davies, Rose and Co., Boston. Price 25 cents for 0.85 oz. A white powder with the odor of rose.

Loss @ 100° C	10.69	Carbonic acid	13.68
Alcohol insoluble	47.44	Sodium	present
Alcohol soluble	37.37	Heavy metals, alkaloids, salicylic acid, ether extract	none
Boric acid	19.84		
Ash	49.92		

The above analysis indicates the preparation to consist of soap, borax and a sodium carbonate in nearly equal parts.

Goldman's Gray Hair Color Restorer.

3407. *Mary T. Goldman's Gray Hair Color Restorer, No. 1*, Mary T. Goldman Co., St. Paul, Minn. "A Colorific Preparation". Price one dollar for 5.5 fl. oz. A water-white liquid with an ammoniacal odor.

Specific gravity @ 15.5° C.	1.0053	Nitrogen as ammonia	0.281
Alcohol	none	Nitrogen as nitric	0.058
Solids	0.84	Boric and salicylic acids	none
Ash	0.52	Reaction	strongly alkaline
Glycerine	none		
Silver (0.481) = silver nitrate	0.76		

It is a weak ammoniacal solution of silver nitrate. The silver nitrate present of course acts as a dye, the silver being reduced on contact with the organic matter of the hair. It would seem that such a powerful caustic must be injurious to the hair. The following are some of the remarkable statements made in connection with this preparation:—

"In the past years it has been impossible to restore gray or faded hair to its original color. It has been the effort of the writer for the past 20 years to compound something that would act directly, and therefore quickly, on the life-giving functions of the hair. * * * * Is a clean and harmless preparation. * * * * Give it the most severe tests you can, and you will find that the color is in the hair, through and through, and really is lasting and natural."

Hair Reviver.

3404. *Hair Reviver*, prepared for T. P. Gillespie and Co., New Haven. "Alcohol 30 per cent." Price 50 cents for 5.8 fl. oz. A reddish liquid.

Specific gravity @ 15.5° C.	0.9871	Quinine	present
Alcohol by volume	28.12	Cantharidin	(?)
Wood alcohol	none	Heavy metals, boric acid, salicylic acid	none
Solids	8.99	Reaction	neutral
Glycerine	8.29		
Ash	0.02		

A strongly alcoholic solution containing glycerine, quinine and possibly cantharidin.

Hairwand.

3691. *Concentrated Hairwand Powder*, The Lesslie Co., Dayton, O. "A concentrated compound of the highest efficiency for the treatment of the hair and as a tonic and scalp dressing. Makes one pint liquid hair tonic." Price 43 cents for 0.46 oz. A red-brown powder, colored with a coal-tar dye and with the odor of oil of bitter almonds.

Loss @ 100° C.	11.80	Salicylic acid	3.23
Chlorine	26.32	Sodium, resorcin	present
Boric acid	30.75	Capsicum	present (?)

The above data indicate that *Hairwand* consists of about 44 per cent. common salt, 47 per cent. crystallized borax, 4 per cent. sodium salicylate and 5 per cent. of water and volatile matters, with small amounts of resorcin and possibly capsicum.

The label tells us that by using *Hairwand* "the removal of dandruff, and the vitality and lustre of the hair soon follows", a most damaging statement, if true. Possibly here the manufacturer's English is more at fault than his preparation.

Liquid Arvon.

3686. *Liquid Arvon for Removing Dandruff*, The R. L. Watkins Co., Cleveland, O. "Alcohol 5 per cent." "For external use only". Price one dollar for 4.0 fl. oz. A brown solution with a green fluorescence, of undertermined odor, possibly rose geranium.

Specific gravity @ 15.5° C	1.0033	Ash = potassium carbonate	0.42
Alcohol by volume	4.84	Salicylic acid	present
Wood alcohol	none	Resorcin	probably
Solids	2.72	Heavy metals, borax	none
Glycerine	1.49		

This is an extremely dilute alcohol-glycerine solution containing salicylic acid, potassium carbonate and possibly resorcin.

Jacobs' Luxuriant Hair Tonic and Grower.

3395. *Luxuriant Hair Tonic and Grower*, J. M. Jacobs, New Haven. "Alcohol 20 per cent.; free from grease." Price 25 cents for 2.9 fl. oz. A brownish-yellow liquid with the odor of wild cherry.

Specific gravity @ 15.5° C.	1.0020	Quinine, resorcin	present
Alcohol by volume	15.60	Cantharidin	(?)
Wood alcohol	none	Heavy metals, boric acid, salicylic acid	none
Solids	8.58	Reaction	acid
Glycerine	7.33		
Ash	0.02		

A strongly alcoholic solution containing glycerine, resorcin, considerable quinine and possibly cantharidin. It contains 4.40 per cent. less alcohol than is claimed.

Nyal's Hirsutone.

3430. *Nyal's Hirsutone*, New York and London Drug Co., New York City. "Alcohol 15 per cent." Price 50 cents for 5.5 fl. oz. A pale yellow liquid with the odor of rose geranium.

Specific gravity @ 15.5° C.	0.9942	Boric acid, quinine	present
Alcohol by volume	13.96	Capsicum, cantharidin	(?)
Wood alcohol	none	Heavy metals, salicylic acid	none
Solids	3.62	Reaction	acid
Glycerine	2.17		
Ash	0.38		

An alcoholic solution containing about 2 per cent. of glycerine with small amounts of boric acid, quinine and possibly capsicum and cantharidin.

Parisian Sage Compound.

1124. *Parisian Sage Compound*, The Giroux Mfg. Co., Buffalo, N. Y. "12 per cent. alcohol." Price 36 cents per 4.0 fl. oz. A yellowish-brown liquid with the odor of lavender and probably other volatile oils.

Specific gravity @ 15.5° C	0.9915	Sage, resorcin, capsicum	present
Alcohol by volume	11.60	Cantharidin	(?)
Wood alcohol	none	Heavy metals, alkaloids, sulphur, salicylic acid, boric acid, pilocarpine, ether extract	none
Solids	2.54		
Glycerine	1.95		
Ash	0.05		

This preparation appears to be an alcoholic infusion of sage and small amounts of resorcin, capsicum, glycerine and possibly cantharidin. "Sage unites tonic, astringent and aromatic properties. By the ancients it was highly esteemed; it is at present little used, except as a condiment." *U. S. Dispensatory, 19 Ed.*, p. 1080.

Parker's Hair Balsam.

3432. *Parker's Hair Balsam*, Hiscox and Co., Patchogue, N. Y. Price 50 cents for 4.0 fl. oz. It is a water-white liquid with considerable sediment and the odor of sassafras.

Specific gravity @ 15.5° C.	1.0836	Lead (1.55) = lead acetate	2.84
Alcohol	none	Acetates	present
Solids	26.58	Boric acid, salicylic acid alkaloids	none
Glycerine	19.67	Reaction	neutral
Ash	2.12		
Sulphur	1.79		

This a glycerine-water solution of lead acetate with considerable free sulphur. It closely resembles *Allen's Hair Color Restorer* in composition and the same criticisms against its use apply (See page 281).

Penslar Hair Tonic.

3203. *Penslar Hair Tonic*, Peninsular Chemical Co., Detroit, Mich. "Alcohol 20 per cent. Contains F. E. Arbor Vitae, Tinct. Cantharides, Pilocarpin, Cinchonidine, Salicylic Acid, Resorcin." Price 50 cents for 5.8 fl. oz. A yellowish liquid with the odor of cologne.

Specific gravity @ 15.5° C.	0.9792	Quinine, pilocarpine, resorcin, salicylic acid	present
Alcohol by volume	17.30	Cantharidin	(?)
Wood alcohol	none	Heavy metals, ether extract, glycerine	none
Solids (non-volatile)	0.14	Reaction	acid
Ash	0.04		

It is an alcoholic solution containing minute quantities of quinine, pilocarpine, resorcin, salicylic acid and possibly cantharidin. The rather imposing formula given on the label loses much of its significance in view of the fact that only 0.14 per cent. of non-volatile solids is present.

Plain Yellow Minyol.

3523. *Plain Yellow Minyol Compound*, The Prescription Products Co., Dayton, O. "The Third Degree." "Valuable for the Treatment of Hair and Scalp." Price 75 cents for 4.80 oz.

Sodium oxide	40.73	Ether extract	2.83
Chlorine	46.82	Water and volatile matter	15.47

This remedy, therefore, which possesses according to its claim "antiseptic, disinfectant, alterative, demulcent, detergent, herpetic, nutritive, restorative and tonic" properties, is composed of 77.25 per cent. common salt, 2.83 per cent. fatty base and 15.47 per cent. water, with small amounts of camphor, oil of rose and possibly menthol.

"Maud writes: 'Can anything be done for an itching scalp? My scalp is covered with dandruff and I am in great distress.' Answer: You can very easily be cured of an itching scalp, also dandruff, if you will get a four oz. jar of plain yellow minyol and use according to directions given on the jar. Two or three applications have been known to cure. Try it fairly and you will advocate its use to your friends."—*The Doctor's Advice by Dr. Lewis Baker.*

Mrs. Potter's Walnut Tint Hair Stain.

3420. *Mrs. Potter's Walnut Tint Hair Stain*, Mrs. Potter's Hygienic Supply Co., Cincinnati, O. "Alcohol 12 per cent. Guaranteed free from lead, sulphur and silver." Price one dollar.

The preparation consists of two small bottles of liquid, one (1.3 fl. oz.) colorless, the other (1.2 fl. oz.) brown, with considerable black sediment. The cork of the former was bleached and the solution contained 1.16 per cent. of absolute hydrogen peroxide. The solution in the second bottle was partially decomposed and showed the following composition:—

Specific gravity @ 15.5° C	0.9879	Solids	0.90
Alcohol by volume	11.80	Ash	0.56
Wood alcohol	none	Paraphenylene diamine	present

Many authorities have called attention to the poisonous qualities of paraphenylene diamine.

"Eighteen cases of poisoning have been reported by Cathelineau. Brocq described a severe form of dermatitis due to this chemical; Balso reports a case of poisoning due to wearing hose which had been dyed

with the chlorate of paraphenylene diamine, and Mewborn reported a case of dermatitis from the use of a hair dye having this chemical for its base."— *Nostrums and Quackery, p. 353.* In addition to the above, thirty-two cases of poisoning due to the use of the Potter Stain itself have been reported to the *Journal of the American Medical Association.*

Not only is this preparation exceedingly dangerous to use but its manufacturer attemps to allay fears as to its poisonous properties by emphasing the fact that it is "free from lead, sulphur and silver". Furthermore, she claims that "this scientific preparation is the only known remedy for ruined hair—caused by the use of peroxide and other powerful chemicals", and yet one of the liquids making up the stain consists of hydrogen peroxide, which this manufacturer insists is particularly ruinous to the hair. Before the passage of the Federal Food and Drugs Act the stain was labeled "Walnut Juice," not "Walnut Tint", the name now being changed to avoid the charge of misbranding.

Stephan's Clescalp.

3220. *Stephan's Clescalp*, E. S. Stephan, New Haven. "Removes the Cause of Dandruff". Price 35 cents for 8.8 fl. oz. A greenish liquid with the odor of geraniol. (?)

Specific gravity @ 15.5° C.	1.0040	Arsenic	0.246
*Wood alcohol by volume	1.19	Alkaloids, formaldehyde, salicylic acid, ether extract	none
Solids	0.67		
Ash	0.56		
Boron, sodium, potash	present	Reaction	slightly acid

* See below.

It is a very dilute aqueous solution of potassium arsenate containing a small amount of wood alcohol and borax. Here we have exhibited a preparation containing two dangerous poisons without the slightest word of warning to the intending purchaser. The manufacturer insisting that wood alcohol did not enter into his formula and that its presence was due to an error in compounding, a second sample was bought in the open market from another dealer, and in this no wood alcohol was found.

Ther-Ox.

3393. *Ther-Ox*, The American Ther-Ox Co., Detroit, Mich. Price 75 cents for 3.53 oz. (weight claimed 4 oz.) A dry white powder.

Boric acid	78.86	Sodium	present
Ash insoluble in acid	7.00		

The material consists essentially of 93 per cent. of borax ($Na_2B_4O_7 \cdot 5\ H_2O$) and 7 per cent. of talc or a similar substance. A small quantity of borax worth a few cents, by being given the name "Ther-Ox" acquires a value of 75 cents. The manufacturer, apparently not content with the price charged, gives 0.47 oz., or 12 per cent., less weight than claimed.

Westphal's Auxiliator.

3227. *Westphal's Auxiliator*, Paul Westphal, New York City, "55 per cent. grain alcohol." Price 50 cents for 5.3 fl. oz. A yellowish liquid with the odor of rose water.

Specific gravity @ 15.5° C.	0.9469	Boron	present
Alcohol by volume	47.24	Cantharidin	(?)
Wood alcohol	none	Alkaloids, salicylic acid, heavy metals	none
Solids	3.90		
Glycerine	3.27	Reaction	neutral
Ash	0.20		

This is a strongly alcoholic solution containing a small amount of solids, mostly glycerine, a boron compound and possibly cantharidin. The formula has evidently been changed in part as in 1907 the New Hampshire Board of Health found nearly 11 per cent. of wood alcohol present. It contains nearly 8 per cent. less than the claimed amount of alcohol.

Wyeth's Sage and Sulphur Hair Remedy.

1125. *Wyeth's Sage and Sulphur Hair Remedy*, The Wyeth Chemical Co., New York City. "Alcohol 5 per cent. An Ideal Hair Remedy and Dressing. Imparts color to faded and gray hair, etc., etc." Price 50 cents for 5.5 fl. oz. A greenish-yellow liquid with considerable sediment and the odor of rose water.

Specific gravity @ 15.5° C	1.0109	Lead (0.43) = lead acetate	0.79
Alcohol by volume	3.52	Sulphur	1.72
Wood alcohol	none	Sage, acetates	present
Solids	3.39	Alkaloids, salicylic acid, boric acid, ether extract	none
Glycerine	0.83		
Ash	0.70	Reaction	neutral

The manufacturer emphasizes on the label the presence of sage, sulphur, glycerine, cantharides, capsicum and alcohol, but is silent as to lead acetate, its most active ingredient. The presence of lead acetate makes the remedy a dangerous one to use, and shows the falsity of the claim that it is "good for the hair and scalp", and that "everything entering into the composition of this great hair Remedy combines to make it an ideal preparation for preserving and restoring the color of the hair, for removing dandruff, for stopping hair falling, and for making the hair grow". The glycerine, lead acetate and sulphur together amount to 3.34 per cent., so that not more than 0.05 per cent. of the other valuable "remedies", sage, cantharides and capsicum, can be present. It is a weak glycerine-water-alcohol solution of lead acetate with considerable free sulphur and a minute amount of sage infusion with possible traces of cantharidin and capsicum.

Mme. Yale's Excelsior Hair Tonic.

3455. *Mme. Yale's Excelsior Hair Tonic*, Mme. M. Yale, New York City. "Alcohol 20 per cent." Price one dollar for 12.5 fl. oz. A pale yellow liquid with slight sediment and the odor of oil of bergamot.

Specific gravity @ 15.5° C.	0.9833	Ash	.02
Alcohol by volume	18.08	Quinine	present
Wood alcohol	none	Heavy metals, boric acid, salicylic acid	none
Solids	1.68	Reaction	neutral
Glycerine	1.25		

This is an alcoholic solution containing glycerine and quinine, and possibly other ingredients in minute quantities. 100cc. of the preparation gave no reaction for resorcin, cantharidin, phenols or capsicum. Since prosecution under the federal law this preparation no longer claims to "stop hair falling, cures and prevents dandruff and all scalp diseases and overcomes any heredity tendency to baldness and grayness."

REMEDIES FOR KIDNEY AND LIVER DISEASES.

Carter's Little Liver Pills.

3391. *Carter's Little Liver Pills*, Carter Medicine Co., New York. "Purely vegetable." Price 15 cents for 42 pills, weighing 1.84 gms., or 28.4 grs. White pills (interior black) with the taste and odor of aloes.

Loss @ 100° C.	4.45	Starch	14.08
Ash	5.15	Alcohol extract	60.49
Petroleum ether extract	1.05	Aloes	present
Reducing sugars, as dextrose	21.92	Soap, capsicum, alkaloids	none

These are essentially aloes pills, that drug largely predominating, although podophyllin and licorice may be present. In the advertising matter we are especially warned against "those medicines which depend on their strongly cathartic properties for their success—with their violent purgative action." The chief constituent of the Carter pills, aloes, is an active cathartic, and podophyllin, which they are reported to contain, is a drastic purgative.

Hood's Vegetable Pills.

3386. *Hood's Vegetable Pills*, C. I. Hood Co., Lowell, Mass. "The Great Liver Invigorator." "Purely vegetable. Price 25 cents for 52 pills, weighing 5.11 gms., or 78.9 grs. Light-brown pills (interior black) with the taste and odor of aloes and capsicum.

Loss @ 100° C.	3.60	Alcohol extract	64.48
Ash	2.90	Aloes, capsicum	present
Petroleum ether extract	3.85	Soap, ginger, phenols, alkaloids	none
Reducing sugars, as dextrose	13.24		
Starch	11.59		

These are essentially aloes and capsicum pills. Colocynth, ginger and jalap have been reported in English analyses (and the manufacturer claims gamboge, podophyllin, gentian and ipecac as well), but we were unable by available methods to identify these drugs in the present sample.

Doan's Kidney Pills.

3201. *Doan's Kidney Pills*, Foster-Milburn Co., Buffalo, N. Y. "Contain no morphine, cocaine, nor other habit-producing drugs." Price 50 cents for 40 pills, weighing 13.3 grams. Gray pills with a brownish-yellow interior, with a resinous odor and a sweet, pitchy taste.

Water and volatile matter.	7.52	Ash	6.70
Starch	22.25	Potash	3.58
Reducing sugars, as dextrose	28.48	Nitric nitrogen	1.11
Petroleum ether extract	15.50	= Potassium nitrate	7.98
Other organic matters	19.55	Alkaloids	none

The active ingredients of the pills appear to be potassium nitrate (saltpeter), pitch and possibly a trace of oil of juniper, and other unidentified organic drugs (powdered fenugreek according to a British analysis).

Self-medication for kidney diseases is particularly dangerous, especially when the remedy comes laden with false statements and misrepresentations. As an illustration of the advertising methods and the reliability of the testimonials of *Doan's Kidney Pills*, we may cite the fact that

"The *Blackwell* (Okla.) *News* of August 24, 1911, contained an advertisement in which a Mrs. Charles Butcher of that city testified as to the virtues of *Doan's Kidney Pills*. As a matter of fact, Mrs. Charles Butcher had been dead nearly two months before the advertisement appeared; and she died of kidney disease."— *Nostrums and Quackery, 1912, p. 687.*

Dr. Kilmer's Swamp Root.

1605. *Dr. Kilmer's Swamp Root*, Dr. Kilmer and Co., Binghamton, N. Y. "Kidney, Liver and Bladder Remedy." "9 per cent. alcohol." Price one dollar for 10.5 fl. oz.

Specific gravity @ 15.5° C.	1.1771	Reducing sugars, as dextrose	5.08
Alcohol by volume	8.68	Non-sugar solids	2.49
Wood alcohol	none	Ash	0.06
Solids	42.39	Alkaloids	none
Sucrose	34.72	Oxymethylanthraquinone	present

The preparation is an alcoholic sugar solution with a small amount of vegetable extractives of drugs yielding emodin or chrysophanic acid. In the pamphlet accompanying the sample we read:

"It is not recommended to cure all diseases to which flesh is heir" and yet on the opposite page we find it recommended for forty-seven different ailments. We also read:

"Have you ever tried the simple test of setting aside your urine in a bottle or common glass for twenty-four hours? A sediment or settling in the urine is usually an indication of either kidney or bladder trouble, or perhaps both."

Such a result is generally not an indication of kidney or bladder trouble, and is frequently found in normal urine.

Throughout all the company's literature we find a most skillful evasion of legal responsibility for misleading statements. For instance:

"We do not wish to have anyone take Swamp Root who does not need it, but if people take it who need it, the remedy will do the rest and thus fulfill its great mission—thus affording relief and *restoring health to the afflicted*" (*italics ours*).

If these words do not imply that the remedy is a "cure," what do they mean? Furthermore, it is hard to conceive of a physician prescribing a remedy containing nearly 9 per cent. of alcohol for a patient suffering from Bright's disease, or one containing 40 per cent. of sugar for a diabetic.

SKIN AND COMPLEXION REMEDIES.

Cadum.

3218. *Cadum*, Omega Chemical Co., New York. "The New Remedy for Eczema and other Skin Troubles." "Soothing, Healing, Antiseptic." "Is made of oil of cade, zinc oxide, washed sulphur, salicylic acid, eucalyptol, soft white petrolatum, white ceresin." Price 25 cents for 1.1 oz.

Loss @ 100° C. (water and volatile)	0.65	Zinc oxide	13.05
Ether extract (—sulphur)	76.72	Free sulphur	6.45
Ether extract unsaponified	61.55	Salicylic acid	0.91
Ether extract saponified	15.17	Oil of cade	present
Alcohol extract (hot 95%)	35.64	Eucalyptol	present
Chloroform insoluble	13.11	Boric acid, starch, alkaloids	none

This preparation, therefore, consists of about 15 per cent. saponified oils and fats, 61.5 per cent. unsaponified fats (probably base), 13 per cent. zinc oxide, 6.5 per cent sulphur, 1 per cent. salicylic acid, 0.5 per cent. water and volatile matter, and 2.5 per cent. undetermined, thereby in general confirming the manufacturer's formula.

Champlin's Liquid Pearl.

3406. *Champlin's Liquid Pearl*, Champlin Mfg. Co., New York City. "Alcohol 1 per cent." "Contains nothing injurious

to the most delicate skin." Price 50 cents for 3.6 fl. oz. A clear liquid with the odor of lemon oil, and with much sediment.

Specific gravity @ 22° C.	1.0899	Bismuth oxide	2.52
Alcohol by volume	1.88	Calcium oxide	5.39
Wood alcohol	none	Carbonates	present
Solids	14.44	Other heavy metals	none
Glycerine	present		

The material is a weakly alcoholic solution containing 2.85 per cent. bismuth subcarbonate ($Bi_2O_2.CO_2.H_2O$) and 9.62 per cent. calcium carbonate, with glycerine.

Citrox.

3458. *Citrox*, for the Treatment of Eczema, Tetter, Ringworm and other Scaly Skin Diseases, United Citrox Co., Detroit, Mich. Price 75 cents for 3.88 oz.

It was found to be entirely sodium hyposulphite colored blue, possibly with indigo.

"The Citrox Treatment is offered with great confidence because of the success with which it has already been used in various cases of long standing. It is simple and economical and merits a thorough trial. Do not expect it to cure a bad case in a few days; although it has been remarkably effective, no claim is made that it will work miracles."

Sodium thiosulphate (photographers' "hypo"), undoubtedly useful for parasitic affections of the skin, can be bought for 10 or 15 cents per pound.

D. D. D. Prescription.

3394. *D. D. D. Prescription for the Skin and Scalp*, Ordinary Strength, D. D. D. Co., Chicago and Toronto. "Alcohol 38 per cent., chloral hydrate 7 grs. per oz." "For external use only." Price 49 cents per 2.2 fl. oz. A yellow solution with the odor of wintergreen and phenol.

Specific gravity @ 22° C.	0.9822
Alcohol by volume	32.10
Wood alcohol	none
Solids	8.60
Ash	0.02
Glycerine	present
Chloral hydrate	7.8 grs. per fl. oz.
Phenol, thymol, methyl salicylate salicylic acid	present

The analysis shows the material to be a strongly alcoholic solution containing 7.8 grs of chloral hydrate per fl. oz., with small amounts of phenol, thymol, salicylic acid and oil of wintergreen. The ingredients of this preparation doubtless have antiseptic value. The claims made for it, however, are as follows:

"Diseases cured by D. D. D. Eczema in all forms, acne and pimples, dermatitis, ring worms, herpes, hives, bites of insects, poisonous rashes, itching piles, psoriasis, dandruff and affections of the scalp, barber's itch and sycosis, salt rheum and tetter, scabies, lichen, red nose, roughness, and itch of all kinds."

"The thousands of patients who have testified to remarkable cures indicate that ultimately, even the most obstinate cases of eczema, psoriasis, barber's itch, or similar skin diseases, must yield to this remedy." "There is no doubt that D. D. D. Prescription cures skin diseases, thousands and thousands of people can and do testify to that." "The second or third bottle has cured thousands." "Is a specific for just one kind of a disease."

In view of the above statements it is strange that in the list of sixty-five drugs given by the U. S. Dispensatory as useful in the treatment of eczema, chloral hydrate, phenol and oil of wintergreen are not mentioned.

Derma-Royale.

3456. *Derma-Royale*, The Derma-Royale Co., Cincinnati, O. "Alcohol 2 per cent". Price 85 cents for 7.7 fl. oz.

Specific gravity @ 22° C.	0.9944	Ash	0.15
Alcohol by volume	2.48	Heavy metals, borates, salicylates, phenols	none
Wood alcohol	none	Camphor	present
Solids	3.55	Myrrh, benzoin	probably present
Glycerine	2.93		
Non-volatile suspended solids	0.25		

This preparation is a dilute alcohol-glycerine solution with small amounts of camphor, myrrh, benzoin, and possibly other aromatics in suspension.

Notwithstanding the extreme simplicity of this preparation, it is surprising to note the curative powers claimed for it.

"Nothing will cure, Clear and Whiten the skin so quickly as *Derma-Royle*." "The new discovery for curing cutaneous affections, removing discolorations from the cuticle, and bleaching, brightening and beautifying the complexion. It is as pure and mild as dew, and so harmless one may

drink a whole bottleful without any bad effects. * * * * Those, however, who are troubled with eczema, tetter, acne, blotches, eruptions, or other cutaneous affections, should apply *Derma-Royle* several times a day. They need suffer no longer from any defect of the skin." "There Never was Anything Like It." "It has never failed—IT CANNOT FAIL."

El-Gantis Beautifier.

3228. *El-Gantis Beautifier*, Seaside Laboratory, Bridgeport, Conn. "A liquid face powder, absolutely greaseless." Price 50 cents for 5.5 fl. oz. A colorless solution containing much heavy white sediment.

Specific gravity @ 22° C.	1.1142
Alcohol	none
Solids	17.98 gms. per 100 cc.
Bismuth oxide	2.25 gms. per 100 cc.
Zinc oxide	10.13 gms. per 100 cc.
Residue on ignition	11.98 gms. per 100 ac.
Nitrates, glycerine	none
Carbonates, lime	present
Odor, orris root	

The above analysis indicates a composition of 2.55 per cent. bismuth sub-carbonate and 10.13 per cent. zinc oxide, with about five per cent. of precipitated chalk.

Epp-o-tone.

3449. *Epp-o-tone*, for the Complexion. The La Cottel Mfg. Co., Detroit, Mich. Price 50 cents for 3.28 oz.

Magnesium oxide	18.10	Color, cochineal	
Sulphuric anhydride	35.40		

The preparation is partially dehydrated Epsom salts, $MgSO_4 \cdot 6H_2O$, colored with cochineal. It is a "prescription" very similar to *Spurmax* (see page 306).

"The formula for Epp-o-tone is the discovery of an eminent Parisian specialist. The secret of this preparation has been heretofore guarded jealously, but it was obtained by an American woman, who was the guest of a friend in Paris, from whom the ingredients were obtained."

The above analysis is almost a cruel revelation of another of the "mysteries of Paris."

Eptol.

3688. *Eptol*, for making Greaseless Vanishing Massage Cream, Cooper Pharmacal Co., Chicago. Price 50 cents for 1.5 oz. A white powder perfumed with rose.

Loss @ 100° C.	10.75	Heavy metals	none
Boric acid	24.06	Stearic acid and soap	present
Alcohol soluble (hot 95%)	97.80		

From the above the preparation appears to consist essentially of about 37 per cent. crystalline borax and 63 per cent. stearic acid and soap, perfumed with rose.

Hill's Freckle Lotion.

3479. *Hill's Freckle Lotion*, J. V. Hill, Providence, R. I. "Poison" label on back of the bottle. "This lotion has been in constant use for fifty years, and is absolutely harmless when used externally according to directions." Price 75 cents for 5.7 fl. oz. A clear, colorless solution.

Specific gravity @ 22° C.	1.0154	Mercuric chloride	1.84
Alcohol	none	Salicylates and phenols	none
Glycerine	none		

It is an aqueous solution of 1.84 per cent. of mercuric chloride (corrosive sublimate).

"Removes moth, tan, freckles, pimples, ringworms and all eruptions of the skin."

It contains 18.4 parts of corrosive sublimate per 1,000, and is an extremely dangerous preparation. For the danger from using corrosive sublimate see remarks under *Kingsbery's Freckle Lotion*, page 300. If one part in 2,000 is dangerous, it is surely criminal to offer for indiscriminate use a solution thirty-six times that strength.

Hinds Honey and Almond Cream.

3212. *Hinds Honey and Almond Cream.* A. S. Hinds, Portland, Me. "Alcohol 7 per cent." "For the face, hands, skin and complexion." Price 45 cents for 4.5 fl. oz. A white emulsion with the odor of oil of bitter almonds.

Specific gravity @ 22° C..	0.9862	Ether extract.....	5.98
Alcohol by volume.....	7.28	Glycerine.....	5.79
Wood alcohol.....	none	Boric acid.....	0.97
Solids.....	13.26	Sodium.....	present
Ash.....	0.86	Sugar, heavy metals.....	none

It is essentially an emulsion containing 7.28 per cent. alcohol, 5.79 glycerine, 5.98 partly saponified beeswax and 1.49 per cent. crystallized borax, scented with oil of bitter almond. No honey was present.

Holmes' Fragrant Frostilla.

3208. *Holmes' Fragrant Frostilla*, for the Toilet, Clay W. Holmes, Elmira, N. Y. "Alcohol 17 per cent." "Contains nothing greasy or sticky." "Contains no chemical salts whatever." Price 25 cents for 1.9 fl. oz. A whitish turbid liquid with the odor of rose.

Specific gravity @ 22° C..	1.0034	Ash.....	0.08
Alcohol by volume.....	16.64	Gum tragacanth.....	0.87
Wood alcohol.....	none	Glycerine.....	present
Solids.....	15.02	Heavy metals.....	none

This material is essentially a mixture of alcohol, glycerine and gum tragacanth.

Kingsbery's Freckle Lotion.

3476. *E. W. Kingsbery's Freckle Lotion*, 1st Strength, E. W. Kingsbery, Randolph, Mass. Price 25 cents for 4.1 fl. oz. A clear, colorless solution.

Specific gravity @ 22° C..	1.0045	Mercuric chloride.....	0.532
Alcohol.....	none	Salicylates and phenols.....	none

It is an aqueous solution of 0.53 per cent. of mercuric chloride (corrosive sublimate).

"Will positively remove freckles, tan, moth patches, etc. from the face, hands and arms without the slightest injury to the most sensitive skin." "Unequalled for use in ivy and dogwood poison, insect bites and stings, salt rheum, eczema and all skin irritations, stopping the itching immediately and counteracting the poison."

This preparation contains 5.3 parts of corrosive sublimate per 1,000, and is an exceedingly dangerous remedy to use. The U. S. Dispensatory speaks as follows regarding the use of corrosive sublimate as an antiseptic:

"The solution of one in one thousand may be used for washing the hands, disinfecting furniture, etc., and is even employed in the disinfecting of wounds; usually, however, a much weaker solution than that just mention is employed by the surgeon. It is rarely if ever justifiable to use upon a mucous surface or a wound a solution stronger than one in two thousand, and if the solution is to be used freely and continuously, as in washing out the vagina, etc., one in ten thousand is as strong as should be employed indeed, the employment of a vaginal wash of this strength has been followed by violent poisoning * * * * In a number of cases a solution of one part in fifteen hundred used locally by the surgeon has produced death."

Although this preparation is recommended only for external use, it is caustic in its action and might cause an open sore in its destruction of the freckled cuticle. Furthermore, the average face is seldom free from some abrasion of the skin, especially when suffering from ivy poisoning or insect bites, for which this remedy is especially recommended. The authority above quoted tells us that "its (corrosive sublimate) use requires care, as fatal poisoning has followed a single application of the alcoholic solution of corrosive sublimate to a moderate surface of ringworm."

The preparation bears no poison label nor is there any warning as to its dangerous character except the wholly inadequate clause "for external use only."

Kintho Beauty Cream.

3531. *Kintho Beauty Cream*, Kintho Mfg. Co., Buffalo, N. Y. Price 40 cents (wholesale) for 1.27 oz. A white ointment with the odor of rose.

Loss @ 100° C. (water and volatile).....	20.83	Bismuth oxide.....	5.56
Alcohol extract (hot 95%).	36.94	= Bismuth subnitrate.....	7.05
Chloroform soluble.....	58.85	Borax, ammonia, nitrates, chlorides.....	present
Chloroform insoluble.....	20.32		
Mercury.....	8.95	Phenols, salicylates, starch....	none
= Ammoniated mercury.	11.28		

The preparation contains in part 20.8 per cent. water and volatile matter, 7.1 per cent. bismuth subnitrate, 11.3 per cent. ammoniated mercury (white precipitate), and 1.9 per cent. borax

and undetermined. Any preparation containing such a dangerous poison as ammoniated mercury should be used with extreme care. Formerly this was labeled "harmless," but since prosecution by the U. S. government for misbranding, the caution "Do not allow the cream to get into the eyes or open cuts or sores" appears on the label.

Kroy Wen Ointment.

3211. *Kroy Wen Ointment*, Manhattan Drug Co., New York. "A Harmless Healing Nutritive Emollient for Wounds, etc., and all Skin Diseases." "Contains the healing and antiseptic properties of carbolic acid, witch hazel, arnica, menthol, thymol, zinc oxide, oil of hemlock, oil of cajaput, oil of cade, sulphur and boracic acid, combined with a readily absorbent, non-irritating and healing base." Price 25 cents for 1.92 oz.

Loss @ 100° C. (water and volatile)	19.96	Insoluble in chloroform	8.84
Ether extract (—sulphur)	66.70	Zinc oxide	5.61
Ether extract unsaponified	47.62	Free sulphur	1.16
Ether extract saponified	19.08	Phenols	0.33
Alcohol extract (hot 95%)	38.43	Menthol, boric acid	present
		Alkaloids, starch	none

The above analysis may be summarized as follows: water and volatile matter (phenol, menthol, etc.) 20 per cent., saponified oils and fats 19 per cent., unsaponified fats (probably base) 47.5 per cent., zinc oxide 5.6 per cent., sulphur 1.2 per cent., boric acid and undetermined 6.7 per cent.

Luxor.

3217. *Luxor*, for making Eczema Remedy, H. S. Peterson and Co., Chicago. Price 39 cents for 3.2 oz.

Zinc oxide	28.40	Water, by difference	11.84
Boric acid	59.76		

This is a mixture of about two parts of boric acid and one part of zinc oxide.

May-A-Tone.

3521. *May-A-Tone*, The May-A-Tone Co., Chicago. Price 75 cents for 1.92 oz.

Magnesium oxide	14.42	Sodium	present
Sulphuric anhydride	28.26	Color, cochineal or cudbear	
Boric acid	13.18		

The above analysis indicates a mixture of about 87 per cent. Epsom salts, $Mg\ SO_4 . 7\ H_2O$, and 13 per cent. anhydrous borax, $Na_2\ B_4\ O_7$, colored with cochineal or cudbear.

In its advertising May-A-Tone claims responsibility for the "soft and velvety" skin of the Japanese women, and that its formula was given to the world through Madame D'Mille "one of Paris' most famous beauties just passing through Chicago."

Mrs. McCorrison's Famous Diamond Lotion.

3528. *Mrs. McCorrison's Famous Diamond Lotion*, No. 1, E. K. Guenther, Waldoboro, Me. Price 75 cents for 3.4 fl. oz. A clear, colorless solution.

Specific gravity @ 22° C.	1.0240	Alcohol, glycerine, salicylates, phenols	none
Mercuric chloride	2.82		

An aqueous solution of 2.82 per cent. of mercuric chloride (corrosive sublimate).

"Will remove moth, tan, freckles, pimples, blackheads, salt rheum, eczema, and all the various affections of like character." "It is unlike any other preparation for the skin and complexion."

Unfortunately, it is not "unlike any other preparation" for *Kingsbery's Freckle Lotion*, *Hill's Freckle Lotion*, *Perry's Moth and Freckle Lotion* and *Madame Ruppert's Face Bleach*, elsewhere referred to, are very similar preparations. The *McCorrison* compound, however, has the distinction of being even more dangerous than the others, as it contains 28.2 parts of corrosive sublimate per 1,000. (See remarks under *Kingsbery's Freckle Lotion*, page 300.)

Mercolized Wax.

3425. *Pure Mercolized Wax*, Dearborn Supply Co., Chicago, Ill. Price 85 cents for 1.0 oz. A white ointment with the odor of rose.

Loss @ 100° C. (water and volatile)	19.08	Mercury	4.46
Alcohol extract (hot 95%)	61.54	= Ammoniated mercury	5.61
Chloroform soluble	64.85	Ammonia, boric acid	present
Chloroform insoluble	16.07	Phenols, salicylates, alkaloids, starch	none
Zinc oxide	9.65		

The above analysis may be summarized as follows: water and volatile matter 19.08, chloroform soluble (petrolatum or paraffin base) 64.85, zinc oxide 9.65, ammoniated mercury 5.61, and boric acid (by difference) 0.81 per cent.

This is another of the familiar "prescriptions" of the Health and Beauty Columns, in which familiar ingredients are combined under a fancy name. Any preparation containing such a dangerous poison as ammoniated mercury should be used with the greatest caution.

Othine.

3685. *Othine—Double Strength*, for the Removal of Freckles, Othine Laboratories, Buffalo, N. Y. "Do not let the Cream get near the eyes or open cuts." Price one dollar for 1.4 oz.

Loss @ 100° C.	15.45	Ammoniated mercury	11.52
Ether extract	54.92	Bismuth subnitrate	7.65
Ether extract saponified	47.28	Phenols, salicylates, alkaloids	none
Ether extract unsaponified	7.64		

This preparation contains 15.5 per cent. water and volatile matter, 7.7 per cent. bismuth subnitrate, 11.5 per cent. ammoniated mercury (white precipitate) with a fatty base. It resembles *Kintho Beauty Cream* very closely in composition, and its use is equally dangerous (see page 301). The manufacturer recognizes this danger by the warning noted above.

Perry's Moth and Freckle Lotion.

3532. *Perry's Moth and Freckle Lotion Compound*, Brent Good & Co., New York City. Price $2.00 per 5.1 fl. oz. A colorless solution containing considerable white sediment.

Specific gravity @ 22° C.	1.0147	Lead	0.132
Alcohol, glycerine	none	Phenols, salicylates	none
Mercuric chloride	1.646		

The preparation is an aqueous solution of 1.65 per cent. of mercuric chloride (corrosive sublimate) with a lead salt equivalent to 0.13 per cent. of lead.

"A specific remedy for those brown spots or discolorations on the face and neck, called chloasma or moth patch and lentigo or freckles."

While we are advised by the bottle label that the lotion "is intended for external application only. It must not be taken internally under any circumstances," and while the bottle bears a "poison" label, we are told in the circular accompanying the bottle that the "lotion is for the safe and speedy eradication of moth patches, freckles and tan." These are certainly contradictory statements. No preparation containing 16.5 parts of corrosive sublimate per 1,000 can be considered a "safe" remedy even for external use. Furthermore, we are told that the lotion is "the only sure cure for them (moth and freckles) known to dermatology," obviously a false statement.

Madame Ruppert's World Renowned Face Bleach.

3529. *Madame Ruppert's World Renowned Face Bleach*, Madame A. Ruppert Co., New York City. "Alcohol 6 per cent." Wholesale price $1.34 for 7.7 fl. oz. A solution with considerable sediment, and with the odor of benzoin.

Specific gravity @ 22° C.	0.9939	Mercuric chloride	0.413
Alcohol by volume	4.60	Benzoin	present
Wood alcohol	none	Salicylates, phenols	none

This is an alcoholic solution of 0.41 per cent. of mercuric chloride (corrosive sublimate), with a small amount of benzoin.

This solution, containing four parts of corrosive sublimate per 1,000, is falsely labeled "harmless." "Positively removes all skin blemishes, harmless and sure." The same objections apply to its use as already noted in our discussion of similar preparations. (See *Kingsbery's Freckle Lotion*, page 300.)

Sartoin.

3530. *Sartoin*, Globe Pharmaceutical Co., Chicago. Price 50 cents for 3.2 oz. (claimed weight four oz.)

Magnesium oxide	17.95	Boric acid	0.99
Sulphuric anhydride	34.29	Color, cochineal or cudbear	

It consists, therefore, of about 99 per cent. of partially dehydrated Epsom salts, $MgSO_4 . 6H_2O$, and 1 per cent. of boric acid, colored with cochineal or cudbear.

This preparation for the skin and complexion was sold as "Sar-

toin Skin Food" with most extravagant claims, until the interference of the U. S. Government caused a change of name and a modification of its claims. The sample analyzed was 0.8 oz., or 20 per cent., short weight.

Saxolite.

3450. *Pure Powdered Saxolite,* Dearborn Supply Co., Chicago. Price 40 cents for 1.0 oz.

Magnesium oxide	6.30	Aluminum oxide	6.80
Sulphuric anhydride	33.64	Potassium oxide	6.27

The preparation is approximately a mixture of 63.14 per cent. of potash-alum, $Al_2(SO_4)_3 . K_2SO_4 . 24H_2O$, and 36.86 per cent. of Epsom salts, $MgSO_4 . 7H_2O$. This is another beauty prescription for the removal of wrinkles, etc.

"My wrinkles I got rid of by an equally simple method. By dissolving an ounce of powdered saxolite in a half-pint of witch hazel and bathing my face in the solution, every line completely disappeared. First the finer lines, finally the deep crow's feet, vanished entirely."—*Mona Morrow* in *Town Tattler.*

Saxon Salve.

3478. *Saxon Salve,* for Skin Affections, Chester Kent & Co., Boston. Price 50 cents for 2.25 oz.

Loss @ 100° C	8.00	Zinc oxide	12.16
Ether extract	*83.47	Sulphur, free	10.38
Ether extract, saponified	54.58	Phenol, resorcin, oil of wintergreen	present
Ether extract, unsaponified*	28.89		
Chloroform, insoluble	15.39	Salicylic acid, starch	none

This preparation contains 8.00 per cent. water and volatile matter (phenol, oil of wintergreen), 12.16 per cent. zinc oxide, 10.38 per cent. free sulphur, resorcin and a fatty base. The claims made for it are more guarded than usual. The claim that "there is from two to four times as much in the package as in other eczema remedies sold at the same price," however, is not true.

Spurmax.

3209. *Spurmax,* for making Face Lotion, H. S. Peterson & Co., Chicago. Price 50 cents for 3.63 oz.

* Not corrected for free sulphur.

Magnesium oxide	16.63	Color, erythrosin	
Sulphuric anhydride	32.48	Odor, rose geranium	

The preparation is ordinary Epsom salts, $MgSO_4 . 7H_2O$, colored with erythrosin and scented with oil of rose geranium. This is one of the "Beauty Column" prescriptions, in which the user pays 50 cents for Epsom salts worth about one cent.

"Miss. H. O.—Your skin trouble sounds as if it were caused by your use of ordinary face powders. They give an artificial look—especially if one is inclined to be sallow or pimpled. The very thing for you is spurmax—the best liquid lotion I know about. It is economical because you mix it yourself at home. Get four oz. spurmax (at any drug store) and mix it with one-half pint hot water, add two teaspoonfuls glycerine, apply it to face, neck and arms. The effect will surprise you with its beauty and naturalness. It will cling as if a part of your skin, and last during an entire evening. It will not only disguise cold sores, blemishes, etc., but in time it will relieve them entirely."—*The Home Beauty Parlor,* by *Betty Dean.*

Zintone.

3689. *Zintone,* for Softening and Whitening the Skin, Cooper Pharmacal Co., Chicago. Price 50 cents for 0.9 oz. A grayish white powder perfumed with vanillin.

Loss @ 100° C	5.65	Alcohol soluble (hot 95%)	96.30
Boric acid	14.88	Heavy metals	none

The material consists of about 23 per cent. crystallized borax and 77 per cent. stearic acid and soap. The name *Zintone* suggests the presence of zinc, which we find to be absent.

SOOTHING SYRUPS.

Kopp's Baby's Friend.

3527. *Kopp's Baby's Friend,* The Kopp's Baby's Friend Co., York, Pa. "Alcohol 8.5 per cent., 1/8 gr. morphine sulphate per fl. oz., besides other medicinal ingredients." Price 25 cents per 1.3 fl. oz.

Specific gravity @ 15.5° C	1.1444
Alcohol by volume	8.70
Morphine or morphine derivative	0.068 gr. per fl. oz.
Bromides	none

A partial analysis of this remedy shows 8.70 per cent. alcohol and about one-sixteenth of a grain per fl. oz. of morphine or a

morphine derivative. An analysis made by the American Medical Association in 1905 showed about one-third of a grain of morphine sulphate per fl. oz. *Nostrums and Quackery, p.* 431, reports the death of eight children from using this remedy. The same authority refers to experiments of Dr. Siegelstein of Cleveland, who gave 30 drops of the preparation to a three-days-old puppy and the same amount to a two-weeks-old kitten, both animals being "put to sleep forever." In spite of these facts this medicine is claimed to be "The King of Baby Soothers," and the prescribed dose for a child two months old is from 20–25 drops, only a little less than the dosage of Dr. Siegelstein which killed a puppy and a kitten.

Nyal's Soothing Syrup.

3392. *Nyal's Soothing Syrup*, New York and London Drug Co., New York City. "Each fluid ounce represents: sodium bromide 16 grs., fennel seed syrup and lupulin syrup, q. s." "Contains no opiates." Price 25 cents per 2.0 fl. oz.

The material contained 11.2 grs. sodium bromide per fl. oz.; lupulin was present; no opiates.

This soothing syrup is free from the objection of opiates being present. While sodium bromide has a less depressant action than the potassium salt, bromides are not a desirable ingredient in children's medicines, especially in unskilled hands.

Mrs. Winslow's Soothing Syrup.

3213. *Mrs. Winslow's Soothing Syrup*, Anglo-American Drug Co., New York City. "Contains neither opium or morphine or their derivatives. Purely vegetable, not narcotic." "Contains five per cent. alcohol, oil of aniseed, carraway, coriander, jalap 1-1500th, senna, sugar syrup." Price 25 cents per 1.7 fl. oz.

Specific gravity @ 15.5° C.	1.2440	Essential oils	present
Alcohol by volume	5.42	Morphine	none
Senna	present	Bromides	none

This soothing syrup used to contain 1-10th gr. morphine sulphate per fl. oz.; a later English analysis reported two per cent. potassium bromide and no opiates; our analysis is entirely different from either of these, and yet in spite of these changes in the formula we are told by the manufacturer—

"For over seventy years we have put up and sold throughout the world this well-known household remedy—the prescription of one of the most experienced and skillful nurses in New England."

STOMACH AND BOWEL REMEDIES.

Beecham's Pills.

3221. *Beecham's Pills*, Thomas Beecham, St. Helens, Eng. and New York. Price 10 cents for 12 pills, weighing 1.41 gms., or 21.8 grs. White pills (interior black) with the taste and odor of aloes.

Loss @ 100° C.	4.25	Reducing sugars, as dextrose	2.04
Ash	36.40	Starch	12.38
Ash insoluble in HCl	29.69	Aloes	present
Alcohol extract	41.90	Ginger	?
Petroleum ether extract	4.45		

The British Medical Association analyzed these pills and found the approximate composition per pill to be aloes 0.5 gr., powdered ginger 0.55 gr. and powdered soap 0.18 gr. We find 36.4 per cent. ash, of which 29.6 is a talc-like mineral, and 59.35 per cent. organic matter, of which 2.04 is sugar, 12.38 starch, and the remainder aloes, soap and possibly ginger.

"Beecham's Pills will cure bilious and nervous disorders, indigestion, want of appetite, fullness after meals, vomiting, sickness at the stomach, torpid liver, sick headache, cold chills, flushings of heat, lowness of spirits, etc." The pills are also recommended for headache, insomnia, scurvy and scorbutic affections, skin diseases, ulcers, kidney and urinary disorders, rheumatism, constipation and "for females of all ages Beecham's Pills are specially suitable."

The medical ingredients of this remedy, which has been on the market for many years and which is claimed to be efficacious for such a wide range of diseases, appear to be simply aloes, ginger and soap. We are told that the pills "are made entirely from medicinal herbs," in spite of the fact that they contain nearly 30 per cent. of acid-insoluble mineral matter.

Cardiol.

3693. *Compound Essence Cardiol Concentrated*, The Prescription Products Co., Dayton, O. "17 per cent. alcohol." Price

39 cents for 0.97 fl. oz. A dark-brown liquid flavored with oil of wintergreen.

Specific gravity @ 15.5° C.	1.0378	Glycerine	none
Alcohol by volume	18.70	Reducing sugars, as dextrose	3.00
Wood alcohol	none	Other organic extractives	9.38
Solids, non-volatile	14.19	Senna, cascara	present
Ash	1.81		

This preparation appears to be nothing more than a flavored, slightly sweetened fluidextract of senna and cascara sagrada.

Dr. Edwards' Olive Tablets.

3467. *Dr. Edwards' Olive Tablets*, a Substitute for Calomel, The Olive Tablet Co., Columbus, O. "Contains only vegetable drugs." Price 25 cents for 45 tablets, weighing 8.075 gms., or 124.6 grs. Green pills (interior blackish-brown) with the taste and odor of aloes and ginger.

Loss @ 100° C.	3.40	Reducing sugars, as dextrose	27.28
Ash, (chiefly calcium carbonate)	28.00	Starch	1.32
Petroleum ether extract	1.90	Other organic matter (chiefly aloes and ginger)	38.10

The active ingredients of these tablets are aloes and ginger. If any olive oil is present it must be so in an amount less than two per cent. an altogether negligible quantity when the dosage is considered.

"Every one knows that calomel is one of the best laxatives—we mean the best to produce bowel action. But calomel is injurious—its after-effects are not only unpleasant, but in many cases dangerous. Doctors have sought for years to discover a substitute. It remained for Dr. Edwards to develop this compound. For fifteen years while practicing he sought the desired combination for the sole benefit of his patients. He developed it to perfection and found it too good to confine to a few. So it is now placed within the reach of all."

Aloes, the active ingredient of these tablets, has been known for centuries as an active cathartic.

Eno's Fruit Salt-Derivative Compound.

3454. *Eno's Fruit Salt-Derivative Compound*, J. C. Eno, Ltd., London, Eng., J. Bailey and Son, Baltimore, Md. "Containing about 48 per cent. of Fruit Derivative together with about 52 per cent. of Alkaline Salt for Producing Effervescence." Price 90 cents for 9.1 oz. A white powder with a slightly acid taste.

Carbon dioxide	24.20	Tartaric acid	48.67
Sodium oxide	22.27		

These data indicate that it is made up of about 46.24 per cent. sodium bicarbonate, 30.26 per cent. sodium bitartrate and 23.60 per cent. tartaric acid. The preparation is therefore quite similar to ordinary Seidlitz powder, sodium bitartrate being substituted for the Rochelle salt.

It is true that tartaric acid in a sense may be considered a fruit derivative, as it is made from tartar, or argol, a substance deposited on the inside of wine casks during the fermentation. It is difficult, however, to appreciate wherein the tartrate present in this compound becomes a "natural means for regulating the action of the liver." Few direct statements are made concerning the *Fruit Salt*, but indirectly it is recommended as a cure or preventive of fevers, biliousness, constipation, sick headache, measles, skin eruptions, diarrhoea, seasickness, impure or impoverished blood, colds, influenza and consumption. Surely a long list of ailments to be cured or prevented by Seidlitz powders, known for many years as a useful and pleasant aperient.

Fruitola.

3477. *Fruitola*, Pinus Medical Co., Los Angeles, Cal. "System Cleanser. Recommended for Gall Stones and Stomach Trouble." Price one dollar. It consists of 4.7 oz. of an oil, and two powders weighing one oz. and 0.23 oz., respectively.

The liquid is olive oil flavored with anise, with a specific gravity @ 15.5° C. of 0.9176, and refractive index of 1.4710 at the same temperature.

The powder in the blue paper contained sodium oxide 17.11, potassium oxide 12.09, tartaric acid 39.45 per cent., with considerable carbon dioxide. These were equivalent to 74.22 per cent. Rochelle salt and 25.78 per cent. sodium bicarbonate. The powder in the white paper proved to be simply tartaric acid. The proportions of Rochelle salt, sodium bicarbonate and tartaric acid were almost identical with those required for Seidlitz powders by the Pharmacopoeia.

The manufacturer claims that "it is purely vegetable." The oil is certainly vegetable, but the powders contain 17 per cent.

potash, 12 per cent. soda and considerable carbon dioxide, certainly not vegetable compounds. The medicine is especially recommended for "gall stones;" "it has been successfully used in hundreds of cases of Stomach Trouble and Gall Stones." Of nine testimonials published in the booklet accompanying *Fruitola* its efficacy for the removal of gall stones is affirmed in all. The following extracts are taken from these testimonials:

"After taking the first bottle of Fruitola, I passed fully a teacupful of gall-stones, the second brought fully as many, and the third more than either of the other two." "Took fourteen or fifteen bottles. I passed more gall stones than you could hold in your hat." "The following morning I passed 268 gall stones, some as large as hickory nuts." "I was relieved of at least a pint of gall stones in twenty-four hours." "More than a hundred gall stones were removed."

It is well-known that giving a patient large doses of olive oil, especially when followed by a dose of salts, will result in the passing of soapy concretions. These greenish lumps of various sizes are mistaken by the uninformed for "gall stones," and the victim "feels he is getting his money's worth in proportion to the number of these 'stones' that are passed." Analysis of such "gall-stones" in the laboratory of the American Medical Association has shown them to be principally mixtures of fatty acids and soaps produced by the action of the alkaline intestinal fluids on the large amount of oil taken.

When the American Medical Association analyzed *Fruitola* in 1910, the sample for which one dollar was charged consisted of 8 oz. of oil and six powders. Our sample selling at the same price contained 4.7 oz. of oil and only two powders; in other words the amount supplied was diminished by more than half.

Mayr's Wonderful Stomach Remedy.

3533. *Mayr's Wonderful Stomach Remedy*, Geo. H. Mayr, Chicago. Price one dollar. It consists of 5 oz. of an oil and two powders weighing 0.64 and 0.45 oz., respectively.

The liquid was olive oil colored a reddish brown, with a specific gravity @ 15.5° C. of 0.9156, and refractive index of 1.4713 at the same temperature.

Powder No. 1, weighing 0.64 oz., was light yellow in color with the taste of licorice; it contained 16.08 per cent. magnesium oxide and 31.83 per cent. sulphuric anhydride, equivalent to 98.2 per cent. Epsom salts, $MgSO_4 . 7H_2O$, and 1.8 per cent. licorice powder.

Powder No. 2, weighing 0.45 oz., of a white color, contained 34.46 per cent. sodium oxide, 39.54 per cent. phosphoric anhydride, and lost on ignition 25.80 per cent. This appears to be partially dehydrated sodium pyrophosphate, $Na_4P_2O_7 . 10H_2O$. 74.13 per cent of the anhydrous salt with 25.87 per cent. water would show an analysis very close to the above.

While all published analyses of this remedy with which we are familiar agree as to the identity of the oil, the powders differ very materially in composition, showing that the "wonderful remedy" is made according to the whim of the compounder according to what drugs happen to be on hand. The analysis of the American Medical Association reported in *Nostrums and Quackery*, page 443, showed one powder to consist of Rochelle salt with six per cent. of compound licorice powder, the other of the same salt with four per cent. powdered licorice root. The North Dakota department reported in Special Bull. ii, No. 16, June, 1913, page 269, that powder No. 1 contained 85.74 per cent. of sodium sulphate and 14.26 per cent. of sodium hydrogen phosphate, while No. 2 was entirely commercial sodium acid phosphate. The Michigan department in *Fakes and Frauds*, page 4, reports No. 1 as being effervescent Epsom salts and No. 2 as Rochelle salt. Thus we have reported four entirely different analyses of the powders.

This remedy is very similar in nature and effect to *Fruitola*, and the criticisms of that remedy apply to this (see page 311). The following are some of the claims made for it in its literature (italics ours):—

"For Stomach Troubles, Indigestion, Gas on the Stomach and Intestines, Dizziness and Fainting Spells, Colic Attacks, Torpid Liver, Constipation, etc. The above ailments are mainly caused by the clogging of the intestinal tract with mucoid and catarrhal accretions allowing poisonous fluids into the stomach and otherwise deranging the digestive system. *This remedy painlessly removes these accretions without surgical operation* * * * * allays inflammation in the intestinal tract and assists in rendering the same antiseptic."

"I was preparing to submit to the operation (for gall stones) when my attention was called to a remedy that the *most eminent physicians of France* were employing with successful results, and after satisfying myself regarding the merits of the remedy, *I sent for* and obtained a supply for myself."

"In the spring of 1909, I had labels and cartons printed, and the sale of the remedy, the main ingredients of which *I obtain in France*, has been

growing and extending so rapidly that I am now employing a large number of people constantly in the bottling and preparing it for the market."

"I am not a professional '*Patent Medicine Man*' as this is the first and only remedy that I have ever put up and offered to the public outside of my drug stores, *but in self-defense I had to put this remedy on the market.* * * * * I would not think of offering any remedy unless that remedy had *the most unusual and exceptional merit*, and in these days of *quackery and many patent nostrums* the discerning public must undoubtedly welcome *this meritorious gift* to stomach sufferers."

"This medicine is not the powerful drug that a great many people believe it must be to obtain such results. The contents of the bottle is composed of nothing but strictly pure nature's ingredients and *would not harm a child or the weakest stomach.*"

As in the case of *Fruitola* the "gall-stones" passed after use of *Mayr's Wonderful Stomach Remedy* are mainly soap.

Munyon's Paw-Paw Pills Compound.

3480. *Munyon's Paw-Paw Pills Compound*, Munyon Remedy Co., Philadelphia, Pa. Price 20 cents for 57 pills, weighing 3.907 gm., or 60.3 grs.

The pills contained 6.02 per cent. water, 13.24 ash and 80.74 organic matter. The ash was insoluble in water, and considerable was also insoluble in hydrochloric acid; no carbonates present.

The diastatic action of the pills was slight, 0.5 gm. of the powdered pills digesting 1cc. of one per cent. starch solution to the red-violet stage after six hours at 50°C.

The proteolytic action was very faint, if present at all. The surface of the gelatin showed some unevenness and was less firm than a corresponding blank trial; this surface was not appreciably lowered after 48 hours at room temperature.

From the above data it is evident that not more than a trace of the ferments of the paw-paw can be present in these pills, certainly not enough to warrant the use of the word "paw-paw" in connection with them.

Pape's Diapepsin Compound.

3422. *Pape's Diapepsin Compound*, The Pape, Thompson and Pape Co., Cincinnati, O. "Pure aseptic pepsin, papain, diastase, prec. calcium carbonate, cascara sagrada, powdered ginger, powdered cardamon, sugar q.s., oil Canada snake root." Price 45 cents for 46 tablets weighing 63.977 gms., or 2.26 oz.

The tablets, "triangules," contained 1.55 per cent. water, 38.51 ash and 59.94 organic matter. The ash was insoluble in water, partly soluble in dilute hydrochloric acid with much effervescence; considerable was acid-insoluble.

The diastatic action was not strong, 0.5 gm. of the powdered tablets having only partially digested 1 cc. of one per cent. starch solution after six hours at 50°C.

The proteolytic action of the tablets, as compared with an equal weight of straight powdered pepsin, was almost negligible. The gelatin surface was uneven and less firm than in blank trials with 0.1 per cent. hydrochloric acid alone and might have been due to some slight peptonizing action. The tests were continued through 48 hours at room temperature with toluol as an antiseptic.

It is evident that the great digestive powers claimed for these tablets do not exist, and it is unnecessary to repeat here the long list of digestive troubles for which they are recommended.

Mi-o-na.

3468. *Mi-o-na*, Booth's Hyomei Co., Buffalo, N. Y. Price 50 cents for 47 yellow uncoated tablets of a sweet, bitter taste, and weighing 12.77 gms., or 197 grs.

Loss @ 100° C.	5.04	Magnesium oxide	0.41
Ash	35.00	Water-soluble	38.44
Reducing sugar, as dextrose	25.36	Alcohol-soluble	26.62
Bismuth oxide	11.80	Strychnine, gallic acid	present
Calcium carbonate	23.69	Na, K	present

The tablets consist essentially of bismuth subgallate, calcium carbonate, extract of nux vomica and sugar. Practically no claims are made for this remedy either on the label or in the booklet accompanying the medicine. According to the manufacturer our sample represents old stock, the new formula being materially different from that shown above.

Dilaxin Pills.

3522a. *Dilaxin Pills*, The Marmola Co., Detroit, Mich. Four pills, enclosed as a sample with *Marmola*, and weighing 1.04 gms., or 16 grs. They contained phenolphthalein in large amount and possibly cascara. They are supposed to be used in connection with *Marmola*, although that remedy itself contains phenolphthalein, and cascara is claimed as one its ingredients.

Para-Lax.

3573. *Para-Lax*, The Kellogg Food Co., Battle Creek, Mich. Price one dollar for 16 oz.

Water	34.3	Oil	60.8
Solids	65.7	Acacia and flavor	present
Ash	0.25		

The oil obtained by the Roese-Gottlieb method was colorless, odorless and tasteless. Its specific gravity was about 0.865, its refractive index @ 20° C. was 1.47209, and it was insoluble in hot acetic anhydride. These properties are characteristic of liquid paraffin (Russian mineral oil). The material used to effect the emulsion appeared to be acacia; no saccharin was found. The preparation appears to be, therefore, a flavored emulsion of about 61 per cent. of liquid paraffin with acacia. It is claimed to be "an efficient and harmless remedy for constipation, colitis and intestinal auto-intoxication", claims which are quite in accord with modern medical practice.

REMEDIES FOR TENDER AND TIRED FEET.

Calocide Compound.

3451. *Calocide Compound*, Remedy for Foot Ailments, Medical Formula Co., Chicago. Price 25 cents for 4.23 oz.

Boric acid	46.13	Loss @ 100° C.	8.93
Aluminum oxide	8.30	Tannin, sodium	present
Chlorine	13.60	Potash	trace
Sulphuric anhydride	23.91		

The above data indicate its composition to be about 22.44 per cent. sodium chloride (common salt), 37.58 per cent borax, 39.35 per cent. sodium aluminum sulphate, $Al_2 (SO_4)_3 . Na_2 SO_4$, (soda alum) and a small amount of tannin.

TONICS.

Greene's Nervura.

1120. *Dr. Greene's Nervura Blood and Nerve Remedy*, Drs. F. A. and J. A. Greene, New York City. Warranted Pure Vegetable. Contains no poisonous minerals or injurious drugs. Alcohol 18 per cent." Price one dollar for 10.6 fl. oz. A dark brown liquid with considerable sediment.

Specific gravity @ 15.5° C.	1.0081	Ash	0.75
Alcohol by volume	17.27	Alkaloids	faint trace
Wood alcohol	none	Chlorides, sulphates, lime, magnesia	present
Solids	6.69	Phosphates, iron	traces
Sucrose	4.43		

It is an alcoholic solution containing 1.51 per cent. of vegetable extractives, 4.43 per cent. of cane sugar and 0.75 per cent. of mineral matter. This small amount of vegetable matter is recommended with great assurance as a remedy for

"Nervousness, Nervous Debility, Weakness, Poor Blood, Kidney and Liver Complaints, Rheumatism, Neuraliga, Female Weakness, Malaria, Chills and Fever, Exhausted Nervous Vitality, Nervous Prostration, Sleeplessness, Despondency, Mental Depression, Hysteria, Paralysis, Numbness, Trembling, Pains in the side and back, Apoplexy, Epileptic Fits, St. Vitus Dance, Palpitation, Nervous and Sick Headache, Dyspepsia, Indigestion, Loss of Appetite, Constipation and all Affections of the Nervous System."

In extenuation of the use of such a large amount of alcohol we read:—

"This amount is necessary to extract and hold in solution the medicinal virtues of the herbs, roots, leaves and barks from which Dr. Greene's Nervura is made. Pure grain alcohol is used. It is not only perfectly harmless when compounded as above, but is very beneficial, as it adds a mild strengthening tonic effect, which is permanently maintained by the curative properties of the remedy. If alcohol is objectionable on principle, please expose each dose in a glass or saucer for a few moments before taking, and the few drops contained therein will evaporate."

The prescribed adult dose of the medicine, three teaspoonfuls, or 12 cc., would contain 2 cc. of absolute alcohol, and by exposure to the air "for a few moments" only an inappreciable amount of this alcohol would be lost. To those to whom alcohol "is objectionable on principle" Dr. Greene's advice might be praphrased as follows: "Do not drink your wine from the bottle, but, after letting it stand a few moments, from your glass; in this way the alcohol will 'evaporate' ". As a matter of fact this remedy contains much more alcohol than most of the common natural wines.

KARDENE.

3483. *Kardene*, for making Blood Tonic, H. S. Peterson and Co., Chicago. Price 43 cents for 1.64 oz. A brownish powder with a bitter-sweet, acid taste.

Sucrose	82.42	Iron oxide (Fe_2O_3)	1.30
Reducing sugar	2.60	Ammonia (NH_3)	0.27
Ash	1.27	Tartaric acid, total	6.60
Quinine sulphate	1.94	Tartaric acid, free	5.70

From these data *Kardene* appears to be made up about as follows:—

Cane sugar	82.42	Tartaric acid	5.70
Reducing sugar	2.60	Iron and ammonium tartrate, by difference	7.34
Quinine sulphate	1.94		

REXALL EVERY DAY TONIC.

1119. *Rexall Every Day Tonic*, United Drug Co., Boston. "Containing 15 per cent. of alcohol." "A medicinal constitutional tonic against loss of appetite, repugnance to eating, and for the general 'toning up' of the various bodily functions." Price 50 cents for 11.5 fl. oz. A clear brownish-red liquid.

Specific gravity @ 15.5° C.	1.0849	Ash	1.18
Alcohol by volume	9.75	Iron oxide (Fe_2O_3)	0.22
Wood alcohol	none	Quinine, saccharin, phosphates	present
Solids	24.22	Chlorides, sulphates, lime	traces
Glycerine	present	Color, fluorescent dye similar to phloxin	
Sucrose	14.35		
Reducing sugar, as dextrose	1.05		

This preparation contains 9.75 per cent. of alcohol (15 per cent. claimed), with 24.22 per cent. of solids, of which 15.40 per cent. is sugars, 1.18 per cent. ash and 7.64 per cent. glycerine and vegetable extractives. Iron, quinine and saccharin are present, as well as a fluorescent dye giving reactions similar to phloxin. The manufacturer advises us that at the present time the preparation does not contain alcohol, phosphorus or saccharin.

TONA VITA.

3405. *Tona Vita* (*Tonique Royale*), The Approved Formula Co., Dayton, O. "Alcohol 20 per cent." "For Tired People, Old Folks, Invalids and Convalescents. Especially intended for use in cases of debility, malnutrition, impoverished blood, indigestion, nerve exhaustion and as a general stomachic". Price $1.25 for 23.7 fl. oz. A rather thick brown liquid with the taste and odor of celery.

Specific gravity @ 15.5° C.	1.0356	Ash	0.67
Alcohol by volume	20.68	Nitrogen	0.151
Wood alcohol	none	Iron	trace
Solids	14.51	Celery	present
Reducing sugars as dextrose	10.78		

In the pamphlet accompanying the sample we read:

"A tonic was introduced in leading European cities to help build up the countless numbers of run-down, nervous, debilitated people, produced by the strain of modern methods of living. In the chief cities of Europe thousands have renewed their vitality through the use of this tonic * * * * The preparation, itself, is a vegetable compound. It is pleasant to take and contains no minerals or harmful ingredients."

It is difficult to see wherein this preparation differs materially from ordinary *Beef, Wine and Iron*, a much-vaunted preparation of exceedingly small value. The average composition of 92 samples of the latter material analyzed in this laboratory in 1908 showed alcohol 18.39, solids 14.55, ash 0.80, iron 0.114 and nitrogen 0.121 per cent, an analysis singularly like our present one of *Tona Vita*. Whatever virtue this material possesses probably lies in the alcohol it contains.

VINOL.

WATERBURY'S COMPOUND, PLAIN.

4515. *Vinol*, mfgd. for Chester Kent & Co., Boston. "18% alcohol." "The Modern Tonic Reconstructor containing the medicinal extractives of Fresh Cod Livers with Peptonate of Iron." Price one dollar for 15.9 fl. oz.

4521. *Waterbury's Compound, Plain*, Waterbury Chemical Co., Des Moines, Ia. "Alcohol 11%." "Made from cod liver oil, digestive ferments, malt extract unfermented, hypophosphites comp. special, extr. cherry, eucalyptus, aromatics, etc." Price 75 cents for 15.8 fl. oz.

	Vinol	Waterbury's
Specific gravity @ 15.5° C.	1.0111	1.0499
Alcohol by volume	18.69	11.25
Wood alcohol	none	none
Total extract, gms. per 100 cc	8.72	16.78
Ash, gms. per 100 cc	.885	.673
Iron oxide, gms. per 100 cc	.240	trace
Sodium oxide, gms. per 100 cc	.194	.115
Potassium oxide, gms. per 100 cc	.141	.045
Calcium oxide, gms. per 100 cc	trace	.014
Phosphoric acid, gms. per 100 cc	.090	.092
Nitrogen, gms. per 100 cc	.350	.178
Reducing sugars, as dextrose, gms. per 100 cc	3.32	9.72
Glycerine, gms. per 100 cc	.323	.812
Chloroform-ether extract, acid, gms. per 100 cc	.187	.713
Chloroform-ether extract, alkaline, gms. per 100 cc	.010	.006
Fatty acids, gms. per 100 cc	.016	.032
Salicylic acid, gms. per 100 cc	.095	.546
Alkaloids	none	none
Acidity per 100 cc. = $\frac{N}{10}$ NaOH	55.0	28.5
Polarization @23.5° C., direct	−2.1°	+3.7°
Polarization @ 23.5° C., invert	−2.2°	+3.85°

These two preparations are types of the so-called cod liver oil wines or cordials, which are claimed to contain the medicinal properties of cod liver oil without the oil. No oil is present in either sample, although traces of fatty acids are found in each, which give the Pettenkoffer test for biliary products. That .016 or .032 per cent. of these fatty acids could have any appreciable effect as reconstructives is entirely beyond credence. In fact, actual feeding experiments, made in this laboratory* show very conclusively that *Vinol* and the *Waterbury* preparation at best barely more than sustained normal weight in white rats, whereas ordinary cod liver oil fed under similar conditions resulted in a marked and rapid growth.

It is evident, therefore, that the emphasis placed on the supposed virtues extracted from the cod liver oil is quite unwarranted and that, if they do have any value as tonics and reconstructives, it is due in the case of *Vinol* to the alcohol and peptonate of iron, and

* Jour. Amer. Med. Asso., 64, 638–643.

in the case of *Waterbury's Compound* to the alcohol and malt extract.

Vinol is claimed to be "a tonic, body-builder and strength-creator." That the alcohol and iron it contains may have a tonic effect is readily admitted, but there is nothing in its composition which suggests value as "a body-builder and strength-creator".

The following extract explains what an alleged boon *Vinol* is to suffering humanity:

"Up to about 15 years ago, if you needed cod liver oil you could have your choice between the plain, raw oil, and one of the numerous greasy, sticky, white emulsions. If the latter were not quite so hard to take, you had to take twice as much to get the same dose of oil; so that there was little choice after all. But the two great French chemists changed all that. They studied cod liver oil for 20 years and finally proved that it was not a simple oil, but that it dissolved certain ingredients from the cod's liver, and these ingredients are the valuable medicinal and strengthening elements. Let's make this very clear. *It is not the grease, but the medicinal elements which the oil has dissolved out of the livers, that make cod liver oil valuable as a medicine.* * * * * The result is VINOL. It represents the only real advance in the use of cod liver oil for at least 30 years. And this is largely because there is no oil in it, to disgust the palate and offend the stomach."

In opposition to the above claims we may refer to the experiments of Osborne and Mendel with albino rats (*Jour. Biol. Chem., 17, 1914, p. 402*), who report:

"We have likewise obtained uniform success by substituting cod liver oil for a portion of the lard in our standard diets. * * * * Not only was growth resumed in most cases at a very rapid rate but all evidence of malnutrition, especially the affection of the eyes, promptly disappeared."

The value of cod liver oil itself as a nutrient in comparison with certain other oils such as lard and almond oils being established, it is interesting to note the results of feeding experiments in which such preparations as *Vinol* have been compared with straight cod liver oil. The following are some of the data of our own experiments, already referred to. Young albino rats were fed a standard ration for several months, when an equivalent amount of dealcoholized *Vinol* was substituted for a part of the lard in the ration, the *Vinol* later being substituted by an equivalent amount of cod liver oil. The rats were weighed twice each week with the following results:

	Rat17 gms.	Rat 18 gms.	Rat 30 gms.
Vinol period.....	136.1	152.4	170.5
	140.0	151.7	167.8
	141.5	155.9	168.3
	140.8	157.3	164.6
	140.3	159.0	.....
	.....	159.5	.....
	.....	156.7	.....
	.....	157.2	.....
Cod liver oil period.....	154.3	160.9	179.2
	158.8	172.6	188.8
	161.6	175.6	189.8
	163.7	174.6	198.8
	167.3	175.9	200.5

In other words rat 17 with *Vinol* in 16 days gained 4.2 gms; with cod liver oil in 25 days it gained 27.0 gms. Rat 18 with *Vinol* in 18 days gained 4.8 gms.; with cod liver oil in 17 days it gained 18.7 gms. Rat 30 with *Vinol* in 11 days lost 5.9 gms.; with cod liver oil in 17 days it gained 35.9 gms. These experiments seem to indicate that as a "body-builder" *Vinol* is far inferior to ordinary cod liver oil, which it would supplant.

Waterbury's Compound was formerly sold under the name "Waterbury's Metabolized Cod Liver Oil Compound". *Notice of Judgment No. 303* of the U. S. Government declared that when sold under this name the product was misbranded, and the present indefinite name for the preparation was adopted. The label, however, still claims that the compound is made from cod liver oil. We are told that it is

"The blood building tonic, builds tissue rapidly, stimulates impaired digestive and assimilative functions, thereby aids in the utilization of ordinary food material." "The ideal nutrient tonic. No odor of cod liver oil. No taste of cod liver oil. Test this product for its red blood building properties." "Aids digestion, allays fermentation, assists assimilation, but does not disturb the stomach." "Has broadened the field of usefulness of cod liver oil many times as it is now applicable to many conditions for reasons of its palatability and enzymotic efficiency."

In view of these sweeping claims our experiments in feeding this preparation to albino rats in comparison with ordinary cod liver oil are interesting. The experiments were conducted in a similar way to those already referred to in connection with *Vinol*, the details of which are published elsewhere. The weekly weighings of the rats were as follows:

	Rat 22 gms.	Rat 23 gms.	Rat 25 gms.
Waterbury period.....	143.3	136.2	144.2
	131.1	129.3	129.9
	133.5	134.2	134.9
	140.6	140.0	135.4
	146.5	145.2	130.8
	147.5	145.3	.....
Cod liver oil period.....	155.7	155.0	158.9
	160.3	159.9	174.4
	155.4	159.9	175.8
	158.6	160.0	.....
	158.6	161.6	.....
	162.6	164.0	.....
	158.3	165.9	.....
	163.5	172.1	.....

In other words rat 22 with *Waterbury* in 30 days gained 4.2 gms. while with cod liver oil in 60 days it gained 16.0 gms. Rat 23 with *Waterbury* in 30 days gained 9.1 gms.; while with cod liver oil in 56 days it gained 26.8 gms. Rat 25 with *Waterbury* in 14 days lost 13.4 gms.; while with cod liver oil in 18 days it gained 45.0 gms. The last rat was particularly interesting as it was apparently wasting away on the *Waterbury* ration at the rate of over 6 gms. a week, but when cod liver oil was substituted gained at the rate of about 18 gms. a week. Even the presence of malt extract apparently was not sufficient to counteract the lack of nutriment in the *Waterbury* preparation.

The experiments with both *Vinol* and the *Waterbury Compound* show very conclusively that these cod liver oil wines do not possess the nutrient qualities of cod liver oil, and any one using them as a nutrient in place of cod liver oil is certain to be grievously disappointed in the results. The alcohol and iron, or the alcohol and malt extract, may show some tonic effects, but when strength is needed and actual nutriment is desired some other means is necessary than the use of these cod liver oil wines.

WORM SYRUPS (VERMIFUGES).

Twelve of these preparations were analyzed. In general, these consisted of a flavored alcohol extract of santonin together with a cathartic drug (generally cascara or senna), santonin being found in all but two of the syrups. In one instance worm seed (chenopodium) was claimed and in two pinkroot (spigelia) to-

gether with santonin. There is no question of the efficacy of santonin, spigelia and chenopodium in the destruction or expulsion of intestinal worms. However their use, especially in the case of santonin, is by no means unattended with danger. Commenting on the danger from the use of santonin, the U. S. Dispensatory, p. 1087, says:

"In regard to the fatal minimum dose, two grains are said to have killed a feeble child five years old, and one six or seven years old is said to have suffered death from six grains after development of haematuria; four grains produced very serious symptoms in a child four years old."

In addition to the above the writer knows of a two-year old child in New Haven who came close to death after being given a certain worm syrup in the amount directed by the manufacturer. The official prescribed dosage for a two-years old child is from 0.016 to 0.032 gm., or from 0.25 to 0.50 gr. It will be noticed from the table given below that in the ten preparations containing santonin, the amount of this drug contained in one teaspoonful, the quantity prescribed in every case but one, ranges from 0.010 to 0.034 gm., or from 0.15 to 0.52 gr. These amounts, with one exception, are well within the U. S. D. limits, yet the directions generally recommend three daily doses, and in one case the medicine is to be taken every two hours. It is evident that such frequent dosage might easily be dangerous, yet we find three of the preparations labeled "safe and effective," or "harmless in effects."

Nine samples contained alcohol, ranging from 4.2 to 19.1 per cent. The latter sample claimed no alcohol and was clearly misbranded under the law.

Below will be found copies of the labels of the syrups. The samples were tested only for santonin, alcohol and emodin-containing drugs, the results being given in Table X.

3464. *Adee-co Worm Syrup*, prep. for The Alderman Drug Co., Hartford. "Comp. fluid extract of wormseed; contains six per cent. alcohol." Price 25 cents for 2.53 fl. oz.

3463. *Dike's Worm Syrup*, Dike Drug Co., New York (Dist.) "Santonin, sodium bicarbonate, cascara tasteless, aromatics." Price 25 cents for 2.03 fl. oz.

3388. *Dr. Hand's Worm Elixir*, Hand Medicine Co., Philadelphia, Pa. "Alcohol seven per cent." "Contains no stupefying narcotic drugs." Price 25 cents for 1.37 fl. oz.

3411. *Dr. Hobson's Laxative Santonine Worm Syrup*, Pfeiffer Chemical Co., Philadelphia, Pa. "Alcohol 13 per cent." "Safe and effective." Price 25 cents for 1.77 fl. oz.

3421. *Manhattan Worm Syrup*, Manhattan Drug Co., New York. "Alcohol five per cent." "Harmless in effects." Price 25 cents for 1.93 fl. oz.

3401. *Worm Syrup*, prep. for J. A. Notkin, New Haven. "Fl. extr. senna 48, fl. extr. spigelia 50, santonine 5, syrup 300, dil. alcohol 30, oil anise 3 parts." Price 25 cents for 1.77 fl. oz.

3465. *Nyal's Worm Syrup*, New York and London Drug Co., New York. Price 25 cents for 2.20 fl. oz.

3481. *Penslar Worm Syrup*, Peninsular Chemical Co., Detroit, Mich. "Alcohol two per cent." "Each fl. oz. contains pinkroot 36 grs., senna 22, santonin 1." Price 25 cents for 1.80 fl. oz.

3453. *Rexall Worm Syrup*, United Drug Co., Boston. Price 25 cents for 1.90 fl. oz.

3207. *Dr. True's Elixir, Family Laxative and Worm Expeller*, Dr. J. F. True & Co., Auburn, Me. and Knowlton, Que. "Eight per cent. alcohol." "Harmless and effectual." Price 50 cents for 4.67 fl. oz.

3398. *Vegetable Worm Syrup*, E. Wadewitz, New Haven. Price 25 cents for 1.80 fl. oz.

3396. *Whitman Worm Syrup*, prep. for Whitman Chemical Co., Boston. "Alcohol five per cent." Price 25 cents for 1.70 fl. oz.

TABLE X:—ANALYSES OF WORM SYRUPS.

Brand.	Alcohol. Claimed. Per cent.	Alcohol. Found. Per cent.	Santonin. gms. per 100 cc.	Santonin in Prescribed Dose, gms.	Emodin.	Flavor.
Adee-Co.....	6	7.0	0	0	Yes	Wintergreen
Dike's.....	0	0.0	0.564	0.023	Faint	Anise
Hand's.....	7	10.2	0.482	0.010	Yes	Peppermint
Hobson's....	13	9.1	0.269	0.011	Probably	Anise
Manhattan...	5	10.9	0	0	Yes	Anise
Notkin's	3	4.7	0.862	0.034	Yes	Anise
Nyal's.....	0	0.0	0.597	0.024	?	Anise
Penslar.....	2	4.2	0.249	0.010	Yes	Anise
Rexall.....	0	0.0	0.346	0.014	Faint	Anise
True's.....	8	8.5	0.235	0.009	Yes	?
Wadewitz ...	0	19.1	0.727	0.029	Yes	Anise
Whitman....	5	4.4	0.461	0.018	Yes	Anise

MISCELLANEOUS REMEDIES.

Chi-Ches-ters Diamond Brand Pills.

3427. *Chi-Ches-ters Diamond Brand Pills*, Chichester Chemical Co., Philadelphia, I a. Price two dollars for 20 pills, weighing 7.71 grams. White pills with black interior, with the odor and taste of aloes.

Loss @ 100° C.	6.75	Reducing sugars, as dextrose.	6.60
Ash	28.20	Sucrose	17.60
Calcium oxide	11.40	Alkaloids	none
Carbon dioxide	9.00	Aloes, glycyrrhiza, jalap	present
= Calcium carbonate	20.48	Ergot, tansy	?
Iron oxide	4.00	Pennyroyal, savin, podophyllum	none
= Iron sulphate	7.60		
Sulphuric anhydride	3.98		

The active ingredients in these pills are aloes and iron sulphate with small amounts of licorice and jalap, and possibly traces of ergot and tansy. The calcium carbonate and sugar, which make up nearly half the weight of the pills, are in the coating.

Formerly these were sold as "*Chichester's English Pennyroyal Pills*," but as no pennyroyal could be found in them the Food and Drugs Act necessitated a change of name to avoid the charge of misbranding. They are a peculiarly vicious preparation because of their reputed abortion-producing properties. There are no restrictions whatever as to their sale; they are shamelessly advertised in our newspapers and equally shamelessly sold by certain of our druggists, who cannot be ignorant of their nature and purpose. As a matter of fact they are simply the well-known aloes and iron sulphate pills, slightly modified.

"Since it is well-known there is no drug or combination of drugs which taken by the mouth, will with certainty produce abortion, it is not probable, to judge from the constituents found in these pills, that they would produce the result desired by the purchaser. Nevertheless, the use of this nostrum is pernicious and in the interest of public health and public morals its sale, and the sale of similar nostrums, should be prohibited."
Jour. Amer. Med. Asso., May 27, 1911.

The following statement in the company's booklet at least suggests the purpose for which they are recommended:

"Treatment may be begun at any time, although in some instances the pills are more effective if taken about the regular time for the menstrual flow. As a rule, however, it is found that more satisfactory results are secured by beginning treatment at once, and continuing it until the pills give relief. In order to assist the efforts of nature to reestablish the menstrual flow at the regular period, the patient should exercise care in regard to diet and general health."

Here follow some excerpts from the company's testimonials, with their thinly-disguised suggestiveness as to the effectiveness of the pills as abortifacients:

"Am happy to say they had the desired effect. I cannot be thankful enough." "They proved successful after taking only 11 pills." "They had the desired effect." "Proved very effective in my case." "Found immediate relief." "Brought speedy relief." "Only took five pills which was all that was necessary."

A sample of pennyroyal and one of tansy, bought by us for experimental purposes, each contained an advertisement of these pills. As pennyroyal has the property of "exciting the menstrual flux" and tansy "has been used to a considerable extent as a domestic abortifacient," the implied purpose of these pills is obvious, in spite of the guarded statements in the company's literature.

Hanford's Balsam of Myrrh.

3526. *Hanford's Balsam of Myrrh*, G. C. Hanford Mfg. Co., Syracuse, N. Y. "Wood alcohol 80 per cent." Price 25 cents for 1.4 fl. oz. A brown liquid with black sediment and the odor of wood alcohol.

Specific gravity @ 22° C.	0.8586	Solids	7.39
Wood alcohol	81.31	Myrrh	present

The material appears to be essentially a tincture of myrrh and possibly other vegetable drugs in which wood alcohol is used as the solvent. The medicine is recommended at present only for external use on domestic animals.

Kosine.

3223. *Kosine*, The Kosine Co., Washington, D. C. "A Reliable Remedy for Epilepsy, St. Vitus Dance and all nervous disorders due to a diseased condition of the nervous system." "Con-

tains no alcohol, morphine or any preparation of opium." Price $1.50 per 16 fl. oz. A dark-brown liquid with a salty taste and neutral reaction.

Specific gravity 15.5° C.	1.0712	
Alcohol	none	
Solids	12.21	gms. per 100cc.
Ash	5.87	gms. per 100cc.
Antipyrine	0.75	gms. per 100cc.
Bromine	6.89	gms. per 100cc.
Nitrogen	0.872	gms. per 100cc.
= Ammonia	1.12	gms. per 100cc.
Sodium oxide	0.616	gms. per 100cc.
Sugars, alkaloids	none	

The material is an aqueous solution of 0.75 gm. of antipyrin, 6.50 gms. of ammonium bromide and 2.04 gms. of sodium bromide per 100 cc. The analysis shows that the activity of the remedy depends largely on bromides, drugs commonly used in the various epilepsy "cures" on the market. It is well recognized by competent authorities that the bromides are not a "cure" for epilepsy, but simply a palliative or sedative tending to suppress the attacks. There is no drug treatment known that will cure this disease, which is one of the most intractable diseases to treat. Furthermore, the long-continued use of the bromides is not without danger.

"If pushed too far, death may intervene with acute bromide poisoning. This happened in the case of a boy of 12 years, whom I knew, whose parents gave him too frequent doses of a patent nostrum, the essential ingredient of which, as with the bulk of patent epileptic cures, was bromide of potassium. It is a frequent experience to see patients brutalized by bromide, go months without fits, but with a loss of mental and physical activity."—*Dr. W. T. Spratling,* quoted in *Nostrums and Quackery, page 302.*

The amount of drugs in the 16 oz. bottle of *Kosine* would cost at retail about 7.5 cents.

Crystos.

3399. *Crystos,* for making Eye Remedy, H. S. Peterson & Co., Chicago. Price 50 cents for 0.92 oz. A white powder with a salty taste.

Boric acid, total	78.61	Chlorine	13.95
Boric acid, free	70.68	Sodium	present

The above analysis indicates a composition of about 23 per cent. sodium chloride, seven per cent. anhydrous borax and 70 per cent. boric acid.

"George L.:—A home-made eye tonic that will prevent your eyes from becoming dull, red or inflamed is easily procurable. Just get from your druggist one ounce of crystos, and dissolve it in a pint of water * * * * This tonic keeps the eyes bright and clear, strengthens the sight, and will benefit you if you wear glasses."—*Health and Beauty Advice by Mrs. Mae Martyn.*

Nurito.

3466. *Nurito,* The Magistral Chemical Co., New York City. "A prescription for Rheumatism, Sciatica and Neuritis. Free from Opiates and Narcotics." Price 87 cents for five powders weighing 79.7 grains, or one-sixth of an ounce.

Phenolphthalein	6.51	Lactose	33.84
Pyramidon	59.65	Chloroform-insoluble	33.20

Each powder contains about one grain of phenolphthalein, 9.5 grains of pyramidon and 5.5 grains of milk sugar. Pyramidon itself is a proprietary preparation derived from antipyrine and has the latter's antipyretic and anodyne properties. Its toxic effects are not clearly known as yet, although some observers claim that it is more likely to cause collapse than either antipyrine or acephenetidine, both well-known dangerous remedies.

Sargol.

3456. *Sargol,* for the thin and emaciated, The Sargol Co., Binghamton, N. Y. Price 85 cents for box of pills. The three boxes purchased contained 41, 36 and 38 pills, weighing 22.96, 18.22 and 18.50 gms., respectively.

The coatings were separated from a number of the pills, six tablets showing 55.6 per cent. mass and 44.4 per cent. coating, while another lot of 25 tablets showed 58.1 per cent. mass and 41.9 per cent. coating.

The coating showed the following composition:—

Sucrose	58.00	Lime	8.23
Starch	7.00	Iron and aluminum silicate	2.82
Ash	17.26	Carbonates	present

In other words the coating consisted of sugar, starch, calcium carbonate and a talc-like mineral.

The finely ground tablets were analyzed as well as the separated mass, in part, as follows:

	Tablets.	Dried Mass.
Water	2.32	4.44
Sucrose	27.21	.....
Starch	2.93	.....
Ash	38.37	42.00
Ash, insol. in acid	4.35	9.59
Calcium oxide	8.86	4.98
Hypophosphorous acid	8.76	14.52
Magnesium oxide	4.70	1.67
Potassium oxide	1.92	2.89
Sodium oxide	1.63	2.16
Water-soluble	55.10	38.91
Alcohol-soluble	30.56	23.97
Ether-soluble	2.81	3.79
Nitrogen	0.26	....
Chloroform-soluble	0.13	....
Strychnine	present	
Emodin	present	
Heavy metals	none	
Organic acids	none	

The phosphorus was almost entirely soluble in water; an aqueous solution reduced mercuric chloride and gave no precipitate with ammonium molybdate or magnesia mixture. The phosphorus was not present in organic combination as it was soluble in water and none was extracted by ether. It appears to exist in *Sargol* as *potassium, sodium and calcium hypophosphite.*

The alcohol-soluble portion was likewise partly soluble in water, the latter being precipitated by dilute acid as curdy, greasy flocks, soluble in ether (*soap*). The alcohol-soluble portion was also partly soluble in ether, giving an oily residue which was easily saponified (*fat or vegetable oil*).

Five gms. of the ground tablets gave 0.0066 gm. of residue extracted by chloroform from an acid solution made alkaline with ammonia. This was identified as *strychnine.*

Five gms. of the ground tablets extracted with dilute sulphuric acid and the acid solution extracted with ether gave a residue of 0.0048 gm., which gave reactions for *an emodin-like body.*

The aqueous solution of the pills contained but a trace of chlorides and sulphates; no nitrates, no carbonates, no organic acids (tartaric, oxalic or acetic); calcium, sodium and potassium were present. This solution did not give the biuret reaction for proteins. The source of the small amount of nitrogen present, 0.26 per cent., we were unable to identify, it was not in the form of ammonia, nitrates, or soluble proteins.

No heavy metals were present, special tests for zinc being made with negative results.

The active ingredients identified in the pills were potassium, sodium and calcium hypophosphites, a magnesium salt, strychnine and a vegetable drug or drugs yielding emodin. These were associated in the mass with soap and a fat or vegetable oil. In other words these are simply tonic pills with laxative qualities, and contain nothing, barring of course the sugar and starch of the coatings, which will offer nutriment to the "thin and emaciated".

Furthermore, *Sargol*, according to published analyses, is of most variable composition. An English analysis shows ash 3.75, protein 7.45, alcohol-soluble phosphatides 0.017, and caffein and theobromin present. (Abstracted in *Chem. Abstr, 7, 3188.*) Still another English analysis showed sugar 18.0, coagulable albumins 10.8, soluble albumins 4.2, sodium and potassium hypophosphite 7.7, lecithin 1.9, zinc phosphide 0.7, with talc as an excipient. An analysis made by the North Dakota Station is quite dissimilar to either ours or the English analyses.

The following quotations are taken from the company's circular:

"Sargol is offered as this missing link between food eating and fat making, as the cog wheel which your system lacks. Sargol should give you the power to assimilate what you eat. When you do that you will fat up to the proper proportions quickly. * * * * The new treatment for turning food into flesh. Those who have tried Sargol state that it is the most marvelous body builder which science has, so far, produced. * * * * Is not a 'tonic' in the common sense, yet by its use the system is toned. * * * * Is not a stimulant, yet when you take it you soon have a feeling of better condition; weakness gives way to strength, and all the time you are gaining flesh daily, all the time your figure is rounding out. * * * * Sargol should make you assimilate your food properly. Its plan is to make the sugars, the starches, the albuminoids and the fats turn into their proper channels, and not pass fruitlessly away from you as heretofore. * * * * The use of Sargol should increase the amount of the blood and promote what is known as cellular activity."

"Sargol, according to letters received, seems to possess a most remarkable effect in quickly and permanently rounding out the feminine form divine. It does not develop one portion of the figure at the expense of another, but in perfect harmony; the face should fill out to the perfect oval, the neck and bust become firm and plump, the arms round out to graceful proportions, and the limbs take on the curves which alone are signs of beauty."

"Let crazy diet alone; eat what you want, throw the nerve foods out

of the window, wave a last farewell to the health resorts and sanitariums, by restoring to the body that which has been destroyed, the assimilative principle."

In each regular package of *Sargol* there is a coupon entitling the purchaser to a special letter of advice from the manufacturer. We took advantage of this generous offer and sent such a coupon to the Binghamton office, receiving in return a circular (typewritten) letter entitled "Special Suggestions regarding Diet and General Health which help to promote gain in weight." The suggestions made are in some respects excellent: Eat plenty of flesh-making foods, as milk, cream, raw eggs, cocoa, chocolate, oat meal, potatoes, beans, bread, cheese, nuts, salads with oil dressing, sugar, etc.; chew the food thoroughly; avoid constipation; drink plenty of water; exercise moderately but regularly; don't worry; get plenty of calm, restful sleep; and all the time take *Sargol* four times a day.

It is apparent that should there be a gain in weight by following such advice, a result most likely to be secured, *Sargol* cannot be responsible for it. The hypophosphites have been believed by some to possess tonic properties, but they are largely discredited at the present time by the most competent authorities. Strychnine of course is a valuable tonic and stimulant, and doubtless whatever value *Sargol* has is mainly dependent upon the strychnine it contains. Although *Sargol* is claimed to be "not a laxative,' the emodin-yielding drugs, such as aloes and senna, possess that quality.

FOOD AND DRUG PRODUCTS EXAMINED FOR THE DAIRY AND FOOD COMMISSIONER.

Twelve hundred and fifty-one samples were examined for the Dairy and Food Commissioner. Since the details regarding them in many instances were not supplied to us, only a brief summary of the results is given here. Of the whole number of samples examined 548 were not found to be adulterated, 14 were legally labeled compounds, while 460 were adulterated, misbranded or below standard.

Butter and Butter Substitutes. Of 49 samples examined 6 were butter, 22 renovated butter and 21 oleomargarine.

Cider. Five samples were tested for preservatives with negative results.

Eggs. One hundred and ninety-two samples of storage eggs were examined in connection with the new egg law. Candling and subsequent breaking indicated that the eggs were of widely varying quality. While most of them were acceptable storage eggs, in six cases the eggs were distinctly bad.

Fish Scrap. The sample examined was of excellent quality, but, although sold as a poultry food, it did not bear a statement of the percentages of protein and fat as required by law.

Honey. Two samples were tested for water; one contained 22.0, the other 28.1 per cent, the latter exceeding the Government standard by 3.1 per cent.

Ice Cream. Thirty-seven samples were examined in connection with a study of the butter-fat content of Connecticut ice creams. The samples, taken in twelve towns, ranged from 5.5 to 22 per cent. fat, with an average of 12.2 per cent.; six contained less than 8 per cent., thirteen from 8 to 12, fourteen from 12 to 16 and four over 16 per cent. Previous analyses made in 1911, 1912 and 1913 of sixty-nine samples showed a range from 1 to 18.5 per cent. In spite of this wide range in composition it is apparent that good ice cream may be purchased in Connecticut, although in the absence of a standard a product of almost any quality may be purchased under the name "ice cream."

Jam. The sample of strawberry jam examined contained no chemical preservative.

Milk. Four hundred and four samples were examined. Of these 182 conformed to the legal standards, while 78 were deficient only in solids-not-fat. One hundred and thirty-five were below standard in solids, 55 in fat, and 218 in solids-not-fat, 222 samples failing to meet the legal requirements in one or more particulars. Two samples were skimmed, and 50 were watered.

The skimmed milks were taken in Brookfield and Wethersfield; the watered milks in Newington, Wethersfield, Huntington, Meriden, Bristol, North Branford Orange, Marlboro, Newtown, Naugatuck, Hamden, Norwich, Danielson, Ansonia, Guilford, Greenwich, Southington, Woodstock, Torrington, Putnam and Brookfield.

Molasses. The four samples examined were not adulterated.

Olive Oil. Two samples were examined; one was not adulterated, while the other contained cotton seed oil.

Salt. The sample examined contained 97.09 per cent. sodium chloride, 1.02 calcium sulphate and 0.69 calcium chloride.

Temperance Drinks. Eighty-nine samples were examined chiefly for the presence of saccharin and artificial color. Of the 89 samples only 31, chiefly ginger ales, were found to contain neither of these adulterants; 25 contained saccharin, 9 saccharin and a permitted coal-tar color, 20 a permitted coal-tar color, 3 an unpermitted coal-tar color (acid magenta), and 1 benzoic acid and a permitted coal-tar color. Fifty-one samples, in connection with this same examination, were analyzed in 1913. The following summary, which accurately reflects the bottled temperance drink business in this state, gives our findings for the whole 140 samples:

47 no saccharin or coal-tar color.
44 saccharin.
15 saccharin and permitted coal-tar color.
2 saccharin and unpermitted coal-tar color.
26 permitted coal-tar color.
5 unpermitted coal-tar color.
1 benzoic acid and permitted coal-tar color.

In other words 61, or 44 per cent., of the samples contained saccharin.

Vinegar. Two hundred and ninety-four samples of vinegar were tested for acidity, solids and ash. Of these, 151 met the legal requirements for acidity and solids for cider vinegar; 42 distilled, 2 malt, 1 sugar and 16 compound vinegars were sold under the proper designation. Twelve samples of distilled vinegar were sold as cider vinegar, 3 distilled as cider, 15 compound vinegars as cider, and 2 compound as malt vinegar. Seventeen cider vinegars were below standard in acidity, 17 in solids, and 5 in both acidity and solids; 6 compound vinegars, 4 distilled and 1 wine were low in acidity.

Whiskey. Five samples of whiskey and one of kümmel and rum were tested for alcohol. They contained 44.94, 37.34, 36.30, 45.33, 49.42 and 40.79 per cent. by volume. None of the samples contained wood alcohol or chloral hydrate.

Bay Rum. One sample contained 49.64 per cent. ethyl alcohol, the other, 26.32 per cent., the latter showing a great deficiency.

Tincture of Aconite. Forty samples were analyzed; they contained from 0.013 to 0.051 gm. aconitine per 100 cc, 28 samples being below the U.S.P. standard of 0.045 gm. Two samples bore no "poison" label.

Tincture of Belladonna. Forty samples were analyzed; they contained from 0.0040 to 0.0471 gm. belladonna alkaloids per 100 cc; 23 samples being below the U.S.P. standard of 0.030 gm. Five samples bore no "poison" label.

Tincture of Nux Vomica. Forty samples were analyzed; they contained from 0.082 to 0.105 gm. strychnine per 100 cc; only two were notably deficient, these containing 0.082 and 0.084 gm. instead of the 0.10 gm. required by the U.S.P. Three samples bore no "poison" label.

Tincture of Opium (Laudanum). Forty samples were analyzed, 36 of which ranged from 1.116 to 1.321 gms. of crystallizable morphine per 100 cc., reasonably close to the U. S. P. standard, 1.2 to 1.25 gm. One sample was excessively strong, containing 1.44 gms., while three were weak, containing 1.094, 1.080 and 1.008, respectively. One sample bore no "poison" label.

Turpentine. The two samples examined were adulterated with mineral oil.

MISCELLANEOUS MATERIALS SENT BY PRIVATE INDIVIDUALS.

Milk. Of the 47 samples tested 32 were of standard quality. Six samples were watered, 4 were skimmed, and 5 were below standard in one or more particulars.

Cream. Forty samples were analyzed; these ranged from 15.0 to 53.5 per cent. fat, all but one meeting the legal standard of 16 per cent. However, 15 samples sold as 40 per cent cream, ranged from 28.5 to 40.8 per cent, only 4 containing the guaranteed amount.

Skim Milk. The sample contained 90.3 per cent. water, 1.1 fat, 3.3 protein, 0.7 ash and 4.6 lactose.

Human Milk. The sample contained 12.7 solids and 4.8 per cent. fat.

Dried Skimmed Milk. The sample contained 4.4 water, 1.4 fat, 32.9 protein, 8.1 ash and 53.2 lactose.

Milk Albumen. The sample contained 4.7 water, 4.3 fat, 56.5 protein, 22.0 ash and 12.5 lactose.

Butter. The single sample examined was not adulterated.

Vinegar. Of the 94 samples examined 48 satisfied the legal

standards for acidity and solids. Twenty samples were low in acidity, 20 in solids and 3 in both acidity and solids; three samples contained excessive ash; one sample contained 12.71 per cent. solids.

Berries. A sample suspected of containing poison from spraying contained no arsenic.

Casein. A sample of *No. 60 Casein* of the Casein Mfg. Co., New York, contained 81.79 per cent. casein.

Cheese. A sample suspected of having poisoned certain users of it contained no preservative or metallic poison. An assistant in the laboratory consumed a considerable quantity with no ill effects.

Cider. One sample contained 4.15 per cent. alcohol by volume and 0.08 per cent. salicylic acid; the other sample contained 3.16 per cent. alcohol.

Color. A sample of color used in making ice cream cones proved to be Naphthol Yellow S, a coal-tar color, one of the permitted dyes.

Grape Juice. A sample of *Haines' Grape Juice* had a specific gravity @ 15.6° C. of 1.0811 and contained 0.45 per cent. alcohol by volume, 24.91 per cent. invert sugar and 0.011 per cent. sulphurous acid.

Ice Cream. The eleven samples, all from New Britain, contained from 4.0 to 21.0 per cent. of fat, three containing less than 8 per cent. and five over 15 per cent.

Infant Food. A sample of *Mamma-la*, an imported food, contained 5.15 water, 5.50 ash, 25.58 protein, 10.95 fat and 52.82 per cent. nitrogen-free extract; no starch present.

Jelly. A sample suspected of having caused sickness contained no chemical preservative.

Nuts. A sample of whole pecan nuts was found to be coated with an ochre-like substance or a "rouge", the color being due chiefly to oxide of iron mixed with an unidentified organic vehicle.

Olive Oil. One sample was not adulterated; the other, *Umberto Albertini Brand,* Meyer and Lang, New York, consisted largely of cotton seed oil.

Salt. The sample contained 49.96 per cent. chlorine, equivalent to 82.43 per cent. soduim chloride and 14.95 per cent. calcium sulphate (plaster).

Sanatogen. The sample contained 82.17 per cent. casein.

Sugar. The sample contained 99.8 per cent. sucrose and no insoluble mater.

Water. A sample of water suspected of having poisoned several people was tested for lead with negative results.

Whiskey. A sample of *Antiquary* Scotch whiskey contained 45.82 per cent. ethyl alcohol by volumes; a sample of so-called "Polish" whiskey contained 39.70 per cent. ethyl alcohol by volume.

Arsenate of Lead. One sample contained 31.57 arsenious oxide, 0.43 of which was water-soluble (24 hours), and 63.35 per cent. lead oxide. Another sample showed only 0.25 per cent. water-soluble arsenious oxide after ten days.

Cocaine, Heroin, Morphine and Opium. Thirty samples of these drugs were analyzed in connection with the police crusade against their sale in New Haven. Four samples contained cocaine, sixteen heroin, seven morphine and three gum or powdered opium. Four other samples sent in in connection with the above proved to be milk sugar, talcum powder, or *Sal Hepatica.*

Drug. A powder sent in by the user consisted largely of sodium salicylate with an unidentified bitter principle (not strychnine or quinine); no alkaloids present.

Poisoning Cases. A sample of a well-known proprietary cod liver oil preparation contained 3.03 per cent. of corrosive sublimate, which had been introduced with criminal intent.

Another sample, tea, contained 2.29 grs. of potassium cyanide. The contents of fifteen bottles, seized at the house of the suspect, were analyzed in part. Among other miscellaneous materials identified were fusel oil, hydrochloric acid, oxalic acid, chloride of gold, oil of cloves, sodium carbonate, fixing powder, developer, sodium bicarbonate, and laxative pills, all but the latter probably having been used for photographic purposes.

Miscellaneous. The sediment found in cream bottles picked up on a city dump contained 27 per cent. of ash, consisting chiefly of lime. A suspected fatty residue from milk was found to be butter fat. The stomachs of two cows, suspected of having been poisoned, were tested for arsenic with negative results. A piece of meat, supposed to be poisoned bait, contained no arsenic or strychnine. A sample of suspected cracked corn contained no arsenic. A sample of wood suspected of having been injured by arsenical spraying, was received; 2 gms. of the wood taken from

the middle of the shoot showed a very slight trace of arsenic; the deposit found on the wood contained 9.53 per cent. arsenious oxide and 32.88 per cent. lead oxide.

TABLE XI:—SUMMARY OF RESULTS OF EXAMINATION OF FOOD AND DRUG PRODUCTS, 1914.

	Not found adulterated.	Adulterated or below standard.	Compound.	Total number examined.
Sampled by Station				
Biscuits and Crackers	..	..	..	88
Bran Biscuits and Laxative Preparations	..	..	..	12
Condensed Soups	2	..	..	2
Diabetic Foods	..	..	..	72
Wheat Bran	5	..	..	5
Bay Rum	19	24	..	43
Belladonna Plasters	5	2	..	7
Blackberry Brandy and Cordial	5	5	..	10
Malt Extract	..	21	2	23
Proprietary Medicines	..	..	..	130
Total	36	52	2	392
Sampled by Dairy Commissioner				
Butter	6	43	..	49
Cider	5	..	..	5
Eggs	..	..	..	192
Fish Scrap	..	1	..	1
Honey	1	1	..	2
Ice Cream	..	..	..	37
Jam	1	..	..	1
Milk	182	*222	..	404
Molasses	4	..	..	4
Olive Oil	1	1	..	2
Salt	1	1	..	1
Temperance Drinks	27	48	14	89
Vinegar	196	82	16	294
Whiskey	2	4	..	6
Bay Rum	1	1	..	2
Tincture Aconite	12	28	..	40
Tincture Belladonna	17	23	..	40
Tincture Nux Vomica	38	2	..	40
Tincture Opium	38	2	..	40
Turpentine	..	2	..	2
Total	532	461	30	1251
Sampled by Private Individuals	129	112	..	275
Total from all sources	697	625	32	1918

*Including 78 below standard in solids-not-fat only.

III. SPECIAL INVESTIGATIONS.

During the past year the chemical laboratory has undertaken a number of special investigations, all of which are completed. The results of these experiments will be published elsewhere. The following were the projects undertaken:

1. The Carbohydrates and Enzymes of the Soy Bean. (in press in Jour. Ind. and Eng. Chem.)

2. The Feeding Value of Sanatogen compared with Commercial Casein with respect to Maintenance and Growth (published in *Jour. Amer. Med. Asso., Nov. 21, 1914, pp. 1831–35.*)

3. The Comparative Nutritive Value of Cod Liver Oil Cordials and Cod Liver Oil. (The cordials tested were Hagee's, Vinol, Wampole's and Waterbury's Compound). (Published in *Jour. Amer. Med. Asso., Feby. 20, 1915, pp. 638-643.*)

4. The Differentiation of Vegetable Drugs yielding Emodin and Chrysophanic Acid. (*Amer. Jour. Pharmacy, 87, 145*).

5. Methods for determining Phenolphthalein in Medicinal Preparations.

6. Co-operation with the Association of Official Agricultural Chemists in studying methods for determining (a) morphine, (b) the availability of organic nitrogen in fertilizers, and (c) caffeine and antipyrin in admixture.

7. The chief chemist as a member of the Standards Committee of the A. O. A. C. prepared definitions and standards for gluten flour, gluten bread, diabetic foods, asafetida, colocynth, beef wine and iron, and saccharin preparations. Studies on the composition of bread and the moisture content of dried fruits are also under way.

THE EFFECT OF FOOD INSPECTION IN CONNECTICUT.

A Review of Nineteen Annual Inspections.

The first general pure food law in Connecticut went into effect on August 1, 1895. Inspections were made by the Station under this law until January 1, 1908, when the present law, closely resembling the Federal Food and Drugs Act, became operative. Under the first law the Station made frequent inspections of the different classes of foods, and any adulteration or form of illegal sale was reported to the Dairy and Food Commissioner. At times second samples were taken by that official as a basis for prosecution. The Station has, therefore, not only made all the necessary chemical and microscopical analyses for the Dairy and Food Commissioner, but has also conducted many independent inspections. The latter because of their frequency and the way in which they were made, give useful evidence as to the relative purity of the various classes of foods at the time of the different inspections. In these inspections no effort was made to select samples suspected of adulteration, but rather to take from 50 to 100 or more samples from all grades of stores in different parts of the state, and thus gain an idea as to the relative purity of the food in question throughout the state. On the other hand, the samples taken by the Commissioner, except in the case of vinegar and molasses which were collected under special statutes, were usually taken because they were suspected of adulteration, and data secured from such inspections of course do not reflect accurately the general condition of such foods in the markets of the state. The Station has made no independent inspection of butter, analyzing only the samples taken by the Commissioner, but in regard to most other important classes of food products its records supply sufficient data to give a very close approximation of food conditions in Connecticut, and to show whether or not our food laws have had any material effect in improving the quality of our food.

The word "purity" in the following discussion has been used in its strictest sense. Under the law correct labeling of a food in many cases makes its sale legal whereas otherwise it could justly be condemned as adulterated. A jam or jelly, for instance, in which glucose has been largely substituted for granulated sugar, and in which artificial color and flavor have been used, may be legal in this state if the manufacturer has stated these facts clearly

on the label. It would seem to be equally obvious however, that such a jam or jelly is not a "pure" product, if the popular understanding and the practices of the best manufacturers are to have any weight in forming a judgment.

The present Connecticut law is almost identical with the Federal law. Accordingly, any regulations made by the Washington authorities affect the administration of the law in our own state. Whatever may be the attitude of the state authorities towards the governmental sanction of the use in foods of benzoate of soda and certain specified coal-tar colors, it is futile to attempt prosecutions when these extraneous materials are found, as the precedents and the prestige of the government are almost insuperable barriers against the state. By force of governmental regulation, therefore, the use of benzoate and the seven permitted coal-tar colors is unwillingly recognized in this state. In the following discussion only those food products are classed as "pure" which conform to the standards of the national standards committee and to the best trade practice and the term does not include "compounds." It must be clearly understood, however, that lack of "purity," while generally indicating inferiority, does not necessarily carry with it the idea of harmfulness. A pepper containing pepper shells, a buckwheat flour containing wheat flour, a cocoa containing corn starch, or a coffee containing chicory is certainly no more injurious to health than the pure articles, yet its sale without notice of its compound nature is a fraud, and even with such notice on the label it is removed from the category of "pure" food in the following tabulations.

Table I.—Foods Examined 1896–1914.

No. of Samples.	Food	Purity at Last Inspection.	No. of Samples.	Food.	Purity at Last Inspection.
		%			%
206	Allspice	84	318	Carbonated drinks	30
14	Almond extract	57	105	Cheese	98
1	Asparagus, canned	..	2	" head	..
141	Baking powder	83	6	Cherries, Maraschino	0
2	Banana extract	0	49	Chili sauce	50
10	Beans, canned	100	112	Chocolate	88
2	Beets, canned	..	17	Cider	71
101	Biscuits and crackers	..	206	Cinnamon	100
201	Bread	..	173	Cloves	82
64	Breakfast foods	100	166	Cocoa	97
779	Butter and substitutes	..	2	Cocoanut, shredded	..

No. of Samples.	Food.	Purity at Last Inspection.	No. of Samples.	Food	Purity at Last Inspection.
		%			%
28	Codfish	13	3	Milk powders	..
588	Coffee, ground	100	33	Mince meat	90
3	" hygienic	..	3666	Molasses	93
15	" substitutes	..	321	Mustard	94
204	" whole	100	43	" prepared	0
13	Colors and flavors	80	50	Noodles	0
305	Confectionery	73	6	Nutmeg	100
29	Cordials	7	3	Nut oil	..
62	Corn, canned	..	591	Olive oil	86
1	" oil	..	31	Orange extract	60
1	Cotton seed oil	..	95	Oysters	95
407	Cream	90	15	Paprika	80
512	Cream of tartar	93	15	Peanut butter	100
1	Curd	..	1	" oil	..
5	" Dehydro " foods	..	134	Peas, canned	87
32	Dessert preparations	13	1	Pecan nuts	..
336	" Diabetic " foods	..	515	Pepper, black	88
2	Egg powders	..	153	" cayenne	95
192	Eggs	..	147	" white	96
3	Flour, banana	..	18	Peppermint extract	24
270	" buckwheat	66	69	Pickles and relishes	43
1	" potato	..	13	Pineapple extract	0
2	" rye	..	39	Preservatives	..
31	" wheat	..	23	Pumpkin, canned	70
3	"Frostlene"	..	10	Raspberry extract	14
102	Fruits, dried	78	62	Rice	50
104	Fruit juices	36	12	Root beer extract	92
23	Gelatin	86	2	Sage	..
286	Ginger	89	11	Salad dressing	75
37	" extract	22	24	Salt	86
23	Hamburg steak	50	44	Sardines	98
193	Honey	96	21	Sauces, table	95
1	Horse radish	..	420	Sausage	40
155	Ice cream	..	...	Soda Water. See Carbonated drinks	..
28	" " cones	81			
14	" " powders	..	271	Soda water syrup	13
26	Infant foods	..	55	Soups, canned	100
153	Jams and preserves	7	2	Starch, arrowroot	..
133	Jelly	32	28	" corn	100
343	Ketchup	7	2	" potato	..
1	" Konut "	..	1	" tapioca	..
4	" Korno " preparations	..	31	Strawberry extract	0
1031	Lard	90	7	Succotash, canned	..
1	" oil	..	24	Sugar	..
393	Lemon extract	31	10	Syrup	..
22	Liquors, distilled	..	91	Tea	100
54	" malt	74	42	Tomatoes, canned	78
56	Macaroni, vermicelli and spaghetti	95	2	Vanilla crystals	..
			390	" extract	53
4	Mace	..	3271	Vinegar	63
10	Maple sugar	100	1	Wesson's cooking oil	..
167	" syrup	27	5	Wheat bran	100
1	Meat, chopped	..	43	Wine	..
40	" extract	28	12	Wintergreen extract	50
5477	Milk	37	450	Special investigations	..
78	" condensed	89			

The present bulletin summarizes the data secured by the station in its nineteen inspections. Brief reference will also be made to the forms of adulteration observed during that period, and to those forms which still persist.

From 1896 to the present time the annual appropriation granted to the Station by the state for food investigation has been $2,500.

Table I shows the total number of foods, 26,012 samples, examined in this laboratory from 1896 to 1914 inclusive, and the percentage purity shown at the last inspection of each food, of which sufficient samples were taken on which to base a fair judgment. Reference to the tables which follow will show the comparative purity of the various individual classes of foods from inspection to inspection.

Table II.—Dairy Products.

	No. of Samples	Percentage Purity. '96	'97	'98	'00	'01	'02	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14
Butter	779	..	90	59	25	47	66	..	62	24	57	39	40	18	35	45	15	12
Cheese	105	*100	..	..	..	..	*67	..	..	..	..	..	..	..	..	..	..	..
Cream	407	..	..	*88	73	93	80	94	96	92	94	55	..	73	*92	..	69	70
Condensed Milk	78	..	..	..	..	..	..	86	..	38	..	..	89	..	..	..	..	..
Milk	5477	*78	*94	..	*72	*90	*89	*92	*61	*55	70	80	75	72	*37	20	39	47

* Only suspected samples examined, except in the years marked with an asterisk.

Butter being inspected under a special law by the Commissioner, the Station has never made a general inspection of the product. The percentages given in the table, therefore, refer only to suspected samples and give no indication of the actual purity of butter as generally sold. The first inspection of cheese was for foreign fats only, none being found; the inspection of 1902 was for preservatives only in fancy cheeses; an examination of 86 samples of cheddar cheese made during the present year, and not included in the table, showed no filled cheese and only two samples deficient in fat. Cream has been inspected but twice by the Station, both inspections showing a high degree of purity. The last inspection of condensed milk shows a high purity; the inspection

of 1906, being limited to a relatively small number of samples, is hardly comparable with those of 1904 and 1909. The last inspection of market milk made in 1911 shows Connecticut milk still to be in a very unsatisfactory condition; watering, skimming and milk of sub-standard quality are all too prevalent; chemical preservatives, however, are found only in very rare instances at the present time.

TABLE III.—BAKING MATERIALS, FLOUR AND NOODLES.

	No. of Samples	Percentage Purity.						
		'96	'00	'01	'04	'05	'06	'07
Baking Powder	141	..	89	..	83	..	..	..
Cream of Tartar	512	70	69	79	79	90	92	93
Buckwheat Flour	270	..	55	..	57	..	..	66
Noodles	50	..	..	14	0	..	..	..

Baking powder shows no material change in purity; the purity of cream of tartar has increased from 70 to 93 per cent.; that of buckwheat flour from 55 to 66 per cent. At the last inspection of 22 brands of noodles none was found to be genuine egg noodles.

TABLE IV.—SAUCES AND RELISHES.

	No. of Samples	Percentage Purity.								
		'97	'01	'02	'04	'05	'07	'09	'10	'11
Chili Sauce	49	..	11	..	0	..	0	..	..	50
Ketchup	343	15	18	..	0	..	4	..	7	..
Pickles and Relishes	90	..	..	5	..	..	..	43	..	69
Prepared Mustard	43	..	..	..	27	0	..	..	..	..

Chili sauce, pickles and relishes show a marked improvement. Ketchup in 1910 was no purer than it was in 1897, but it was as a rule much more honestly labeled, except as to the amount of benzoate of soda present, which was commonly understated. The last inspection of prepared mustard in 1905 showed all the brands to contain cereal starch, salicylic acid, turmeric or coal-tar colors, the turmeric possibly being a permissible ingredient.

TABLE V.—CHOCOLATE, COCOA AND COFFEE.

	No. of Samples	Percentage Purity.												
		'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'09	'11
Chocolate	112	..	..	..	..	..	..	..	73	..	..	..	70	..	88
Cocoa	166	..	..	..	..	..	..	58	..	..	..	..	90	..	97
Coffee, ground	588	9	13	32	80	80	84	91	70	54	52	74	82	100	..
" whole	204	75	92	84	98	..	..	..	100	..	..	..	..	..	..

Chocolate shows a steady improvement and cocoa a very great increase in purity; the claims for cocoa as regards strength and nutritive value are still very commonly grossly exaggerated. Ground coffee shows the greatest improvement in purity of any of the food products examined, increasing from nine per cent. in 1896 to 100 per cent. in 1909. The last examination of whole coffee made in 1903 showed no adulteration, while in 1896 75 per cent. was impure.

TABLE VI.—CARBONATED DRINKS, FRUIT JUICES AND SODA WATER SYRUPS.

	No. of Samples	Percentage Purity					
		'99	'02	'09	'11	'13	'14
Carbonated Drinks (Soft Drinks)	318	63	41	..	..	31	30
Fruit Juices	104	71	24	67	36	..	..
Soda Water Syrups	271	42	33	..	13	..	..

Carbonated and other bottled temperance drinks, fruit juices and soda water syrups show no improvement in purity compared with 1899. They are, perhaps, more honestly labeled than at that time, but they are still grossly adulterated, glucose, chemical preservatives, synthetic flavors, coal-tar colors and saccharin being frequently present.

TABLE VII.—HONEY, JAM, JELLY, MAPLE SYRUP AND MOLASSES.

	No. of Samples	Percentage Purity.															
		'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'12
Honey	193	22	..	73	..	..	..	..	..	..	..	..	92	..	..	..	96
Jams and Preserves	153	..	..	8	..	..	7	..	..	..	..	..	..	7	..	..	..
Jellies	133	..	..	29	..	..	26	..	..	..	..	..	..	32	..	..	..
Maple Syrup	167	*79	..	..	..	..	..	..	..	..	..	8	39	..	27	..	..
†Molasses	3666	..	68	84	79	85	87	83	96	98	93	99	98	99	..	100	93

* Misleading, as very imperfect methods of examination were used in 1896.
† Not examined for sulphurous acid.

Honey shows a great improvement, from 22 to 96 per cent. purity. Molasses likewise shows an increased purity from 68 to 93 per cent., although it must be remembered that usually it has been tested only for glucose, no examination for sulphurous acid having been made. The first examination of maple syrup is misleading as the methods of analysis used in 1896 were very incomplete and unsatisfactory. Modern methods were used in 1906, 1907 and 1909, and a slight improvement was noted in the last year compared with 1906. The purity of jams, preserves and jellies shows little improvement over 1898, but as pointed out elsewhere these products at the present time are as a rule legally labeled, aside from the amount of preservative present.

TABLE VIII.—FLAVORING EXTRACTS.

	No. of Samples.	Percentage Purity.						
		'01	'05	'06	'07	'08	'09	'10
Lemon	393	20	41	40	52	40	31	..
Orange	31	33	..	..	..	..	..	60
Vanilla	390	30	29	31	51	50	53	..
Miscellaneous	137	5	..	..	..	..	..	24

The condition of flavoring extracts continues to be very unsatisfactory. As a rule they are legally labeled, but the percentage of pure extracts of full standard strength is still very low.

TABLE IX.—SPICES.

Kind.	No. of Samples.	Percentage Purity.									
		'96	'97	'98	'01	'02	'04	'05	'06	'07	'08
Allspice	206	..	54	81	63	97	71	..	98	84	..
Cinnamon	206	..	76	92	79	93	90	..	..	100	..
Cloves	173	..	54	65	76	86	78	..	..	82	..
Ginger	286	..	..	74	84	..	..	100	..	88	89
Mustard	321	22	..	69	55	..	..	88	84	94	..
Pepper, black	515	59	67	86	59	55	55	78	78	88	..
" cayenne	153	..	60	100	85	89	65	..	59	..	..
" white	147	71	80	92	76	96	47	75	87	96	..

The spices sold in Connecticut are as a rule of a very high degree of purity. The average purity has increased from 65 per cent. in 1897 to 90 per cent. in 1907. The increase in purity of mustard from 22 to 94 per cent. is very striking.

TABLE X.—MISCELLANEOUS FOODS.

	No. of Samples.	Percentage Purity.																	
		'96	'97	'98	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14
Codfish	28	..	0	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..
Gelatin	23	..	..	..	..	..	..	..	..	..	..	..	..	63	..	..	..	86	..
Lard	1031	54	..	..	87	..	65	50	..	55	66	77	..	90	..	..	..	..	..
*Mince Meat	33	..	100	100	..	..	..	..	..	..	..	..	..	..	90	..	..	..	..
Olive Oil	591	..	68	..	60	..	..	..	..	65	75	86	..	100	86	..	..	..	..
*Oysters	95	..	80	..	..	..	..	..	..	..	95	..	..	..	..	..	..	..	..
Sausage	483	..	36	26	..	..	..	..	..	..	52	..	..	50	..	..	40	..	..
Vinegar	3271	..	61	63	71	80	85	82	81	..	50	77	62	75	77	48	..	67	63

* Examined for preservatives only.

Lard shows an increase in purity from 54 to 90 per cent., very little adulterated lard being sold in the state at present. Olive oil also has increased in purity from 68 per cent. in 1897 to 100 per cent. in 1906; the slight decrease noted in 1910 was due to the fact that the inspection of that year was limited to drug stores from which the oil was not purchased in original packages, such samples always showing a higher degree of adulteration. Sausage

offers an interesting example of how food conditions in the state have changed. The low percentage of purity in 1897 was due to the very general use of boric acid as a preservative; in 1912 only a slight increase in purity was shown, but boric acid was found in no sample and sulphurous acid in only a few, the adulterant generally being either cereal or potato starch; in other words a harmful chemical preservative had been supplanted by harmless, though commercially objectionable, starches. An examination just completed confirms the continued absence of boric acid in sausage, and shows that the use of sulphurous acid and cereal starches is constantly lessening. Vinegar has shown scarcely any improvement in quality during a period of 18 years.

Summary.

The above data are summarized for the most extensively inspected foods in the following tables. Table XI includes the simpler foods and Table XII those of a more or less compound nature. In the foods of the first group the average purity has increased from 59 to 90 per cent.; in the compound foods the increase has been only from 27 to 34 per cent., but as already pointed out the great majority of these compound foods are so labeled that the intelligent consumer by reading the label may know the quality of the food offered to him.

Table XI.—Average Purity of Simple Foods.

	Inspection. First.	Last.		Inspection. First.	Last.
Cream	88	92	Allspice	54	84
Cream of tartar	70	93	Cinnamon	76	100
Buckwheat flour	55	66	Cloves	54	82
Chocolate	73	88	Ginger	74	89
Cocoa	58	97	Mustard	22	94
Coffee, ground	9	100	Pepper, black	59	88
" whole	75	100	" cayenne	60	95
Honey	22	96	" white	71	96
Molasses	68	93	Vinegar	61	63
Lard	54	90			
Olive Oil	68	86	Average	59	90

Table XII.—Average Purity of Compound Foods.

	Inspection. First.	Last.		Inspection. First.	Last.
Chile sauce	11	50	Maple syrup	8	27
Ketchup	15	7	Lemon extract	20	31
Pickles and relishes	5	69	Orange extract	33	60
Carbonated drinks	63	30	Vanilla extract	30	53
Fruit juices	71	36	Miscellaneous extract	5	24
Soda water syrups	42	13	Sausage	36	40
Jams and preserves	8	7			
Jellies	29	32	Average	27	34

Forms of Food Adulteration Observed in Connecticut, 1896–1914.

Allspice. Clove stems, cocoanut shells, peas and wheat.

Baking Powder. Gypsum, talc and tremolite.

Beer. Salicylic acid.

Buckwheat Flour. Corn starch, oat flour, sand and wheat flour.

Butter. Oleomargarine and renovated butter sold as genuine butter.

Cheese. Boric acid, deficiency in fat, excessive water.

Chocolate. Cane sugar, cocoanut oil, corn starch, potato starch, saccharin and wheat starch.

Cider. Benzoic acid, saccharin and salicylic acid.

Cinnamon. Buckwheat hulls, cocoanut shells, corn starch, cotton seed meal, ginger, mustard hulls, red sandalwood, sand and wheat.

Cloves. Allspice, clove stems, cocoanut shells, nut shells, peas, sand and wheat.

Cocoa. Arrowroot starch, cane sugar, cocoa shells, corn starch, sand and wheat starch.

Codfish. Boric acid.

Coffee. Chicory, imitation coffee, peas and wheat.

Confectionery. Charcoal, coal-tar colors, gelatin and starch.

Cordials. Coal-tar colors and glucose.

Corn Oil. Cotton seed oil.

Cream. Boric acid, formaldehyde, sucrate of lime and water.

Cream of Tartar. Alum, corn starch and gypsum.

Flavoring Extracts. In *almond extract*, hydrocyanic acid and nitrobenzol; in *lemon extract*, coal-tar colors, glycerin, synthetic flavors, turmeric, wood alcohol and deficiency in oil; in *orange extract*, coal-tar colors, synthetic flavors, turmeric and deficiency in oil; in *vanilla extract*, acetanilid, caramel, coumarin, glucose, glycerin and synthetic vanillin and coumarin; in *ginger extract*, capsicum, caramel, glycerin, molasses and deficiency in resins and alcohol; in *miscellaneous extracts*, coal-tar colors and synthetic flavors.

Fruit Juices and Syrups. Alcohol, benzoic acid, coal-tar colors, glucose, salicylic acid, saccharin, sulphurous acid (lime juice) and synthetic flavors.

Fruits, Dried. Glucose (figs), sand (currants) and sulphurous acid.

Ginger. Buckwheat hulls, cayenne, charcoal, cocoanut shells, coffee hulls, corn starch, gypsum, mustard hulls, rice, sawdust, turmeric and wheat starch.

Honey. Glucose and cane sugar.

Ice Cream. Coal-tar colors and synthetic flavors.

Ice Cream Cones. Boric acid and coal-tar colors.

Jams and Jellies. Apple stock, benzoic acid, coal-tar colors, glucose, phosphoric acid, salicylic acid, starch paste, synthetic flavors and tartaric acid.

Jelly Powders. Coal-tar colors and synthetic flavors.

Lard. Beef stearin, cotton seed oil and mineral oil.

Mace. Bombay mace.

Maple Sugar. Cane sugar.

Maple Syrup. Cane sugar, glucose and excessive water.

Maraschino Cherries. Benzoic acid, coal-tar colors and synthetic flavors.

Meat extracts. Salicylic acid, saltpeter and excessive salt.

Milk. Boric acid, color, formaldehyde, skimmed milk and watered milk.

Mince Meat. Benzoic acid and sulphurous acid.

Molasses. Glucose, sulphurous acid and excessive water.

Mustard. Cassava starch, color, corn starch, gypsum, rice, sand, turmeric and wheat starch.

Mustard, Prepared. Benzoic acid, color, salicylic acid, starch and turmeric.

Noodles. Color, turmeric and deficiency in egg.

Olive Oil. Cotton seed oil, peanut oil and sesame oil.

Oysters. Boric acid.

Paprika. Olive oil.

Pepper, Black. Beans, buckwheat hulls, cayenne, charcoal, cocoanut shells, coffee hulls, corn starch, linseed hulls, mustard hulls, nut shells, olive stones, pepper shells, sand, sawdust, turmeric and wheat products.

Pepper, Cayenne. Buckwheat hulls, coal-tar colors, corn starch, gypsum, nut shells, red sandalwood, sand, sawdust, turmeric and wheat products.

Pepper, White. Buckwheat hulls, cassava starch, cayenne, corn starch, gypsum, olive stones, rice, sawdust and wheat products.

Pickles. Alum, benzoic acid, color, glucose, saccharin and salicylic acid.

Rice. Glucose and talc.

Root Beer Extract. Benzoic acid.

Salad Dressing. Benzoic acid, boric acid, coal-tar colors and turmeric.

Salt. Calcium carbonate phosphate and sulphate, magnesium carbonate and chloride, and sodium sulphate.

Sausage and Chopped Meat. Boric acid, coal-tar colors, corn starch, potato starch, sulphurous acid and wheat starch.

Spaghetti. Artificial color.

Table Sauces. (Chili sauce, ketchup, Worcestershire sauce, etc.). Benzoic acid, coal-tar colors, saccharin and salicylic acid.

Tea. Tea fruit.

Temperance Drinks. Alcohol, benzoic acid, boric acid, capsicum (ginger ale), coal-tar colors, glucose, saccharin, salicylic acid and synthetic flavors.

Vegetables, Canned. Copper (peas), sodium fluoride (asparagus), sulphurous acid, tin (peas and pumpkin), and excessive water.

Vinegar. Deficiency in acidity and solids; colored distilled vinegar sold for cider or malt vinegar; use of second pressings and other sugary material.

Present Food Conditions in Connecticut.

Many of the adulterations enumerated above are no longer found in Connecticut foods. Such gross adulterations as imitation whole coffee beans, ground rock in baking powder, chicory and cereals in coffee, and wholesale manipulation of the various spices are rarely, if ever, found in this state at the present time. The present law, moreover, which is essentially an honest labeling law, requires the label to tell the truth, and this requirement is quite generally complied with. Consequently while the percentage purity of our jams, jellies and ketchups, for instance, is scarcely higher than it was 19 years ago, yet with very few exceptions the labels of these products tell the truth and give the consumer full warning as to their real quality.

The following are some of the more important adulterations found at the present time.

Butter. Much oleomargarine and renovated butter is still sold as genuine butter, and there is a decided tendency to incorporate more water in the butter than the standard allows. Unfortunately an Act of Congress permits the coloring of butter, and consequently the dairyman is allowed to sell butter colored to resemble June butter 12 months of the year, while the oleo manufacturer using a similar color must pay a tax of 10 cents per pound for colored oleo.

Confectionery. Glucose is very commonly used wholly or in part for cane sugar; gelatin is used in such candies as marshmallows and jelly beans; the glaze on fudge, burnt almonds and some kinds of chocolates has been found to contain traces of arsenic; charcoal is commonly found in licorice candies, and anise flavoring instead of licorice; occasionally paraffin is found

in caramels and "molasses kisses"; mottoes and the various wafers frequently contain excessive amounts of starch; and coal-tar dyes are very commonly used. Artificial color is rarely used in confectionery for deceptive purposes, and its use can be viewed with more tolerance in candy than in any other food product. The charges made against confectionery, especially of the cheaper sorts, are largely sensational and have little basis of fact. The unsanitary conditions under which candy is often sold, and the excessive consumption of it by young children at inappropriate times calls for much more condemnation than the adulterants occasionally found.

Cream. Cream is sold on an entirely illogical basis. The state standard requires a minimum of 16 per cent. of butter fat. The law makes no distinction between light and heavy cream, and as a result we find creams containing from 16 to 56 per cent. of fat sold at the same price. Chemical preservatives are rarely used, but the Station has frequently found sucrate of lime, or "viscogen," added to give a fictitious appearance of richness to a thin pasteurized cream.

Flavoring extracts. As a rule these are honestly sold, but the consumer must read the extract labels very carefully to avoid being deceived. Tonka bean and synthetic vanillin and coumarin are commonly used in the compound and artificial vanilla extracts, as well as caramel for coloring purposes. Lemon extract is often found below the standard strength of five per cent. of lemon oil, and colored with turmeric or a coal-tar dye. The terms "one-fifth" or "two-fifths standard strength" on the label should always be a warning to the consumer that the product is of inferior quality. The so-called "terpeneless" extracts are widely sold, and generally legally, but they are essentially simply bottled smell and do not have the flavor and body of a genuine lemon extract. Such extracts as banana, pineapple, raspberry and strawberry consist almost always of artificial flavors, although during the last year or two certain manufacturers have put on the market genuine flavors of this class.

Fruit Juices. These are far from being in a satisfactory condition. Benzoic acid, coal-tar colors, glucose and saccharin are widely used. In sweet cider salicylic acid is often found; in grape juice and lime juice, sulphurous acid and excessive water.

Ice Cream. At the present time this term has little meaning

in this state other than referring to the temperature of the product. Samples have been found containing only one or two per cent. of milk fat, while others contained as much as 20 per cent. Gelatin, thickeners, coal-tar colors and artificial flavors are commonly used.

Jams and Jellies. The percentage of pure jams and jellies sold in the state is very small. Glucose is commonly substituted in large measure for cane sugar; apple stock is the predominating ingredient in the cheaper products no matter what the alleged name; benzoate of soda, coal-tar colors and synthetic flavors are still widely used. The labeling of these products, however, usually complies with the law.

Lard. An adulterated lard is seldom found at the present time. Compound lards and lard substitutes, containing beef stearin and cotton seed oil, are still sold, but usually under a correct label.

Maple Syrup. Glucose is seldom found now as an adulterant as it was in the past, but granulated sugar or brown sugar are frequently used; excessive water is also a common adulterant in this product. The compound maple syrups require careful inspection of the label. The words " made from granulated sugar and maple sugar " usually mean that very little maple syrup is present, seldom over 10 per cent. When the word " maple," however, appears first in the descriptive labeling the consumer may be reasonably certain that maple syrup predominates in the compound.

Milk. Milk is still very frequently watered, occasionally skimmed, and rarely both watered and skimmed. This condition will maintain until our courts cease to look upon the pure food law as a joke, and inflict more severe punishments than the ridiculously inadequate fine of one dollar, even this sometimes being remitted. Chemical preservatives, however, are rarely found in Connecticut milk at the present time, formaldehyde being the only preservative detected, and that only four times, in over 2,000 samples in the past eight years.

Mince meat. In this product meat is often present in extremely small amounts, in some brands no meat whatever being used; benzoic acid and sulphurous acid are occasionally found.

Molasses. This is scarcely ever adulterated with glucose at the present time, but excessive water is frequently found, and the practice of " sulphuring " molasses is very prevalent.

Noodles. Eggs, which are an essential ingredient of this food, are often used very sparingly, and at times are entirely absent; the deficiency in eggs is frequently concealed by the use of turmeric or a coal-tar dye.

Olive oil. This product is rarely adulterated in this state, especially when bought in original containers. When the packages have been broken, the Station still continues to find occasional adulteration with cotton seed, peanut and sesame oils.

Pickles. These are generally legally labeled. Benzoic acid is used as a preservative, alum to make the pickles crisp, saccharin as a substitute for cane sugar, and coloring matter to give old cucumbers a fictitious appearance of youth and tenderness.

Sausage. Boric acid as a preservative in sausage has practically ceased to be used in this state, and sulphurous acid is only occasionally found. The use of cereal or potato starch has become a rather common practice, owing to the water-retaining property of the starch, and the manufacturer is thus enabled to obtain a pork price for starch and water. In frankfurts coal-tar colors are frequently found.

Spices. Probably no food product sold in the state shows a higher degree of purity than the spices. When reference is made to the long list of adulterants found by the Station in spices, as given on an earlier page, the striking effect of our pure food legislation is shown. In no state of the Union is the consumer offered purer spices than in Connecticut.

Table sauces. The ketchups and similar table sauces are in a condition very much like that of jams and jellies. While a few pure brands, in the sense of freedom from preservatives and artificial color, are sold, the vast majority are of a compound nature. Benzoate of soda, coal-tar colors and saccharin are widely used, and worst of all the tomato or apple stock used as the base of the ketchups is at times decomposed and moldy, and entirely unfit for human consumption.

Temperance drinks. The bottled "soft" drinks and soda fountain syrups are probably more widely adulterated than any other food product in the state. Coal-tar colors, benzoic acid, saccharin, glucose and artificial flavors are commonly found. Ginger ale is very frequently fortified with capsicum to give the desired "bite." The conditions of manufacture and sale of these very popular beverages often seem quite as objectionable as the ingredients used in their preparation.

Vegetables, canned. This class of products, as a rule, requires only commendation. The use of saccharin and sulphurous acid in corn has practically ceased; sulphate of copper has been forbidden by the government, and no imported "French" peas containing it are now admitted to our ports. The use of the lacquered and "sanitary" can has greatly improved the purity and quality of the canned products. Slack fill, the use of soaked peas and beans and over-mature corn, and excessive added water, especially in tomatoes, offer the chief basis of criticism of canned vegetables at the present time.

Vinegar. Cider vinegar is still frequently adulterated, and much inferior vinegar is sold. On the part of the farmer and small producer this is generally due to defects in manufacture; on the part of the larger manufacturer it is due to the coloring of distilled vinegar with molasses vinegar or an infusion of malt, the addition of acetic acid, or the use of second pressings or other sugar-containing matter.

SUMMARY.

From the above outline of present day adulterations of food it is evident that the millennium of pure food has not yet arrived. We are now rather in the era of legal food, and, while this indicates a distinct forward step, it throws an added burden of responsibility on the consumer. The law requires the label to tell the truth, but if the consumer fails to read the label, or does not understand the label after he has read it, the main protection given to him under the law confers little benefit upon him. A careful reading of many a food label should be sufficient to condemn that food in any well conducted household, and refusal to buy such foods would be even more effective in driving them from our markets than the most drastic legislation. The manufacturer produces only what he can sell, and when the consumer learns to insist that his foods shall not contain chemical preservatives, coal-tar colors, saccharin and other injurious and non-nutritious ingredients, the manufacture of foods of this class will certainly cease.

Generally speaking, therefore, most of our food products show

a gratifying increase in purity. The problem of the future will be in part the insistence that legal food shall also be pure food, but even more the requirement that all of our food shall be made from good, sound raw material and that the manufacture, sale and handling of our foods shall be conducted in a sanitary manner.

CORRECTION.

The first line on p. 235 of this report should be transferred to p. 234, first line.

PART VI.

REPORT OF THE BOTANIST FOR 1914.

G. P. CLINTON.

CHLOROSIS OF PLANTS WITH SPECIAL REFERENCE TO CALICO OF TOBACCO.

CHLOROSIS TROUBLES IN GENERAL.

Definition. Chlorosis as considered here is that unusual state of a green plant in which the chlorophyll, through either diseased or limited development, does not possess its normal bright green color, but becomes lighter, yellowish-green, or even distinctly yellowish or whitish. In extreme cases, the leaf even loses its yellow tint, and becomes a pure white, when the term albinosis or albinism is applied.

Chlorosis may show as a general yellowing of the leaves from lack of sufficient sunlight or various other causes. It is not, however, such types that we wish particularly to discuss in this article, but rather the more unusual and abnormal mottling or variegation whereby greenish, yellowish, or whitish spots are scattered indefinitely over the leaves in the normal green tissue, or occur in rather constant and definitely placed areas, bands or borders.

The Century dictionary describes chlorosis as follows:—"Etiolation. The term is sometimes limited to the blanching which occasionally occurs in plants from lack of iron, an element which is found to be essential to the formation and green color of chlorophyll granules." Cowles (Textbook of Botany, p. 523) gives a somewhat similar definition:—"Iron salts and nitrates are regarded as favorable for chlorophyll development, whitening due to lack of iron being called chlorosis."

The Century's definition of variegation agrees more nearly with the type of chlorosis considered here, and is as follows:—"A condition of plants in which the leaves become partially white or of a very light color from suppression or modification of the

chlorophyll. Plants showing this unnatural condition may be otherwise quite healthy, and are often prized on account of their peculiar appearance. The cause is not well known. It sometimes occurs in a single branch of a tree, and may be thence propagated by grafting. As a permanent and often congenital peculiarity it is to be distinguished from chlorosis."

In common with Baur and other writers, however, we have taken the term chlorosis in a more general sense, covering all of these variations, rather than limited, as in the above definitions, to a uniform diminution of chlorophyll throughout the tissues.

Types—Variegation. One of the most common types of chlorosis is that met with in the so-called "variegated" plants, when limited to those forms which merely show a variation from the normal green through direct modification of the chlorophyll, (exclusive of those where it is merely obscured by other coloring matter, etc.), and are known as horticultural varieties of the normal species, such as *variegata, alba, aurea,* "golden," etc.

We have made a cursory study of many of these plants from the rather extensive collections in a local nursery. The plants as a whole do not have a sickly look, appearing almost as vigorous as the normal green specimens. Under unfavorable conditions, however, such as drought and cold, they do not usually survive in as good shape. Ordinarily these plants are propagated by cuttings, etc., and usually come true to type, though a certain percentage, especially of some forms, may revert to the normally green condition. A few reproduce the variegations through their seed, though this method is much less reliable.

Most of these varieties have originated from cuttings made from abnormal branches or plants, and have appeared suddenly for no particular reason as far as ordinary observation could detect. We have in mind a variegated Japanese barberry, that appeared as a single seedling in the New Haven City nursery, which the superintendent, Mr. Amrhyn, has propagated by cuttings. The leaves show blotches of yellowish or whitish-green, and less frequently of a reddish color. Some years ago we found in the Elm City Nursery a plant of *Elaeagnus umbellata* that had a single branch with the leaves irregularly blotched with light to whitish-green. A cutting from this showed somewhat similar markings on some of the new leaves during the year or two when the plant was under observation.

Baur (5–7) of Germany, among recent investigators, has thrown the most light on the nature of such variegations. He found that certain of these were propagated through cuttings and grafts, while certain others were not only so propagated, but had the power to transfer their peculiarity to the new growth of the normal stock or cion with which they were united. So he distinguishes two forms of chlorosis, namely, non-infectious and infectious.

Among the many vines and shrubs which show chlorosis, chiefly of the variegated type, and apparently of non-infectious form, may be mentioned the following: Golden elderberry, *Sambucus canadensis aurea,* with the normal green of the leaves more or less replaced by a golden-yellow or yellow-green color (see Plate XXVI a); variegated elderberry *Sambucus* sp., with leaves more or less irregularly mottled with white; *Euonymus radicans variegata,* with a variable band of white around the margin of the leaves; *Hibiscus syriacus variegata,* with a narrow whitish border around margin of leaves, and some light spotting in the interior; *Spiraea bumalda* (a Japanese variety) with some of the small axillary shoots quite abnormal, having golden-yellow, sickly looking leaves; *Diervilla rosea variegata,* quite variable, with leaves having a wide, irregular, light or greenish-yellow border.

Examples among trees are perhaps not so numerous, but are fully as striking. A number of our ordinary cultivated species are now represented by variegated or aurea types, of which the following are examples: Golden-leaf English elm, *Ulmus campestris* var. (Plate XXV b), with most of the leaves thickly speckled with small whitish or light greenish spots, or sometimes with larger, irregular mottled areas of normal green, light suppressed green, and pure white, usually limited by the veins; Variegated Sycamore maple, *Acer pseudoplatanus,* with large whitish areas, the green mottled with lighter spots (Plate XXV a); Golden Box Elder, *Negundo aceroides* var. (Plate XXV c), with a yellowish or whitish band occupying a wide, but quite variable area around the margin of the leaf, the normal green being limited to the center, usually surrounding the midribs, and often separated in places from the whitish area by a lighter submerged green. A variegation similar to the last appeared on one of the branches of a seedling in our forest nursery some years ago, and

no doubt this variety was originally obtained by such a chance development being propagated through grafts.

Among herbaceous perennials, we have examples of similar variegation in the grasses, such as *Miscanthus sinensis zebrina*, with bands of yellowish-white crosswise of the leaves, and our more common ribbon grass, *Phalaris arundinacea*, with white stripes lengthwise of the leaves. Among greenhouse plants, there is *Vinca major variegata*, frequently used in hanging baskets, having leaves with a wide marginal band of a whitish or yellowish color. Among annual plants, where such abnormalities have to be propagated through the seed, the examples are apparently not so numerous. One of the best is the Variegated Queen variety of nasturtiums, the leaves having irregular areas of green, yellow and white.

Types.—Injuries. Where such peculiarities of foliage appear on ornamental plants, they are considered as adding to the beauty or variety of the plant, and are carefully preserved for further distribution. When, however, the same kind or very similar leaves appear on food plants, they are considered in their true light, as an injured or diseased condition of the plant, which is liable to cause decrease of vigor and production. Sometimes it is rather difficult to determine this decrease, but in other cases it becomes very noticeable, especially in perennial plants.

There are a great many of these chlorosis troubles that appear rarely on individual plants or leaves. These are of no especial importance save from a scientific point of view. During the past few years we have observed a number of these, and it is usually difficult or impossible to explain their occurrence. One occasionally finds on apple trees a small branch with leaves that, for no visible reason, show narrow white areas in the neighborhood of the veins. Not infrequently the common species of clover show yellowish-green irregular areas. Individual stunted plants of corn sometimes have white or longitudinally striped leaves. In deeply shaded places, single leaves or branches of various plants often exhibit unusual variegations.

Previous to defoliation in fall, many trees develop chlorosis of various types, more or less intimately associated with early frosts. Ferns sometimes also exhibit somewhat similar peculiarities. Late spring frosts often produce white spots where the chlorophyll has been entirely obliterated, on young garden plants

(Plate XXVIII c-d) set out too early or accidentally exposed in greenhouses or hotbeds.

A few years ago there were brought to our office for examination leaves of a palm which the owner said had been injured by frost, where a window had been carelessly left open, and on these leaves there was a peculiar mottling of lighter yellowish-green which he said was an exact reproduction of the pattern of the rug in the room. We cannot conceive of such a relationship, though there may have been some connection between this injury and the shading of lace window curtains.

Types—Diseases. We also have types where the chlorosis is so general on the plants, appearing in succeeding new foliage and in perennials usually from year to year, that it can be considered as a disease, and frequently receives a distinct name more or less descriptive of the abnormal condition.

Yellows of raspberry is one of these diseases in which the leaves of the infected plants have an irregular yellowish and green mottled appearance, and are frequently crinkled. The plants gradually decline, decrease in productiveness, and usually die under unfavorable conditions. New shoots are affected, so that the trouble is perpetuated in the plantation, or may be carried into new ones. No remedy is known and very little information concerning the nature of this disease is available, except that it is considered physiological. See Plate XXVI c.

Peach yellows is another disease common in this state. For several years it may be quite abundant, and then gradually decrease. It begins with yellowish foliage, premature and highly colored fruit, and there follows a general decline and death of the trees after a few years. It can be propagated through the buds, and can be thus inoculated into a perfectly healthy tree. In this respect it very much resembles infectious chlorosis of Abutilon and other ornamental shrubs, as described by Baur (5).

Another type of disease, differing from the preceding in that it is communicable by juice from the infected plants, is the calico or mosaic disease of tobacco, tomatoes, etc. So far as we know, this is, with the possible exception of a similar disease of pokeweed, the only disease that can be communicated to healthy growing plants merely by touching their leaves with juice from a diseased plant on the hands. In this disease, which will be fully treated later on, the chief characteristic is a yellowish-green mottling of the leaves. See Plate XXX.

We have occasionally found in greenhouses a disease of sweet peas which resembled that of tobacco, though this plant belongs to an entirely different family. We have made no study of this, but it is evidently the mosaic disease described by Taubenhaus (29) who considers it identical with that of tobacco, although he apparently made no experiments to cross-inoculate them. He did, however, show that the disease could be transferred to healthy vines by aphids, or by a needle pricked first into the diseased leaves and then into the healthy ones.

In 1914 we found at Meriden, a disease of pokeweed (Plate XXVIII a), growing in a moist place. This so nearly resembled the calico of tobacco that we tried to produce the disease by placing crushed, moistened tissues of the pokeweed on tobacco (see Exper. No. 256) without very evident results. In a previous experiment with calicoed tobacco juice on pokeweed (No. 167) we also failed to obtain infection. Allard (2), however, recently described a mosaic disease of pokeweed similar to this that was infectious on healthy pokeweed, though not on tobacco, nor was the tobacco mosaic infectious on pokeweed.

Very similar in appearance to these mosaic diseases are various chlorosis troubles that appear more or less commonly on a variety of cultivated plants. We have noted such troubles briefly in previous Station reports (9) on cultivated Lima and string beans (Plate XXVIII b), muskmelon (Plate XXVII a), and squash. While some of these troubles are scarcely to be distinguished in their effect on the leaves from the calico of tobacco, we have never been able to transfer them to other plants through the juice, or to infect such plants from the juice of calicoed tobacco.

Classification. From the data given in the preceding discussion we may conveniently classify the different types of chlorosis according to their methods of perpetuation, as follows:—

I. Infectious chlorosis:
  (A) Communicable through the juice.
  (B) Communicable through the tissues,
    (a) By buds.
    (b) By grafts.

II. Non-infectious chlorosis:
  (A) Non-perpetuating,
    (a) Affecting plants generally.
    (b) Affecting isolated leaves or branches.
  (B) Perpetuating,
    (a) Through seeds.
    (b) Through cuttings.
    (c) Through buds or grafts.

Nature. All types of chlorosis have at least this feature in common, namely, that the trouble centers in the chlorophyll, or green coloring of the leaf. Very frequently, especially where the chlorosis is of the mosaic or variegated type, it seems to start in the very young tissues, and not after the leaves are fully grown. The work of chlorophyll is well known; under the stimulus of sunlight it elaborates out of inorganic material the carbohydrates so essential both to plant and animal nutrition. The nature of chlorophyll, however, is not so well understood. It is a coloring matter contained in the higher plants in definite, roundish, microscopic, protoplasmic bodies called chloroplasts, situated within certain cells of the leaves and sometimes in exposed cells of the stem. Concerning it, Barnes (Textbook of Botany, p. 367) writes "The yellow-green pigment is called chlorophyll, but it is not a single substance. Several pigments can be separated more or less completely, of which only two are abundant and constant in all higher plants, the one bluish-green and the other pale yellow. The names applied to these are confusing. To distinguish them we shall employ the terms *chlorophyllin* and *carotin*. To the bluish-green one no distinctive term has been generally applied, but it has usually been called chlorophyll (not distinguishing it from the combination) or chlorophyll proper. For the yellow one, *xanthophyll*, *etiolin* and *carotin* have been used. The last is preferable. * * * Etiolin was applied to the pale yellow pigment which appears when plants have been 'etiolated' by being grown or kept for a time in darkness. * * * Chlorophyllin and carotin may be partially separated by their unequal solubilities."

The New International Encyclopoedia states under "chlorophyll": "The chemical nature of chlorophyll is not satisfactorily known. It is a complex and exceedingly unstable nitrogenous carbon compound, probably not containing iron, as once believed. Attempts to analyze result in so complex a series of decomposition products that it is difficult to draw any conclusions. * * * Chlorophyll is chemically related to haemoglobin, the red coloring matter of the blood."

From the preceding statements it can be seen that chlorophyll

is a very important element in plant nutrition, and anything that disturbs or destroys it acts on the general vigor and health of the plant. In most chlorosis troubles the tissues assume a yellowish-green or yellowish appearance; to the writer this indicates that the chlorophyllin in the pigment has been lessened or destroyed, thus allowing the carotin, or yellowish pigment, to give color to the tissues. In cases where the tissues are white, the carotin has also been destroyed; and in those varying from yellowish to whitish its amount is less than normal. Only rarely have we seen examples which seemed to indicate that the carotin was affected sooner than the chlorophyllin, as illustrated in calico of tobacco in a very young state when the affected tissues had a deeper or bluer green than the normal tissues, but later changed into the typical yellowish-green.

Causes. There are apparently a variety of causes that will produce chlorosis, but it is sometimes difficult to determine exactly the particular cause. It is now considered by some investigators that infectious chlorosis troubles are connected in some way with disturbed enzymic activities of the cells, either through the presence of abnormal enzyms or excessive amounts of those normally present; or by their activities being interfered with by the presence of toxins. Sorauer (Handb. Pflanzekrank. **1**:308) considers the non-inheritable and non-infectious types due to improper nutrition or to injurious physical conditions, and the inheritable and infectious ones as probably due to enzymic disturbances. To our mind, if these inheritable and infectious diseases are enzymic, it does not preclude the possibility that they may have been due originally to outside causes no longer directly responsible.

We have seen cases where drought undoubtedly caused yellowing of the leaves, as in peaches, pigweed, etc. Again, lack of sufficient light or improper fertilization often appears to produce a general chlorosis of the plant. Likewise, insufficient aeration of the roots in water-soaked soil may have a similar effect. Smith (Cal. Agr. Exp. Stat. Bull. 218:1139) states that mottled leaf of orange is "due to an irregular supply of moisture and plant food." Orton (Journ. Agr. Res. **3**:174) describes the pecan rosette as a chlorotic disease which, as indicated by the evidence "is caused by improper nutritive supply, and it seems probable that it is directly related to a lack of balance between two or more soil ingredients."

Frost is a very common cause of non-infectious chlorosis in which the chlorophyll is locally killed in areas that later show white. We have observed a number of such cases in which there is no question that frost was responsible. Plate XXVIII c-d shows examples of this type of trouble in young cabbage and parsley leaves. In the case of the latter, plants kept under observation for some time afterward showed no indication of the trouble in the leaves which developed later. This seems to be the usual outcome in such cases.

Chlorosis troubles may be caused by local injury by insects, as in the case of stigmonose of carnations by aphids, as mentioned by Woods. Curly top of beets, sometimes classed with chlorosis troubles, is another example of disease caused by insects. Fungi may sometimes cause a chlorotic effect, as in the case of orange rust of blackberry (Plate XXVI b) when the mycelium does not mature the fruiting stage in the infected leaves; a condition almost identical with the so-called yellows of raspberry (Plate XXVI c). Repeated pruning, through starvation of new growth, may cause a chlorosis, such as the dwarf mulberry disease of Japan.

Gas leaks in the soil around trees also produce troubles somewhat similar in nature. Spraying muskmelons with Bordeaux mixture sometimes causes a chlorosis of certain of the leaves (Plate XXVII b) which is scarcely to be distinguished from a similar trouble (Plate XXVII a) of unknown origin, which occasionally occurs on the whole vine.

CALICO OR MOSAIC DISEASE OF TOBACCO.

Nomenclature. This disease of tobacco has received here, as elsewhere, a variety of names, such as " mosaic disease," " Frenching," " brindle," " mongrel," and " gray top," which are in part descriptive of certain stages or supposed differences. The term " calico " is the one by which it is most generally known in Connecticut. Mosaic disease, however, is the name that elsewhere seems to have the most general recognition.

Character. Calico always develops in the very young leaves, and when once strongly showing in a leaf, it seems to be permanent, and to appear in all the new growth, or at least in that which starts above the leaves first infected. The disease shows as lighter, or yellowish-green, irregular areas of varying extent, that mottle the leaves, the normally green tissues as a rule occurring in the neighborhood of the veins (Plate XXX b). Rarely

in very young leaves, we have seen these calicoed areas where they seemed to have a deeper or bluish-green color.

As stated under the discussion of chlorosis in general, this abnormal color is due to a diseased condition or a scarcity of chlorophyll, the green coloring matter in the chloroplasts. Woods (32) says: "That the disease is not primarily of the chloroplasts, as Beijerinck thought, is evident from the fact that in the less pronounced cases the chloroplasts, though fewer in number, are not decreased in size or activity. * * * In some pronounced cases the chloroplasts are light colored or wholly without color." He also found that the cells of the healthy and diseased areas in the leaves differed as follows: "In the latter, in the less pronounced cases of the disease, there is a shortening and broadening of the palisade parenchyma cells, and in the more pronounced cases there is an entire suppression of these cells, so that on simply looking across the surface of the leaf depressions are seen where the light areas occur, and apparently blister-like development in the green area."

Usually the calicoed leaves are more crinkled than the normal, due to the uneven growth of the tissues in the diseased and healthy spots. Ordinarily the shape of the leaves is not changed to any great extent, but they are probably reduced somewhat in size. Occasionally the leaves become somewhat misshapen, chiefly by irregular development at the margin. Rarely strap-shaped leaves (Plate XXX a) are developed, though these are not confined to calicoed plants.

Infected plants average smaller than perfectly healthy ones (Plate XXXII a), the difference varying from a few inches to two or three feet. Certain species of tobacco, such as *Nicotiana rustica scabra* (Plate XXXII b) showed in our experiments a decided dwarfing of plants infected soon after being set out.

Allard (2) has described a peculiar color blotching of the blossoms of calicoed plants. We have noticed this somewhat in the Havana, but in Broadleaf have found little difference evident in the blossoms of healthy and calicoed plants. According to our limited observations, the blossoms on calicoed plants of *Nicotiana forgetiana* seemed to have a deeper red color than on those not calicoed.

A serious leaf injury known locally as "rust" (Plate XXXI b-c) often occurs on the older calicoed leaves. It shows as small,

roundish, reddish-brown spots of dead tissue, more or less thickly covering the leaves; sometimes these merge into large irregular areas, resembling sun scorch injury of other plants. This is probably the same trouble described by various European writers as "pockenkrankheit," ascribed by some to bacteria. In this state rust is not a necessary accompaniment of calico, but rarely if ever occurs except on leaves showing calico or signs of suppressed calico. We believe that it is of the nature of sun scorch, since it usually occurs in bright, hot weather, suddenly following a rainy or cloudy period, and that it develops on the calicoed leaves because of their weakened condition.

Another trouble, not nearly so serious, and occurring on both healthy and calicoed plants, is the "white spot" (Plate XXXI a) which, as the name indicates, shows as white spots of rather small size scattered over the leaves. The cause of this is not definitely known. It may be the same as the "taches blanches" of Delacroix, which he considered a bacterial trouble. We have always thought that white spot might be an injury due to insect punctures, although we have no definite evidence along this line.

Hosts. Calico occurs in Connecticut not only in the tobacco, but also less frequently in the tomato fields. As first shown by us (9), this disease is readily transferred from one host to the other (Plate XXIX b). A mosaic trouble occasionally found here on sweet peas has apparently been proved by Taubenhaus (29) to be the same or a similar disease. By infection experiments we have also produced this disease on a number of different species of tobacco and a few related plants (see Conclusions, Nos. 24–25), but we have not found it on these otherwise. Orton (Phytopath. **3:** 69) and Melchers (23) report its occurrence on potatoes, but we have never seen it in our potato fields, and have never succeeded in producing it on the vines, though we did once succeed in infecting a greenhouse seedling.

Prevalence. Calico has probably been present in Connecticut tobacco fields for a long time, though first reported in 1898 by Sturgis (27). Calico in tomato fields was first reported by the writer (9) in 1907. The disease, while not so prevalent on the latter host, seems to be on the increase.

It is difficult to estimate the percentage of infected tobacco plants, since this varies in different fields and from year to year. Counts (see Table VI) made some years ago in twenty-four differ-

ent fields showed 2,343 plants calicoed out of 18,044, or 13 per cent. This is probably too high an average for the state, as several fields included in these counts were calicoed to an unusual degree.

Injury. We have never tried to estimate the injury to tomato plants from this disease, though last year it was so common in the Station field that it must have caused some injury which was not very evident from a superficial examination. Norton (Phytopath. **4:** 398) states that in the greenhouse healthy plants set 33 per cent. more fruit than the calicoed.

With tobacco we have shown (Table VII) that calicoed plants averaged considerably less in height than the healthy (Plate XXXII a), and this must result in a decreased yield of leaves. How much this decreased yield would average per plant cannot be stated; however, the loss in yield is not the chief injury caused, since calico is generally regarded as greatly affecting the quality of the leaves, and buyers frequently cut the price if they find that the crop contains a considerable percentage of calico. As a result, growers sometimes pull up calicoed plants, preferring to lose them outright rather than run the risk of a possible reduction in price. We know of cases where calico was so serious that the growers estimated the damage as amounting to several hundred dollars.

Distribution. Calico occurs in all tobacco regions not only in this country, but apparently all over the world where it is grown; at least, it has long been known in various European countries, and has been reported in the tobacco fields of the East and West Indies, Asia and Africa, and elsewhere.

Literature. Sturgis (27) of this Station was the first investigator in America to discuss calico, and he conducted later (28) a few experiments for its prevention by liming. Loew (21) soon after made observations on the nature and causes of the disease. Important papers by Woods (31 and 32) also appeared about this time, in which he propounded his oxidase-enzym theory, and gave the results of his observations and experiments. More recently, Selby (25), Allard (1–4), Chapman (8), the writer (9), and others, have published the results of investigations.

However, calico was first discussed by investigators of Europe, and much of our knowledge concerning it is due to them. Among the more prominent of these we may mention Mayer (22), who in 1885 made the first important contribution on this subject,

Iwanowski (17 and 18), Beijerinck, Koning, Hunger (15 and 16), Delacroix (10 and 11), and Westerdijk (30). We give at the end of this article references to their work and that of others, with brief abstracts, so that it will not be necessary to further discuss the subject here, except in relation to theories advanced as to cause.

Theories. Concerning the cause of calico of tobacco there have been many theories advanced. These have ranged from that considering it as a purely physiological, non-infectious trouble to those claiming it as a highly infectious germ or enzymic disease. Evidence has now clearly shown that it is infectious, though there is still much difference of opinion whether or not germs, enzyms or toxins are responsible. Further data concerning these theories are given under the abstracts of literature. Recently rather full bibliographies and discussions of these theories have been published by Melchers (23) and Allard (4).

Among recent American writers Allard (3) and Flexner (12) favor the germ theory. Except for its infectious nature, there is no evidence that calico is a bacterial or similar disease, but the possibility of ultra-microscopic organisms has been made to apply here. Also the discovery of various filterable viruses, such as that of infantile paralysis, by Flexner, and the discovery of bacteria as the cause of crown gall, by Smith and Townsend, have been advanced as favoring a germ theory for this disease.

Taubenhaus (29) is another recent writer who favors this theory or a modification of it. He writes: "In my investigations, repeated trials failed to reveal the presence of either fungus or bacteria in culture. Nevertheless, I do not believe with Woods that the disease is physiological and enzymic. I strongly believe the trouble to be either bacterial or protozoic, and the pathogenic nature of the disease strongly points to this conclusion. That all attempts to obtain a living micro-organism in pure culture have failed does not argue against the possibility of its being either bacteria or protozoa, but simply that our present cultural or filtering methods are not suitable for its detection or retention."

On the other hand, Chapman (8), who has been making a special chemical study of the subject, has recently come out clearly in favor of Woods' (32) enzymic theory of the disease. In the review of his recent short article on calico he says: "Mosaic, 'brindle,' 'calico' or 'mottled top' of tobacco is a physiological

disease purely, and has no fungous or bacterial origin. It is caused by the excessive activity of the oxidase and peroxidase enzyms in the plant and the partial loss of function of catalase, another enzym, which carries off some of the residual products of the others mentioned. It is not due to one enzym alone, or to any specialized virus." He also states that in a future paper more detailed information will be given. As yet we have not seen this paper.

Our personal observations and experiments lead us to believe with Woods and Chapman that the disease is in some way bound up with a local disturbance of the enzymic activities of the affected cells, and that the disturbing enzym or enzyms are infectious and capable of re-creation in the young tissues. For more detailed statements, see Nos. 30 to 36 of our Conclusions given later.

EXPERIMENTS WITH CALICO OF TOBACCO, ETC.

In the following paragraphs we give details of numerous experiments and observations, chiefly with calico of tobacco, carried on by us during the past nine years. During the last few years we have been under obligations for help in carrying these out to our assistant Mr. Stoddard.

In 1906, E. S. Hale Farm, Portland.

Exp. 1. June 10, calicoed leaves were crushed in hand, and young upper leaves of 50 half grown field plants were rubbed lightly, leaving pieces of crushed calicoed leaf on each. July 30, when examined again, every one of the plants had developed conspicuous cases of calico in the upper leaves. Plants began to show calico within two weeks after touching, according to Mr. Hale. Plants dwarfed somewhat. Calicoed, 100%.

Exp. 2. Check to No. 1, no treatment. At the other end of this row, out of 50 plants examined July 30, only 4 showed calico. Calicoed, 8 %.

Exp. 3. July 30, upper fully grown leaves of 6 topped plants were touched after crushing calicoed leaves in hand. Plants harvested twenty-one days later showed no signs of calico on main leaves, according to Mr. Hale. Calicoed, 0%.

Exp. 4. Check to No. 3. Another man, with no calico juice on his hands, touched 6 similar plants at the same time. No calico developed. Calicoed, 0%.

In 1907, Experiment Station Farm, Centerville.

Exp. 5. July 1, 152 plants were set out (plants in Nos. 6–27 were also set at this time) that had been watered several times by Mr. Hale while in the seedbed at Portland with tobacco water from calicoed last year stems. This is a treatment sometimes given in order to kill angle worms. At the time of pulling only half a dozen plants showed calico in the seedbed, and only one of those transplanted showed it. July 20, no calico showing yet. July 30, 80 plants, or 53%, showed calico. Aug. 5, 96 plants, or 63%, calicoed. Aug. 14, 106 plants, or 70%, showed some signs of calico. Aug. 26, 109 plants, or 72%, calicoed. Sept. 10, 111 plants, or 73%, calicoed. Of these, 66 were very badly, 29 moderately, and 16 slightly, calicoed.

Exp. 6. Check to No. 5. These were 75 plants from the same seedbed not watered with tobacco water. Examined July 20 and 30, Aug. 5, 8, 14, 26, and no calico found on any of them. On Aug. 26 some of these were used for other calico experiments, but 43 left for checks, and of these on Sept. 10, only 2 showed slight signs of calico, and 1 considerable calico, or 7% calicoed, as compared with 73% in Experiment 5.

Exp. 7. Aug. 5. The leaves of every other one of 20 plants, eight to twenty inches high were pulled through hands containing calico juice. Experiment made at 5:00 P. M. on a cloudy day. Aug. 14, one plant calicoed; Aug. 23, all plants showed calico on upper leaves; Sept. 10, all badly calicoed. Calicoed, 1st exam., 10%; last exam., 100%.

Exp. 8. Check to No. 7, treatment same except leaves of the odd numbered plants were pulled through hands containing no calico juice. Aug. 14, and 23, 1 plant calicoed. Sept. 10, 5 out of the 10 calicoed, 3 slightly and 2 badly; Sept. 25, 2 free, 5 slightly, and 3 badly calicoed. The calicoed plant of Aug. 14th was probably an outside infection, and from it more or less of the subsequent infection may have followed. Calicoed, 1st exam., 10%, last exam., 80%.

Exp. 9. Aug. 8, treatment same as in No. 7, made with 10 alternate plants, at 4:00 P. M. of a bright day. Aug. 23, all plants showed calico in upper leaves. Sept. 10, all badly calicoed. Calicoed, 1st and last exam., 100%.

Exp. 10. Check to No. 9, with treatment same as in No. 8. Aug. 23, none of the plants calicoed. Sept. 10, 3 out of the 10 slightly calicoed. Sept. 25, 5 free, 4 slightly, and 1 badly calicoed. Calicoed, 1st exam., 0%; last exam., 50%.

Exp. 11. Checks, 15 plants with no treatment whatever. Aug. 28, no calico; Sept. 25, 10 plants with no, and 5 with little calico. Calicoed, 1st exam., 0%; last exam., 33%.

Exp. 12. Aug. 14, water in which had been crushed fresh calicoed tobacco leaves (soaked in minimum of water for a few minutes) was poured over 7 plants. Aug. 23, slight indications of calico appearing; Sept. 10 and 25, all showed calico on upper leaves. Calicoed, last exam., 100%.

Exp. 13. Check to No. 12. Pure water was poured over 7 plants. Sept. 25, only one plant calicoed (apparently accidentally). Calicoed, 14%.

Exp. 14. Aug. 14, leaves of 12 plants about two feet high were rubbed with calico juice on hands, touching (a) upper young leaves of 6, and (b) lower mature leaves of the other 6. Aug. 23, calico began to show on young leaves of some plants. Aug. 28, all plants showed calico on young upper leaves, but none on old lower leaves. Plants where young leaves were touched showed the calico somewhat more prominently than those where old leaves were touched. Sept. 10, upper leaves of all plants badly calicoed, but those where young leaves had been touched averaged about eleven calicoed leaves to a plant, and those where old leaves were touched, about seven. Calicoed, last exam., 100%.

Exp. 15. Aug. 26, a calicoed tobacco leaf was placed on each of 10 plants, without otherwise touching them. Sept. 10, 5 plants showed signs of calico, though very evident only on one. Sept. 25, same as before, but calico now evident on 5 plants. Calicoed, 1st and last exam., 50%.

Exp. 16. Aug. 26, young calicoed leaves were drawn across young leaves of 10 tobacco plants, without touching plants. For first 5 plants unbruised leaves were used, and for second 5, leaves somewhat bruised. Sept. 5, only 1 of first 5 showed calico, while all 5 of second lot showed it. Sept. 25, same as Sept. 5, but more evident. Calicoed, 1st and last exam., 60%.

Exp. 17. Aug. 26, same as No. 16, except old calicoed leaves showing rust stage were used on 10 plants. Sept. 10, all but one of first 5 showed calico, and all of second 5. Sept. 25, same as before, but more advanced. Calicoed, 1st and last exam., 90%.

Exp. 18. Aug. 26, crushed calicoed tobacco leaves were soaked for one hour in ether, and the mixture poured on leaves of 5 tobacco plants. On contact with the ether, the tissues immediately turned blue-green and then brown, showing serious injury. Sept. 25, no signs of calico. Injured tissues dropped out. Calicoed, 0%.

Exp. 19. Check to No. 18, pure ether was poured over leaves of 5 plants. Sept. 25, no calico, injury by ether same as in No. 18.

Exp. 20. Aug. 28, using atomizer, leaves of 5 plants were sprayed with strained juice from crushed calicoed leaves soaked twenty-four hours in ether. Sept. 25, no calico.

Exp. 21. Aug. 28, juice from crushed young calicoed leaves soaked twenty-four hours in water, strained, and sterilized one-half hour in autoclave, was poured on young leaves of 8 plants. Sept. 25, no calico.

Exp. 22. Check to No. 21, treatment same, except calicoed juice not sterilized used on 8 plants. Sept. 25, 4 showed calico, or 50%.

Exp. 23. Aug. 28, same as No. 22, but juice poured only on old lower leaves of 2 plants. Sept. 25, neither showed calico.

Exp. 24. Sept. 4, tobacco worm taken from calicoed plant was placed on a healthy one. It squirted juice on the leaves, but probably did not stay long on the plant, as it was replaced once or twice. Sept. 25, showed no calico.

Exp. 25. Sept. 6, 5 plants were topped by cutting off with a knife which, each time before using, was cut through a calicoed leaf. Sept. 25, calico showed in suckers of all except one, which was broken at base when topped. Calicoed, 80%.

Exp. 26. Check to No. 25. Treatment the same, except that knife was not used on calicoed tobacco, and was thoroughly wiped each time before topping the 5 plants. Sept. 25, calico showed in none of the suckers, except on one plant, a leaf of which had been broken by a calicoed plant leaning against it. Calicoed, 20%.

Exp. 27. Sept. 10, a short slit was cut in top of stem of 5 plants, after using knife each time to cut through a calicoed plant. Sept. 25, calico showed in only 1 plant, or 20%.

In 1907–08, Station Greenhouse, New Haven.

Exp. 28. Nov. 11, tomato plant was touched after crushing fresh leaves of calicoed tobacco in hands. Nov. 25, young leaves and stems showed elongated, irregular, discolored streaks or burns, like a bacterial disease, but no true calico-like appearance. Check plants showed no similar trouble. Jan. 8, plant dead of wilt, but before dying, some leaves showed signs of true calico. The bacterial-like burn of the leaves, however, was the conspicuous trouble.

Exp. 29. Nov. 27, juice and crushed fragments of leaves from tomato plant used in No. 28 were placed on a larger tomato. Jan. 8, plant dead of wilt, but before dying, showed some little burn, as No. 28, and more or less calico (leaves mottled and crinkled).

Exp. 30. Nov. 27, same treatment as in No. 29, but sprinkled with water after treatment. Dec. 11, first showed burn on one leaf. Eventually, burn became more prominent, especially on the stem, and there were slight signs of calico on the leaves.

Exp. 31. Nov. 27, same treatment as Exp. 30, but on small plant. No burn showed at any time, but after a considerable period calico showed slightly on youngest leaves.

Exp. 32. Nov. 27, juice and fragments of leaves from tomato used in No. 28 transferred by hand to tobacco plant. Dec. 12, showed calico, but no burn. Calico appeared prominently later. Here we have a case of transferring calico to tobacco from a tomato showing burn prominently, but little calico; this tomato was originally infected from calicoed tobacco (see Plate XXIX b, showing leaves from these three generations).

Exp. 33. Nov. 27, juice from calicoed tobacco transferred by hand to tomato. This did not show burn, and for quite a while no calico, though eventually the young leaves became calicoed.

Exp. 34. Nov. 27, same as No. 33, but plant sprinkled with water afterwards. Dec. 6, showed slight burn injury on young leaves, which became more prominent by Dec. 9. This burn was finally the most noticeable of any on plants treated Nov. 27 (see Plate XXIX a).

Exp. 35. Jan. 9, a young tobacco plant (a) and a tomato plant (b) sprayed with cultures of bacteria in water. These bacteria originally came from rusted spots in calicoed tobacco leaves, but may have been accidental surface bacteria. Apr. 27, no calico showed for some time, but did on this date on both plants. No rust spots present. Whether

this infection was due to the bacteria or to adjacent calicoed plants is not certain.

Exp. 36. Jan. 31, young tomato plants, size for transplanting, exposed to out of door temperature at 15° Fahr. for short periods, with the following results: (a) Plant exposed five minutes, with result that all leaves and tip of stem were killed; (b) plant exposed ten minutes, with same results, but stem more severely injured; (c, d) plants exposed one minute, with result that lower leaves were killed, and upper more or less frosted at edges, but stem not injured; (e) plant exposed two minutes, with results same as in c, d; (f, g) check plants not exposed. Feb. 13, all plants set in greenhouse bed; no signs of calico on any as yet; (a, b) sending out buds from base of plants. Mar. 1, (a, b) now dead, as frost injury was too severe to allow of transplanting. Neither they nor the other plants showed any signs of calico. By July 14 all plants but one were dead, but none of them showed any signs of calico.

Exp. 37. Mar. 17, young tobacco plants exposed out of doors at temperature of about 33° Fahr., as follows: (a) One plant for five minutes (b) one plant for ten minutes; (c) one plant for one hour and forty minutes. July 21, none of these plants showed calico, though none were appreciably injured by frost at the time of exposure.

Exp. 38. Apr. 14, leaves of 2 tobacco plants rubbed with juice and fragments of perfectly healthy tobacco on hand. July 21, no signs of calico.

Exp. 39. Same as No. 38, but leaves of 3 tomato plants were rubbed. July 21, no signs of calico.

Exp. 40. Same as No. 38, but leaves of 2 tobacco plants were rubbed with juice on hands from calicoed tobacco plant. Apr. 28, both plants showed calico plainly on new leaves.

Exp. 41. Same as No. 40, but 3 healthy tomato plants used. Apr. 28, no signs of calico, but slight burn on one plant. May 11, burn now evident, but calico not. July 21, all 3 plants now showed calico plainly, though it was much longer in appearing than in No. 40.

Exp. 42. Apr. 14, 2 healthy tobacco plants cut off near base, leaving small bud. July 21, no signs of calico.

Exp. 43. Apr. 14, healthy tomato plant cut off near ground, leaving one small basal sprout. On February 17th this plant was pruned in a similar way. July 21, no signs of calico.

Exp. 44. Check tobacco plant for tobacco experiments of Apr. 14, no treatment. July 21, no signs of calico.

Exp. 45. Two check tomato plants for tomato experiments of Apr. 14, no treatment. July 21, no signs of calico.

Exp. 46. Apr. 27, same as No. 35, on (a) tobacco and (b) tomato plant, except that bacteria were from a different colony in the original Petrie dish. May 11, no signs of calico, but a few small burned spots on the tomato. July 21, no signs of calico on tobacco, and tomato dead, having never shown calico, as far as observed.

Exp. 47. Apr. 27, same as No. 46, but bacteria from separate cultures obtained from stem of tomato plant in No. 30. May 11, no signs of calico

on either host. July 21, no sign of calico on tobacco; tomato dead, apparently not calicoed.

In 1908, Experiment Station Farm, Centerville.

Exp. 48. July 20, upper young leaves of the alternate odd-numbers in a row of 50 plants, touched with fresh calicoed juice on hands, renewed each time before touching plant. July 31, every one of the 25 plants showed signs of calico. Aug. 6, every plant evidently calicoed in upper leaves. Aug. 24 and Sept. 16, plants all badly calicoed on upper leaves. Calicoed, first and last exam., 100%.

Exp. 49. Checks to Nos. 48 and 50, every even-numbered plant was touched without calico juice on hands. July 31, none of the plants showed calico. Aug. 6, only one calicoed plant. Aug. 24, 18 plants without calico, 1 with calicoed main leaves, and 6 with calicoed suckers only. Sept. 16, 10 without calico, 1 with main leaves calicoed, 14 with calicoed suckers. On Aug. 5th a severe wind storm blew the tobacco over, so that the healthy came in contact with the calicoed, and this may account for the later appearing calico in the suckers of these checks, and also in some of the other experiments. Calicoed, 1st exam., 0%; last exam., 60%.

Exp. 50. July 20, same as No. 48, but only lower full-grown leaves of 25 plants were touched. July 31, all apparently showing calico, but not so evident as in No. 48. Aug. 6, every plant evidently calicoed in upper leaves only. Aug. 24 and Sept. 16, every plant badly calicoed in upper leaves. Calicoed, 1st and last exam., 100%.

Exp. 51. July 20, crushed, dried calicoed tobacco leaves, which had been kept in-doors since the previous fall, were soaked in water for two hours, and used as follows: (a) Placed a handful of wet leaves around uncovered roots of 10 plants, and then recovered with dirt; (b) poured half a pint of this strong tobacco water on exposed roots of 15 plants, and re-covered; (c) Sprinkled leaves of 21 plants freely with this tobacco water. July 31, (a) and (b) showed no calico; (c) all showed calico except possibly one. Aug. 6, (a) and (b) no calicoed plants; (c) all plants calicoed evidently in upper leaves, some badly calicoed and stunted. Aug. 24, (a) 9 free, 1 calicoed in sprouts; (b) 14 free, 1 calicoed in sprouts; (c) all badly calicoed. Sept. 16, (a) 7 free, 3 with calicoed sprouts; (b) 11 free, 4 with calicoed sprouts; (c) same as on Aug. 24. Calicoed, 1st exam., (a) 0%, (b) 0%, (c) 100%(?); last exam., (a) 30 %,(b) 27%, (c) 100%.

Exp. 52. July 20, same as No. 51–c, but calicoed tobacco water sprinkled over (a) 20 to 25 nearly full-grown potato vines, and (b) 10 large tomato plants. Aug. 6, no sign of calico on potato vines, but some indication of it on the tomatoes. Aug. 13, calico showed plainly on some tomatoes, but not prominently. Sept. 15, no calico appeared on potatoes (perhaps too old when treated), but most of the tomatoes showed calico on some of the young leaves, though not so prominent as on tobacco in No. 51–c.

Exp. 53. July 20, crushed stems and leaves of dried "yellows" asters (kept indoors over winter) soaked for two hours in water, and

used as follows: (a) Poured half a pint of this "yellows" water on uncovered roots of 10 tobacco plants, and re-covered with dirt; (b) sprinkled leaves of 20 tobacco plants freely with this "yellows" water. July 31, no calico showing. Aug. 6, no calico showing except in one plant in (a), which was probably an accidental outside infection. Aug. 24 (a), 6 plants free, 1 with main leaves calicoed, and 3 with calicoed sprouts; (b) 18 free, 2 calicoed in sprouts. Sept. 16, (a) 5 free, 1 with calicoed main leaves, 4 calicoed in sprouts; (b) 13 free, 7 with calicoed sprouts. Calicoed, 1st exam., (a) and (b) 0%; last exam., (a) 50%, (b) 35%.

Exp. 54. July 20, two fresh leaves of calicoed tobacco were drawn rather gently, so as not to tear the tissues, over leaves of 25 tobacco plants. July 31, no calico showing, except possibly on one plant. Aug. 6, all plants except one showing calico. Aug. 24, all plants but one evidently calicoed on main leaves, and on Sept. 16 this plant also showed it on the suckers. Calicoed, 1st exam., 4%, last exam., 100%.

Exps. 55–65. July 23–4, 25 grams of fresh calicoed leaves (in Nos. 55–60, tobacco, in Nos. 61–65, tomato leaves), cut in small fragments were soaked over night in 100 grams of liquid as indicated below. Next morning, the liquid was strained through cheese cloth, and used on tobacco plants that afternoon, as follows:

Exp. 55. After filtering off alcohol used in No. 58, the cut fragments of calicoed leaves were soaked again for one and one-half hours in 50 cc. distilled water, and then poured on the leaves of 5 plants. Aug. 6, 2 showed calico; Aug. 24 and Sept. 16, 1 free, 1 missing, 2 calicoed on main leaves, and 1 on sprouts. Calicoed, 1st exam., 40%, last exam., 60%.

Exp. 56. Chloroform water was used as the liquid, and after straining, this was poured on the leaves of 5 plants. Aug. 6, 2 showed calico; Aug. 24 and Sept. 16, 2 missing, 1 calicoed on main stem, 2 on sprouts. Calicoed, 1st exam., 40%, last exam., 60%.

Exp. 57. Distilled water was used as the liquid, and after straining, this was poured on leaves of 5 plants. Aug. 6, none calicoed. Aug. 24 and Sept. 16, 1 missing, 3 free, 1 calicoed in sprouts. Calicoed, 1st exam., 0%, last exam., 20%.

Exp. 58. 95% alcohol was used as the liquid, and after straining, and evaporating most of this over a water bath by gentle heat, the remainder was placed on leaves of 5 plants. Aug. 6, 2 calicoed; Aug. 24 and Sept. 16, 2 free, 1 calicoed in main leaves, 2 in sprouts. Calicoed, 1st exam., 40%, last exam., 60%.

Exp. 59. Pure chloroform used as the liquid. Treated same as in No. 58, and then the paste-like residue rubbed on the leaves of 5 plants. Aug. 6, 1 calicoed; Aug. 24, 3 free, 1 calicoed in stem leaves, 1 in sprouts; Sept. 16, another plant showed calicoed sprouts. Calicoed, 1st exam., 20%, last exam., 60%.

Exp. 60. The chloroform in No. 59 did not mix with some of the juice extracted from the leaves, and this latter was poured off, diluted with 50 cc. water, and then poured over leaves of five plants. Aug. 6, none calicoed. Aug. 24, 4 free, 1 with calicoed leaves. Sept. 16, 3 free, 1 with calicoed leaves, 1 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 40%.

Exp. 61. Same treatment as in No. 56, except calicoed tomato leaves were used, and the liquid poured on 5 tobacco plants. Aug. 6, 3 calicoed. Aug. 24 and Sept. 16, 1 missing, 3 with calicoed leaves, 1 with calicoed sprouts. Calicoed, 1st exam., 60%, last exam., 80%.

Exp. 62. Same treatment as in No. 57, except calicoed tomato leaves were used. Aug. 6, 2 calicoed. Aug. 24, 1 free, 1 doubtful, 2 calicoed in leaves, 1 calicoed in sprouts. Sept. 16, 2 with calicoed leaves, 3 with calicoed sprouts. Calicoed, 1st exam., 40%, last exam., 100%.

Exp. 63. Same treatment as in No. 58, except calicoed tomato leaves were used. Aug. 6 and 24, none calicoed. Sept. 16, 2 free, 3 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 60%.

Exp. 64. Same treatment as in No. 60, except calicoed tomato leaves were used. Aug. 6, 1 calicoed. Aug. 24 and Sept. 16, 2 free, 1 missing, 1 with calicoed leaves, 1 with calicoed sprouts. Calicoed, 1st exam., 20%, last exam., 40%.

Exp. 65. Same treatment as in No. 59, except calicoed tomato leaves were used. Aug. 6 and 24, none calicoed. Sept. 16, 4 free, 1 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam, 20%.

Exp. 66. Checks to Nos. 55–65, 5 plants, no treatment. Aug. 6 and 24, none calicoed. Sept. 16, 4 free, 1 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 20%.

Exp. 67. July 24, vines cut off rather close to the ground from (a) 16 hills of potatoes, and (b) several large tomato vines. Aug. 16, no signs of chlorosis in new growth. Sept. 15, while potato vines did not re-sprout very well, the growth that did appear showed no signs of chlorosis, neither did that of the tomatoes.

Exp. 68. July 31, unbruised calicoed tobacco leaves wrapped around young upper leaves of 15 tobacco plants. Aug. 7, no signs of calico except on one plant. Sept. 4, 8 free, 3 slightly calicoed on main leaves, and 4 on sprouts. Calicoed, 1st exam., 7%, last exam., 47%.

Exp. 69. July 31, same as in No. 68, except that calicoed leaves were cut with knife. Aug. 7, no signs of calico. Sept. 4, 1 missing, 4 free, 3 calicoed on main leaves, and 7 on sprouts. Calicoed, 1st exam., 0%, last exam., 67%.

Exp. 70. July 31, a calicoed leaf (not crushed so as to get juice on hands), was touched each time before touching young leaves of 15 tobacco plants. Aug. 7, no signs of calico. Sept. 4, 2 free, 13 calicoed in sprouts. Calicoed, 1st exam., 0%, last exam., 87%.

Exp. 71. July 31, fresh calicoed tomato leaves were crushed in hands, and juice and fragments transferred to young leaves of 15 tobacco plants. Aug. 7, no signs of calico. Sept. 4, all calicoed in sprouts, some showing rust spots. Calicoed, 1st exam., 0%, last exam., 100%.

Exp. 72. July 31, young calicoed tobacco leaves were crushed in the hands, staining fingers with juice, and then 40 tobacco plants were touched one after another, without renewing juice on hands. Aug. 7, no signs of calico; Sept. 4, none free, 4 calicoed in main leaves and 36 in sprouts. Calicoed, 1st exam., 0%, last exam., 100%.

Exp. 73. After Exper. No. 72, next 5 plants in same row were touched, after washing hands thoroughly with soap and water. Aug. 7, no signs of calico; Sept. 4, all 5 plants free. Calicoed, 1st and last exams., 0%.

Exp. 74. Check plants for Nos. 68–73, no treatment, 9 plants. Aug. 7, no signs of calico; Sept. 4, 7 free, 2 calicoed in sprouts; calicoed, 1st exam., 0%, last exam., 22%.

Exp. 75. Aug. 6, 15 healthy plants were tied carefully near the top with string to 15 calicoed plants. Two healthy plants left not tied as checks. Sept. 4, 5 free, 2 with calicoed main leaves, 8 with calicoed sprouts; Sept. 16, 1 free, 2 with calicoed main leaves, 12 with calicoed sprouts. The two check plants were free. Calicoed, 1st exam., 67%, last exam., 93%.

Exp. 76. Aug. 6, each alternate (even numbers) of 118 plants was topped by cutting off with a knife which was passed through a calicoed leaf each time before using. Sept. 4, all of the 58 plants showed calico in sprouts (one dead plant not counted), or 100%.

Exp. 77. Check to No. 76, each alternate (odd numbers) of the 118 plants was topped, being careful to convey no tobacco juice during the topping. For the first 20, knife was wiped with paper and sterilized in flame before each topping, and for the remainder, top was broken off by hand, touching only the part of the plant removed. Sept. 4, of the first 20, 16 were free, and 4 calicoed in sprouts; of the remaining 39, 30 were free, 1 dead, and 8 showed calicoed sprouts. Altogether only 20% were calicoed, as against 100% in Experiment 76.

Exp. 78. Aug. 7, check to No. 80, 14 plants cut off close to ground with knife sterilized as in Experiment 77. Sept. 4, 6 plants failed to sucker, the other 8 all grew suckers free from calico, or 0% calicoed.

Exp. 79. Check to No. 80, 14 healthy plants cut off close to the ground but without cleaning knife each time. Sept. 4, 9 plants failed to grow suckers, and the other 5 grew suckers free of calico, or 0% calicoed.

Exp. 80. Aug. 7, 15 healthy plants cut off close to the ground, with knife passed through calicoed plants each time before using. Sept. 6, all died without producing suckers. Probably cut too close to the ground.

Exp. 81. Checks to Nos. 48–80 no treatment given during the season, 24 plants. Aug. 6, all free from calico except possibly one. Sept. 4, 18 free from calico, 6 showing calico in sprouts only. Calicoed, 1st exam., 0%(?); last exam., 25%.

In 1908, Experiment Station Grounds, New Haven.

Exps. 82–85. This tobacco was the same as that used that year at the Centerville Farm, and was set out about the same time, the middle of June. The seedlings in both cases were obtained from Mr. Hale's bed at Portland, and this may account for the few calicoed plants that appeared on the land used for this experiment, where tobacco had never been grown previously, and no other tobacco grew in the vicinity. It was planted here to see if it would be entirely free from calico, and to act as a check on the experiments at the Mount Carmel farm. July 28, examined tobacco carefully, and found two apparently calicoed plants, which were pulled up before topping experiments were made. Another calicoed plant was pulled up August 1st. All calico that developed later in the sprouts of eight plants was on plants near these originally calicoed ones.

Exp. 82. July 28, 19 healthy plants topped with knife sterilized as in No. 77. Aug. 24 and Sept. 15, 18 plants free, 1 with calico only on small leaves of sprout (next to suspicious plant removed July 28). Calicoed, 1st and last exam., 5%.

Exp. 83. July 28, 17 healthy plants topped, but knife not cleaned after each topping. Aug. 24 and Sept. 15, 15 free, 1 with sprout prominently calicoed, 1 with sucker slightly calicoed. (Both near suspicious plant removed July 28.) Calicoed, 1st and last exam., 12%.

Exp. 84. July 28, 20 plants topped with sterilized knife, as in No. 77. One plant showed calico in sprout at top. This was topped, but removed Aug. 1st. Aug. 24, 16 free, 3 with calico on sprouts (these were next to calicoed plant removed). Sept. 15, 14 free, 5 with calicoed sprouts. Calicoed, 1st exam., 16%, last exam. 26%.

Exp. 85. Checks, no topping, 9 plants. Aug. 24 and Sept. 15, no calico. Calicoed, 0%.

Exp. 86. Aug. 1, leaves of tobacco plant touched with hands containing juice and fragments from leaves of Golden variety of Sambucus. Sept. 15, no calico resulted.

Exps. 87–91. July 23, leaves and stems of dried "yellows" asters, kept in-doors since previous fall, were soaked in water over night and this material used on asters, as indicated below. At the time of treatment, at least two of these asters showed yellows, so that the few plants that developed it later probably had latent yellows when treated.

Exp. 87. Roots of 7 plants (one already showing yellows) were uncovered and after placing on them "yellows" leaves macerated in water, they were re-covered. Sept. 15, no further yellows developed.

Exp. 88. "Yellows" water containing tissue was poured liberally over leaves of 7 plants (one already showing yellows). Sept. 15, no further yellows developed.

Exp. 89. Two rows of check plants, not treated. No yellows showing except in one plant. Sept. 15, there had developed a few probable cases of yellows in these check plants.

Exp. 90. Leaves of 7 plants were touched after crushing fresh "yellows" leaves in hands, leaving part of the crushed tissues on them. Sept. 15, one plant developed yellows.

Exp. 91. Leaves of 7 plants were touched after crushing calicoed tobacco leaves so as to get juice on the hands. (One plant already showed probable yellows.) Sept. 15, besides the original yellowed plant, 1 developed yellows, 1 doubtful yellows, 4 remained free.

In Winter of 1908–09, Station Greenhouse, New Haven.

Exp. 92. Dec. 17, pure juice of calicoed tobacco (extracted from calicoed leaves by hydraulic press in September, and preserved by film of toluol) was used on leaves of a small tobacco plant. Jan. 4, younger

leaves showing calico in fine mottling. Jan. 15, calico prominent on four or five additional leaves. Jan. 22, whole plant prominently calicoed.

Exp. 93. Dec. 17, same as No. 92, but before extracting juice from calicoed leaves, these were wet thoroughly. Jan. 4, 15 and 22, showed calico the same as in No. 92.

Exp. 94. Dec. 17, crushed dried calicoed tobacco leaves, kept indoors since fall were soaked one-half hour in water, and used immediately on small tobacco plant. Jan. 4, showed faint traces of calico. Jan. 15, calico about the same as in No. 92, but not so prominent on worst leaves. Feb. 18, plant in seed, leaves yellowed, and therefore calico not so conspicuous. The same experiment on other plants showed very similar results.

Exp. 95. Dec. 17, check to Nos. 92–94. Jan. 4 and 15, Feb. 1 and 18, no calico showing at any time, though on Feb. 18 the plant was in fruit.

Exp. 96. Dec. 17, treatment same as in No. 92, except young tomato plant was used for infection. Jan. 4, no calico, but top killed by Fusarium wilt. Jan. 15, cut off dead top. No sure signs of calico below. Feb. 18, new growth showed calico.

Exp. 97. Dec. 17, treatment same as in No. 93, except young tomato plant was used for infection. Jan. 4, calico just showing on young leaves. Feb. 5, calico very evident on new leaves. Feb. 18 and Mar. 6, all new growth badly calicoed.

Exp. 98. Dec. 17, same treatment as in No. 94, except young tomato plant was used for infection. Jan. 4 and 15, slight indications of calico. Feb. 5, calico very evident on new leaves. Feb. 18, all new growth calicoed. Feb. 23, leaves showed some of the peculiar bacterial-like burn noticed last year. Mar. 6, all new growth badly calicoed. The same experiment on other tomato plants failed to produce calico, though at first they seemed to show signs of it.

Exp. 99. Dec. 17, check to Nos. 96–98. Jan. 4 and 15, Feb. 5 and 18, Mar. 6, examinations showed no signs of calico.

Exp. 100. Dec. 17, same treatment as in No. 94, except liquid was filtered through filter paper before using on tobacco plant. Jan. 4, calico beginning to show. Jan. 15, two leaves with calico evident. Jan. 27, calico very evident. Feb. 18, plant badly calicoed and somewhat stunted.

Exp. 101. Dec. 17, same treatment as in No. 100, except filtered juice was used on tomato. Jan. 4, 15 and 27, Feb. 5 and 18, examinations showed no calico; reason for failure not apparent.

Exp. 102. Dec. 18, same treatment as in No. 94, except tobacco water was twenty-four hours old when used on tobacco plant. Jan. 4, calico evident. Jan. 15, calico more prominent on young leaves. Jan. 27, calico very evident, especially on six leaves. Feb. 18, badly calicoed and somewhat stunted.

Exp. 103. Dec. 18, same as No. 102, except tomato plant was used. Jan. 4, calico apparently present. Jan. 15, faint but sure signs of calico. Jan. 27, calico very evident on new leaves. Feb. 18, new growth continued to calico.

Exp. 104. Dec. 19, same as No. 94, except tobacco water was two days old when used on tobacco plant. Jan. 4, 15 and 27, Feb. 5, 18 and 23, Mar. 13, examinations showed absolutely no signs of calico.

Exp. 105. Dec. 21, same as No. 94, except tobacco water was four days old when used on tobacco plant. Jan. 4 and 15, no calico. Jan. 27, faint signs of calico on two young leaves. Feb. 5, calico not so evident. Feb. 18, calico only moderate, plant stunted.

Exp. 106. Dec. 21, same as No. 105, except tomato plant was used. Jan. 4, possibly some slight signs of calico. Jan. 5, plant severely injured by escaped guinea pig. Jan. 15 and 27, calico not surely present. Feb. 11, plant had made poor growth, but calico now showed in younger leaves. Feb. 18, calico moderately prominent.

Exp. 107. Dec. 21, same treatment as in No. 100, except water was evaporated over radiator, and four days later crystalline residue was dissolved in small amount of water before placing on tobacco plant. Jan. 4, 15 and 27, Feb. 5 and 18, Mar. 13, no calico.

Exp. 108. Dec. 21, same treatment as in No. 107, except tomato plant was used. Jan. 4, 15 and 27, Feb. 5 and 18, Mar. 24, no calico.

Exp. 109. Dec. 21, check tobacco plants (a, b) to Nos. 94, 100, 102, 104, 105, 107, 111. Jan. 4, 15 and 27, no calico. Feb. 5, (a) not calicoed, but (b) suspicious. Feb. 18, (a) no calico, but (b) with younger leaves prominently calicoed (possibly infected by guinea pig which injured plant, as mentioned above). Feb. 23, (a) no calico, cut off close to ground with sterilized knife. Mar. 13, (a) no calico in new growth.

Exp. 110. Dec. 21, check tomato plant, for Nos. 98, 101, 103, 106, 108, 112. Jan. 4, no calico. Jan. 15, dead from injury by guinea pig on Jan. 5.

Exp. 111. Jan. 4, treatment same as in No. 94, except tobacco water was eighteen days old when used on tobacco plants (a, b). Jan. 15 and 29, Feb. 5 and 18, no calico. Feb. 23, (b) free, (a) with calico showing on young growth. Mar. 13, (b) free, (a) with upper leaves badly calicoed.

Exp. 112. Jan. 4, treatment same as in No. 107, except crystalline residue was dissolved eighteen days after evaporation, and used on tobacco plants (a, b). Jan. 15 and 27, no calico. Feb. 5, (a) no calico, (b) showing first stages on young leaves. Feb. 18, (a) no calico, (b) badly calicoed in new growth. Mar. 13, (a) now showed calico on new growth.

Exp. 113. Jan. 16, treatment same as in No. 94, except fresh tobacco water was used on young (a) Lima bean and (b) string bean. Feb. 1 and 18, no calico. Mar. 6, (a) no calico, cut off plant near ground with sterilized knife. Apr. 7 and 28, (a) no sure signs of chlorosis in new growth.

Exp. 114. Jan. 16, treatment same as in No. 92, except preserved calicoed juice was used on young (a) Lima and (b) string bean. Feb. 1 and 18, no calico. Apr. 1, (a) no calico, cut off plant near ground. Apr. 28, (a) no signs of calico in new growth.

Exp. 115. Jan. 16, check (a) Lima and (b) string beans, for Nos. 113–114. Feb. 1 and 18, Apr. 18, no calico.

Exp. 116. Jan. 18, (a) Lima and (b) string beans cut off close to ground with sterilized knife. Feb. 18, no chlorosis. Mar. 6, slight yellowish mottling on (b); both plants cut off again down to lowest branch. Apr. 28, no very evident chlorosis on new growth of either plant.

Exp. 117. Jan. 16, treatment same as in No. 94, but fresh calicoed water placed on all eight leaves of young tobacco plant. Feb. 1, no calico. Feb. 11, calico just showing on young leaves. Feb. 18, calico prominent on upper ten leaves and bracts. Feb. 23, plant cut off near ground. Mar. 13, calico just showing in suckers. Apr. 28, all new growth strongly calicoed.

Exp. 118. Jan. 23, same treatment as in No. 117, except same tobacco water was preserved seven days with film of toluol before using. Feb. 1, no calico. Feb. 5, calico just showing on younger leaves. Feb. 11, calico now more prominent than in No. 117, probably because plant grew faster. Feb. 18, calico very evident, especially on middle leaves. Feb. 23, plant in bud, cut off near ground. Apr. 28, new growth calicoed, and with bacterial-like burn.

Exp. 119. Jan. 16, check tobacco plant for Nos. 117, 118. No treatment. Feb. 1 and 18, no calico. Feb. 23, no calico, plant in flower.

Exp. 120. Jan. 20, juice from calicoed leaf of plant in No. 92 used on another tobacco plant. Feb. 1, calico appearing on young leaves. Feb. 18, calico prominent on eleven leaves and bracts. Feb. 23, plant in bud, cut off near ground. Mar. 13, calico just showing in suckers.

Exp. 121. Jan. 20, same as No. 120, except juice from plant in No. 94 was used. Feb. 1, 18 and 23, Mar. 13, treatment and calico same as in No. 120. Apr. 28, all new growth of suckers strongly calicoed.

Exp. 122. Jan. 20, same as No. 120, except juice from plant in greenhouse calicoed from unknown cause before experiments started (not quite typical, leaves lighter green), was used. Feb. 1, no calico. Feb. 5, calico showing on younger leaves. Feb. 18, calico similar to that on original plant. Mar. 6, upper leaves free from calico; cut off near ground. Mar. 13, no calico. Apr. 28, badly calicoed, running toward albino type, leaves misshapen.

Exp. 123. Jan. 10, check for Nos. 120–122. Feb. 1, no calico. Feb. 11, calico just beginning to appear on young leaves, but as these leaves touched calicoed plants of Nos. 120 and 121, they probably became infected from these. Feb. 18, calico showing only on upper leaves. Feb. 23, cut off near ground. Mar. 13, calico appearing in suckers. Apr. 28, all new growth calicoed.

Exp. 124. Jan. 21, juice from uncalicoed lower leaf of calicoed tobacco plant in No. 94 was used. Feb. 1 and 18, no calico. Feb. 23, no calico; cut off near ground with sterilized knife. Mar. 13, Apr. 28, no calico in suckers.

Exp. 125. Jan. 21, check to No. 124. Same treatment, but juice from plant showing no calico was used. Feb. 1 and 18, no calico. Mar. 6, no calico; plant cut off near ground with sterilized knife. Apr. 28, no calico in resulting suckers.

Exp. 126. Jan. 21, similar to No. 94, but 6 grams crushed calicoed leaves were soaked one hour in 150 cc. of distilled water and filtered through cloth before using on tobacco plants (a, b). Feb. 1, (a) no calico, but (b) calico showed on younger leaves. Feb. 5, (a) calico now appearing. Feb. 18, (a, b) calico on all new leaves since first appearance. Feb. 23, (a) plant cut off near ground; (b) now badly calicoed. Mar. 13, (a) sucker calicoed. Apr. 28, (a) sucker wholly calicoed.

Exp. 127. Jan. 21, same treatment as in No. 126, except part of the tobacco water was filtered through Berkefeld filter, and then used on young tobacco plants (a, b). Feb. 1, (a) no calico; (b) just showing calico on younger leaves. Feb. 5, (a) no calico; (b) calico evident. Feb. 18, (a) showed suppressed calico; plant cut off near base; (b) calico very evident. Mar. 6, (b) badly calicoed, with bacterial-like burn. Apr. 28, (a) sucker wholly calicoed.

Exp. 128. Jan. 21, same treatment as in No. 127, but tobacco water was sterilized in autoclave before using on young tobacco plants (a, b). Feb. 1, 5 and 18, no calico. Feb. 23, no calico, cut off (a) with sterilized knife. Mar. 6, (b) calicoed in upper six leaves; cut off with sterilized knife. Mar. 13, (a) no calico in sucker. Apr. 28, (a, b) suckers of both showed calico, (a) the worst (probably an accidental infection; see Nos. 141 and 150).

Exp. 129. Jan. 21, check tobacco plants (a, b) for Nos. 126–128. Feb. 1, and 18, no calico. Mar. 6, no calico; plants cut off near ground with sterilized knife. Apr. 28, (a) dead; (b) suckers showing no sure signs of calico.

Exp. 130. Jan. 22 and 30, Feb. 24, preserved calicoed juice (see No. 92) used on these dates on all leaves of three tobacco plants. Feb. 1, no calico. Feb. 18, calico showed on young leaves. Apr. 28, plants grew poorly; all calicoed, one an albino.

Exp. 131. Jan. 22 and 30, Feb. 24, same as in No. 130, but young tomato used. Feb. 1 and 18, no calico. Feb. 23, calico on youngest leaves. Apr. 28, whole plant calicoed, but not albino.

Exp. 132. Jan. 22, calicoed plant of No. 93 was placed in diffused light under bench. Feb. 18, plant not so strongly calicoed, leaves turning yellowish.

Exp. 133. Jan. 22, same as No. 132, but calicoed plant, No. 92, placed in dark room. Feb. 18, calico not so evident; leaves turning yellowish, then brown, and dying. Calicoed spots usually first affected.

Exp. 134. Jan. 22, preserved calicoed juice, same as in No. 92, used on leaves of young green-leaved geranium. Feb. 1 and 18, no signs of calico on this or the check plant.

Exp. 135. Jan. 25. Uninjured end of fresh calicoed tobacco leaf was soaked for three hours in a small amount of water, then this water poured on tobacco plant. Feb. 1 and 18, no calico, Apr. 28, failed to grow properly, as plant was shaded; no sure signs of calico, though one or two leaves suspicious.

Exp. 136. Jan. 25, several glandular hairs, removed by forceps from fresh calicoed tobacco, were soaked three hours in a few drops of water,

then placed on tobacco plant. Feb. 1 and 18, Mar. 13, no calico, but plant made poor growth because shaded. Apr. 28, no calico except in a few young upper leaves.

Exp. 137. Jan. 26, crushed dried leaves of pole Lima beans, gathered in September, and showing chlorosis which looked like calico, were soaked in small amount of water, filtered, and then used on young (a) Lima bean, and (b) tobacco plant. Feb. 1 and 18, Mar. 13, Apr. 1 (cut off (a), Apr. 28), no calico or chlorosis showing on either (a) or (b) except that on last date (b) showed a few leaves with apparently accidental infection.

Exp. 138. Jan. 26, same treatment, etc., as in No. 137, except calico-like chlorosis of string beans, gathered in the same place, was used on young (a) string bean, and (b) tobacco plant. Feb. 1, 8 and 18, Mar. 13, Apr. 28, no calico showed on either (a) or (b).

Exp. 139. Jan. 27, same as No. 126, except tobacco water six days old was used. Feb. 1, no calico. Feb. 11, calico just showing. Feb. 18, calico evident on all new growth. Mar. 13, Apr. 28, all new growth since inoculation badly calicoed.

Exp. 140. Jan. 27, same as No. 127, except tobacco water was used six days after filtering through Berkefeld filter, on young tobacco plant. Feb. 1, no calico; plant cut off near ground with sterilized knife. Feb. 18, no calico. Mar. 6, slight signs of calico on new sucker. Mar. 13, calico more evident. Apr. 28, all new growth calicoed.

Exp. 141. Jan. 27, same as No. 128, except sterilized tobacco water was used six days after sterilization on young tobacco plant. Feb. 1 and 18, Mar. 6, no calico; cut off plant near ground with sterilized knife. Apr. 28, plant dead.

Exp. 142. Jan. 27, check to Nos. 139–141, no treatment. Feb. 1 and 18, no calico. Apr. 28, a few upper leaves calicoed.

Exp. 143. Jan. 27, two healthy tomato plants about two feet high were cut off near the ground, using hot sterilized knife. Feb. 1 and 18, Mar. 6, no calico; most of new growth cut off on last date, as before. Apr. 28, dead, but no calico observed up to this date.

Exp. 144. Feb. 1, same treatment as in No. 143, except instead of sterilizing knife, it was used each time to cut through calicoed tomato leaf before cutting off healthy plants (a, b). Feb. 18, (a) doubtful signs of calico; (b) no calico in new growth. Mar. 6, (a) still doubtful, but (b) calicoed without question.

Exp. 145. Feb. 1, same as No. 143, but healthy tobacco plant was cut off instead. Feb. 18 and 23, Mar. 13, Apr. 28, no calico showed on sucker, though on Feb. 23d a mottling of some leaves due to shading appeared, but later disappeared entirely.

Exp. 146. Feb. 1, same as in No. 144, but before cutting off tobacco plants (a, b) calicoed tobacco leaf was cut through. Feb. 18, (a) all new growth calicoed; (b) little new growth made on account of shading by other plants, and this not calicoed. Feb. 23, Mar. 6, (a) prominently, and (b) evidently calicoed, shade having been removed. Apr. 28, (a, b) all new growth prominently calicoed.

Exp. 147. Feb. 1, Calyx of healthy tobacco plant, just flowering (see

No. 95) was slit with knife, and preserved calicoed tobacco juice (that used in No. 92) was injected into ovaries with hypodermic syringe, as follows: (a) ovaries with ovules not yet fertilized; (b) ovaries with ovules just fertilized. Feb. 18, seed maturing, but ovaries often split open at point of inoculation, and pods wrinkled on this account; no signs of calico on flower parts. Mar. 8, seed ripe, that from pods most promising saved. No signs of calico on plant.

Exp. 148. Feb. 1, same as in No. 147 (a, b), except calicoed plant was used for injection, and floral parts were not slit. Feb. 18, seed maturing; no signs of calico on pods. Mar. 8, seed from two most promising pods saved.

Exp. 149. Mar. 5, same as in No. 126, except tobacco water was forty-three days old when used on young tobacco plants (a, b, c). Mar. 20, (a) just showing calico, (b, c) free. Apr. 28, (a) slightly calicoed; (b, c) free.

Exp. 150. Mar. 5, same as in No. 128, except sterilized tobacco water was forty-three days old when used on young tobacco plants (a, b, c). Apr. 28, all free from calico; (a) badly sunburned.

Exp. 151. Mar. 5, same as in No. 127, except tobacco water which had been filtered through Berkefeld filter into sterilized test tubes forty-three days before was now used on young tobacco plants (a, b, c). Apr. 28, (a, b) calicoed, but (c) apparently free.

Exp. 152. Mar. 5, same preserved juice as in No. 92 used on two young tobacco plants. Mar. 29, both plants showing signs of calico. Apr. 28, both badly calicoed.

Exp. 153. Mar. 5, juice from fresh calicoed tobacco leaves (from plant in No. 102) used on young tobacco plants (a, b). Mar. 13, (a) calico showed only on youngest leaves. Mar. 29, calico now showed on young leaves of (b). Apr. 28, (a, b) both badly calicoed.

Exp. 154. Mar. 5, checks to Exps. 149-153, no treatment, tobacco plants (a, b). Apr. 8, (a) seemed to be just developing calico; (b) free. Apr. 28, (a) calicoed (probably accidental infection by white fly); (b) free.

Exp. 155. Mar. 5, same as No. 149, except on young petunia. Apr. 28, no calico.

Exp. 156. Mar. 5, same as No. 150, except on young petunia. Apr. 28, no calico

Exp. 157. Mar. 5, same as No. 151, except on two young petunias. Apr. 28, both apparently free, or very faintly calicoed.

Exp. 158. Mar. 5, same as No. 152, except preserved juice was used on young petunias (a, b). Apr. 3, (a) apparently free, but (b) for first time showed lighter colored, somewhat mottled foilage, like calico of tobacco, but not so prominent. Apr. 28, (a, b) showed distinct signs of calico.

Exp. 159. Mar. 5, same as No. 153, except fresh calicoed juice was used on young petunias (a, b). Apr. 28, (b) showed evident signs of calico, but (a) very faint, if any.

Exp. 160. Mar. 5, two petunias, checks for Nos. 155-159, no treatment. Apr. 28, both free.

Exp. 161. Mar. 5, same as No. 149, except on young tomato. Apr. 28, no calico.

Exp. 162. Mar. 5, same as No. 150, except on young tomato. Apr. 28, no calico.

Exp. 163. Mar. 5, same as No. 151, except on young tomato. Apr. 28, apparently free.

Exp. 164. Mar. 5, same as No. 152, except on young tomato. Apr. 28, considerably calicoed.

Exp. 165. Mar. 5, same as No. 153, except on young tomato. Mar. 27, showed calico on young leaves. Apr. 28, calicoed considerably.

Exp. 166. Mar. 5, tomato, check to Nos. 161–165. Mar. 24, no calico; cut off near base, but no further growth.

Exp. 167. Mar. 5, same as No. 152, except on young pokeweed. Apr. 28, no calico on this or the check plant.

Exp. 168. Apr. 3, juice of crushed leaves of petunia (No. 158–b) transferred by hand to young petunia. Apr. 28, leaves not typically calicoed, but probably so, as more yellowish than check plant.

Exp. 169. Apr. 28, juice from fresh calicoed tobacco (*Nicotiana Tabacum*) transferred by hand to five plants of *Nicotiana Sandrae*. July 29, two dead, three plainly calicoed, or 60%, while none of the check plants showed any sure signs of calico.

Exp. 170. Apr. 28, same as No. 169, except on five plants of Giant Red tobacco. July 29, all five plants calicoed, or 100%. Two of the five checks also showed calico, or 40%.

Exp. 171. Apr. 28, same as No. 169, except on five plants of *Nicotiana affinis*. July 29, no signs of calico on any of these or the five check plants.

Exp. 172. Apr. 28, same as No. 169, except on two plants of *Nicotiana tomentosa*. July 29, one plant certainly calicoed, but the other probably not. No checks.

Exp. 173. Apr. 28, same as No. 169, except on two small seedling potatoes. July 29, one dead, but the other showing positive signs of calico.

In 1910, Experiment Station Farm, Centerville.

Exp. 174. June 28, tobacco seedlings grown from seed saved in injection experiment No. 147 were set out, using (a) plants from seedpod a–1, and (b) plants from seedpod a–2. Aug. 30, (a) 11 plants free, 12 calicoed, or 52%; (b) 23 plants free, none calicoed. Totals, free 34, calicoed 12, or 26%.

Exp. 175. June 28, same as in No. 174, but seed from No. 147 used, as follows: plants from (a) seedpod b–1; (b) seedpod b–2; (c) seedpod b–3; (d) seedpod b–4. Aug. 30, (a) 13 plants free, 10 calicoed, or 43%; (b) 42 free, 2 calicoed, or 5%; (c) 36 free, 11 calicoed, or 23%; (d) 36 free, 5 calicoed, or 12%. Total, free, 127; calicoed, 28, or 18%.

Exp. 176. June 28, same as No. 174, but seed from No. 148, using plants from (a) seedpod a–1, (b) seedpod a–2. Aug. 30, (a) 36 plants free, 5 calicoed, or 12%; (b) 45 plants free, 1 calicoed, or 2%. Totals, 81 free, 6 calicoed, or 7%.

Exp. 177. June 28, same as No. 174, but seed from No. 148, using plants from (a) seedpod b–1, and (b) seedpod b–2. Aug. 30, (a) 31 plants free, 2 calicoed, or 6%; (b) 23 free, none calicoed. Total, 54 free, 2 calicoed, or 4%.

Exp. 178. June 28, checks for Nos. 174–177, no treatment, 45 plants. Aug. 30, 43 free, 2 calicoed, or 4%.

Exp. 179. July 29, dried crushed calicoed tobacco leaves (gathered in October, 1907) were soaked for two hours in a small amount of water, and then water and fragments were placed on alternate (odd-number) plants (a) in row of 54 plants, leaving even-number plants (b) for checks. Aug. 9, calico hardly evident as yet on (a), not at all on (b). Aug. 12, (a) 9 out of 27 plants calicoed; (b) all 27 plants free. Aug. 30, (a) 17 calicoed, 10 free; (b) all free. Calicoed, 1st exam., (a) ?%, (b) 0%; last exam., (a) 63%, (b) 0%.

Exp. 180. July 29, treatment same as in No. 179, except fresh calicoed tobacco leaves soaked in water and used on (a) each alternate (odd-numbered) of 87 plants, with alternate even numbers untreated (b) for checks. Aug. 9, (a) calico hardly evident as yet; (b) no signs of calico. Aug. 12, (a) 27 of the 44 plants calicoed; (b) all of the 43 plants free. Aug. 30, (a) 36 calicoed, 8 free; (b) one calicoed in top, 42 free. Calicoed, 1st exam., (a) ?%; (b) 0%; last exam., (a) 82%, (b) 2%.

Exp. 181. July 29, each alternate (odd-numbered) plant in row of 85 touched with (a) juice from fresh calicoed leaf, renewing on hand each time before touching; (b) even-numbered plants left untouched for checks. Aug. 9, (a) calico just beginning to show on practically every plant; (b) all free. Aug. 12, (a) all 43 plants plainly calicoed; (b) no calico in the 42 plants. Aug. 30, (a) all badly calicoed; (b) 2 calicoed in upper leaves only, 40 free. Calicoed, 1st exam., (a) 100% (?), (b) 0%; last exam., (a) 100%, (b) 5%.

Exp. 182. July 29, each alternate (odd-numbered) plant in row of 60 touched as in No. 181, but juice on hand not renewed (a); even numbers left untouched (b) as checks; after washing hands thoroughly with soap and water, 14 additional plants (c) were touched in same row. Aug. 9, calico just beginning to show in practically every plant in (a), but not at all on (b) and (c). Aug. 12, (a) all plants plainly calicoed, (b) all 30 plants free, (c) all 14 plants free. Aug. 30, (a) all badly calicoed; (b) 2 calicoed in top only, 28 free; (c) all free. Calicoed, 1st exam., (a) 100%; (b) 0%, (c) 0%; last exam., (a) 100%, (b) 7%, (c) 0%.

Exp. 183. July 29, same as No. 181–a, except five muskmelon vines were touched. Aug. 10, no signs of calico or chlorosis showed on this date or later.

Exp. 184. July 29, same as No. 179, except five young muskmelon vines were used. Aug. 10, no signs of calico or chlorosis appeared on this date or later.

Exp. 185. Aug. 30, 88 plants cut off close to ground, as in No. 186. (a) alternate odd-numbered plants cut off with knife used on calicoed leaf before each cutting; (b) alternate even numbered plants cut off with knife cleaned each time before using with soap and water, and

wiped dry with fresh paper; 5 odd and 5 even numbered plants showed calico when cut off. Sept. 30, (a) 8 with suckers free, 5 (plants calicoed when cut off) with calicoed suckers, 31 (plants apparently free when cut off) with calicoed suckers; (b) 37 with suckers free, 5 (plants calicoed when cut off) with calicoed suckers, 2 (plants apparently free when cut off) with calicoed suckers. Calicoed (a) 82%, (b) 16% (including the five originally calicoed, or only 5% without these).

Exp. 186. Aug. 30, same as No. 185, but 76 healthy plants merely topped, using (a) calicoed knife on alternate odd-numbered, and (b) cleaned knife on even-numbered plants. Oct. 10, the topping was made too late for sufficient growth of suckers to determine certainly whether calicoed or not, so results show a small percentage of calico on this date, as follows: (a) 28 free, 10 calicoed, or 26%; (b) 36 free, 2 calicoed, or 5%.

In 1911, Experiment Station Farm, Centerville.

Exp. 187. Aug. 2, juice from fresh calicoed leaves used on hands, touching each alternate (even-numbered) (a) of 40 plants, the odd-numbered (b) being left untouched as checks. Sept. 12, (a) 20 plants badly calicoed, none free; (b) 14 free, 3 doubtful, 2 with calicoed shoots, 1 with main leaf calicoed. Calicoed, (a) 100%, (b) 15%.

Exp. 188. Aug. 2, juice was used from peculiar malformed leaves of "string leaf" disease, received from Tariffville, where trouble was bad in field. These plants had the color of suppressed calico, but other similar plants kept in crocks in the greenhouse for a time regained their normal color. Each alternate (a) (odd-numbered) of 30 plants was touched with juice on hands, while even-numbered (b) were left untouched as checks. Sept. 12, (a) 1 calicoed (probably from original unknown infection), 14 free; (b) all 15 plants free.

Exp. 189. Aug. 15, upper leaves of each alternate (odd-numbered) of 38 plants (a) touched with hands containing fresh calicoed juice (not renewed after each touching); while alternate even-numbered plants (b) were left untouched as checks. Most of the plants in Nos. 187–189 were too nearly grown to admit of infection except in sprouts or suckers. Sept. 12, (a) 1 plant with main leaves badly calicoed, 14 with upper leaves and sprouts calicoed, 4 with sprouts only calicoed, none free; (b) all 19 plants free. Calicoed, (a) 100%, (b) 0%.

Exp. 190. Aug. 15, dried crushed calicoed tobacco leaves (kept indoors since October, 1907), were soaked in water, and the material used (a) on upper leaves of alternate (odd-numbered) plants in row of 41, leaving the even numbers (b) untreated as checks. Sept. 12, (a) 1 plant with main leaves calicoed, 20 with upper leaves and sprouts calicoed, none free; (b) 19 free, 1 with sprout calicoed. Calicoed, (a) 100%, (b) 5%.

Exp. 191. Aug. 15, pure calicoed juice preserved in toluol since September, 1908 (same as used in No. 92), used on upper leaves of (a) alternate odd-numbered plants in row of 30, keeping (b) the even-numbered untreated as checks. Sept. 12, (a) 2 with main leaves calicoed, 4 with upper leaves and sprouts calicoed, 6 with sprouts only calicoed, 2 doubtful, 1 free; (b) all 15 free. Calicoed, (a) 80 to 93%, (b) 0%.

Exp. 192. Aug. 23, upper leaves of 6 young tobacco plants (set out late) were touched with juice on hands from fresh calicoed tobacco. Sept. 12, all 6 plants badly calicoed, or 100%.

Exp. 193. Aug. 23, same as No. 192, but only lower mature leaves were touched. Sept. 12, all 6 plants badly calicoed above, but old leaves not showing calico. Calicoed, 100%.

Exp. 194. Aug. 23, same as No. 190, but calicoed tobacco water, etc., seven to eight days old was used on 6 plants. Sept. 12, 4 plants free, 2 calicoed, or 33%.

Exp. 195. Aug. 28, same as No. 194, but infusion freshly made, on 6 plants. Sept. 12, all 6 plants calicoed, or 100%.

Exp. 196. Aug. 23, same preserved calicoed juice was used as in No. 191, on 12 young plants. Sept. 12, for some undetermined reason this treatment did not act as before, and none of the plants showed calico on this date. Were not examined later.

Exp. 197. Aug. 23, 12 young tobacco plants were touched with juice on hands from fresh leaves of healthy tobacco. Sept. 12, all plants free, or 0% calicoed.

Exp. 198. Plants set out late, July 5, same as in Nos. 192–197. These plants were grown from seed taken from calicoed plants Nos. 174–177, which in turn came from seed from plants injected with calicoed juice. Sept. 12, 1 calicoed, 174 free. Sept. 30, 8 calicoed, 6 doubtful, 161 free; plants hardly mature yet. Calicoed, 1st exam., ½%, last exam. 5%.

Exp. 199. Sept. 12, 38 plants used in No. 189 were topped with knife which was washed with soap and water and wiped with fresh paper each time before topping. At this time 19 of the topped plants showed signs of calico, and 19 showed no signs of it. Sept. 30, all the 19 calicoed plants showed calicoed sprouts, while of those apparently free, only 2 produced calicoed sprouts, or 11%.

In 1912, Experiment Station Farm, Mount Carmel.

Exp. 200. June 8, just before transplanting, roots of 21 tobacco plants were dipped in pure juice from fresh calicoed tobacco leaves. Care was used not to get any of the juice on any other part of the plant. July 10, 2 dead, 2 apparently free, 17 plants plainly calicoed. Sept. 10, 2 missing, 19 calicoed badly, so as to stunt their growth. Calicoed, 1st exam., 81–90%, last exam., 90–100%.

Exp. 201. June 8, part of same calico juice used in No. 200 placed on leaves of 10 plants after setting. July 10, 3 apparently free, 7 plainly calicoed. Sept. 10, 9 badly calicoed and stunted in their growth, 1 stunted, but apparently not calicoed. Calicoed, 1st exam., 70%, last exam., 90%.

Exp. 202. June 8, tap root, with most of rootlets, cut off from 25 plants just before setting out. July 10, 1 plant dead, 1 calicoed, 23 free. Sept. 10, 1 missing, 2 calicoed, 22 free. Calicoed, 1st exam., 4%, last exam., 8%.

Exp. 203. June 8, tap root of 15 plants bent back before setting out. July 10, none calicoed. Sept. 10, 1 calicoed, 14 free. Calicoed, 1st exam., 0%, last exam., 7%.

Exp. 204. June 8, checks to Nos. 200–203, no treatment, 20 plants. July 10, 1 dead, 1 calicoed, 2 doubtful, 16 free. Sept. 10, 1 missing, 2 calicoed, 17 free. Calicoed, 1st exam., 5% (?), last exam., 10%.

Exp. 205. July 10, crushed dried calicoed tobacco leaves (herbarium specimens obtained from Southington in July, 1902) soaked in small amount of water for about four hours, and used on leaves of (a) 6 young tobacco plants, leaving (b) 4 similar plants as checks. Sept. 10, (a) all 6 plants free from calico; (b) 3 free, 1 calicoed. Calicoed, (a) 0%, (b) 25%.

Exp. 206. July 10, same as No. 205, except calicoed and rusted tobacco leaves gathered in September, 1907, at Centerville, were used on 6 young plants (a), leaving 4 plants (b) as checks. Sept. 10, (a) 4 free, 2 calicoed, (b) 3 free, 1 calicoed in upper leaves. Calicoed, (a) 33%, (b) 25%.

Exp. 207. July 10, same as No. 205, except calicoed and rusted leaves gathered in August, 1911, in Middletown, were used on 6 young plants. (Check plants were the same as in Nos. 205–206.) Sept. 10, 2 free, 1 calicoed in upper leaves, 3 calicoed all over. Calicoed, 67%.

Exp. 208. Aug. 28, fresh calicoed and rusted mature leaves from No. 201 were gathered, washed, and cut into bits, and the juice extracted in hydraulic press, part of this filtered through Berkefeld filter into flasks, and used on leaves of 19 half-grown Havana tobacco plants about eighteen hours later. Sept. 10, 18 free, 1 calicoed in upper leaves. Sept. 27, 1 with main leaves calicoed, 3 with calicoed sprouts, 15 free. Calicoed, 1st exam., 5%, last exam., 21%.

Exp. 209. Aug. 23, same treatment as in No. 208, except that after filtering, juice was sterilized in autoclave one-half hour, and used at same time on leaves of 19 similar tobacco plants. Sept. 10, all 19 plants free. Sept. 27, 16 free, 2 doubtful, 1 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 5% (?).

Exp. 210. Aug. 23, same treatment as in No. 208, except juice was neither filtered nor sterilized before using on 18 similar tobacco plants. Sept. 10, 16 plants free, 2 calicoed in upper leaves. Sept. 27, 14 free, 2 doubtful, 2 calicoed in upper leaves. Calicoed, 1st exam., 11%, last exam., 11–22%.

Exp. 211. Aug. 23, checks for Nos. 208–210, no treatment, 13 plants. Sept. 10, all 13 free. Sept. 27, 12 free, 1 calicoed. Calicoed, 1st exam., 0%, last exam., 8%.

Exp. 212. Aug. 23, same treatment as in No. 208, except young calicoed, but not rusted leaves, from same source, were used on 18 Havana tobacco plants nearly in bloom. Sept. 10 and 27, all free. Calicoed, 0%.

Exp. 213. Aug. 23, same treatment as in No. 209, except juice from leaves as in No. 212 was used on 18 similar plants. Sept. 10 and 27, all free. Calicoed, 0%.

Exp. 214. Aug. 23, same treatment as in No. 210, except juice from leaves as in No. 212 was used on 18 similar plants. Sept. 10, all free. Sept. 27, 15 free, 3 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 17%.

Exp. 215. Aug. 23, checks to Nos. 212–214, no treatment on 18 plants. Sept. 10 and 27, all free. Calicoed, 0%.

Exps. 208–215. In these experiments Havana instead of Broadleaf tobacco was used, and yet this does not explain why calico failed to appear where naturally expected in Nos. 208, 210, 212 and 214, because before treatment some of the Havana plants not used in the experiments showed calico. The plants when treated were a little old, and this may have made some difference, but to overcome this, all of those showing blossoms were topped on September 10, using a knife washed with soap and water and wiped dry after each topping, yet the suckers from these did not develop calico. It looks as if the trouble might be due to the use of calicoed juice which may have lost its power of infection from standing eighteen hours, without any preservative to prevent bacterial fermentation; or because the juice was not rubbed in but merely dropped on the plants.

In 1913, Experiment Station Farm, Mount Carmel.

Exp. 216. June 25, juice on hands from fresh calicoed leaves was used in touching, with considerable pressure, single leaf on 20 young tobacco plants just starting to grow, renewing juice on hands before each touching. June 27, leaves more or less injured where touched, looking like burn. July 8, calico showing on young leaves of apparently all the plants. July 28, 19 prominently calicoed, 1 doubtful. Aug. 21, all badly calicoed, and somewhat stunted. Calicoed, 100%.

Exp. 217. June 25, same as No. 216, but two leaves of 20 plants were touched, and juice on hands was not renewed after touching first plant. June 27, same injury as in No. 216. July 8, all plants apparently calicoed. July 28, all plants prominently calicoed. Aug. 21 and Sept. 11, all badly calicoed. Calicoed, 100%.

Exp. 218. June 25, checks for Nos. 216–217, no treatment, 15 plants. July 8 and 28, all 15 plants free. Aug. 21, Sept. 11, 2 plants calicoed slightly in upper leaves, 13 free. Calicoed, 1st exam., 0%, last exam., 13%.

Exp. 219. June 27, fresh calicoed tobacco leaf tissue was crushed in very small amount of water, juice poured off, and two drops used on each of three leaves of 20 young tobacco plants. July 8, 6 plants apparently calicoed, 14 free. July 28, same as before, except calico evident in all 6 plants. Aug. 21, 9 with calicoed main leaves, 4 with upper leaves, 7 free. Sept. 11, 9 with main leaves badly calicoed, 5 with upper leaves only, 1 calicoed in sprouts, 5 free. Calicoed, 1st exam., 30%, last exam., 75%.

Exp. 220. June 27, same as No. 219, except juice was mixed half and half with similar juice from Coprinus sps., obtained by soaking crushed tissue in small amount of water and then filtering through filter paper. Two drops of this juice was used immediately after mixing on three leaves each of 20 young tobacco plants. July 8, 4 plants doubtful, 16 free.

July 28, all 20 apparently free. Aug. 21 and Sept. 11, 1 calicoed in upper leaves only, 19 free. Calicoed, 1st exam., 0 % (?), last exam., 5%.

Exp. 221. June 27, same as No. 220, except juice from tobacco and Coprinus was mixed three hours before using on 20 young tobacco plants. July 8, 3 plants apparently calicoed, 17 free. July 28, 5 plants apparently calicoed, 15 free. Aug. 21, 5 with main leaves calicoed, 4 calicoed in upper leaves only, 11 free. Sept. 15, 5 with main leaves calicoed, 4 calicoed in upper leaves only, 6 with calicoed sprouts, 5 free. Calicoed, 1st exam., 15%, last exam., 75%.

Exp. 222. June 27, same as No. 220, except juice of Coprinus only was used without adding the calicoed tobacco juice, on 15 young tobacco plants. July 8 and 28, all free. Aug. 21 and Sept. 11, 1 calicoed in upper leaves only, 14 free. Oct. 3, 2 plants with calicoed sprouts, 12 free. Calicoed, 1st exam., 0%, last exam., 20%.

Exp. 223. June 27, checks for Nos. 219–222, no treatment, 14 plants. July 8 and 28, all plants free. Aug. 21, 1 calicoed, 13 free. Sept. 11, 1 calicoed in main leaves, 1 in sprouts, 12 free. Oct. 3, 2 with calicoed sprouts, leaving 11 free. Calicoed, 1st exam., 0%, last exam., 21%.

Exp. 224. July 9, fresh leaves of "yellows" raspberries from Benham's, Highwood, crushed in hands and two upper leaves of 10 tobacco plants touched, renewing juice on hands each time before touching. July 23 and 28, all plants free. Aug. 24, 5 free, 4 calicoed in upper leaves only, 1 with main leaves calicoed. Sept. 11, same as before, except one additional plant with calicoed sucker. (Probably some infection carried from a latent calicoed tobacco plant in touching, was responsible, rather than the "yellows" of the raspberry, for the late infection.) Calicoed, 1st exam., 0%, last exam., 60%.

Exp. 225. July 9, same as No. 224, except juice from fresh calicoed tomato leaves from same farm, was used on 10 tobacco plants. July 23, all plants calicoed. July 28, all badly calicoed. Aug. 24 and Sept. 11, all plants very badly calicoed on main leaves, and somewhat stunted. Calicoed, 1st and last exam., 100%.

Exp. 226. July 28, fresh specimens of Coprinus were crushed in small amount of water, then tissue and juice were placed on three or four leaves of 5 calicoed tobacco plants used in No. 216. Sept. 11, these calicoed plants showed no recovery from calico as compared with adjacent calicoed plants.

Exp. 227. July 29, fresh calicoed tobacco leaves of No. 216 were washed with small amount of water, cut in strips, and juice pressed out in hydraulic press (9.00 A. M.) and used (3.00 P. M.) by pouring a few drops on three leaves each of 10 tobacco plants. Aug. 24, 2 free, 1 doubtful, 7 calicoed in upper leaves. Sept. 11, 8 calicoed in upper leaves, 2 with calicoed sprouts. Calicoed, 1st exam., 70–80%, last exam., 100%.

Exp. 228. July 29, same treatment as in No. 227, except juice was sterilized in autoclave before pouring it on the leaves of 10 tobacco plants. Aug. 24, 9 free, 1 calicoed in upper leaves only. Sept. 11, 8 free, 1 calicoed in upper leaves, 1 calicoed in sprouts. Oct. 3, same as before, but one more plant showing calicoed sprouts. Calicoed, 1st exam., 10%, last exam., 30%.

Exp. 229. July 29, same treatment as in No. 227, except juice was filtered through Berkefeld filter into sterilized test tubes before pouring on leaves of 10 tobacco plants, as follows: (a) 5 plants with juice rubbed in after pouring, with fresh piece of paper for each plant; (b) 5 plants with juice not so rubbed in. Aug. 24, (a) all 5 plants with upper leaves calicoed; (b) all 5 plants free. Sept. 11, Oct. 3, same, except (b) 1 plant showing calicoed sprout. Calicoed, 1st exam., (a) 100%, (b) 0%; last exam., (a) 100%, (b) 20%.

Exp. 230. July 29, same leaves as in No. 227, after pressing, were thoroughly ground in mortar with small amount of water added, and this juice dropped on 10 tobacco plants. Aug. 24 and Sept. 11, all 10 plants with upper leaves calicoed Calicoed, 100%.

Exp. 231. July 29 same as No. 230, except juice was sterilized in autoclave before pouring it on 10 tobacco plants. Aug. 24, all 10 plants free. Sept. 11, 9 free, 1 calicoed in sprout Oct 3, 8 free, 2 calicoed in sprouts Calicoed, 1st exam, 0%, last exam., 20%.

Exp. 232. July 30, same treatment as in No. 227, except juice twenty-four hours older, not preserved, used on 10 plants (a) and (b) as in No. 229. Aug. 24, (a) all 5 plants calicoed in upper leaves; (b) 4 free, 1 calicoed in upper leaves. Sept 11, same as before, except (b) with 3 free, 1 calicoed in upper leaves, 1 calicoed in sprouts. Oct 3, same as before, except (b) with 2 now calicoed in sprouts. Calicoed, 1st exam., (a) 100%, (b) 20%; last exam., (a) 100%, (b) 60%.

Exp. 233. July 30, same treatment as in No. 228, except sterilized juice twenty-four hours older, not preserved, used on 10 plants. Aug. 24, Sept. 11, all 10 plants free. Oct. 3, 8 free, 2 calicoed slightly in sprouts. Calicoed, 1st exam., 0%, last exam., 20%.

Exp. 234. July 30, same treatment as in No. 229, except filtered juice twenty-four hours older, in sterilized tube, was used on 10 plants (a) and (b) as in No. 229. Aug. 24, (a) 4 plants with upper leaves calicoed, 1 with main leaves calicoed; (b) all 5 plants free. Sept. 11, same as before, except (b) 1 plant with a few upper leaves calicoed. Calicoed, 1st exam., (a) 100%, (b) 0%, last exam., (a) 100%, (b) 20%.

Exp. 235. July 30, same treatment as in No. 227, except juice preserved with film of toluol after extraction, and now twenty-four hours older, was used, on 10 plants (a) and (b) as in No. 229. Aug. 24 and Sept. 11, (a) all 5 plants with upper leaves calicoed; (b) 2 free, 2 with upper leaves calicoed, 1 with calicoed sprouts. Oct. 3, (b) one additional plant with calicoed sprouts. Calicoed, 1st exam., (a) 100%, (b) 60%, last exam., (a) 100%, (b) 80%.

Exp. 236. July 30, same treatment as in No. 230, except juice preserved with film of toluol and used twenty-four hours later on 10 plants. Aug. 24, Sept. 11, all 10 plants with upper leaves calicoed. Calicoed, 100%.

Exp. 237. July 30, checks for Nos. 224-236, no treatment, 10 plants. Aug. 24, Sept. 11, 9 plants free, 1 calicoed in upper leaves only. Calicoed, 10%.

Exp. 238. Aug. 7, same treatment as in No. 227, except juice now

nine days older, not preserved, used on 10 plants. Aug. 24, 7 free, 3 calicoed in upper leaves only. Sept. 11, 4 free, 3 calicoed in upper leaves, 3 in sprouts only. Oct. 3, 1 more calicoed in sprouts, leaving 3 free. Calicoed, 1st exam., 30%, last exam., 70%.

Exp. 239. Aug. 7, same treatment as in No. 228, except sterilized juice nine days older, not preserved, used on 10 plants. Sept. 11, 5 free, 2 calicoed in upper leaves, 3 calicoed in sprouts. Oct. 3, 1 more calicoed in sprouts, leaving 4 free. Calicoed, 1st exam., 50%, last exam., 60%.

Exp. 240. Aug. 7, same treatment as in No. 229, except filtered juice nine days older, not preserved, used on 10 plants. Sept. 11, 8 free, 2 calicoed in upper leaves only. Oct. 3, 5 free, 2 calicoed in upper leaves, 3 calicoed in sprouts only. Calicoed, 1st exam., 20%, last exam., 50%.

Exp. 241. Aug. 7, same treatment as in No. 227, except juice preserved in toluol after pressing out, and now nine days older used on 10 plants. Sept. 11, 4 free, 1 calicoed in upper leaves, 5 calicoed in sprouts only. Oct. 3, 2 free, 1 calicoed in upper leaves, 7 in sprouts. Calicoed, 1st exam., 60%, last exam., 80%.

Exp. 242. Aug. 7, fresh calicoed tobacco leaves from No. 225 (originally calicoed from tomato leaves) were crushed in the hands and, without renewing, one leaf each of 25 tobacco plants were touched in succession. Sept. 11, none free, 8 calicoed in upper leaves, 17 calicoed in sprouts only. Calicoed, 100%.

Exp. 243. Aug. 7, same as in No. 242, except after touching these plants, hands were washed thoroughly with soap and water, and 25 plants were touched as before. Sept. 11, 24 free, 1 doubtful. Oct. 3, 23 free, 2 calicoed in sprouts only. Calicoed, 1st exam., 0% (?), last exam., 8%.

Exp. 247. Aug. 7, checks for Nos. 238–243, no treatment, 20 plants. Sept. 11, all free. Oct. 3, 19 free, 1 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 5%.

Exps. 244–255. Aug. 14–21, these were experiments made with a fresh lot of crushed juice from calicoed tobacco leaves, and many of the experiments Nos. 227–241 were repeated. The experiments were started too late in the season to obtain full results, but as far as shown, they confirmed those previously made.

In 1914, Experiment Station Farm, Mt. Carmel.

Exp. 256. July 10, chlorosis pokeweed leaves, recently collected at Meriden, were thoroughly mashed in a small amount of water, and after standing two and one-half hours, juice and pulp were poured on leaves of 20 young tobacco plants, and rubbed in, using fresh piece of paper each time. None showed calico at this date. Aug. 7, 1 calicoed, 19 free; Sept. 10, 3 calicoed, 2 calicoed in sprouts only, 15 free. Calicoed, 1st exam., 5%, last exam., 25%.

Exp. 257. July 10, fresh calicoed tobacco leaves were thoroughly mashed in small amount of water, and after standing for two and one-half hours, the greenish liquid was poured off and mixed with equal parts of blackish liquid from fresh *Coprinus micaceus* similarly treated; five

minutes after mixing, several drops were placed on a leaf of each of 10 small tobacco plants, and rubbed in, using fresh paper each time, without touching the plants with the hands. Only one showed calico at the time, or 10%. Aug. 7, 9 calicoed, 1 free; Sept. 10, all 10 calicoed. Calicoed, 1st exam., 90%, last exam., 100%.

Exp. 258. July 10, check to No. 257. Same treatment, except instead of mixing with *Coprinus micaceus* juice, an equal amount of water was added, on 10 young plants, 3 of which showed calico. Aug. 7 and Sept. 10, all 10 calicoed. Calicoed, 1st and last exam., 100%.

Exp. 259. July 10, used only the Coprinus liquid, same as in No. 257, which was not rubbed in, after placing on 3 calicoed plants and 2 previously touched with calicoed juice on hands. Aug. 7, Sept. 10, all 5 calicoed. Calicoed, 1st and last exam., 100%.

Exp. 260. July 10, checks to Nos. 256–9, 261-2,no treatment, but of the 15 plants, 2 already showed calico at this time. Aug. 7 and Sept. 10, 3 calicoed, 12 free. Calicoed, 1st exam., 13%, last exam., 20%; therefore we would naturally expect at least 13–20% of the plants in the experiments this year to show calico without treatment of any kind. See Nos. 264–266 for data regarding source of infection.

Exp. 261. July 14, one or more leaves of 24 tobacco plants (2 of which showed calico at the time) were touched with fresh calico juice on the hands, and same treatment repeated on July 28th. Aug. 7 and Sept. 10, all 24 plants calicoed. Calicoed, 1st and last exam., 100%.

Exp. 262. July 21, slaked lime, about one pound per plant, was placed around 19 small tobacco plants, which on July 10th showed no signs of calico. Aug. 7, 2 calicoed, 17 free; Sept. 10, 4 calicoed (1 only in upper shoots), 15 free. Calicoed, 1st exam., 11%; last exam., 21%.

Exp. 263. July 21, about one-third pound of acid phosphate was placed around each of 19 small tobacco plants, of which only one showed calico on July 10th. Aug. 7, only one calicoed; Sept. 10, 14 free, 2 completely calicoed, 2 calicoed in upper leaves only, and 1 in sprouts only. Calicoed, 1st exam., 11%, last exam., 26%.

Exp. 264. All plants in Nos. 256–265 were raised as seedlings in our greenhouse in sterilized soil, carefully reset in trays of 100, and when set out in the field, were set about six feet apart so that they would not touch each other. These precautions were taken so that there would be little or no calico in the plants except as due to the experiments. Unfortunately, in the same greenhouse but in another room, old calicoed tobacco had been grown all winter, and the white fly was more or less abundant there. Without question these flies carried the calico to some of the young seedlings, and it may have been further spread by handling in resetting, since when we started to set these plants out in the field, on June 3d, we found one or more plants in each tray showing the first signs of calico. These and the surrounding plants were all discarded, and in order to prevent further infection, care was taken to wash the hands frequently with soap and water, and to touch the leaves of the plants as little as possible. Most of these plants, the 156 Broadleaf of this experiment and the Havana plants of No. 265, were left without

further treatment, and the amount of calico determined from time to time. This amount would have been greater had we not taken the above precautions at the time of transplanting.

July 10, 26 wholly calicoed, 3 doubtful or missing, 127 free; Aug. 7, 35 wholly calicoed, 8 doubtful or missing, 113 free; Sept. 10, 39 wholly calicoed, 15 calicoed in upper leaves only, 3 calicoed in sprouts only, 4 doubtful or missing, 95 free. Calicoed, 1st exam., 17%, 2d exam., 23%, last exam., 37%. The first and second examinations probably show about the percentage of calico due to infection in the greenhouse and handling in transplanting to the field, while the increase in the third examination shows that due to secondary field infection.

Exp. 265. Same as No. 264, except that 125 plants of Havana were used. July 10, 4 wholly calicoed, 1 doubtful or missing, 120 free; Aug. 7, 9 wholly calicoed, 4 doubtful or missing, 112 free; Sept. 10, 12 wholly calicoed, 10 calicoed in upper leaves only, 16 calicoed in sprouts only, 22 doubtful or missing, 65 free. Calicoed, 1st exam., 3%, 2d exam., 7%, last exam., 30%. It was more difficult to determine calico positively on the Havana than on the Broadleaf.

Exp. 266. Other seedlings grown in the same greenhouse, and therefore subject to infection, were planted elsewhere for plant breeding experiments, and an examination of these on July 10th showed 155 calicoed plants out of 1,452 counted, or 11%. No doubt later counts would have shown the same proportional increase as in our experimental plots. This percentage of calico was much larger than we have usually had in the field at this time of year. Young tomato plants grown in the same greenhouse, when set out in the field, showed a very unusual amount of calico early in the season.

Exp. 267. July 14, *Nicotiana rustica scabra*, (a) leaves of 7 plants were touched with juice on hands from fresh calicoed Broadleaf tobacco; (b) 7 plants with juice from fresh calicoed tomato leaves; (c) checks, 5 plants, no treatment. All the plants in Nos. 267–277 were kindly furnished by Dr. E. M. East, and were grown at the greenhouses of the Bussey Institution, Boston, Mass., and planted out-of-doors at Mt. Carmel on June 17th. Dr. East wrote that some of these seedlings did not grow well, due to cold or poor soil, and showed indications of chlorosis. This may explain the yellowish mottling of the foliage, not typical calico, on some of the plots, including the checks, later in the season.

Sept. 3, (a) all 7 plants *decidedly dwarfed*, six to twelve inches high, much branched; *leaves very much reduced, irregular, crinkled*, somewhat mottled with yellow, but not typical calico variegation (see photo); (b) all 7 plants similar to *a*; (c) checks with normal foliage, and two to two and one-half feet high, except one undersized normal plant and one large plant with foliage a little off color.

Exp. 268. Same as No. 267, but on *Nicotiana alata grandiflora*. (a) Calicoed tobacco juice on 4 plants; (b) calicoed tomato juice on 4 plants; (c) checks, 2 plants. Sept. 3, (a) 2 with upper leaves showing rather typical calico chlorosis and some of them irregular in shape; 1 plant dead; 1 plant apparently normal; (b) 2 plants calicoed, 1 doubtful, 1 normal; (c) both checks apparently normal, but a little off color.

Exp. 269. Same as No. 267, but on *Nicotiana attenuata*. (a) Calicoed tobacco juice on 6 plants; (b) calicoed tomato juice on 6 plants; (c) checks, 6 plants. Sept. 3, (a) all 6 plants decidedly smaller than the checks, and with foliage more slender and showing more yellowing, but not typical calico chlorosis; (b) similar to *a*; (c) checks apparently normal in growth and color of foliage.

Exp. 270. Same as No. 267, but on *Nicotiana plumbaginifolia*. (a) Calicoed tobacco juice on 8 plants; (b) calicoed tomato juice on 8 plants; (c) checks, 4 plants. Sept. 3, (a) and (b) similar, all living plants *decidedly dwarfed*, averaging less than one foot high, not much branched, with foliage scanty, small, and more or less yellowish and crinkled; one plant in each lot dead; (c) all check plants alive, apparently healthy, good color, plants bushy and averaging two feet high.

Exp. 271. Same as No. 267, but on *Nicotiana quadrivalis*. (a) Calicoed tobacco juice on 4 plants; (b) calicoed tomato juice on 4 plants; (c) checks, 3 plants. Sept. 3, (a) and (b) similar, all living plants *very small, stunted*, about three or four inches high, with foliage narrow and yellowish; only 4 of the 8 plants alive; (c) one check dead, but the other two normal green in color and about ten inches high.

Exp. 272. Same as No. 267, but on *Nicotiana alata* var. (a) Calicoed tobacco juice on 4 plants; (b) calicoed tomato juice on 4 plants; (c) checks, 4 plants. Sept. 3, (a) and (b), 4 out of the 8 plants dead, the others failed to show calico in leaves on main stem, but those of the shoots showed typical mottling, and all plants were shorter (about one to one and one-half feet high) and less bushy than the checks; (c) 1 plant dead, the other 3 normal height (three feet) and bushy, color of leaves normal except one, which had a little calico mottling on the sprouts.

Exp. 273. Same as No. 267, but on *Nicotiana forgetiana*. (a) Calicoed tobacco juice on 2 plants; (b) calicoed tomato juice on 1 plant; (c) check, 1 plant. Sept. 3, not so much difference between infected plants and checks as in some other species, as plants were apparently too old when infected. Chief differences seen were that the infected plants were slightly smaller (two feet high as compared with three feet for check), with some leaves having typical mottling and with blossoms a deeper red color.

Exp. 274. Same as No. 267, but on *Nicotiana vincaeflora*. (a) Calicoed tobacco juice on 5 plants; (b) calicoed tomato juice on 5 plants; (c) checks, 4 plants. Sept. 3, (a) 2 plants dead, the other 3 somewhat smaller and less thrifty than the checks, with no typical calico, but some yellowish chlorosis of leaves, which also showed somewhat on the checks; (b) plants similar to checks, but slightly smaller, hard to recognize as calicoed; (c) plants all alive and apparently normal, except for some yellowing of foliage.

Exp. 275. Same as No. 267, but on *Nicotiana paniculata*. (a) Calicoed tobacco juice on 7 plants; (b) calicoed tomato juice on 7 plants; (c) checks, 6 plants. Sept. 3, (a) and (b) most plants of each lot show-

ing calico through smaller size (some quite dwarfed), with some of the main stem leaves merely yellowed, and others showing true calico mottling; remaining plants not surely calicoed, though somewhat irregular in size; (c) checks normal, except some having leaves yellow-spotted, not typical of calico.

Exp. 276. Same as No. 267, but on *Nicotiana rustica humilis*. (a) Calicoed tobacco juice on 2 plants; (b) calicoed tomato juice on 2 plants; (c) check, 1 plant. Sept. 3, (a) and (b) all plants showing calico through dwarfed size, poor foliage, some with typical calico mottling; (c) check vigorous, height, branching, and color of foliage normal.

Exp. 277. Same as No. 267, but on a mixture of the preceding species of tobacco and their crosses. (a) Calicoed tobacco juice on 10 plants; (b) calicoed tomato juice on 9 plants; (c) checks, 8 plants. Sept. 3, (a) 8 plants certainly showing signs of calico, as indicated by size, mottling, etc., and 2 doubtful; (b) 8 showing calico, 1 free; (c) 1 doubtful, signs of calico in sprouts, 7 free.

Exp. 278. July 10, fresh calicoed tobacco leaves were crushed in the hands, and leaves of (a) 7 plants of wild ground cherry, *Physalis* sp., were touched, leaving (b) 3 check plants. Sept. 10, (a) 2 plants showed faint signs of calico mottling and wrinkling of foliage, like suppressed calico; other plants normal, except that one was much smaller; (b) all 3 plants normal size and color, except one with some leaves of yellow cast, not like calico.

Exp. 279. Same as No. 278, except that (a) 7 egg plants, *Solanum melongena*, were treated, leaving (b) 3 for checks. Sept 10, (a) and (b) no signs of calico could be found on any of the plants, treated or untreated.

Exp. 280. Same as No. 278, except that (a) 7 pimento pepper plants *Capsicum annuum* var., were treated, leaving (b) 3 for checks. Sept. 10, (a) 5 plants dead (2 of these were alive Aug. 7th, and showed some signs of calico then), the other 2 smaller than the checks, but showing no sure signs of typical mottling of foliage; (b) checks all alive and normal.

Exp. 281. Same as No. 278, except that (a) 7 petunia plants, *Petunia* sp., were treated, leaving (b) 3 for checks. Sept. 10, (a) 5 plants with some leaves showing typical mottling, but not very evident on whole plant; 2 plants doubtful; (b) all 3 plants free.

Exp. 282. Same as No. 278, except that (a) 7 tomato plants, *Lycopersicum esculentum*, of different varieties were treated, leaving (b) 3 for checks. Sept. 10, (a) 5 plants evidently calicoed, as shown by typical mottling of leaves, 2 plants of Dwarf Champion doubtfully calicoed, as mottling was not so evident, though crinkling of leaves was more prominent than usual; (b) checks free, except sprout of one possibly calicoed.

Exp. 283. July 14, (a) young cucumber vine, *Cucumis sativus*, touched with juice from fresh calicoed tobacco leaves on hands; (b), same, but with juice from fresh calicoed tomato. Aug. 7, no signs of calico on either vine.

Exp. 284. Same as No. 283 (a) and (b), but young musk melon vines, *Cucumis melo*, 3 in each case, were touched. Aug. 7, no signs of calico on any of the vines.

Exp. 285. Same as No. 283, but tops of potato plants, *Solanum tuberosum*, were cut off in part before leaves were touched, in order to start new growth, and then three each were touched, as in (a) and (b). Aug. 7, plants made new growth, but no positive signs of calico appeared on this or on the old leaves of any of the plants.

Exp. 286. Same as No. 283, but on ordinary cultivated peppers, *Capsicum annuum*, (a) on 3 plants; (b) on 3 plants; (c) several check plants. Sept. 10, (a) and (b) 2 plants dead, 2 with no mottling, but plants somewhat smaller than checks, 1 plant with evident mottling on a few leaves, and 1 with faint typical calico mottling; (c) checks normal.

Experiments to Lessen Calico by Removing Calicoed Plants.

Some farmers, who believe that calico is contagious, pull up the calicoed plants they see when going through their fields. Often they do not know that calico can be transmitted by handling calicoed and then healthy plants, and so they are likely to do more harm than good through thoughtless handling or bugging of the plants at this time.

In order to gain some idea as to whether calico could be lessened in a field by the removal of calicoed plants at regular intervals, experiments along this line were undertaken in 1909 in the fields at Windsor belonging to Elias F. Aldrich and James H. Smith. These fields eventually showed considerable calico, and so quite a number of plants were removed from certain selected rows, while in other check rows they were not removed, but the number was determined in each case. The calicoed plants were first removed on July 16th, care being taken at all times not to spread the disease in any way by contact of calicoed plants with healthy or by handling healthy plants. As the calico first began to show in the fields a week or ten days previously, it would have been better if the first removal of calicoed plants had been made at that time. The particular data for each field are given under the following headings. The figures in case of the calicoed plants indicate that calico showed on the leaves of the main stem. Where it occurred only on sprouts, additional figures are sometimes given in parentheses.

Field of Elias F. Aldrich.

The plants were set out June 20th; but many had to be reset on account of cut worms. On July 16th they were quite unequal in height, but averaged about one foot. The seed bed had been used for four years, and the tobacco field for about the same length of time, previous to which it had not been in tobacco for

ten years. Some calico showed last year, but more showed this year. In Row 8, calicoed plants regularly alternated with healthy ones for a considerable distance and then gradually disappeared. Evidently these were set out by the same man, and were infected by juice from his hands. The plants were topped August 14th, shortly before the last count, but too early to show any calico in the young sprouts at that time. Rust was abundant on this date. September 25th, some time after cutting, we examined the stubs, but the suckers were not far enough developed in most cases to determine accurately the percentage of calico. See Tables I and II.

TABLE I. ROWS FROM WHICH CALICOED PLANTS WERE REMOVED.

Row No.	Total plants	July 16 removed	Aug. 2 removed	Aug. 19 counted but not removed	Total calicoed
1	296	11	6	3 (1)**	20 (1)
2	299	27	11	11 (3)	49 (3)
3	299	7	19	6	32
4	283	1	1	2	4
5	297	6	5	5 (3)	16 (3)
6	298	5	5	8 (1)	18 (1)
7	304	12	12	4 (4)	28 (4)
8	287	65	17*	7 (2)	89 (2)
9	305	4	5*	3 (3)	12 (3)
10	291	1	4*	5 (4)	10 (4)
11	327	2	1*	0 (3)	3 (3)
12	305	5	5*	7 (4)	17 (4)
13	289	39	9*	1 (1)	49 (1)
14	308	11	11*	4	26
Totals	4188	196	111	66 (29)	373 (29)
Per cent.	100	4.7	2.6	1.6	8.9

* Not removed, but on Aug. 19 only additional calicoed ones counted.
** Figures in parentheses indicate additional plants showing calico in axillary sprouts only.

TABLE II. ROWS FROM WHICH CALICOED PLANTS WERE NOT REMOVED.

Row No.	Total plants	Calicoed on July 16	Calicoed on Aug. 2	Calicoed on Aug. 19
15	307	5	9	12 (3)
16	300	18	25	26 (4)
17	287	3	7	22 (2)
18	295	49	64	76 (4)
19	311	26	29	44 (7)
20	292	17	25	31 (3)
21	307	15	17	26 (4)
22	301	1	1	12 (3)
23	292	1	2	5 (2)
24	255	1	1	7 (3)
Totals	2947	136	180	261 (35)
Per cent.	100	4.6	6.1	8.9

Field of James H. Smith.

This field was across the street from Mr. Aldrich's, and the plants on July 16th were somewhat larger and more even in height. They came from a new seed bed, and the field had been in tobacco for only three years recently. There was little calico last year. The plants were topped a short time before those of Aldrich, so that on August 19th the suckers were more advanced, but these had been removed on most of the plants in Rows 1 to 34. In Rows 35 to 51 the suckers had not been removed, and the numbers in parentheses show those plants that had developed calico in the sprouts only. As the plants were harvested earlier than those of Aldrich, the suckers from the stubs on September 25th had mostly developed far enough to determine whether or not they were calicoed; so their condition is also indicated in the table. The details of the examinations are given in tables III and IV.

TABLE III. ROWS FROM WHICH CALICOED PLANTS WERE REMOVED.

Row No.	Total plants	July 16 removed	Aug. 2 removed	Aug. 19 counted but not removed	Total calicoed	Sept. 25 suckers** Calicoed	Sept. 25 suckers** Free
1	76	0	0	1	1	17	30
2	73	0	1	0	1	12	41
3	76	2	2	0	4	17	48
4	81	4	1	0	5	23	42
5	80	3	1	1	5	23	32
6	80	7	2	1	10	21	33
7	81	4	2	3	9	26	34
8	81	2	0	2	4	29	38
9	81	1	1	4	6	24	39
10	82	1	3	2	6	26	37
11	79	2	5 (4)*	4	11	26	38
12	81	6	0	2	8	30	42
13	81	2	5	2	9	26	40
14	81	1	2	1	4	27	39
15	80	3	1 (2)	4	8	28	35
16	81	8	2 (1)	2	12	26	35
17	78	4	1 (7)	12	17	31	42
18	80	4	6	3	13	20	35
19	84	7	1 (1)	5	13	28	37
20	81	4	8	1	13	19	20
21	79	7	0 (7)	9	16	26	28
22	80	4	7	3	14	20	29
23	78	4	2 (3)	5	11	24	33
24	85	5	3 (5)	8	16	34	30
25	81	3	1 (2)	4	8	24	40
26	81	6	2 (2)	2	10	20	37
Totals	2081	94	59 (34)	81	234	627	934
Per cent.	100	4.5	2.8	3.9	11.2	40	60

* The figures in parentheses under Aug. 2d give the number of additional plants showing very little calico which were not actually removed, but were topped to prevent spread by handling when other plants were topped. They are included in count of Aug. 19th.
** As not all the sprouts had developed far enough to show whether calicoed or not, the percentage of calico finally developed was probably somewhat greater for all the rows (1–51) than indicated here.

TABLE IV. ROWS FROM WHICH CALICOED PLANTS WERE NOT REMOVED.

Row No.	Total plants	Calicoed July 16	Calicoed Aug. 2	Calicoed Aug. 19	Sept. 25 suckers** Calicoed	Free
27	84	5	8	9	23	36
28	82	15	28	40	29	28
29	80	5	7	9	40	29
30	82	4	6	6	28	30
31	80	4	6	12	33	25
32	83	2	7	11	20	32
33	80	4	5	14	25	25
34	85	3	7	10	26	38
35	83	3	3	5 (25)*	43	30
36	84	6	9	24 (44)	31	43
37	86	2	3	6 (18)	40	26
38	89	1	3	8 (36)	31	31
39	86	1	3	6 (10)	44	24
40	83	4	7	9 (26)	39	20
41	83	1	1	3 (8)	42	26
42	87	0	5	12 (29)	28	32
43	87	0	0	1 (8)	38	39
44	86	0	5	9 (25)	33	29
45	86	3	5	8 (11)	36	17
46	86	2	5	8 (32)	42	20
47	89	2	3	4 (6)	35	26
48	89	0	1	3 (20)	27	30
49	87	0	0	1 (2)	42	35
50	89	0	1	2 (7)	14	40
51	57	0	0	1 (1)	12	33
Totals	2093	67	128	221 (308)	801	744
Per cent.	100	3.2	6.1	10.6	52.	48.

* Figures in parentheses, Rows 35 to 51, give additional plants that showed calico only in the sprouts which had been left, those in plants in Rows 1 to 34 having been removed, so that data could not be obtained.

An examination of the results given in the preceding tables shows that the removal of the calicoed plants did not lessen to any extent the calico appearing on the main leaves of the plants during the season. In the Aldrich field, where the calicoed plants were removed they averaged 8.9 per cent. for the season, while this was exactly the percentage developed where they were not removed. In the Smith field, where the calicoed plants were removed the number calicoed even averaged 11.2 per cent., as against 10.6 per cent. where they were not removed.

These results indicate to us that the calico that develops on the main, or commercial leaves, appears chiefly on plants that were infected in the seed bed or at the time of transplanting, and that the time when especial care is needed to prevent calico in

the field is when transplanting is done. Our data, however, also indicate what our observation further confirms, that the removal of the calicoed plants lessens somewhat the amount of calico that appears in the sprouts and suckers. It would not, however, be profitable to remove calicoed plants for this purpose.

Effect of Planting from a Seed Bed Containing Calicoed Plants.

Near the experiment fields in Windsor previously referred to was another tobacco farm where the owner had been troubled by calico in recent years, and where this year he had noticed calicoed plants in his seed bed when transplanting. On July 16th, when examined by us, the plants remaining in the seed bed showed considerable calico, especially in those beds that had been covered with glass. We examined the field set out from these plants on the same dates as we did the other two fields, with the following results:

TABLE V. EFFECT OF CALICO IN SEED BED.

Rows	Total plants	Calicoed July 16	Calicoed Aug. 2	Calicoed Aug. 19
1–10	522	81	116	163
11–20	711	193	224	286
21–32	867	140	173	228
Total	2100	414	513	677
Per cent.	100	19.7	24.4	32.2

These figures clearly show that it does not pay to set plants from a seed bed where calico is undoubtedly present at the time of setting out, at least not unless especial care is taken not to spread the disease. They also indicate that most of the infection is spread at the time the plants are set out, as on July 16th the percentage of calicoed plants was 19.7, as against 32.2 per cent. on August 19th.

Percentage of Calico in Connecticut Fields.

The percentage of calicoed plants in the Connecticut tobacco fields varies greatly with the care of the growers (especially in recent years, when sterilizing the seed beds seems to lessen the amount), the season, the varieties grown, and the time of year when observations are made.

In 1906 we examined many field in both the Connecticut and the Housatonic Valleys, and on the whole we found less in the latter valley, where comparatively less commercial fertilizer and more horse manure is used. The growers there also seem to think they suffer less from it than the growers in the other valley. We do not know whether the method of fertilization has anything to do with this, however.

We have seen some fields where practically all the suckers produced after the tobacco was cut showed calico. As the calico on these suckers, or even on shoots from the main stem, does little harm, we give in the following counts, made from time to time, only the plants with calico showing on the leaves of the main stem. As a usual thing, the counts were made in different parts of the fields, to get a fair average.

TABLE VI. PERCENTAGES OF CALICO IN CONNECTICUT FIELDS.

No.	Date	Town	Total count	Calicoed	Per cent calicoed	Remarks
1	June 10, 1906	Portland	500	235	47.	Used tobacco water.
2	" 10, 1906	"	500	3	.5	
3	Sept. 10, 1907	Centerville	152	111	73.	Used tobacco water.
4	Aug. 3, 1908	Rainbow	400	8	2.	
5	" 3, 1908	"	400	13	3.	
6	" 3, 1908	"	400	26	6.	
7	" 3, 1908	"	500	18	4.	
8	" 3, 1908	"	400	8	2.	
9	Aug. 10, 1908	Tariffville	500	51	10.	
10	" 10, 1908	"	500	54	11.	Hand picked
11	" 10, 1908	"	500	19	4.	" "
12	" 10, 1908	"	500	11	2.	
13	" 10, 1908	"	500	68	14.	
14	" 10, 1908	"	500	4	1.	Sumatra
15	" 10, 1908	"	500	82	16.	
16	" 10, 1908	"	500	17	3.	
17	" 10, 1908	"	500	136	27.	
18	" 10, 1908	"	500	7	1.	Not topped
19	" 10, 1908	"	500	2	.5	" "
20	July 16, 1909	Windsor	700	156	22.	Seed bed infected.
21	Aug. 19, 1909	"	2,100	677	32.	Seed bed infected.
22	" 19, 1909	"	2,947	261	9.	
23	" 19, 1909	"	2,093	221	11.	
24	July 10, 1914	Mt. Carmel	1,452	155	11.	Seedlings infected
		Total.....	18,044	2,343	13.	

Effect of Calico on Size of Plants.

We have made no especial studies of the effect of calico on the number of leaves or their relative size and shape. Ordinarily calico does not seem to misshape them or even alter their relative length and breadth to any evident degree, though of course they are occasionally more or less irregular in outline. They are probably somewhat smaller in size than healthy leaves, though we have no measurements to prove this. It has, however, been very evident in our experiments that the calicoed plants are not so tall as the healthy plants adjacent to them. The effect of calico in reducing the height depended somewhat on its severity, and especially on how early in its life the plant became infected. Plate XXXII a shows in the first row a number of plants artifically calicoed which were much lower in height at the time the photograph was taken than the healthy plants of the same age at the end of the row.

In 1910 we artifically infected every other plant in two rows by touching them, when young, with calicoed juice on the hands. On October 21st, when fully grown, they were all measured. These measurements show that the 29 calicoed plants in the outer row averaged only 5 ft. 4.1 inches, as against 6 ft. 9.7 inches for those free from calico, or 1 ft. 5.6 inches shorter. In the inner row the difference was not quite so marked, possibly on account of more shade, as the 41 calicoed plants averaged 4 ft. 3.7 inches as against 5 ft. 8.4 inches for the healthy plants, or 1 ft. 4.7 inches shorter. The whole 70 calicoed plants averaged 1 ft. 5 inches shorter than the 70 healthy. The details of the measurements of the plants in the outer row are given in Table VII, where it can be seen that in only two cases did the calicoed plants grow taller than the adjacent free plants, and then only slightly taller, while very often the calicoed plants were decidedly shorter than the adjacent free plants.

TABLE VII. EFFECT OF CALICO ON HEIGHT OF PLANTS.

No.	Condition	Height		No.	Condition	Height		No.	Condition	Height	
		Ft.	In.			Ft.	In.			Ft.	In.
1	Calicoed.	3	6	21	Calicoed.	5	11	41	Calicoed.	6	0
2	Free.....	6	2	22	Free.....	6	9	42	Free.....	6	10
3	Calicoed.	4	2	23	Calicoed.	6	2	43	Calicoed.	5	4
4	Free.....	7	7	24	Free.....	7	0	44	Free.....	6	6
5	Calicoed.	4	8	25	Calicoed.	5	10	45	Calicoed.	6	0
6	Free.....	7	4	26	Free.....	7	7	46	Free.....	7	7
7	Calicoed.	4	11	27	Calicoed.	6	0	47	Calicoed.	4	9
8	Free.....	6	10	28	Free.....	7	6	48	Free.....	6	7
9	Calicoed.	6	5	29	Calicoed.	5	2	49	Calicoed.	4	1
10	Free.....	6	9	30	Free.....	7	1	50	Free.....	6	9
11	Calicoed.	6	4	31	Calicoed.	5	8	51	Calicoed.	4	0
12	Free.....	6	10	32	Free.....	7	3	52	Free.....	7	2
13	Calicoed.	6	6	33	Calicoed.	6	6	53	Calicoed.	5	9
14	Free	6	2	34	Free.....	7	3	54	Free.....	5	6
15	Calicoed.	2	6	35	Calicoed.	5	3	55	Calicoed.	3	1
16	Free.....	7	2	36	Free.....	5	8	56	Free.....	4	9
17	Calicoed.	6	3	37	Calicoed.	6	2	57	Calicoed.	6	3
18	Free.....	6	9	38	Free.....	7	5	58	Free.....	6	10
19	Calicoed.	5	10	39	Calicoed.	6	0				
20	Free.....	7	3	40	Free.....	6	10				

CONCLUSIONS.

(1) Calico is primarily a disease of the chlorophyll or green coloring matter of the infected plants. As this substance largely controls the manufacture of the food products, calico is a trouble that disturbs the nutrition of the plant. This means that calicoed plants average smaller (Table VII) than the healthy, and the leaves, besides having a mottled yellow and green appearance, sometimes are more or less wrinkled and even misshapen through uneven growth.

(2) Calico is an infectious and to a certain extent a contagious disease. Its infectious nature is shown by the following miscellaneous experiments, and also by many others: Nos. 27, 201, 210, 214, 227, 238. In the experiments noted here there were employed 71 plants, which showed 28 per cent. infected on the first, and 48 per cent. on the last examination, a rather low average when compared with many of the other experiments. Its contagious nature is shown by experiments noted under conclusions No. 6, also in various other experiments, as Nos. 264–6.

(3) Calico can be communicated to the leaves through root infection under certain conditions. See Exper. No. 200.

(4) Old calicoed stems and leaves, while a possible source of infection through the roots, can be neglected in the field, but are a serious menace in the seedbed. Exper. No. 51 a–b showed comparatively little infection through the roots by the moist calicoed leaves and water placed around them. This explains why a field may be seriously calicoed one year and not the next, since the rotting of the calicoed tissues in the soil affords little chance for re-infection another year (see Conclusion No. 27). In the seed bed, however, when dried stems are used as fertilizer, or where old decayed stems remain in the soil, even if only one seedling becomes infected, it can, through handling, etc., be the source of subsequent infection to many plants, as will be shown later.

(5) Tobacco water used on seed beds, either as a fertilizer or as a remedy for worms, etc., is a possible source of infection that often proves very serious. Experiment No. 5 shows a final infection of 111 out of 152 plants, or 73 per cent., due to such treatment with water from selected calicoed stems, and the use of ordinary tobacco water by growers has frequently given similar results.

(6) Calico can be communicated at least in some cases by mere contact of calicoed plants with the healthy, as shown by Experiments Nos. 15, 16, 17, 54, 68, 69, 70 and 75, where out of 115 plants used 28 per cent. were calicoed on the first, and 77 per cent. on the last examination (see also notes under No. 49 and Nos. 82–84). In our field experiments we observed that the first or second check in a row next to calicoed plants, especially if touching one, sometimes became calicoed, and that the first check was sometimes badly calicoed and the second slightly, as if infected later.

(7) Juice on the hands from calicoed plants when handling healthy growing plants is certain to spread the disease to a very large percentage, if not to all, of those touched. This is shown by Experiments Nos. 1, 7, 9, 40, 48, 50, 122, 153, 181-a, 187-a, 192, 216 and 261, where juice on the hands was renewed each time before touching the healthy plants, with the result that the first examination showed over 95 per cent. calicoed and the last examination 100 per cent. In Experiments Nos. 72, 182-a, 189-a, 217, 242, where the juice was not renewed on the hands after touching the first plant (from twenty to forty plants each being

used in the different experiments), the infection was just as effective, since of the 134 plants used 100 per cent. of infection showed on both the first and final examinations. Our experiments, therefore, show that this is the most effective way of spreading the disease.

(8) This infection was due to the calicoed juice on the hands, and not to handling, since plants touched at the same time, as checks, without juice on the hands, did not develop calico to any great extent (shown by Experiments Nos. 4, 8, 10, 49, 73, 182-c, 243), as out of 95 plants used only 2 per cent. showed infection on the first examination, and 32 per cent. on the last examination, and this latter percentage was undoubtedly largely due to accidental outside infection which occurred in several of the experiments, as explained in the notes under Nos. 8 and 49.

(9) Washing the hands thoroughly with soap and water entirely removes the possibility of infection from any calicoed juice that may have been on them, as shown by Experiments Nos. 73, 182-c, 243, where of 44 plants touched only 5 per cent. showed calico at any time later.

(10) Destroying all the calicoed plants as soon as they appeared in the field did not in our experiments (Tables I-IV) lessen appreciably the percentage of calico as compared with that part of the field where they were not removed. As ordinarily carried on by growers, this practice of removal may even result in spreading the disease, since they are not usually careful about touching healthy plants after handling the calicoed. However, in some cases it possibly might pay to go over the field three or four weeks after transplanting, and if only occasional calicoed plants occur, to remove these, being careful not to spread the disease in any manner as already indicated.

(11) The calico "virus" is not carried over in the seed of calicoed plants to any great extent, as shown by Experiments Nos. 147,148, 174, 175, 176, 177, 198, where of 519 plants from seed of calicoed plants or from calicoed injected seed pods only 11 per cent. were calicoed. However, that calico might in some cases be carried over in the seed in a small way is suggested by the injection experiments Nos. 174-a, 175-a, 175-c, which gave 35 per cent. calicoed. If this is true, it explains the calicoed plants of unknown origin that appear occasionally in the check plots.

(12) Methods of fertilization, injury to the roots, weather conditions, etc. have not been definitely shown by experimentation to be primarily responsible for the appearance of calico in tobacco, etc., though some writers and growers claim one or the other as causal agents. It is not easy to experiment along these lines, but such miscellaneous experiments as we made (Nos. 36-tomato, 37, 132, 133, 202, 203, 262, 263) gave no increased or decreased percentages of calicoed plants as a result.

(13) True calico is not developed even by severe pruning if not already present or latent in the plant or accidentally introduced in the pruning process, though repeated cutting back sometimes develops more or less of a chlorosis condition in the new tissues. See Experiments Nos. 42, 43, 67 a-b, 78, 79, 116, 143, 185-b, which included among other plants 66 apparently free tobacco plants that after pruning developed only 2 with calicoed growth, or 3 per cent.; also see Conclusion No. 16, topping experiments, where 219 plants showed only 10 per cent. calico after topping, etc. On the other hand, if the plants are already calicoed, even if not yet apparent, the new growth following cutting off will almost certainly be calicoed. (Nos. 117, 118, 120-3, 126-a, 127-a, 128, 185-a, b in part, 199.)

(14) While insects apparently can spread infection somewhat from calicoed to healthy plants, especially in the greenhouse, we doubt if they are a common source of general infection in the Connecticut fields. We have made no special experiments along this line (except No. 24), but in our greenhouse experiments the white fly was very common, and it seemed to us a probable agent in the accidental infection of some of our checks and of our young seedlings grown there for field work in 1914 (Nos. 264–6).

(15) Infected plants in the seed bed are probably primarily responsible for most of the calico in the fields. See Experiments Nos. 5 and 264.

(16) These calicoed seedlings furnish the means for a subsequent general infection through their handling (see Conclusion 7) at transplanting time, and from the resulting infected plants further infections take place through the operations of "bugging," topping, suckering, etc., so that the percentage of calico in the field continually increases until not infrequently, after the plants are harvested, the suckers from a majority of the stubs are calicoed. For the effect of topping, etc., with a calicoed knife, see Experiments Nos. 25, 76, 80, 185-a, 186-a, where of the 135 ap-

parently free plants topped or cut off 80 per cent. developed calicoed sprouts or suckers; while Experiments Nos. 26, 77, 78, 79, 82, 83, 84, 185-b, 186-b, 199, where 219 similar plants were cut off with a clean or sterile knife, gave only 10 per cent.

(17) Calico usually takes from ten to fourteen days to make its appearance after infection. See various experiments giving dates of inoculation and of first examination showing infection. However, the appearance of calico really depends on the rate of growth of the new leaves. As, for instance, in our greenhouse experiments, where conditions were more or less unfavorable for normal growth, infection lagged correspondingly; also, in the field, when tobacco is first set out, it takes a week or two to recover before starting to grow, and the appearance of calico is likewise retarded; and in mature plants calico fails to show at all unless new suckers are developed, which may be hastened by topping, etc.

(18) Whether or not calico shows on all or a part of the plant depends primarily upon its age at the time of infection; that is, it may show on all the main leaves and stunt the growth more or less conspicuously, or it may be limited to the upper new leaves, the axillary shoots, or even to the basal sprouts. This is shown by the following experiments in 1913: No. 216, where the plants were infected when young, June 25th, with the result that all permanent main leaves were fully calicoed and the plants somewhat stunted; No. 230, July 29th, where calico was confined to the upper leaves and subsequent growth; No. 242, Aug. 7th, where calico appeared on the upper leaves in a few cases, but in most plants showed first in the sprouts; and Nos. 244–255, where the treatments of Aug. 14–21 were too late to show full results.

(19) While mature leaves are not visibly affected by inoculation, they may serve as carriers for infection of the younger growing leaves. In other words, calico is a disease of the chlorophyll of the nascent tissues. Experiments Nos. 3, 14-b, 50, 193, show that while the old leaves only were touched and did not calico, yet the results of infection were 100 per cent. (omitting No. 3, where later growth was not observed). Such infection, while as successful, is perhaps not quite as responsive as where the young leaves are touched (see Nos. 14-a and 48).

(20) A plant which once becomes infected remains so, and all subsequent new growth (at least that above the lowest infected

leaf)* usually, if not always, becomes calicoed. See various experiments comparing the data of first observation with that of the last. Shading (Nos. 132, 133), or the aging of leaves often dims or obscures, but apparently does not entirely obliterate the calico or destroy its virus.

(21) "Rust," at least in Connecticut, is associated with calico as a frequent, though not a necessary, later development, and so usually occurs only on the fully grown leaves. It seems to be merely a physiological injury, usually due to the action of the sun in "burning" the weakened tissues, this burning being favored by water on the leaves, or by bright, hot weather following rain storms. Its appearance, therefore, is largely a matter of weather conditions. So far as we have observed, rust occurs here only, or at least almost entirely, on calicoed leaves, though sometimes the calico is of the suppressed type. The relation of sun and water to the rust is indicated in certain greenhouse experiments (Nos. 28, 29, 30, 34, 41, 98, 127–b), where burning took place (Plate XXIX a), especially when the foliage had been intentionally sprinkled with water at the time of infection. In Nos. 216, 217, where some pressure was made on the tissues by fingering at the time of inoculation, there also developed a "burn" type of injury.

(22) "String Leaf" (Plate XXX a) is a malformation of the leaves that sometimes accompanies calico, but is not dependent upon a calicoed condition of the plant for its development. See Experiment No. 188, also Rept. 1914, p. 27.

(23) Chlorosis or calico of tomato is the same as calico of tobacco, and these troubles can be as easily transferred from one host to the other (Plate XXIX b) as calico is transferred from one tobacco plant to another, and in the same ways. For

* We placed the above clause in parentheses because we are not sure whether the calico virus is carried downward in the stem as far or as readily as it is carried upward. If not, it stands to reason that if plants were calicoed late in life by touching and infecting the upper leaves only, and some time later were cut off at the base with a sterile knife, the resulting suckers would not so surely calico as those from plants whose basal leaves were calicoed. Some evidence along this line is shown by Experiment No. 124, where the juice from an apparently healthy leaf at the base of a plant calicoed above failed to infect another plant when applied to it.

transfer from calicoed tomato to healthy tomato see Nos. 29, 30, 31, 144; calicoed tobacco to healthy tomato, Nos. 28, 33, 34, 41, 52b, 96, 97, 98, 101, 103, 108, 131, 161, 163, 164, 165, 282-a; calicoed tomato to healthy tobacco, Nos. 32, 71, 225. Checks, Nos. 45, 99, 110, 166, 282-b, etc.

(24) Calico of tobacco (*Nicotiana Tabacum*) and of tomato (*Lycopersicum esculentum*), besides being inter-transferable, can also be transferred to a number of other species of *Nicotiana*. On some of these it produces the typical calico mottling of the leaves, and on others this character is not so evident, being sometimes largely suppressed, or showing as a yellowish mottling found on plants not calicoed, but the disease manifests itself largely in the dwarfing of the plants and sometimes the misshaping of the leaves, etc. There seems to be considerable difference in susceptibility in the various species. Among those apparently little affected were: *N. affinis*, No. 171; (failed in 1909; possibly same species as *N. alata-grandiflora*, successful in 1914); *N. vincaeflora*, No. 274. Others not always showing typical mottling of leaves, but dwarfing and other symptons, were: *N. rustica scabra*, No. 267; *N. attenuata*, No. 269; *N. plumbaginifolia*, No. 270; *N. quadrivalis*, No. 271. Those showing at least some true calico mottling on the foliage were: *N. tomentosa*, No. 172; *N. Sandrae*, No. 169; *N. alata grandiflora*, No. 268; *N. alata* var., No. 272; *N. forgetiana*, No. 273; *N. paniculata*, No. 275; *N. rustica humilis*, No. 276; miscellaneous crosses, No. 277; Giant Red Tobacco, No. 170.

(25) Besides various species of Nicotiana, calico of tobacco can be transferred to a number of related genera belonging to the same family, Solanaceae. Some of these it is rather difficult to infect, as for instance the potato, *Solanum tuberosum*, with which we partially succeeded in only one case, where seedlings were used (No. 173), while experiments on vines from tubers failed (Nos. 52-a, 285, et al.). On egg plant, *Solanum melongena*, the calico apparently entirely failed to infect (No. 279). On peppers, *Capsicum annum*, etc., a few of the plants showed leaves with typical calico mottling (Nos. 280, 286). On Physalis sp., two plants out of seven showed a few leaves with typical mottling (No. 278). On Petunia sp., we succeeded in producing the typical calico on several plants (Nos. 155–9, 281), and in one case apparently re-transferred calico from petunia to a healthy petunia (No. 168).

(26) While there are a number of plants not members of the family Solanaceae which have chlorosis troubles more or less similar in appearance to the calico of tobacco, we have not been able so far to surely infect healthy plants of these species with juice from calicoed tobacco leaves, nor have we been able to infect them with juice from their own chlorosis leaves, or transfer their disease to tobacco or other plants. The following experiments were along these lines:—Calicoed tobacco juice on cultivated geranium, Pelargonium sp., No. 134; on pokeweed, *Phytolacca decandra*, No. 167; on Lima bean, *Phaseolus lunatus*, Nos. 113-a, 114-a; on string bean, *Phaseolus vulgaris*, Nos. 113-b, 114-b; on cultivated aster *Callistephus hortensis*, No. 91; on musk melon, *Cucumis Melo*, Nos. 183, 184, 284-a; on cucumber, *Cucumis sativus*, No. 283-a: calicoed tomato juice on musk melon, No. 284-b; on cucumber, No. 283-b: juice of "yellows" of raspberry, on tobacco, No. 224: juice of "yellows" of asters, on asters, Nos. 87, 88, 90; on tobacco, No. 53-a, b: juice of calico-like chlorosis of string bean, on string bean, No. 138-a; on tobacco, No. 138-b: juice of calico-like chlorosis of Lima bean, on Lima bean, No. 137-a; on tobacco, No. 137-b: juice of "golden" elderberry, Sambucus sp., on tobacco, No. 86: juice of chlorosis of pokeweed, on tobacco, No. 256: juice of "yellows" of peach on leaves and roots of peach, miscellaneous experiments not reported here.

(27) The dried leaves of calicoed tobacco retain their power of infection for some time (at least a year or two in some degree), but these, and even fresh leaves, seem to lose this power much sooner if kept wet. This explains in part why the wintering over in the fields destroys the infecting power of calicoed tissues, so that the amount of calico each year has little or no relation to the amount the preceding year. Infection experiments with dried calicoed leaves one or more years old, crushed in water and then soaked for a short time before using, were as follows: Nos. 51-c, 94, 100, 117, 126, 179-a, 190, 195, 205, 206, 207. Of 98 plants used in these experiments 76, or 78 per cent., calicoed. Similar experiments with old dried leaves soaked for a longer time, twenty-four hours or more, before using, were as follows: Nos. 102, 104, 105, 107, 111, 112, 139, 149, 194; on tomatoes Nos. 103, 106; and gave 11 out of 20 calicoed, or 55 per cent. Experiments with fresh leaves crushed in water and used im-

mediately, Nos. 12, 180-a, 219, 230, gave 68 out of 81 calicoed, or 84 per cent.; while those left twenty-four hours or more before using, Nos. 22, 23, 57, 232, gave 13 out of 24 calicoed, or 54 per cent.

(28) The purer the calico juice the surer its power of infection; that is, pure juice expressed from calicoed leaves is more effective than the same diluted many times with water; but whether the former affects plants any more strongly than the latter, in the cases where infection does take place, is not so certain. The determining factor as to the amount of injury caused seems to be the age of the plant when infected. We believe, however, that early infection with a large amount of pure calico juice (No. 200 on roots), especially if applications were repeated (Nos. 130, 261), would cause the plants to be more stunted and nearer an albino type than a single application of diluted juice.

(29) However, an exceedingly small amount of the pure juice is capable of infecting a plant. This is shown in our various experiments, where with merely the juice adhering to the fingers, and without renewing it, we were able to infect in some cases as many as forty plants in succession (No. 72).

(30) The "virus" of this juice appears to renew itself or be renewed in some manner in the tissues of the living plants, as shown by the infection of numerous plants by a very small amount of juice on the hands, and the possibility of repeated infection from generation to generation in the same way. Without such increase through renewal in the plants, the ultimate amount of the original "virus" would through dilution become so infinitesimally small as to be eventually incapable of infection, yet, so far as our experience goes, it is just as easy to infect plants repeatedly in this way, and the percentage of infection is just as large and the results as conspicuous as at first.

(31) The "virus" of calico juice is destroyed by heating, as shown by Experiments Nos. 21, 128, 141, 150, 209, 213, 228, 231, 233, 239, in which calicoed juice that had been sterilized to a greater or less degree by boiling was placed on the leaves of 91 plants, and only 16, or 18 per cent., became calicoed. All of these 16 calicoed plants became calicoed so late, that is, only in the upper leaves or sprouts, that there is little question but that they were accidental infections, and not due to the sterilized juice placed on them.

(32) The "virus" of calico is filterable, at least to some extent, through a Berkefeld filter, as shown by Nos. 127, 140, 151, 208, 212, 229, 234, 240, where of 73 plants used 26 were calicoed, or 36 per cent. Possibly some of these calicoed plants were the result of accidental outside infection, yet we believe that we could have obtained with such filtered juice, if used under our present method of rubbing in, a considerably higher percentage of infection.

(33) The "virus" can apparently be extracted from calicoed leaves, at least to some extent, without destroying its infectious qualities, by such liquids as ether, chloroform and alcohol, as shown by Nos. 18, 20, 55, 56, 58–61, 63–65, in which of the 55 plants used 11, or 20 per cent., showed infection on the first examination, and 24, or 44 per cent., on the last.

(34) This "virus" can be preserved for a long time by a small amount of toluol shaken for a short time through the pure calico juice, and then left to form a protective film on the surface, as shown by Experiments Nos. 92, 93, 118, 130, 152, 191-a, 196, 235, 236, 241, where 65 plants were used and 47 calicoed, or 72 per cent. The age of the preserved juice when used in these experiments ranged from one to nine days, three to six months, and in two cases about three years old (where the average infection was nearly 50 per cent.).

(35) Certain of our experiments (see Conclusions 30–34) indicate that the "virus" of calico of tobacco is of the nature of an enzym.

(36) Tests of the juice from both calicoed and non-calicoed tobacco and tomatoes with a tincture of guaiacum shows the presence of an oxidizing enzym; however, the juice from calicoed leaves shows a greater amount, as indicated by the intensity of the test. This suggests that the infectious enzym belongs to the general group of oxidizing enzyms, but whether it is a specific form peculiar to calicoed tobacco, or merely an unusual amount of oxidase, etc., as suggested by Woods, we have made no effort to determine, as this is a subject for investigation by a physiological chemist.

(37) The possibility of the cure or prevention of calico through the use of the auto-digestive enzym of Coprinus species (as possibly illustrated by the work of Baker, Ann. of Bot. **27**:172, on the "Silver-Leaf" disease of plum) was tested in a number of experiments, Nos. 219–223, 257–9, but so far as we could judge

from these, it had no inhibitive or curative action on the infectious enzym of calicoed tobacco (except possibly in No. 220).

(38) So far as we could judge from our observations and the limited number of experiments along this line (Nos. 35, 46, 47), neither calico nor the so-called "rust" that often accompanies it is due to the action of bacteria, as claimed by some investigators. The objection made to the enzymic theory in favor of the bacterial theory, that an excessive effect is produced by an exceedingly small amount of the enzym, is removed by the supposition of the increase of this enzym within the plant tissues, a supposition which is just as allowable as the assumed increase of hypothetical filterable or ultra-microscopic bacteria within the same.

(39) There seems to be some connection between the bruising of the glandular hairs (No. 136) and the certainty of infection, since when the calicoed juice is rubbed in, infection takes place more certainly than by any other method; for instance, when a few drops of calicoed juice were placed on the leaves, infection did not take place so certainly as when these were rubbed in with paper (renewed each time to avoid carrying possible contagion from one plant to another). See Nos. 229, 232, 234, 235. Possibly this bruising of the glandular hairs allows the "virus" to be more readily and quickly absorbed into the circulation of the plant sap.

(40) There is a probability that with check plants more or less calico will develop, but the more careful the attempts to prevent any accidental spreading, the freer the checks. We have tried to use moderate care with our check plants, but more or less calico has developed, much of which we are sure from our later experience might have been prevented had extreme precautionary measures been taken. This percentage of accidental infection has varied from year to year with the varying conditions under which the plants were grown, set out, etc. In order to determine the value of an experiment in producing calico it is necessary to compare it with its immediate checks; yet the average amount of calico that may naturally be expected can be obtained by getting the average of all the checks in our experiments (omitting those of 1914) —Nos. 2, 6, 11, 13, 19, 44, 66, 74, 81,85, 95, 109, 119, 123, 129, 142, 154, 178, 179-b, 180-b, 181-b, 182-b, 187-b, 189-b, 191-b, 204, 211, 215, 218, 223, 237, 247—which showed that out of 561 check plants 13, or 2 per cent., were calicoed on first examination, and 45, or 8 per cent., on last examination.

The checks of 1914, Nos. 260, 264, 265, because of known infection by white fly in the greenhouse, showed a much higher percentage, namely, out of 296 plants 32, or 11 per cent., were calicoed on first examination, and 98, or 33 per cent., on last examination.

PRECAUTIONARY MEASURES.

Any treatment for calico of tobacco must be preventive rather than curative, since when once a plant becomes calicoed it cannot be cured. The following precautionary measures should, if observed, help to lessen the amount of calico in the fields:

(1) If for any reason the grower suspects that his old seed beds are responsible for calico, new beds should be made, or the old ones steam-sterilized. Yearly steaming also lessens expense of weeding.

(2) Beds should never be made on land that had tobacco grown on it the year previous, because of the possibility of infection of some of the seedlings from the old tobacco stalks, etc.

(3) Old tobacco stems, leaves, or tobacco water should never be used on the seed beds or seed plants in any way.

(4) If suspicious plants show in the seed bed, these and the surrounding plants should be carefully pulled up and destroyed. If the seed bed shows unmistakable signs of calicoed plants before transplanting, it is well to secure plants elsewhere.

(5) When setting out plants, wash the hands occasionally with soap and water to lessen the danger of spreading infection.

(6) Never touch healthy plants after touching calicoed ones without first washing the hands.

(7) While it may possibly pay to carefully remove calicoed plants in the field very early in the season, if few in number, it will not later.

(8) Care in bugging, topping and otherwise handling the plants in the fields, especially calicoed ones, helps to lessen the spreading of calico, though infection from these means usually makes its appearance too late to show on any but the upper leaves, and usually only in the sprouts and suckers.

LITERATURE.

Under the authors' names, arranged alphabetically, are given below some of the more important references to the literature of calico of tobacco, etc., with a brief abstract of their contents.

Most of these have been prepared under my direction by my assistant Miss Whittlesey. For more complete bibliographies the reader is referred to articles by Melchers (23) and Allard (4).

1. **Allard, H. A.** The Mosaic Disease of Tobacco. Science **36:** 875–6. 20 D. 1912.

Preliminary to more detailed article (see No. 2). Transferred mosaic disease to other Solanaceous genera from tobacco. Notes effect in appearance of blossoms of tobacco. Thinks calico not produced by simply cutting back plants. Finds that aphids carry the disease. Results of writer's experiments suggest presence of living, active micro-organisms. Does not favor theory of transmission by pollen grains.

2. **Allard, H. A.** The Mosaic Disease of Tobacco. U. S. Dept. Agr. Bull. 40: 1–33. Ja. 1914.

The author considers this disease parasitic in origin. Can be carried by aphids. Description of appearance of affected plants, especially the blossoms. Susceptibility of various Solanaceous plants. Probably distinct from pokeweed mosaic. Was produced by the writer by root inoculation.

3. **Allard, H. A.** Effect of Dilution upon the Infectivity of the Virus of the Mosaic Disease of Tobacco. Journ. Agr. Res. **3:** 295-9. 1915.

Gives results of infection experiments with mosaic virus of different dilutions, from undiluted up to one part to one million of water. 1-1000 is quite as effective as when undiluted; 1–10,000 much less so. The author favors theory of parasitism, an organism gaining entrance to the plant, not an enzym already present.

4. **Allard, H. A.** A Review of Investigations of the Mosaic Disease of Tobacco, together with a bibliography of the more important contributions. Bull. Torr. Bot. Club **41:** 435–58. S. 1914.

Review of literature, giving brief resumé of experiments and conclusions. "Mosaikkrankheit" frequently used to cover two distinct diseases—true mosaic and "pockenkrankheit." Meyer first proved artificial inoculation, no transmission by seed, etc. He held the soil responsible for origin of disease. Prillieux and Delacroix (1894) and Marchal (1897) apparently do not treat of the true mosaic. Beijerinck (1898) proved that immature tissues only were infected. Sturgis (1899) concludes that "mottled top" is a less pronounced phase of calico in nearly mature plants; was the first to regard it as purely physiological. Raciborski gave results of tests to destroy virulence of sap. Van Bijlert (1899) considered coolies responsible for its spread. Woods and Heintzel set forth theory of oxidizing enzyms. This was opposed by Hunger (1902) and (1904). He treats (1907) of the effects of shade and advances a "toxin" theory. Clinton (1908) showed it transferable to tomato. Allard (1914) found it transferable by aphids.

5. **Baur, E.** Ueber die infektiöse Chlorose der Malvaceen. Sitzungsber. Königl. Preuss. Akad. Wiss. **1906:** 11–29.

Infectious chlorosis of the Malvaceae,—experiments with *Abutilon*, etc. Tobacco mosaic differs in being transmitted by other means than grafting. Is latent in the plants, only brought out when conditions are favorable for its development.

6. **Baur, E.** Ueber infektiöse Chlorosen bei *Ligustrum*, *Laburnum*, *Fraxinus*, *Sorbus* und *Ptelea*. Ber. Deut. Bot. Ges. **25:** 410–13. Au. 1907.

Finds that the variegated plants known as *Ligustrum vulgare fol. aureo-variegatis*, *Laburnum vulgare chrysophyllum*, *Laburnum vulgare fol. aureis*, *Fraxinus pubescens aucubifolia*, *Sorbus aucuparia fol. luteo-variegatis*, *Ptelea trifoliata fol. variegatis*, belong with the infectious chlorosis types, while *Sorbus aucuparia Dirkenii aurea* and *Ptelea trifoliata aurea* do not. The infectious nature was proved by grafting buds of the normally green plants on the chlorosis variety, when the resulting growth became variegated. The chlorosis of the *Laburnum* and *Ligustrum* was shown to be similar to the previously investigated chlorosis of Abutilon as regards action of light and failure to reproduce itself through the seed. Buds of *Cytisus hirsutus* grafted on *Laburnum vulgare chrysophyllum* even became variegated, but not in the case of *Laburnum alpinum* or *Cytisus purpureus* on this variety.

7. **Baur, E.** Ueber eine infektiöse Chlorose von *Euonymus japonicus*. Ber. Deut. Bot. Ges. **26:** 711–13. D. 1908.

Investigated two variegated varieties of this species and found one, *Euonymus japonicus argenteo-marginatus*, non-infectious, but perpetuated through seed; while the other, *E. japonicus fol. aureo-marginatis*, was infectious. When this latter was grafted on the normal green variety, or *vice versa*, the subsequent growth from the green plant was variegated but not of the same pattern, and this modified variegation remained constant through propagation by cuttings. He explains this by supposing that the variegated variety had a double chlorosis, one infectious and the other non-infectious, and of course only the infectious chlorosis is communicated to the growth from the normally green plant and so presents a different pattern from that on the variegated one, where both are present.

8. **Chapman, G. H.** "Mosaic" and Allied Diseases, with Especial Reference to Tobacco and Tomatoes. Ann. Rept. Mass. Agr. Exp. Sta. **25:** 94–104. Ja. 1913.

General appearance on both hosts; manner of occurrence, on tomato only in greenhouse and of little economic importance, on tobacco annual loss over one million dollars. Disease physiological, not fungous or bacterial, not a virus caused by retarded enzyms. Caused sometimes by improper sterilization of seed beds, laceration of roots in transplanting, etc. Shade-grown tobacco less liable to it. Plants from heavy seed also less sus-

ceptible. Infectious, but not contagious. Not caused by excess of mineral fertilizers.

9. **Clinton, G. P.** Chlorosis Troubles. Rept. Conn. Agr. Exp. Sta. **1903:** 305 (aster, yellows); *Ibid:* 341 (peach, yellows); *Ibid:* 355 (raspberry, yellows); *Ibid:* 363 (tobacco, calico); *Ibid.* **1907:** 343 (Lima bean, chlorosis); *Ibid:* 362 (tomato, calico); *Ibid.* **1908:** 857 (tomato, calico); *Ibid:* 859 (bean, Lima and string, chlorosis); *Ibid:* 865 (musk melon, chlorosis); *Ibid:* 872–78 (peach, yellows); *Ibid.* **1909-10:** 735 (squash, chlorosis); *Ibid.* **1913:** 27 (tobacco, string leaf); Bull. Conn. Agr. Exp. Sta. 166: 10 (tobacco, calico).

Gives results of observations and experiments with these various chlorosis diseases.

10. **Delacroix, G.** La rouille blanche du tabac et la nielle ou maladie de la mosaïque. Compt. Rend. Acad. Sci. Paris **140:** 678–80. 1905.

The trouble reported by Prilleux and Delacroix in 1894 he concludes not to have been the true mosaic ("la nielle") but a bacterial disease called "rouille blanche." Gives detailed description of each, with distinctions. The "spotting" of Sturgis and "pockenkrankheit" of Iwanowsky, etc., may be the same as "rouille blanche."

11. **Delacroix, G.** Recherches sur quelques maladies du tabac en France. Extrait des Annales de l'Institut National Agronomonique II, **5.** 1906. La nielle du Tabac et la "maladie des taches blanches." pp. 18–63.

Review of previous investigations. Points out the differences in experimental results and theories deduced from them, and impossibility of drawing positive conclusions. Recommends the use of fresh soil for seed beds, crop rotation, care in fertilizing, avoidance of too wet soil. Distinguishes "la maladie des taches blanches" from "la nielle," under which name the author and Prillieux mistakenly described it in 1894. The "mal del mosaico" of Comes and Pirazzoli he considers the same as his "maladie des taches blanches." Also mentions a third trouble, "rouille blanche," spots round and regular, with brown margin. The "taches blanches" appear on the mature foliage, thus differing from mosaic, "la nielle," and the writer succeeded in obtaining bacteria and reproducing the disease.

12. **Flexner, S.** Some Problems in Infection and its Control. Science **36:** 685–702.

An important paper on this subject which may throw some light on infection of plants by fungi. Notes mosaic disease of tobacco as caused by ultra-microscopic parasites or filterable viruses.

13. **Gallatin** (Rept. of J. R. Dodge, Statistician). Rept. U. S. Com. of Agr. **1874:** 58.

Brief note on "Frenching" of tobacco, narrow, dagger-shaped leaves, formation caused by "too much wet weather after the plant starts to grow."

14. **Hasselbring, H., and Alsberg, C. L.** Studies upon Oxidases. Science **31:** 637. 22 Ap. 1910.

Extract of paper read before Sec. G., A. A. A. S., at Boston meeting. The study is a by-product of the investigation still in progress of a disease of cabbage and spinach resembling in some respects the mosaic disease of tobacco. Explanation may not necessarily be increase of oxidase, as suggested by Woods, but may be a decrease of anti-oxidase.

15. **Hunger, F. W. T.** Neue Theorie zur Ätiologie der Mosaikkrankheit des Tabaks. Ber. der Bot. Ges. **23:** 415. N. 1905.

Preliminary article (see No. 16) setting forth author's theory of "physiological-catalytic" action. Brief reference to theories of previous investigators. The author ascribes the mosaic to action of a toxin under certain conditions, producing a substance harmful to the cell development, which is capable of increasing and passing from cell to cell to the younger plant tissues.

16. **Hunger, F. W. T.** Untersuchungen und Betrachtungen über die Mosaikkrankheit der Tabakspflanze. Zeitschr. Pflanzenk. **15:** 257–311. D. 1905.

History and nomenclature, review of different theories of origin, (1) bacterial (Mayer, etc.), (2) "contagium vivum fluidum" (Beijerinck), (3) oxidizing enzyms (Wood) and (Heintzel), and (4) the author's theory, an unorganized ferment rather than oxidizing enzyms. Distinctions given between "mosaik-krankheit" and "pockenkrankheit."

17. **Iwanowski, D.** Die Mosaik-und die Pockenkrankheit der Tabakspflanze. Zeitschr. Pflanzenkr. **12:** 202. O. 1902.

Calls attention to distinction made by him previously between the brown spot and the mosaic disease, which some later writers have not considered distinct, and thereby have brought about errors in their conclusions.

18. **Iwanowski, D.** Ueber die Mosaikkrankheit der Tabakspflanze. Zeitschr. Pflanzenkr. **13:** 2–41. Ap. 1903.

Detailed description, giving various appearances produced on different plants, effect of light, etc. *Nicotiana rustica* immune. Found in coastal countries, e. g. Holland. Apparently originates in the seed beds. Differences noted between mosaik- and pockenkrankheit. Opposes Wood's theory. Gives histology, details of experiments in filtration of sap, cultivation of microbes, tabulated results of infection experiments. Favors bacterial theory.

19. **Jensen, H.** Mosaiek-Zeikta. Mededeelingen van "Het Proef Station voor Vorstenlandsche Tabak" No. 5: 61–67. 1913.

Gives notes of Raciborski and Jensen for years 1898–1911. Contains also (p. 68) article on "string leaf," "Tjakar." This

occurs much less commonly than mosaic. Affected plants sent out healthy growth after transplanting into various soils such as river sand, etc.

20. **Kränzlin, G.** Untersuchungen an panaschierten Pflanzen. Zeitschr. Pflanzenkr. **18:** 193–203. O. 1908.

Found considerable difference in the spectroscopic examination of solutions from leaves of normally green and variegated varieties of the same species (both infectious and non-infectious kinds investigated by Baur).

21. **Loew, O.** Remarks on the Mosaic Disease of the Tobacco Plant. U. S. Dept. Agr. Rept. No. 65: 24–27. 1900.

Gives short description of the disease; notes that the calicoed leaves contain less acid but more of the enzyms oxidase and peroxidase than the normal leaves; and relates experience of growers and his own observations in which the fertilization of the field, the treatment of seed beds, etc., apparently affected the amount of calico finally present in the field.

22. **Mayer, A.** Ueber die Mosaikkrankheit des Tabaks. Landw. Vers. Stat. **32:** 450–467. 1886.

The author proved by experiment that calico could be transmitted to healthy plants by inoculating with juice from diseased ones. He considered it a bacterial disease, but was unable to isolate bacteria which would reproduce it. He found no infection from plant to plant, or by seed. Advised rotation of crops and removal of diseased plants and of refuse in the field.

23. **Melchers, L. E.** The Mosaic Disease of the Tomato and Related Plants. Ohio Nat. **13:** 149–173. Je. 1913.

Gives historical account, characteristics, histology, nomenclature, causes (various theories), prevention measures; chiefly a review of the work of others.

24. **Peters, L.** Krankheiten und Beschädigungen des Tabaks. Mitteil. Kais. Biol. Anst. Land. Forstrw. **13.** Mosaikkrankheit p 58. 1912. [Reprint.]

Description of appearance and development. Cause and nature uncertain, by some considered as caused by parasitic bacteria. Differs from "infectious chlorosis" of Malvaceae in being transferable by infected sap. Author considers seed of infected plants likely to produce more susceptible seedlings, so advises the use of seed from sound plants. Also sterilizing or renewing seed beds infected the year previous; liming seed beds; care in handling; crop rotation. No original investigation work.

25. **Selby, A. D.** The Mosaic Disease. Ohio Agr. Exp. Stat. Bull. 156: 88–95. N. 1904.

Gives general characteristics of the disease; a short but excellent account of results of previous investigations; results of an experiment conducted under his own supervision proving the communicability of the disease by touching plants after having

touched calicoed ones (those touched showed over 68 per cent. calico as compared with less than 5 per cent. among the untouched plants in the field); the percentage of calico in various Ohio tobacco fields; preventive measures; also reports failure to produce calico through seeds from a calicoed plant.

26. **Stone, G. E.** Tomato Diseases. Mass. Agr. Exp. Sta. Bull. 138: 26. Je. 1911.

Brief note on mosaic of tomato. In all cases where seen was associated with too severe pruning. Apparently affects the yield. Reference to later report by G. H. Chapman (8).

27. **Sturgis, W. C.** Preliminary Notes on Two Diseases of Tobacco. Ann. Rept. Conn. Agr. Exp. Sta. **22:** 242–260. 1899.

"Calico" and "mottled top" probably symptoms of same disease, the former occurring early in the season, the latter only on topmost leaves later in the season. Abundant in some places, especially east of the Connecticut River. Not contagious, whether or not infectious no statement can yet be made. The observed facts are not favorable to bacterial theory. Probably physiological.

28. **Sturgis, W. C.** On the Effects on Tobacco of Shading and the Application of Lime. Ann. Rept. Conn. Agr. Exp. Sta. **23:** 252–261. 1900.

Refers to recent work of Woods on calico of tobacco, as favoring enzym theory. Gives results of experiments in liming the land to decrease amount of mosaic, on both shaded and unshaded plots. Results unconclusive, but suggest that the use of lime may not be deleterious, and may tend to decrease prevalance of calico.

29. **Taubenhaus, J. J.** Mosaic Disease of the Sweet Pea. Del. Coll. Agr. Ex. Sta. Bull. 106: 53-61. N. 1914.

Brief review of work of former investigators in mosaic of tobacco. No previous mention of the disease on sweet pea, but it is an important disease. Can be transmitted by needle puncture from diseased to healthy leaves, also carried by aphids. The writer believes it to be bacterial or protozoic, not physiological and enzymic. Apparently not transmitted by soil or seed.

30. **Westerdijk, Joha.** Die Mosaikkrankheit der Tomaten. Mededeel. Phytopath. Lab. "Willie Commelin Scholten," **1:** 1-20. Mr. 1910.

General appearance, infection experiments, influence of light, hereditary nature, comparison with tobacco mosaic. Infectious in tomatoes, but not communicable to tobacco. Intensity increased by strong light. Could not infect tomato with tobacco mosaic. Disease carried over by seed. Sometimes causes monstrosities.

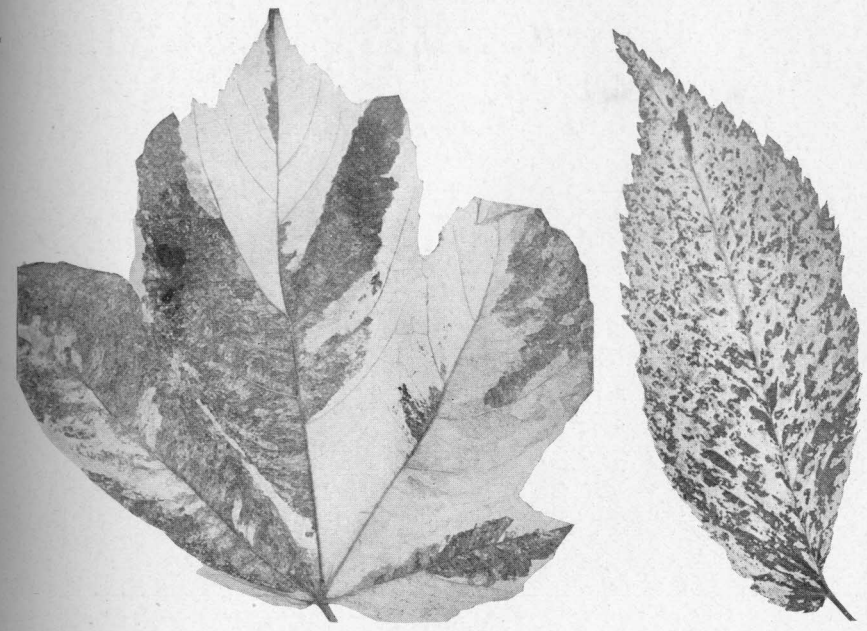
31. **Woods, A. F.** The Destruction of Chlorophyll by Oxidizing Enzyms. Centralb. Bakt. Abth. II. **5:** 745–754. N. 1899.

Treats of the author's observations on the oxidation of chlorophyll by enzyms, which he deems responsible for the autumnal

destruction of chlorophyll and for some forms of disease. Gives details of experiments with *Acer*, *Aesculus*, etc., using guaiac and other reagents to test enzyms. Produced mosaic on tobacco by cutting back rapidly growing plants. Oxidizing enzyms may occur in the soil through decay. His theory is that in rapid, poorly nourished growth many cells are unable to develop normal amounts of chlorophyll because of excessive development of oxidizing enzyms.

32. **Woods, A. F.** Observations on the Mosaic Disease of Tobacco. U. S. Dep. Agr. Bur. Pl. Ind. Bull. 18. My. 1902.

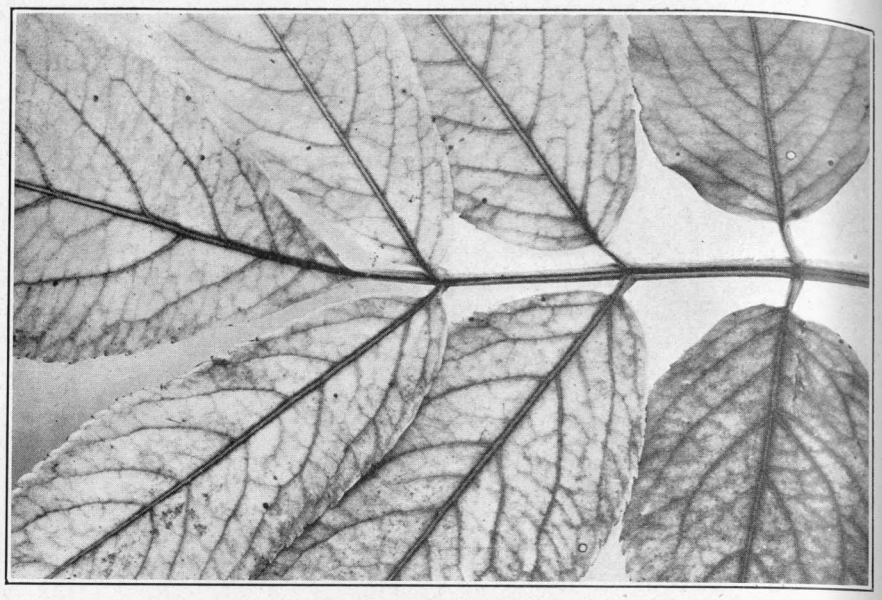
Gives general description, results obtained by Mayer, and subsequent investigators, Beijerinck, Sturgis and Koning, histology, artificial production, Suzuki's theory regarding cutting back of mulberry causing disease, infection experiments, theory of "oxidizing enzyms," preventive measures.



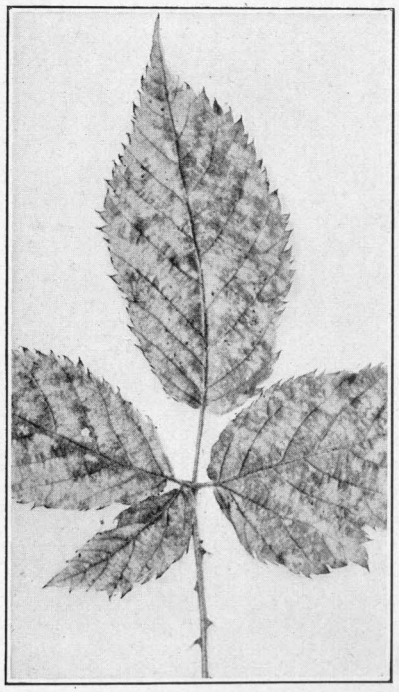
a. Variegated Sycamore Maple, p. 359, and b. European Elm, p. 359.

c. Variegated Box Elder, p. 359.

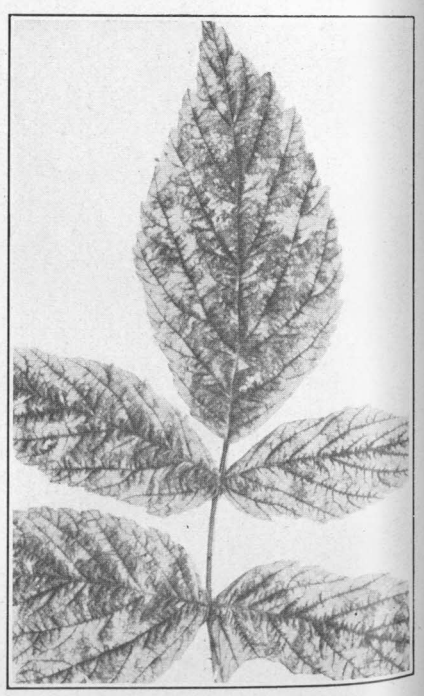
CHLOROSIS OF CULTIVATED TREES.



a. "Golden" Elderberry, p. 359.

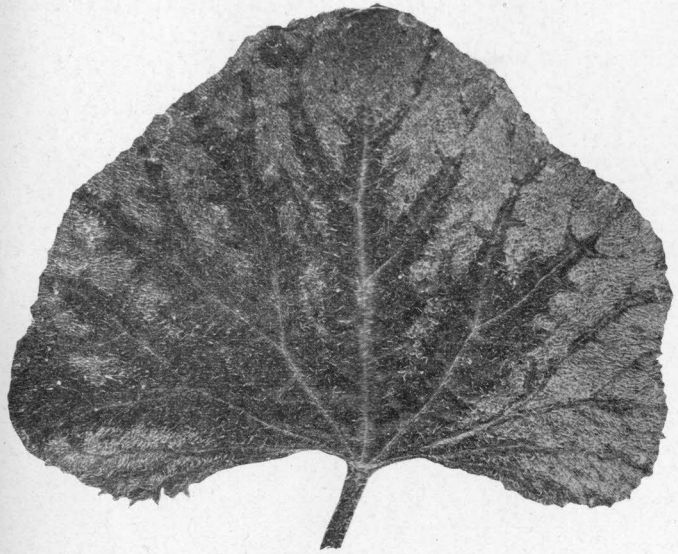


b. Chlorosis of Blackberry, p. 365.

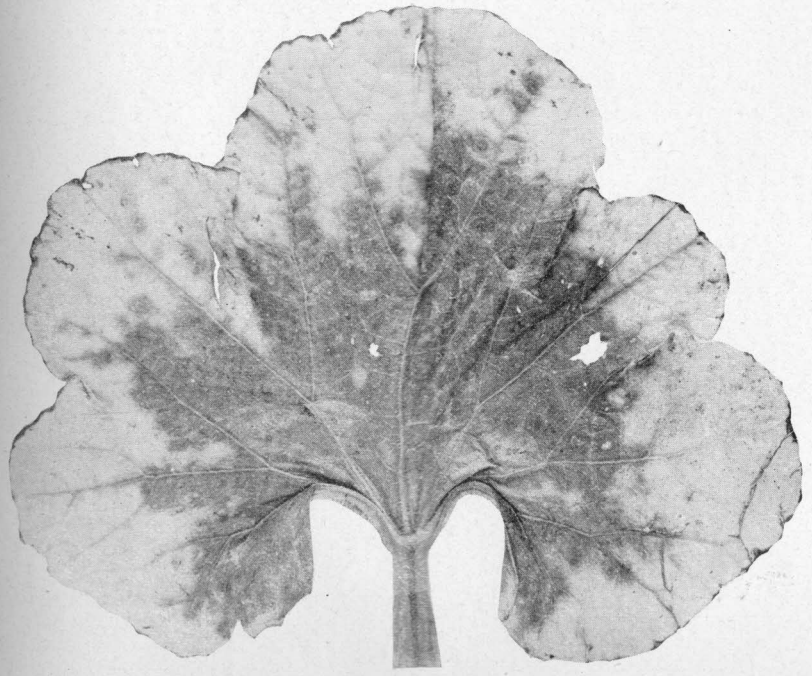


c. "Yellows" of Raspberry, p. 361.

CHLOROSIS OF CULTIVATED SHRUBS.



a. Natural Chlorosis, apparently non-infectious, p 362.

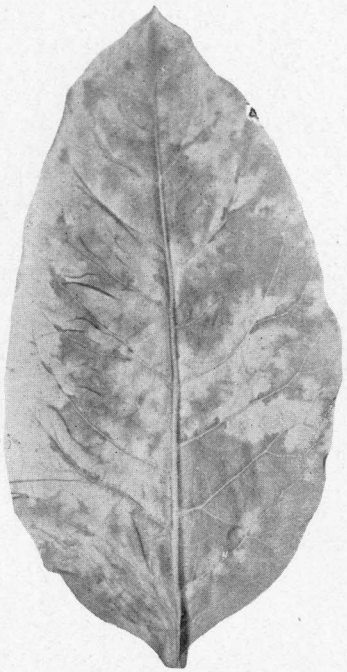


b. Chlorosis produced by Bordeaux Mixture, p. 365.

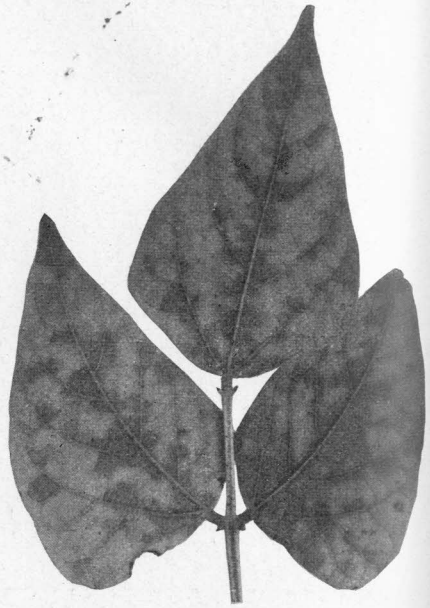
CHLOROSIS OF MUSK MELON.

Infectious.

Non-Infectious.

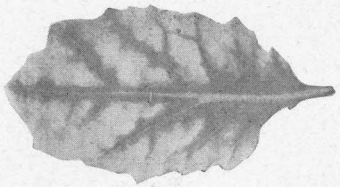


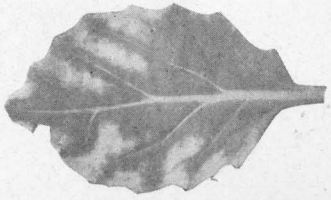
a. Of Pokeweed, p. 362.



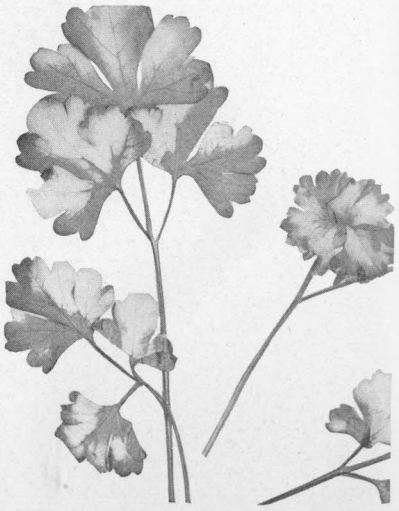
b. Of Lima Bean, p. 362.

Chlorosis resulting from frost injury.





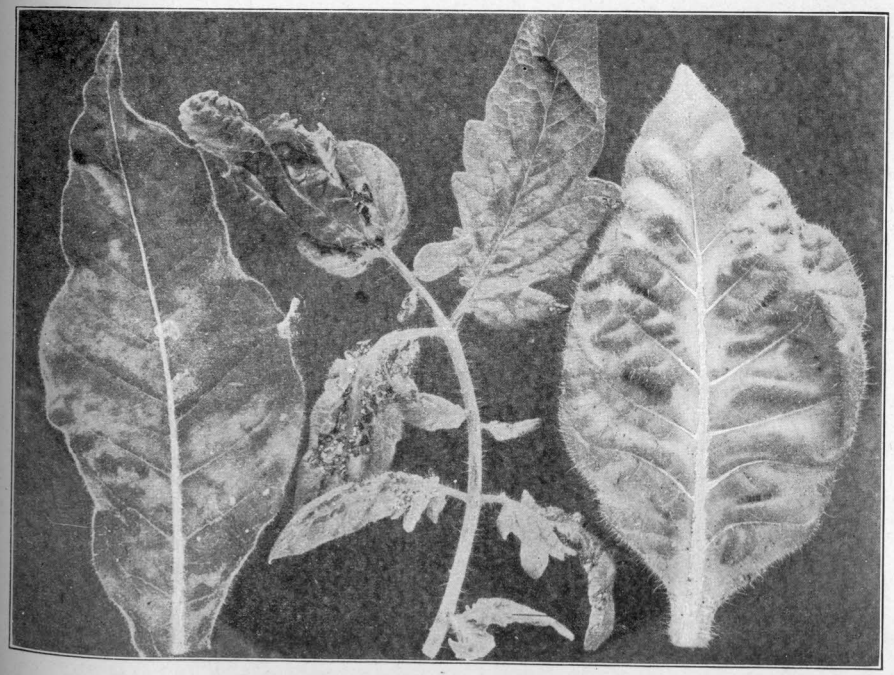
c. Of Cabbage, p. 365.



d. Of Parsley, p 365.

CHLOROSIS OF VARIOUS HERBACEOUS PLANTS.

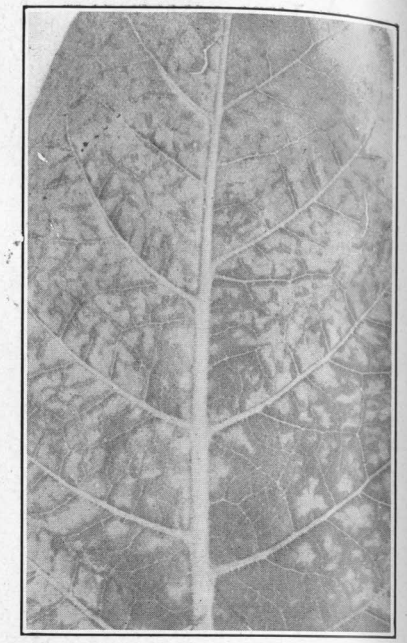
a. Burn on Artificially Calicoed Tomato Leaves, p. 373.



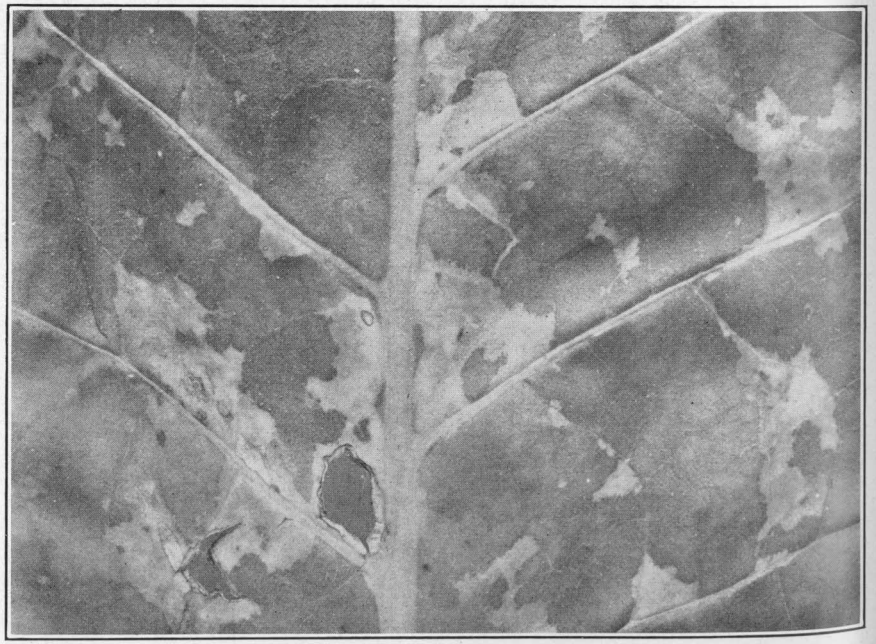
b. Calico from Tobacco on Tomato and then back to Tobacco, p. 373.

CALICO ON TOMATO PLANTS.

a. String Leaves, p. 366.

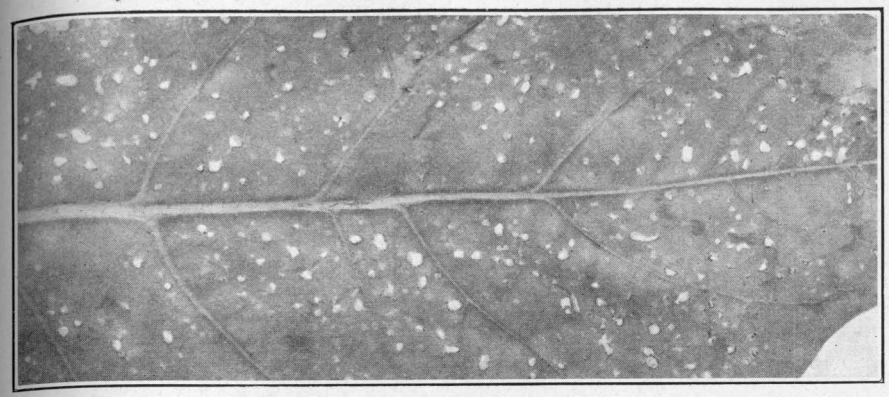


b. Showing relation to Veins, p. 365.

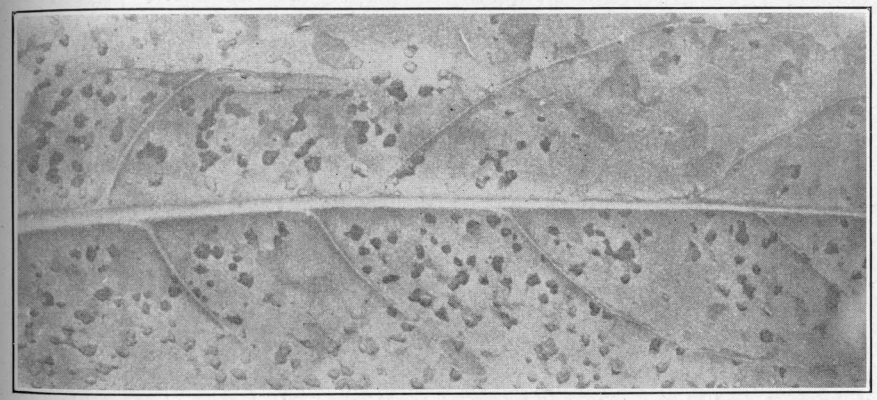


c. Calico Spots, almost White, p. 361.

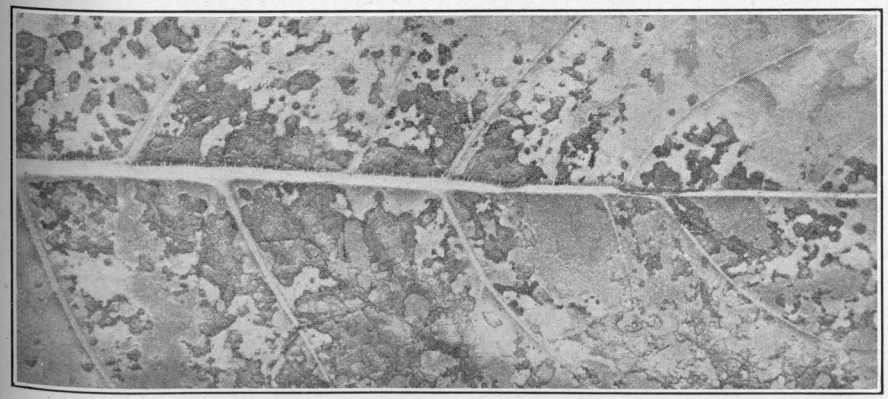
VARIATIONS OF CALICOED TOBACCO LEAVES.



a. White Spot (cause not known), p. 367.



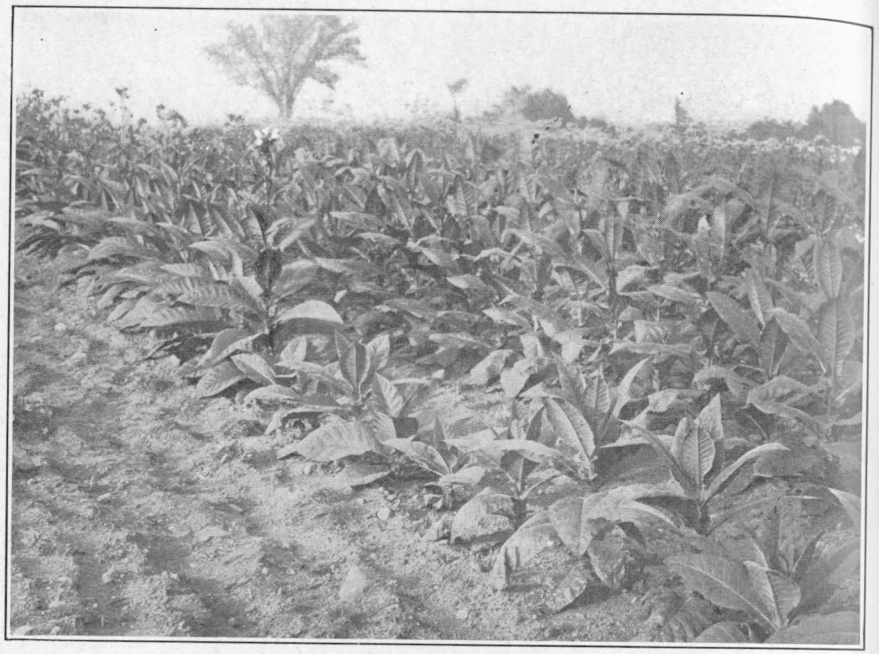
b. Rust showing Spots isolated, p. 366.



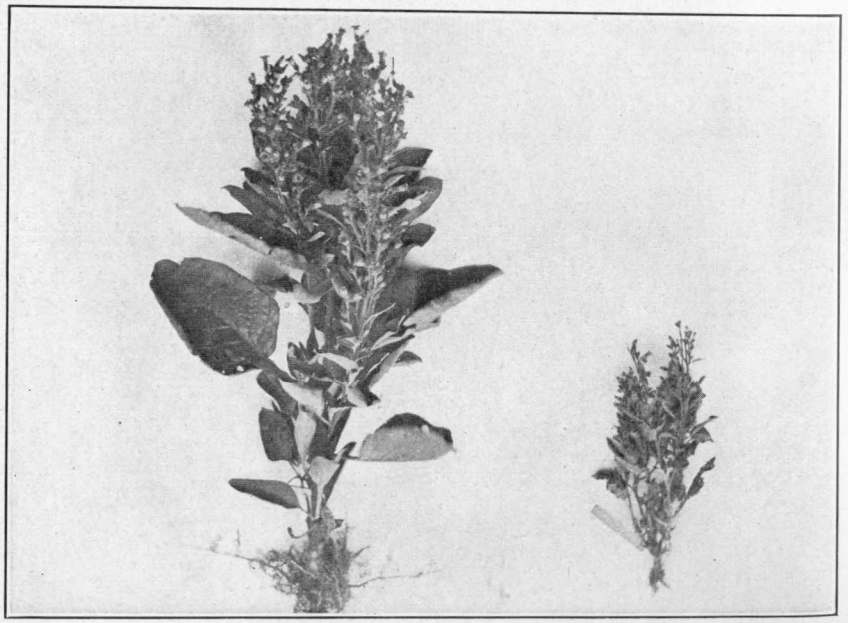
c. Rust showing Spots run together, p 366.

INJURIES FOLLOWING CALICO.

PLATE XXXII.



a. Calicoed and healthy plants of same age in front row, p. 405.



b. Healthy and Calicoed plants of *Nicotiana rustica scabra*, p. 366.

EFFECT OF CALICO ON HEIGHT OF PLANTS.

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