On the writer's hedge, evidence of the pest wholly disappeared later in the season.

The black vine weevil, *Brachyrhinus sulcatus* Fabr., and the strawberry weevil, *Brachyrhinus ovatus* Linn., are rather abundant and cause injury to young conifers by eating the bark of the roots. Larvae of the former were received from Norwalk, and the latter from Cromwell.

The euonymus scale, *Chionaspis euonymi* Comst., is reported by Dr. E. P. Felt as being locally abundant around Stamford.

The white scale or West Indian peach scale, *Aulacaspis pentagona* Targ.-Tozz., has for a number of years infested privet, flowering peach, *Catalpa bungei,* and other trees and shrubs in Fairfield County. Doctor Felt reports that a scale, probably this species, has been injurious at Greenwich.

Insects Attacking Flowers and Greenhouse Plants

The verbena bud worm, *Olethreutes hebesana* Walker, was received July 23 from Durham, where considerable injury was caused to plants in a verbena bed.

The iris root borer, *Macronoctua onusta* Grote, was received from New Haven, August 27.

The variegated cutworm, *Peridroma margaritosa* Haw., var. *saucia* Hübn., was very abundant and injured various plants in greenhouses during April.

The greenhouse leaf tyer, *Phlyctaenia ferrugalis* Hübn., was reported as causing considerable injury to plants in greenhouses in Shelton, May 24.

The chrysanthemum gall midge, *Diarthronomyia hypogaea* Loew, was received from Norwich, July 19, where it caused injury in a greenhouse.

The columbine leaf miner, *Phytomyza aquilegiae* Hardy, was present in many gardens in 1929. Specimens were received from Bridgeport, August 27.

The tarnished plant bug, *Lygus pratensis* Linn., causes considerable injury by sucking the sap from various kinds of plants, especially dahlia and aster. Specimens were received from Thomaston, July 13; Naugatuck, July 29, and from Harwinton, August 3.

The four-lined leaf-bug, *Poecilocapsus lineatus* Fabr., is always present in gardens and injures the tender terminal leaves by sucking out the sap, which results in circular transparent spots. Specimens were received from Hamden, June 12, and from New Haven, July 29.

The cottony cushion scale or fluted scale, *Icerya purchasi* Mask., on acacia in greenhouse, was received from Norwalk, September 5.

The common mealy bug, *Pseudococcus citri* Risso., was received on Impatiens, from Hartford, September 17.

The margined blister beetle, *Epicauta marginata* Fabr., was received from West Haven, July 29, where it was feeding upon the leaves of a variegated foliage plant.

Fuller's rose beetle, *Pantomorus godmani* Crotch, was brought to the Station on September 5 from a greenhouse in Norwalk, where it was feeding on the blossoms of acacia.

The bulb mite, *Rhizoglyphus hyacinthus* Banks, is commonly injurious to bulbs and was received from Ridgefield, July 25.

The garden or greenhouse red spider, *Tetranychus bimaculatus* Harv., is very common on phlox, and specimens were received from Old Saybrook, August 7.

The cyclamen mite, *Tarsonemus pallidus* Banks, is a troublesome pest of cyclamen, larkspur, chrysanthemum, and other plants. Specimens were received from Norwalk and Branford.

Field and Lawn Insects

The Asiatic beetle, *Anomala orientalis* Waterhouse, was found in a small private lawn in Bridgeport, May 17 and 25. This is the first infestation discovered in Connecticut outside of New Haven and West Haven. On July 23 an adult was received from New Haven, outside of the former infested area.

White grubs, *Phyllophaga* sp., were responsible for considerable injury to lawns in Connecticut in 1929. Specimens of grubs in soil were received from Greenwich, April 25; from East Hampton, May 1; from Salisbury, August 15, and from Stafford Springs, September 11. Lawns in Glastonbury were injured and reports received September 18. The grubs from Salisbury and Stafford Springs were nearly all *Phyllophaga fusca* Fröh., according to Doctor Friend. Two adults of *P. gracilis* Burm. were received from Clinton, August 26.

The chinch bug, *Blissus leucopterus* Say., is responsible for killing the grass in a small spot on a lawn in Hartford. Adults and nymphs were very abundant in this spot. Specimens were received October 1.

Wireworms caused some injury to corn at North Haven. Mr. Walden visited the field July 6 and collected material which he identified as *Melanotus* sp., probably *communis* Gyll.

Tobacco plants were seriously injured by flea beetles, *Epitrix cucumeris* Harris, at Windsor in July.

Household Insects

The dog flea, *Ctenocephalus canis* Curtis, often infests dwelling houses and bites human beings. It was seemingly more abundant than usual in 1929. Specimens were received from Hartford, August 16, and from New Haven, August 19.

Specimens of the carpet beetle, *Anthrenus scrophulariae* Linn., were received from Norwalk, July 1, and from West Haven, November 30.

The saw-toothed grain beetle, *Oryzaephilus surinamensis* Linn., which feeds upon cereals and stored grains, was received from Southington, August 2, and from Norwich, August 24.

One species of "silver-fish" or "fish-moth," *Thermobia domestica* Pack., was received from Meriden, October 16, and a small spider-beetle, *Ptinus fur* Linn., from Hartford, November 30. The former injures books by feeding upon the paste used on the bindings and the latter damages wool, fur, clothing, stuffed furniture, seeds and other plant products.

Miscellaneous Insects

An adult of the northern mole cricket, *Gryllotalpa hexadactyla* Perty, was received from Hamden, August 29.

The Japanese beetle, *Popillia japonica* Newman, was somewhat more abundant in Stamford, Bridgeport, New Haven, Hartford and New London, than in 1928. Though nearly all of the cities and larger villages were scouted in 1929 the only new locality for this insect is Willimantic. One specimen was received from Hartford, August 27.

Grubs of the Asiatic garden beetle, *Aserica castanea* Arrow, were discovered in soil in the towns of New Canaan, Fairfield, Ridgefield, Mansfield, Cromwell and Manchester. Adults were collected in New Haven and New London.

The brilliant green-gold beetle, *Chrysochus auratus* Fabr., was thought to be the Japanese beetle, and specimens were received from Warren, July 10; Avon, July 30, and from Woodbury, August 12. This beetle feeds upon milkweed and dogbane, and is much smaller than the Japanese beetle.

The large aquatic bug, *Benacus griseus* Say., leaves the water and is attracted to electric lights. Adult specimens were received from New Haven, June 17, and from Norwalk, July 12.

The leather beetle, *Dermestes vulpinus* Fabr., was received September 30, from Danbury, where it was feeding upon stored rabbit hides.

The cherry tent-maker, *Archips cerasivorana* Fitch, was very abundant on choke-cherry sprouts in Cheshire.

One of the powder-post beetles, *Lyctus opaculus* LeC., was reported in May as injuring the ash wood of an ice box that had been used in the family eight years.

Convention of Entomological Workers

The sixth annual convention of entomologists working in Connecticut was held in the Community House at the Connecticut Agricultural College, Storrs, on Friday, October 25, 1929. These meetings are for the purpose of bringing together the research men, teachers, field men and amateur collectors in the state, and entomologists in the adjacent states are invited. The program of the 1929 conference was planned to include subjects of vital importance to Connecticut, and several Federal men who are working in coöperation with state men on control projects were asked to present papers. The following entomologists from outside Connecticut presented papers: A. F. Burgess, Melrose Highlands, Mass.; H. L. McIntyre, Albany, N. Y.; L. H. Worthley, Boston, Mass.; C. H. Hadley, Camden, N. J.; and Harold C. Hallock, Westbury, N. Y. About 60 attended the conference. Luncheon was served in the College dining hall. The following program was carried out without a single substitution:

Program

A. M.

10:30 Greeting, Dr. Geo. A. Works, President, Conn. Agr. College, Storrs
Prof. G. H. Lampson, Jr., Conn. Agr. College, Storrs

10:45 Present-Day Opportunities in Entomology,
Mr. A. F. Burgess, Gipsy Moth Control, Melrose Highlands, Mass.

11:15 Chief Entomological Events of the Season in Connecticut.
Dr. W. E. Britton, State Entomologist, Agr. Expt. Sta., New Haven

11:30 Survey of Gipsy Moth Conditions,
Mr. H. L. McIntyre, Department of Conservation, Albany, N. Y.

12:00 Shade Tree Insects in 1929,
Dr. E. P. Felt and S. W. Bromley, Stamford

12:15 Present Status of the European Corn Borer in the United States,
Mr. L. H. Worthley, Corn Borer Control, Boston, Mass.

P. M.

1:00 Luncheon

2:00 Inspection of new Entomological laboratories, Beach Hall

2:30 The Japanese Beetle in the United States,
Mr. C. H. Hadley, Japanese Beetle Control, Camden, N. J.

3:00 Notes on Biology and Methods of Control of *Aserica castanea*,
Mr. Harold C. Hallock, Bur. of Entomology, Westbury, N. Y.

3:30 Some Aspects of Asiatic Beetle Control,
Dr. R. B. Friend, Asst. Ent., Agr. Expt. Sta., New Haven

3:45 An Attempt to Rear Parasites for the Control of the Oriental Peach Moth in Connecticut,
Dr. Philip Garman, Asst. Ent., Agr. Expt. Sta., New Haven

4:15 Katydids as Thermometers,
Prof. J. A. Manter, Agr. College, Storrs

4:30 Insecticide Studies at the Bartlett Research Laboratories in 1929,
Mr. Stanley W. Bromley and Dr. E. P. Felt, Stamford

The following were present: John T. Ashworth, Danielson; R. C. Botsford, New Haven; A. I. Bourne, Amherst, Mass.; W. E. Britton, New Haven; S. W. Bromley, Stamford; A. F. Burgess, Melrose Highlands, Mass.; T. M. Cannon, Norwalk; O. B. Cooke, Danielson; S. S. Crossman, Melrose Highlands, Mass.; E. B. Davidson, Hartford; R. M. De Coursey, Storrs; George B. Durham, Storrs; F. S. Eaton, New Haven; Gustavus

Eliot, New Haven; E. P. Felt, Stamford; B. J. Fitzsimmons, Jr., Hartford; R. B. Friend, New Haven; C. W. Frink, Brooklyn; Philip Garman, New Haven; G. H. Geissler, Storrs; L. E. Gibson, Melrose, Mass.; Robert D. Glasgow, Albany, N. Y.; C. H. Hadley, Camden, N. J.; Harold C. Hallock, Westbury, N. Y.; Kenneth N. Hanks, Storrs; Harry C. Helliwell, Shelton; S. P. Hollister, Storrs; Harry Horovitz, Providence, R. I.; C. E. Jennings, Storrs; J. P. Johnson, Shelton; T. H. Jones, Melrose Highlands, Mass.; J. W. Kelley, Jr., Shelton; J. F. Keough, Willimantic; Nathan Koenig, Storrs; G. H. Lampson, Jr., Storrs; Alvin J. Lannon, Providence, R. I.; J. W. Longo, Danielson; J. A. Manter, Storrs; J. B. Marshall, Boston, Mass.; B. W. McFarland, New Haven; H. L. McIntyre, Albany, N. Y.; A. E. Moss, Storrs; G. H. Pallman, New Haven; R. H. Patch, Storrs; Saul Phillips, Albany, N. Y.; Chester J. Poliks, Storrs; K. A. Salman, Amherst, Mass.; A. F. Schulz, Storrs; John C. Schread, New Haven; R. A. Spencer, Bloomfield; A. E. Stene, Kingston, R. I.; Dewey G. Steele, Storrs; J. F. Townsend, Neely Turner, B. H. Walden and B. H. Wilford, New Haven; R. H. Wallace and Geo. A. Works, Storrs; L. H. Worthley, Boston, Mass.; M. P. Zappe, New Haven.

INSPECTION OF NURSERIES IN 1929

W. E. Britton and M. P. Zappe

In 1929, the regular annual inspection of nurseries, as provided in Chapter 265, Public Acts of 1925, was commenced July 1, and completed October 1, except for a few new nurseries that were registered late in the season. This work was in charge of Mr. Zappe, who was assisted by Messrs. A. F. Clark, J. G. Conklin and H. B. Bender. In a few special cases, assistance was rendered by Mr. Stoddard, Mr. Walden and Doctor Britton.

Mr. Bender is a member of the Botany Department and was employed on this work for three months in order to give particular attention to such plant diseases as might be present in the nurseries.

As in former seasons the gipsy moth scouts were instructed to search with particular care in and around all nurseries within the infested area and to report to the office at once in case any gipsy moth eggs were discovered in a nursery or in close proximity to a nursery during 1929. Also as in preceding years the pine blister rust scouts under Mr. J. E. Riley, Jr., examined all nurseries where the presence of the pine-currant blister rust was reported by the nursery inspectors.

In general, the nurseries were in rather better condition than in 1928, due to the fact that they had been given better cultivation and to the dry season, which was not favorable to the growth of weeds. Plant diseases were somewhat less abundant than in 1928, but some insects were quite as prevalent or more so. Aphids were generally abundant. Spruce gall aphids, both *Adelges abietis* and *Gillettea cooleyi,* were found in a larger number of nurseries than ever before. This is due partly because the number of nurseries

is greater than ever before and partly to a seeming increase in the prevalence of these insects. Spraying during the first half of April with a contact spray to kill the over-wintering females has been practiced in a few nurseries, and will need to be practiced much more extensively if this pest is to be kept in control.

In 13 nurseries no pests were found. Following is a list of the insects and plant diseases found in nurseries in the annual inspection of 1929 and the number of nurseries infested by each:

Pests Found in Nurseries in 1929

Number of nurseries uninfested, 13

INSECTS

Name	No. nurseries
Aleyrodes	25
Anisota rubicunda	1
stigma	1
Aphids, apple, green	55
woolly	64
on Bechtel's crab	6
beech (woolly)	2
birch	8
Celastrus	1
cherry	4
chestnut	1
chrysanthemum	1
cotoneaster	1
Crataegus	23
currant	2
Cytisus	1
elm	5
elm (woolly)	10
Euonymus	2
fir	2
flowering crab	10
forsythia	1
hollyhock	1
larch (woolly)	3
Lonicera	1
maple	5
mountain ash	12
oak	1
pear	4
red pine	1
white pine	1
white pine (woolly bark)	75
plum	3
poplar	1
poplar leaf stem gall	1
Prunus pissardi	3
rose	4
spirea	3
spruce	3
Adelges abietis	85
Gillettea cooleyi	62
sumac	1

Name	No. nurseries
Aphids on viburnum	4
weigelia	1
willow	7
Apple and thorn skeletonizer	20
Apple case bearer	2
Borer, apple (*Zeuzera*)	2
Crataegus	1
currant	1
lilac	6
linden	2
maple	1
oak (*Agrilus*)	1
peach	6
rose (*Agrilus*)	2
white pine weevil	37
willow (*Cryptorhynchus*)	6
(*Saperda*)	1
Brachyrhinus ovatus	2
sulcatus	2
Bugs on ash (Capsids)	1
Cutworms	1
Elm case bearer	9
Elm leaf beetle	9
European pine shoot moth	7
Fall webworm	26
Flea beetle, viburnum	1
Crepidodera helxines	3
Epitrix cucumeris	2
Galls, elm (cockscomb)	11
linden	2
oak	5
tulip tree leaf	7
willow	1
Io larvae	3
Juniper webworm	12
Lace bugs, birch	1
juglans	1
kalmia	1
quince	1
rhododendron	41
sycamore	2

Name	No. nurseries
Leaf hoppers, apple	12
ash	1
Crataegus	1
Helenium	1
Japanese maple	1
maple	1
mountain ash	2
poplar	2
rose	1
weigelia	1
wisteria	1
Leaf-miner in apple	12
arborvitae	2
beech	4
birch (*Fenusa pumila*)	63
blueberry	1
boxwood	1
catalpa	31
chestnut	1
columbine	22
elm	16
grape	1
hydrangea	1
lilac	2
linden	2
locust	12
magnolia	1
maple	1
oak	8
peach	3
philadelphus	1
poplar	1
quince	1
sycamore	5
tulip tree	2
Leaf roller, spiræa	2
privet	1
Leaf tylers, sycamore	2
viburnum	1
Luna moth larvae	1
Melalopha inclusa	2
Midges on catalpa	1
Mites, European red	8
pear leaf blister	32
Mite galls on Cephalanthus	1
Exochorda	10

Name	No. nurseries
Mites on silver maple	16
birch	1
Delphinium	4
elm	2
juglans	1
juniper	1
linden	3
mountain ash	1
oak	5
spruce	8
willow	3
Oriental peach moth	48
Ormenis pruinosa	3
Papaipema larvae	2
Pear psylla	2
Pear slug	20
Sawfly larvae on arborvitae	3
birch	1
dogwood	4
mountain ash	1
pine	4
Scale, elm	21
oak gall	2
oyster-shell	78
pine leaf	13
rose	10
San José	22
scurfy	1
tulip tree	2
West Indian peach	5
Slug caterpillars	1
Sphinx larvae	1
Spiny elm caterpillars	1
Spittle bugs on arborvitae	1
forsythia	1
juniper	3
lilac	1
pine	1
weigelia	1
willow	1
Tussock moth eggs	2
Tussock moth larvae	2
Willow leaf beetle, *Plagiodera versicolora*	16
White flies	1
Yellow necked caterpillars	3
Zebra caterpillars	1

PLANT DISEASES

Name	No. nurseries
Anthracnose, cherry	9
currant	8
hollyhock	1
Anthracnose, poplar	5
sycamore	3
Bacterial leafspot, larkspur	46

Name	No. nurseries
Bacterial leafspot, peach	1
Black knot	6
Black rot, apple	24
Botrytus, paeony	16
Brown rot	
flowering almond	11
peach	2
plum	2
quince	1
Canker, poplar	37
Chestnut blight	1
Chlorosis silver maple	1
Crown gall	10
Entomosporium, quince	11
Exobasidium, honeysuckle	3
Symphoricarpos	2
Fire blight	1
Gnomonia ulmi	9
Leaf spot on Andromeda	8
Aristolochia	3
ash	2
Azalea	2
barberry	8
birch	1
box elder	5
boxwood	7
carya	1
catalpa	79
cherry	2
currant	1
dogwood	1
English ivy	2
grape	7
hollyhock	6
horse chestnut	34
iris	62
Japanese maple	55
juglans	1
kalmia	25
larkspur	1
lilac	2
mahonia	1
maple	57
mountain ash	21
oak	1
paeony	1

Name	No. nurseries
Leafspot on peach	1
phlox	74
quince	6
rhododendron	66
rhubarb	21
rose	98
strawberry	28
sycamore	1
yucca	2
Maple tar spot	16
Marsonia juglandis	10
Mildew on ampelopsis	1
apple	16
catalpa	30
golden glow	1
grape	5
Helianthus	1
juglans	1
larkspur	8
lilac	34
mountain ash	1
oak	1
phlox	50
raspberry	1
rose	78
solidago	1
symphoricarpos	1
sycamore	1
Mosaic on apple	23
raspberry	7
Raspberry cane blight	2
Rust on apple	46
ash	5
Bechtel's crab	43
Crataegus	19
hollyhock	7
juniper	11
pear	2
quince	7
Scab on apple	57
pear	2
willow	1
White pine blister rust on pine	2
on Ribes	7
Yellowing of lilacs	20

An examination of the preceding list will show that among the insects, the spruce gall aphid, *Adelges abietis,* as was the case in the last two years, was found in more nurseries (85) than any other insect, followed by oyster-shell scale (78), woolly pine bark aphids (75), apple woolly aphids (64), birch leaf miner, *Fenusa pumila* (63), blue spruce gall aphid, *Gillettea cooleyi* (62), green apple aphid (55), Oriental peach moth (48), rhododendron lace bugs (41), white pine weevil (37) pear leaf blister mite (32), catalpa leaf miners (31), fall webworm (26), aleyrodes (25), aphids on crataegus (23), columbine leaf miner (22), San José scale (22), elm scale (21), apple and thorn skeletonizer (20), pear slug (20), *Plagiodera versicolora* (16), mite galls on silver maple (16), pine leaf scale (13); aphids on mountain ash (12), juniper webworm (12), leaf hoppers on apple (12), leaf miners on apple (12), leaf miners on locust (12), elm cockscomb gall (11), aphids on flowering crab-apple (10), mite galls on Exochorda (10), rose scale (10), woolly elm aphid (10).

Among the plant diseases found in nurseries in 1929, leaf spot of rose heads the list (98), followed by leaf spot of catalpa (79), mildew of rose (78), leaf spot of phlox (74), leaf spot of rhododendron (66), leaf spot of iris (62), apple scab (57), leaf spot of maple (57), leaf spot of Japanese maple (55), mildew of phlox (50), apple rust (46), bacterial leaf spot of larkspur (46), rust of Bechtel's crab (43), poplar canker (37), leaf spot of horse-chestnut (34), mildew of lilac (34), mildew of catalpa (30), leaf spot of strawberry (28), leaf spot of Kalmia (25), black rot of apple (24), mosaic of apple (23), leaf spot of mountain ash (21), leaf spot of rhubarb (21), yellowing of lilacs (20), tar spot of maple (16), mildew of apple (16), *Entomosporium* of quince (11), brown rot of flowering almond (11), rust of juniper (11), *Marsonia juglandis* (10), and crown gall (10).

NINE-YEAR RECORD OF CERTAIN NURSERY PESTS

	1921	1922	1923	1924	1925	1926	1927	1928	1929
Oyster-shell scale	36	44	42	44	38	39	45	57	78
San José scale	28	19	20	32	32	19	16	30	22
Spruce gall aphids[1]	31	21	28	40	27	42	82	120	147
White pine weevil	1	19	17	5	5	8	17	19	37
Apple and thorn skeletonizer		1	18	2	8	9	22	49	20
Poplar canker	21	31	34	25	34	32	39	35	37
Pine blister rust (on *Ribes*)	2	9	6	8	7	9	9	5	7
Nurseries uninfested	36	36	32	33	34	46	37	18	13
Number of nurseries	94	101	106	116	151	162	191	228	266

It should be understood that the figures in the preceding table are not strictly comparable because of the greater number of nurseries since the new law went into effect in 1925. Thus though the number of infested nurseries is greater, the actual percentage may be considerably less.

Number and Size of Nurseries

The number of nurseries in Connecticut has increased each year. The list for 1927 contained 191 names. The list for 1928 contains 228 names and for 1929, 266 names. Of the 266 separate nurseries in the state, a classification on account of size may be made as follows:

[1] Includes both *Adelges abietis* and *Gillettea cooleyi.*

Nurseries containing 50 acres or more	16
" " between 10 and 50 acres	37
" " " 5 and 10 "	29
" " " 2 and 5 "	64
" " 1 acre or less	120
	266

In 1929, 288 nursery inspections were made. The list of nursery firms receiving certificates contains 266 names; 22 being

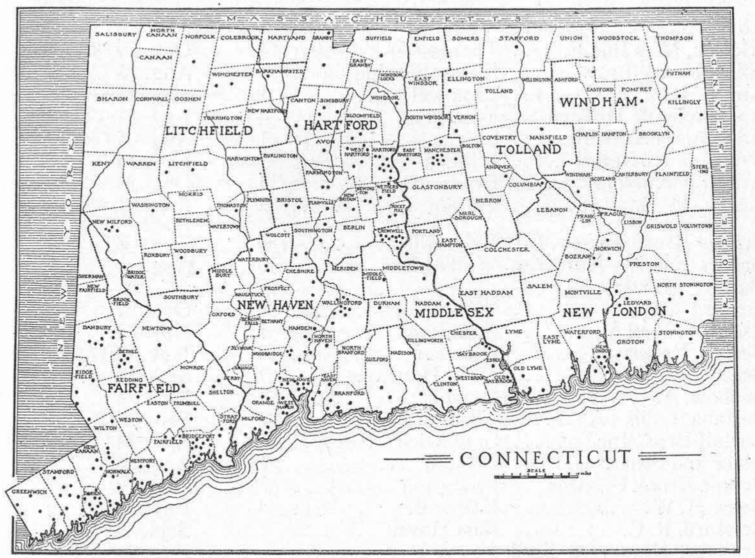

FIGURE 44. Map of Connecticut showing location of nurseries.

new nurseries registered in the winter that were inspected twice, once in the spring and again in the fall.

From the owners of three nurseries failing to register before July 1, as provided in Section 2, Chapter 265, Public Acts of 1925, $40 was collected to cover the cost of inspection, and this amount was sent to the State Treasurer on January 8, 1930. This cost of inspection would have been greater had it been necessary to make special trips from New Haven to inspect each nursery but when men are working in the vicinity of several nurseries the expense of travel is divided between the nurseries.

The total area of nurseries in Connecticut in 1929 is equivalent to about 3,157 acres. The figures were taken for the most part from the estimates of the owners and managers as given on the registration cards, supplemented by the inspector. Each nursery of less than an acre in extent is listed as one acre and where fractions are given, the next whole number is recorded. Certified nurseries now number 266; 49 new ones have been added within the year, and 13 have discontinued the business. Sixteen on last year's list are now listed under different firm names. The location of these 266 nurseries is shown on the map in Figure 44. The list of nursery firms granted certificates in 1929 is as follows:

Connecticut Nursery Firms Certified in 1929

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Alius, Adolf	Stamford	1	Aug. 26	894
Aldrich, Miss Inie E.	Thomaston	5	Oct. 29	1,012
Allen, Henry L.	North Stonington	1	Aug. 5	831
Amato, John	Cromwell	1	Aug. 15	867
Amelunxen & DeWyn	Yalesville	4	July 31	802
Ampelopsis Nurseries	Groton	1	Aug. 5	828
Arawana Nurseries	Milford	1	Nov. 26	1,030
Artistree Nursery	Branford	1	Oct. 24	1,005
Austin, M. E.	Clinton	2	Sept. 21	971
Barnes Bros. Nursery Co.	Yalesville	150	Aug. 2	820
Barnes Eastern Nurseries	Wallingford	10	Aug. 1	819
Barnes Nursery & Orchard Co.	Wallingford	50	Oct. 22	1,003
Barrows, Paul M.	Stamford	1	Nov. 23	1,028
Barton, Robert	Hamden	1	Nov. 9	1,016
Beattie, W. H.	New Haven	1	Sept. 10	936
Benbow, A.	Norfolk	1	Sept. 24	972
Bertana, Louis	Glenbrook	2	Sept. 6	924
Bertolf Bros., Inc.	Greenwich	45	Aug. 14	863
Blake and Stuart	Preston	1	Aug. 5	825
Bonnie Brook Gardens	Rowayton	7	Aug. 20	881
Booy, H. W.	Yalesville	4	July 31	803
Botsford, R. C.	East Haven	1	Sept. 9	932
Brainard Nursery & Seed Co.	Thompsonville	15	Aug. 3	821
Braley, S. A.	Burnside	4	July 31	818
Branford Nurseries	Branford	4	Sept. 7	926
Brass, Fred W.	Andover	3	Aug. 5	823
Bretschneider, A.	Danielson	1	Aug. 19	877
Bridgeport Hydraulic Co.	Bridgeport	300	Nov. 12	1,017
Brimfield Gardens Nursery	Wethersfield	3	Aug. 28	906
Bristol Nurseries, Inc.	Bristol	50	Aug. 29	909
Brooklawn Conservatories, Inc.	Bridgeport	1	Nov. 26	1,031
Brooklawn Nursery	Bridgeport	2	Sept. 24	976
Brouwer & Hancock Nurseries	New London	20	Aug. 14	853
Brown, E. M.	Hartford and West Simsbury	2	Sept. 9	930
Bubenicek, Joseph	Woodmont	1	Sept. 19	966
Bulpitt, Henry F.	Darien	4	Aug. 7	839
Bunting's Nurseries, Inc.	Groton	10	Aug. 5	827
Burke, P. J.	Rockville	1	Aug. 14	851
Burr, Morris L.	Westport	1	Sept. 20	968

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Burr & Co., Inc., C. R.	Manchester, Ellington and Durham	400	Aug. 7	836
Burwell, E. E.	New Haven	1	Nov. 23	1,020
Byram Evergreen Nursery	East Portchester	1	Aug. 14	856
Calvanese, John	Southington	1	July 31	816
Candee, Hollis S.	Hartford	6	Sept. 25	977
Cant, Alexander	Springdale	1	Aug. 27	902
Cardarelli, Emilio J.	Cromwell	4	Sept. 6	923
Carey, Alice L.	Cheshire	1	July 31	807
Cascio, Peter J.	Hartford	1	Dec. 16	1,045
Case, Louis L.	Simsbury	1	Sept. 12	943
Chapman, C. B.	Groton	1	Sept. 10	934
Chippendale Nurseries, Inc.	Lyme	2	Aug. 16	873
Clark, Raymond H.	Milford	2	Dec. 31	1,057
Cleary, Arthur B. (2)	Bethel	1	Sept. 17	960
Clyne, George A.	Middlebury	4	Dec. 23	1,046
Conine Nursery Co.	Stratford	65	Aug. 12	846
Conn. Agr. College (Prof. S. P. Hollister)	Storrs	1	Aug. 15	868
Conn. Agr. Expt. Station (W. O. Filley, Forester)	New Haven, Hamden, Norwich, Simsbury, Storrs	5	Oct. 1	988
Conn. Forestry Nursery	Centerbrook	5	Aug. 16	869
Conn. Valley Nurseries	Manchester	5	Aug. 7	837
Cooper's	Nichols	1	Oct. 2	990
Corrigan, James J.	West Haven	1	Sept. 12	944
Couture, E. R. (2)	Westport	2	Oct. 16	1,002
Cragholme Nurseries, Inc.	Greenwich	10	Aug. 20	882
Cromie, G. A.	New Haven	5	Aug. 26	896
Culver, W. B. (2)	Suffield	1	July 31	810
Dallas, Inc., Alexander	Waterbury	2	Aug. 16	875
Darien Nursery	Darien	6	Aug. 12	849
Dawson, Wm. A.	Willimantic	2	Aug. 14	852
Daybreak Nurseries, Inc.	Westport	12	Nov. 29	1,035
DeMars, F. H.	Winsted	1	Oct. 26	1,009
Doebeli, Charles A. (2)	Bridgeport	1	Dec. 31	1,056
Dondi, Augusto	Hamden	1	Oct. 26	1,008
Dougherty's Nursery	Yalesville	1	July 31	805
Dowd, Inc., F. C. (2)	Madison	2	Dec. 31	1,050
Dunlap, D. S.	Cromwell	3	Aug. 15	865
Dunn, James F.	Stamford	3	Aug. 31	918
Eager, Edward M.	Bridgeport	1	Sept. 14	956
East Rock Nursery Co.	New Haven	1	Aug. 17	876
Eell's Sons	Manchester	1	Dec. 10	1,043
Elfgren & Sons, I. P.	East Killingly	2	Aug. 23	888
Elm City Nursery Co., Woodmont Nurseries, Inc.	New Haven and Woodmont	150	Sept. 17	958
Elmgren, C. J.	Cromwell	1	Aug. 30	916

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Elm Grove Cemetery Assn.	Mystic	1	Nov. 23	1,022
Evergreen Nursery Co.	Wilton	16	Aug. 6	833
Eyberse, John (2)	Norwich	1	Aug. 29	911
Fairty, C. H.	New Canaan	1	Oct. 26	1,006
Farmington Valley Nursery	Avon	3	Aug. 26	892
Flower City Rose Co.	Manchester	20	Aug. 7	838
Fraser's Nurseries & Dahlia Gardens	Willimantic	3	Aug. 24	891
Galligan, C. W. (2)	Orange and North Haven	2	Sept. 9	929
Gallup, Amos M. (2)	Stonington	1	Aug. 5	829
Gardner's Nurseries	Rocky Hill	100	Sept. 7	925
Geduldig's Greenhouses	Norwich	3	Sept. 9	931
Gilbert, Henry G.	Danielson	2	Nov. 25	1,024
Giuliano, John S.	Wethersfield	1	Sept. 18	962
Glastonbury Gardens	Glastonbury	1	June 12	795
Glen Terrace Nurseries	Hamden	35	Nov. 12	1.018
Godfrey's Stratfield Nurseries	Bridgeport	25	Dec. 31	1,052
Golden Hill Nursery	Shelton	2	Oct. 22	1,004
Goodwin Nurseries	Bloomfield	7	Aug. 16	874
Grillo, Nicholas	Milldale	1	July 31	815
Haas, E	Devon	1	Dec. 2	1,039
Hall, Henry A. L. (2)	West Haven	1	Sept. 10	937
Hamden Nurseries	Hamden	1	Sept. 7	927
Hansen, Peter	Fairfield	5	Oct. 8	993
Hartford Board of Water Commissioners (2)	Hartford	25	Oct. 1	987
Hawes, Frank M.	West Hartford	1	Aug. 22	884
Hearn, Thomas H.	Washington	1	Nov. 27	1,034
Heath and Co.	Manchester	10	July 26	797
Henninger, Christ	New Britain	1	Sept. 19	965
Hilliard, H. J.	Sound View	1	July 31	809
Hinckley Hill Nursery	Stonington	2	Aug. 14	859
Hiti Nurseries	Pomfret Center	10	Aug. 14	858
Holcomb, H. Parks	Winsted	2	Oct. 11	999
Holcomb, Irving	Simsbury	1	July 29	799
Holbridge, S. E.	Ledyard	4	Aug. 5	824
Hopeville Gardens	Waterbury	3	Nov. 23	1,025
Horan, James F.	Hartford	3	Dec. 31	1,049
Horan and Son, James	Bridgeport	1	Nov. 30	1,038
Houston, Byron D.	Mansfield	15	Nov. 2	1,013
Hoyt, Charles E.	Danbury	2	Sept. 11	941
Hoyt's Sons Co., Inc., Stephen	New Canaan	300	Aug. 30	914
Hunt and Co., W. W.	Hartford	8	Aug. 28	907
Innes, William	Milford	2	Aug. 27	904
Intravaia & Sons, J.	Middletown	1	Aug. 16	872
Jennings, G. S.	Southport	1	Dec. 31	1,060
Johnson, Tom	Bridgeport	1	Sept. 14	954
Judd, T. H.	Danbury	1	Dec. 31	1,053

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Kelley & Son, James J.	Darien	7	Aug. 28	908
Keystone Nurseries	Danbury	1	Oct. 1	989
Kuen, Rudolph J. (2)	Foxon, East Haven	1	Sept. 9	933
Langstroth Conifer Nursery	Danbury	4	Sept. 11	940
Leghorn, John J.	Cromwell	17	Aug. 15	864
Lewis & Valentine, Inc.	Darien	9	Aug. 27	905
Liljenstein, Carl	New London	1	Aug. 5	826
Lundberg, E. A.	Darien	1	Aug. 26	893
Lynch, Mrs. J. H. (2)	Ridgefield	5	Aug. 14	855
Mallett, Geo. A.	Bridgeport	15	Sept. 13	948
Maplewood Nursery Co.	Norwich	3	Dec. 3	1,040
Marigold Farm	New Canaan	15	Oct. 9	994
Mason, Warren S.	Farmington	1	Aug. 14	861
Mather, S. T.	Darien	1	Nov. 27	1,033
McCarthy, John P. (2)	Danbury	1	Sept. 11	939
McConville, John	Manchester	1	Aug. 14	857
Meachen, Geo. C.[1]	Stratford	1	Sept. 19	967
Meier, A. R.	West Hartford	1	Nov. 23	1,021
Merwin Lane Nursery	East Norwalk	4	Sept. 13	947
Meyer, Carl H. H. (2)	Riverside	10	Aug. 14	860
Meyer, Ludwig	Bridgeport	5	Oct. 7	991
Middeleer, Inc.	Darien	20	Aug. 29	910
Millane Nurseries	Cromwell and Deep River	30	Aug. 31	919
Mill River Nursery	Fairfield	6	Sept. 18	964
Minge, G. H.	Rocky Hill	1	Sept. 24	973
Moraio Bros	Stamford	10	Aug. 27	900
Morgan, Wm. F. (2)	North Stonington	3	Aug. 30	915
Mount Carmel Nursery	Mount Carmel	1	Aug. 27	903
Newell, Raymond E.	West Hartford	1	Aug. 9	841
New Britain Board of Water Commissioners	New Britain	50	Oct. 1	986
New Haven Park Commission	New Haven	16	Aug. 12	847
New London Cemetery Association	New London	1	Sept. 5	920
New London County Nurseries	New London	9	Oct. 16	1,001
New York, New Haven & Hartford Railroad Co. (C. A. Haggerty)	Stamford	5	Sept. 17	959
Nicolson & Thurston	Litchfield	1	Sept. 13	949
North-Eastern Forestry Co.	Cheshire	60	July 26	796
Norwood Nursery	Hamden	1	Aug. 30	912
Oakland Nurseries	Manchester	5	July 26	798
Oakwood Novelty Gardens	East Hartford	1	Aug. 9	840
Old Orchard Nursery	Norwalk	2	Nov. 29	1,036
Ostergren, Herbert	Cromwell	2	July 31	806
Outpost Nurseries	Ridgefield	100	Aug. 14	862
Ouwerkerk, D. K.	Yalesville	10	July 31	804

[1] Deceased.

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Palinkas Nursery (2)	South Norwalk	1	July 31	813
Park Gardens	Bridgeport	1	Dec. 31	1,051
Patterson, John	Old Saybrook	3	Aug. 23	887
Pedersen, Anthon	Stamford	2	Nov. 6	1,014
Pedone & Co., Ludovico	Goshen	3	Sept. 14	952
Pequod Nursery Co.	Yalesville	15	Sept. 14	951
Peschko, Robert	Danbury	1	Sept. 11	942
Pestretto, Frank	West Hartford	1	Dec. 31	1,055
Pestretto, Salvatore	Hartford	1	Sept. 28	983
Pflomm, Charles W. (2)	Bridgeport	1	Sept. 24	975
Phelps & V. T. Hammer Co., J. W.	Branford	3	Dec. 26	1,047
Phillips, Alice G.	Milton	1	Sept. 13	950
Pierson, Inc., A. N.	Cromwell	150	July 31	800
Pinatello, M.	East Hartford	2	Aug. 27	898
Pinchbeck Bros., Inc.	Ridgefield	5	Aug. 22	883
Polish Orphanage Farm	New Britain	1	Oct. 8	992
Pomeroy Blue Spruce Gardens	New Milford	5	Aug. 12	843
Pratt, Jr., George D.	Bridgewater	1	Oct. 26	1,007
Prospect Nurseries, Inc.	Cromwell	12	Aug. 15	866
Prudence Seymour Gardens	New Milford	1	Aug. 12	844
Rabinak, Louis	Deep River	2	Aug. 16	870
Rengerman, A. B.	Granby	1	Aug. 23	890
Reynolds, Stephen	South Norwalk	1	July 31	812
Richards, Warren	Clinton	10	Oct. 10	996
Richmond, Gordon L.	New Milford	3	Aug. 12	842
Rockfall Nursery Co.	Rockfall	90	Aug. 27	901
Rose Hill Nursery (2)	Gildersleeve	1	Nov. 7	1,015
Rottenberg, Julius	Newington	1	Aug. 20	880
Russell, Charles B.	Newington	1	Aug. 6	834
Sage, Hollister	Woodbury	1	July 31	817
Sasco Hill Evergreen Nursery	Southport	1	Sept. 14	955
Saxe-Floto	Waterbury	2	Aug. 14	850
Scarano, Alphonso	Groton	1	Oct. 29	1,011
Schaeffer Bros.	Norwich	4	Nov. 23	1,027
Schneider, Godfrey	West Haven	1	Sept. 12	945
Schulze, Charles T.	Bethel	2	Dec. 3	1,041
Scott's Nurseries	Bloomfield	5	Dec. 12	1,044
Seltsam's Pequonnock Gardens	Bridgeport	1	Sept. 28	980
Seymour, Fred R.	Riverton	1	Sept. 28	979
Shailer, Edwin E.	Haddam	1	Aug. 16	871
Sierman, C. H.	Hartford	8	Sept. 26	978
Silvermine Nurseries	Norwalk	1	July 31	811
Simonsen, H. C.	Plainville	2	Nov. 26	1,032
Snelgrove, S. J.	Windsor	1	Aug. 6	835
Soltes, Martin J.	Shelton	1	Sept. 18	963
Southport Nurseries	Southport	32	Aug. 12	845
South Wilton Nurseries	Wilton	5	Aug. 30	917
Spencer, W. L. L.	Columbia	1	Aug. 5	822
Spring Nurseries	Forestville	1	July 31	814
Stack, Garrett M. (2)	Guilford	1	Sept. 21	969

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Stack, Thomas M. (2)	New Milford	1	Sept. 28	982
Stafford Conservatories	Stafford Springs	1	Sept. 17	957
Stannard, E. H.	Wilton, Woodbury and Southbury	1	Sept. 28	981
State Highway Department (Landscape Division)	Ellington, Putnam, Wethersfield and Wilton	6	Oct. 11	998
State of Conn. (A. F. Hawes, State Forester)	Simsbury, Hartford	5	Aug. 23	889
State Street Nursery	New Haven	2	Aug. 14	854
Steck, Jr., C. A.	Bethel	2	Nov. 23	1,019
Steck, Charles A.	Newtown	10	Dec. 31	1,058
Steck, Nurseries, Inc.	Farmington	10	Dec. 31	1,059
Steck, Sarah B.	Bethel	1	Sept. 30	985
Stolle, J. W.	Bethel	1	Sept. 11	938
Stratford Rose Nurseries	Stratford	2	Sept. 14	953
Sunridge Nurseries (2)	Greenwich	10	Aug. 22	885
Sylvan Avenue Greenhouse	Bridgeport	2	Nov. 23	1,029
Tanner, Edward G.	Manchester	1	Aug. 27	899
Thomas & Sons, Inc., W. D.	Hamden	2	Dec. 31	1,048
Torizzo, P. A.	West Hartford	1	Nov. 23	1,023
Tree Farms, Inc.	Cromwell	15	Sept. 2	946
Tryon, George W.	North Stonington	1	Aug. 5	832
Upson, R. E.	Marion	2	Sept. 5	921
Van der Bom, F.	Bethel	5	Sept. 17	961
Vanderbrook & Son, C. L.	Manchester	30	Aug. 12	848
Vanderstam, C. L.	Yalesville	2	July 31	801
Van Wilgen Nurseries	Branford	10	Oct. 15	1,000
Vasileff, Nicholas	Greenwich	4	Nov. 23	1,026
Verkade's Nurseries	New London	50	Oct. 29	1,010
Vernik Nursery, John	Bridgeport	2	Sept. 24	974
Wallace Nursery	Wallingford	8	July 31	808
Wegner, C. F.	Noroton Heights	1	Oct. 9	995
Weirether, Leo	West Haven	1	Aug. 22	886
Westville Nurseries	New Haven	1	Dec. 31	1,054
Wheeler, C. B.	Stonington	1	Aug. 5	830
Wilcox, Elmer E.	Guilford	1	Sept. 21	970
Wild, Henry	Greenwich	2	Aug. 19	878
Wild, Henry	Norwalk	30	Aug. 19	879
Williams, Harry G.	Shelton	1	Sept. 28	984
Wilridge Nurseries (2)	Branchville	2	Aug. 30	913
Wilson & Co., C. E.	Manchester	100	Sept. 6	922
Wilson, Robert L.	Stamford	1	Aug. 26	895
Woodbridge Nursery Co.	New Haven	6	Oct. 10	998
Woodruff, C. V.	Orange	1	Sept. 7	928
Wyllie, David	Whitneyville	1	Dec. 7	1,042
Yale Forest School Nursery	New Haven	2	Sept. 10	935

Name of firm	Address	Acreage	Certificate issued	No. of certificate
Yale University Landscape Dept.	New Haven	11	Aug. 26	897
Zack Co., H. J.	Deep River	15	Nov. 30	1,037
Total acres		3,157		

Inspection of Raspberry Plantations

Only one firm applied in 1929 for the special inspection and certification of raspberry plants on account of the mosaic and allied diseases in order to meet the requirements of Michigan, Minnesota, New York, Vermont and Wisconsin. The inspections were made and a certificate issued to cover only the varieties indicated, as follows:

Special Certificate on Raspberry Plants

Name of firm	Address	Varieties	Certificate Date of issue	Certificate Number
Conine Nursery Co.	Stratford	Latham LaFrance Saint Regis	Oct. 15	19

Registration of Nursery Dealers

Chapter 265, Public Acts of 1925, provides that dealers in nursery stock must register each year, on or before March 1, with the State Entomologist, and cite the principal sources of their nursery stock. All dealers' permits are for the remainder of the calendar year and expire on December 31. During the year 104 such dealers have registered and received permits. The list of dealers is on file in the office of the State Entomologist, but is not printed in this Report.

Registration of Out-of-State Nurserymen

Nurserymen in other states wishing to ship stock into Connecticut are required to file with the State Entomologist signed copies of their nursery inspection certificates and make application for permits to ship stock into the state. These permits are valid only for the periods covered by the certificates placed on file. During the year 258 permits were issued to nurserymen in other states, but the list of firms receiving them is not printed in this Report.

Parcel Certificates

In addition to the regular inspection and certification of nursery stock, occasionally individuals wish to send shrubs and plants to their friends, and sometimes nurserymen need to ship packages before receiving their regular certificates. Consequently 352 separate parcels of nursery stock were inspected and package certificates furnished.

Inspection of Narcissus Bulbs

On account of Federal Quarantine No. 62, narcissus bulbs grown in Connecticut cannot be shipped into other states unless given two inspections, one in the field in May, and the other after the bulbs have been dug for shipment. In case they are found to be infested with bulb flies or eelworms, they must then be treated. During the year 22,000 such bulbs were inspected and certified.

Inspection of Laurel and Decorative Materials

Considerable decorative material is gathered each year in Connecticut woodlands and shipped into New York City. This is mostly mountain laurel, *Kalmia latifolia*. If gathered within the gipsy moth quarantined area, it is examined by Federal inspectors, and if found clean, is certified for shipment. Much of it is collected outside the quarantined area and yet cannot enter New York without being certified. During the year 42 such certificates were issued.

Inspection of Shelled Seed Corn

On account of the European corn borer having been found in a portion of Connecticut, certain states would not allow shelled sweet corn for seed to enter unless it had been inspected and certified to be free from bits of cob large enough to carry borers. Therefore a large quantity of such seed corn was inspected as it came through the cleaning mill, and 1084 certificate tags were issued covering shelled corn and certain other seeds.

Blister Rust Control Area Permits

In 1929, nine blister rust control areas were legally established in Connecticut. Under such conditions, the Federal regulations require that before any shipments of currants, gooseberries or other species of *Ribes* or white pine or other five-leaf pines are shipped into the state, the shipper must apply to the State Entomologist for a permit. The shipper must give name and address of both consignor and consignee, name and number of plants of each species and variety to be shipped. If the shipment is to be sent to a point outside the control areas and does not contain any prohibited plants, the permit is granted. During the year 334 such permits have been issued. Black currants are now debarred by statute. The text of the law follows:

Public Acts of 1929

CHAPTER 172

AN ACT PROHIBITING THE GROWING OF BLACK CURRANT PLANTS

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. Any person who shall grow, plant, propagate, cultivate, sell, transport or possess any plant, root or cutting of the European black currant, or *Ribes nigrum,* shall be fined not less than five dollars nor more than twenty-five dollars.

Sec. 2. The director of the Connecticut Agricultural Experiment Station is authorized to seize and destroy any plants, roots or cuttings of said European black currant found in the State.

Approved June 3, 1929.

INSPECTION OF IMPORTED NURSERY STOCK

W. E. Britton and M. P. Zappe

Since 1920, the only nursery stock permitted to enter Connecticut directly from foreign countries has been fruit tree seedlings and rose stocks for propagation. This material enters the United States under a Federal system of notices and permits and is released at ports of entry, to be inspected by state inspectors at destination points. All other plant material brought into the country must go to Washington, where it is examined, and where it may be detained, fumigated or destroyed, if there is any question of infestation. All proper precautions are taken by the Plant Quarantine and Control Administration before allowing the plants to be distributed.

The imported nursery stock entering Connecticut in 1928-1929 was inspected at destination by Mr. Zappe, assisted at rush periods by Mr. Johnson, Mr. McFarland and Dr. Friend. They inspected fewer shipments and a smaller number of plants than last year, as the following table shows:

Year	No. of shipments	No. of cases	No. of plants
1920	17	87	814,491
1921	21	126	1,228,560
1922	30	159	1,997,595
1923	35	179	1,981,895
1924	33	313	3,489,170
1925	27	277	2,977,346
1926	32	347	3,443,357
1927	31	321	3,229,915
1928	26	277	2,680,700
1929	23	225	2,022,475

Sources of Imported Nursery Stock, 1928-1929

The greatest number of shipments and plants came from Holland, as in some of the preceding years. The following table shows the sources of this stock:

Country	No. of shipments	No. of cases	No. of plants
Holland	14	137	1,015,475
France	7	85	989,000
England	2	3	18,000
Total	23	225	2,022,475

These 23 shipments were imported by 10 different Connecticut firms, two of which imported 191 of the 225 cases containing 1,800,075 plants. Of the whole number of shipments, 14 contained only rose stocks, six were only fruit stocks and three contained both rose and fruit stocks.

Of this plant material inspected, 1,128,575 plants, or about 55 per cent, were rose stocks and the remainder, 893,000 plants, or about 45 per cent, were fruit seedlings, the quantity of each different variety being shown in the following table:

Kinds of Stock Imported

ROSE STOCKS		
Rosa manetti	998,575	
Rosa rugosa	130,000	
		1,128,575
FRUIT STOCKS		
Apple (all kinds)	290,800	
Cherry (all kinds)	391,600	
Pear	151,500	
Plum	50,000	
Quince	10,000	
		893,900
Total		2,022,475

Time of Arrival and Inspection

This imported nursery stock begins to arrive in the late fall and continues into the winter. Some importers desire an immediate inspection, but others place the stock in storage and ask to have it inspected a little each week as they can use it in grafting and propagating. The following table shows the quantities of stock as inspected by months:

Month	No. of shipments	No. of cases	No. of plants
November	1	2	15,000
December	4	27	231,500
January	9	114	1,212,000
February	5	77	524,575
March	3	4	29,500
April	1	1	9,900
Total	23	225	2,022,475

The time required to inspect this stock is equivalent to one man working 21 days, and this time, together with traveling and other necessary expenses, amounts to nearly $400.

In addition to the material enumerated and tabulated above, there were 13 shipments of new varieties of plants and 28 shipments containing 685 pounds of tree seeds which were not inspected in Connecticut. The plants were inspected and the seeds fumigated with carbon disulfide at Washington, D. C. Reports of the 23 shipments inspected were sent to the Plant Quarantine and Control Administration, Washington, D. C.

Results of Inspection

Of the 23 shipments inspected, 12 shipments, or 52 per cent, were found free from infestation, but in the other 11 shipments, or 48 per cent, there were insects, small animals or plant diseases, some of which are well known pests. Details of these infestations are given below:

INFESTATIONS INTERCEPTED ON IMPORTED NURSERY STOCK

11 SHIPMENTS INFESTED

INSECTS AND OTHER ANIMALS

Aporia crataegi Linn. Nests on apple (1 shipment), Andre Choplin, Maze, France.

Calophasia lunula Hubn. On pear (2 shipments), Andre Choplin, Maze, and A. Fermaud, Angers, France.

Emphytus cinctus Linn. On rose (8 shipments), Andre Choplin, Maze, A. Fermaud and Franco-American Seedling Co., Angers, France; W. C. Slocock, Woking, England; Felix & Dykhius, and Association Flora, Boskoop, Holland.

Lepidopterous pupa. On rose and pear (2 shipments), Andre Choplin, Maze, France; C. Klyn & Co., Boskoop, Holland.

Notolophus antiqua Linn. Rusty tussock moth eggs on cherry, apple and rose (3 shipments), Franco-American Seedling Co., Angers, France; F. J. Grootendorst and Association Flora, Boskoop, Holland.

Spiders Eggs. On rose and pear (2 shipments), Andre Choplin, Maze, and Franco-American Seedling Co., Angers, France.

Woolly aphid. On apple (1 shipment), A. Fermaud, Angers, France.

PLANT DISEASES

Crown Gall on Manetti rose (1 shipment), Association Flora, Boskoop, Holland.

INSPECTION OF APIARIES IN 1929

In 1929, as in former seasons, the apiaries of Connecticut were inspected by Mr. H. W. Coley, of Westport, and Mr. A. W. Yates, of Hartford, who have been paid for each day employed on this work. Mr. Coley covered the southern half of the state, Fairfield, New Haven, Middlesex and New London Counties, and Mr. Yates the northern half, Litchfield, Hartford, Tolland and Windham Counties.

The appropriation, now $4,000 for two years, has never been sufficient to cover the cost of inspecting all known apiaries in the state each year, so an attempt has been made to inspect some of them in alternate seasons in order to cover them all in each two-year period.

This inspection work in 1929 required 167 man days, and together with traveling expenses cost $2,169.10. In all 990 apiaries containing 9,559 colonies were inspected, in 1929, as against 852 apiaries containing 8,133 colonies in 1928. The apiaries averaged 9.55 colonies each in 1929 and 9.41 each in 1928.

The following table shows the number of apiaries and colonies inspected, the average number of colonies per apiary, and the average cost of inspecting each apiary and colony for each year since the inspection started in 1910:

TWENTY-YEAR RECORD OF APIARY INSPECTION IN CONNECTICUT

Year	No. of apiaries	No. of colonies	Average No. colonies per apiary	Average Cost of inspection per apiary	per colony
1910	208	1,595	7.6	$2.40	.28
1911	162	1,571	9.7	1.99	.21
1912	153	1,431	9.3	1.96	.21
1913	189	1,500	7.9	1.63	.21
1914	463	3,882	8.38	1.62	.19
1915	494	4,241	8.58	1.51	.175
1916	467	3,898	8.34	1.61	.19
1917	473	4,506	9.52	1.58	.166
1918	395	3,047	7.8	1.97	.25
1919	723	6,070	11.2	2.45	.29
1920	762	4,797	6.5	2.565	.41
1921	751	6,972	9.2	2.638	.24
1922	797	8,007	10.04	2.60	.257
1923	725	6,802	9.38	2.55	.27
1924	953	8,929	9.4	2.42	.25
1925	766	8,257	10.7	2.45	.22
1926	814	7,923	9.7	2.35	.24
1927	803	8,133	10.1	2.37	.234
1928	852	8,023	9.41	2.12	.225
1929	990	9,559	9.55	2.19	.227

In 1929, apiaries were inspected in 141 towns as against 149 towns in 1928 and 135 towns in 1927. Inspections were made in 1929 in the following 11 towns not visited in 1928: New Haven County—Ansonia, Beacon Falls, West Haven; Middlesex County—Durham; Litchfield County—Barkhamsted, Warren; Windham County—Ashford, Chaplin, Eastford, Hampton, Thompson.

On the other hand, in the following 20 towns visited in 1928, no inspections were made in 1929: Fairfield County—New Fairfield, Sherman, Westport; New Haven County—Bethany, Milford, New Haven, Orange, Oxford, Southbury, Waterbury, Woodbridge; Middlesex County—Saybrook; New London County—Bozrah, New London, Preston, Sprague; Litchfield County—Bridgewater, New Milford, Roxbury; Tolland County—Tolland.

In the following eight towns no inspections were made in either 1928 or 1929: Fairfield County—Bridgeport, Monroe, Newtown, Shelton, Trumbull, Weston; New London County—Lisbon; Tolland County—Willington.

In 1929, one apiary was inspected in Warren where for several years it was believed that no bees were kept; at least, none had been discovered.

European Foul Brood

European foul brood is a disease of the young larvae in the comb caused by a bacterial germ known as *Bacillus pluton.* The cell contents often have the odor of fermentation, though they are not particularly offensive and are not gelatinous or ropy. This disease is usually more troublesome in early summer than at other seasons and requeening with Italian queens and uniting two or more weak colonies to make them strong are the usual methods of treatment.

Of the 990 apiaries and 9,559 colonies inspected in 1929, only two apiaries and three colonies were found infested with European foul brood. This is the lightest infestation of both apiaries and colonies found since the inspection work started in 1910, and amounts to .02 per cent of the apiaries and .003 per cent of the colonies.

The following table shows a complete record of percentages of European foul brood infestation in Connecticut since the inspections were started in 1910:

Record of European Foul Brood

Year	Percentage of infestation Apiaries	Colonies	Year	Percentage of infestation Apiaries	Colonies
1910	75.9	49.7	1920	4.3	1.5
1911	51.8	27.4	1921	3.91	1.26
1912	47.7	23.5	1922	4.14	.85
1913	44.4	24.5	1923	2.34	.36
1914	32.6	13.9	1924	1.78	.526
1915	26.1	10.3	1925	2.48	.507
1916	18.8	7.05	1926	3.19	.858
1917	16.7	4.86	1927	1.12	.282
1918	9.8	3.3	1928	1.05	.324
1919	6.6	1.2	1929	.02	.003

During the season of 1929, European foul brood was found only in two towns: Winchester in Litchfield County, and Coventry in Tolland County. No apiaries infested with this disease were found in Fairfield, New Haven, Middlesex, New London, Hartford, and Windham Counties.

American Foul Brood

American foul brood is likewise a disease of the larvae in the cells, but it occurs at a time when the larvae are nearly mature or more advanced in their development than does the European foul brood. American foul brood is also caused by a bacterial organism or germ known to science as *Bacillus larvae.* The symptoms appear after the cells have been sealed and often after the brood has pupated. The cells are shrunken and if opened the contents have a very offensive odor and a peculiar stringy or ropy consistency. The usual remedy is to shake the bees into clean hives, destroy the infected combs, and disinfect or destroy the old hives. The diseased combs may be sterilized by soaking them in an alcohol-formalin solution containing 20 per cent of formalin, but this treatment is not widely practiced.

Of the 990 apiaries and 9,559 colonies inspected in 1929, 46 apiaries and 115 colonies were infested with American foul brood. This infestation is equivalent to 4.64 per cent of the apiaries and 1.2 per cent of the colonies inspected in 1929. This record is slightly higher than that of 1928; in fact, it is the highest percentage of infestation of American foul brood ever found by the inspectors in any season in Connecticut.

The following table shows a complete record of American foul brood since the apiary inspection work was started in Connecticut in 1910:

Record of American Foul Brood

Year	Percentage of infestation Apiaries	Colonies	Year	Percentage of infestation Apiaries	Colonies
1910	0	0	1920	1.18	.25
1911	0	0	1921	2.5	.56
1912	0	0	1922	1.38	.27
1913	0	0	1923	.985	.323
1914	1.07	.7	1924	1.04	.22
1915	.8	.18	1925	3.26	.424
1916	1.07	.15	1926	1.72	.29
1917	.42	.17	1927	3.11	.70
1918	1.01	.32	1928	4.213	.98
1919	3	1.1	1929	4.64	1.2

In 1929, American foul brood was found in the following 24 towns: Fairfield County—Danbury, Fairfield, Greenwich, Ridgefield, Stamford, Wilton; New Haven County—Cheshire, Hamden, Middlebury, Naugatuck, North Haven, Prospect, Wallingford; Middlesex County—East Hampton, Essex, Middlefield; New London County—Stonington; Litchfield County—Plymouth, Watertown; Hartford County—Bristol, New Britain, West Hartford, Wethersfield; Tolland County—Ellington. This disease was not found in Windham County.

Sacbrood

Sacbrood or pickled brood is a disease that causes the larvae or brood to die at about the time that the cells are capped. They lie on their backs with heads turned upward. Though the body is swollen and the contents are watery, there is no ropiness. The entire cell contents may be removed intact as if enclosed in a sac. The color, though variable, is often light yellowish brown with head nearly black.

The cause of this disease is thought to be a filterable virus, and the usual treatment is to unite the weak colonies to make strong ones. In rare cases where the entire apiary becomes diseased, all colonies should be supplied with new queens.

The following table shows the record of sacbrood in Connecticut since the inspection work began in 1910:

Record of Sacbrood

Year	Percentage of infestation Apiaries	Colonies	Year	Percentage of infestation Apiaries	Colonies
1910	0	0	1920	1.18	.229
1911	....	.51	1921	1.06	.157
1912	....	Several	1922	1.37	.187
1913	....	2.8	1923	.53	.086
1914	2.59	.721	1924	1.78	.52
1915	2.02	.47	1925	3.39	.836
1916	.428	.051	1926	1.1	.138
1917	1.48	.199	1927	.03	.0036
1918	.253	.032	1928	.035	.087
1919	1.24	.19	1929	.001	.0006

This year sacbrood was found in Connecticut only in Wallingford in New Haven County.

Statistics of Inspection

The statistics of apiary inspection by towns and counties are given on the following pages, with summary on page 527.

Inspection of Apiaries, 1929

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Fairfield County							
Bethel	2	0	28	0	0	0	0
Bridgeport ...	0	0	0	0	0	0	0
Brookfield ...	4	0	84	0	0	0	0
Danbury	7	2	62	8	8	0	0
Darien	2	0	45	0	0	0	0
Easton	2	0	86	0	0	0	0
Fairfield	8	2	86	5	5	0	0
Greenwich ...	9	3	74	8	8	0	0
Monroe	0	0	0	0	0	0	0
New Canaan..	11	0	84	0	0	0	0
New Fairfield	0	0	0	0	0	0	0
Newtown	0	0	0	0	0	0	0
Norwalk	6	0	57	0	0	0	0
Redding	5	0	94	0	0	0	0
Ridgefield ...	7	3	54	9	9	0	0
Shelton	0	0	0	0	0	0	0
Sherman	0	0	0	0	0	0	0
Stamford	3	1	20	1	1	0	0
Stratford	1	0	2	0	0	0	0
Trumbull	0	0	0	0	0	0	0
Weston	0	0	0	0	0	0	0
Westport	0	0	0	0	0	0	0
Wilton[1]	7	1	121	3	3	0	0
	74	12	897	34	34	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
New Haven County							
Ansonia	2	0	6	0	0	0	0
Beacon Falls..	1	0	24	0	0	0	0
Bethany	0	0	0	0	0	0	0
Branford	2	0	21	0	0	0	0
Cheshire	11	3	78	10	10	0	0
Derby	2	0	9	0	0	0	0
East Haven ..	2	0	22	0	0	0	0
Guilford	3	0	50	0	0	0	0
Hamden	3	1	31	6	6	0	0
Madison	3	0	18	0	0	0	0
Meriden	11	0	159	0	0	0	0
Middlebury ..	6	3	91	6	6	0	0
Milford	0	0	0	0	0	0	0
Naugatuck ..	4	1	76	3	3	0	0
New Haven ..	0	0	0	0	0	0	0

[1] One colony inspected twice.

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
New Haven County—*Cont.*							
North Branford	1	0	30	0	0	0	0
North Haven	1	1	2	1	1	0	0
Orange	0	0	0	0	0	0	0
Oxford	0	0	0	0	0	0	0
Prospect	4	1	39	1	1	0	0
Seymour	2	0	4	0	0	0	0
Southbury	0	0	0	0	0	0	0
Wallingford	18	5	163	14	8	0	6
Waterbury	0	0	0	0	0	0	0
West Haven	4	0	47	0	0	0	0
Wolcott	4	0	12	0	0	0	0
Woodbridge	0	0	0	0	0	0	0
	84	15	882	41	35	0	6

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Middlesex County							
Chester	10	0	60	0	0	0	0
Clinton	4	0	63	0	0	0	0
Cromwell	4	0	67	0	0	0	0
Durham	11	0	227	0	0	0	0
East Haddam	8	0	242	0	0	0	0
East Hampton	11	2	150	6	6	0	0
Essex	4	1	45	1	1	0	0
Haddam	3	0	50	0	0	0	0
Killingworth	4	0	67	0	0	0	0
Middlefield	4	3	44	11	11	0	0
Middletown	6	0	98	0	0	0	0
Old Saybrook	5	0	64	0	0	0	0
Portland	9	0	89	0	0	0	0
Saybrook	0	0	0	0	0	0	0
Westbrook	1	0	4	0	0	0	0
	84	6	1,270	18	18	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
New London County							
Bozrah	0	0	0	0	0	0	0
Colchester	12	0	188	0	0	0	0
East Lyme	4	0	133	0	0	0	0
Franklin	3	0	95	0	0	0	0
Griswold	4	0	79	0	0	0	0
Groton	6	0	79	0	0	0	0
Lebanon	12	0	208	0	0	0	0
Ledyard	5	0	59	0	0	0	0
Lisbon	0	0	0	0	0	0	0
Lyme	1	0	14	0	0	0	0
Montville	8	0	84	0	0	0	0
New London	0	0	0	0	0	0	0
No. Stonington	1	0	54	0	0	0	0
Norwich	9	0	230	0	0	0	0
Old Lyme	1	0	14	0	0	0	0
Preston	0	0	0	0	0	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
New London County—*Cont.*							
Salem	2	0	21	0	0	0	0
Sprague	0	0	0	0	0	0	0
Stonington	7	1	59	2	2	0	0
Voluntown	3	0	25	0	0	0	0
Waterford	3	0	24	0	0	0	0
	81	1	1,366	2	2	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Litchfield County							
Barkhamsted	6	0	23	0	0	0	0
Bethlehem	4	0	24	0	0	0	0
Bridgewater	0	0	0	0	0	0	0
Canaan	2	0	15	0	0	0	0
Colebrook	7	0	48	0	0	0	0
Cornwall	6	0	33	0	0	0	0
Goshen	4	0	43	0	0	0	0
Harwinton	6	0	22	0	0	0	0
Kent	7	0	122	0	0	0	0
Litchfield	14	0	155	0	0	0	0
Morris	3	0	22	0	0	0	0
New Hartford	12	0	51	0	0	0	0
New Milford	0	0	0	0	0	0	0
Norfolk	5	0	24	0	0	0	0
North Canaan	6	0	91	0	0	0	0
Plymouth	6	2	38	2	2	0	0
Roxbury	0	0	0	0	0	0	0
Salisbury	6	0	79	0	0	0	0
Sharon[1]	9	1	175	1	0	0	0
Thomaston	16	0	74	0	0	0	0
Torrington	14	0	87	0	0	0	0
Warren	1	0	6	0	0	0	0
Washington	5	0	139	0	0	0	0
Watertown	16	1	112	1	1	0	0
Winchester	17	1	86	1	0	1	0
Woodbury	3	0	73	0	0	0	0
	175	5	1,542	5	3	1	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Hartford County							
Avon	13	0	72	0	0	0	0
Berlin	15	0	210	0	0	0	0
Bloomfield	9	0	247	0	0	0	0
Bristol	17	5	155	14	14	0	0
Burlington	9	0	47	0	0	0	0
Canton	9	0	74	0	0	0	0
East Granby	2	0	15	0	0	0	0
East Hartford	9	0	39	0	0	0	0
East Windsor	14	0	92	0	0	0	0
Enfield	7	0	46	0	0	0	0
Farmington	16	0	108	0	0	0	0

[1] One bee paralysis.

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Hartford County—*Cont.*							
Glastonbury ..	15	0	131	0	0	0	0
Granby	11	0	108	0	0	0	0
Hartford	5	0	36	0	0	0	0
Hartland	3	0	110	0	0	0	0
Manchester ..	14	0	83	0	0	0	0
Marlborough..	2	0	31	0	0	0	0
New Britain[1]..	20	1	100	1	0	0	0
Newington ...	5	0	28	0	0	0	0
Plainville	13	0	41	0	0	0	0
Rocky Hill ..	4	0	46	0	0	0	0
Simsbury	10	0	52	0	0	0	0
Southington ..	13	0	73	0	0	0	0
South Windsor	7	0	52	0	0	0	0
Suffield	7	0	69	0	0	0	0
West Hartford	14	1	115	2	2	0	0
Wethersfield[1]..	14	1	65	1	0	0	0
Windsor	16	0	125	0	0	0	0
Windsor Locks	4	0	14	0	0	0	0
	297	8	2,346	18	16	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Tolland County							
Andover	4	0	9	0	0	0	0
Bolton	2	0	19	0	0	0	0
Columbia	6	0	34	0	0	0	0
Coventry	13	1	100	2	0	2	0
Ellington	17	3	85	7	7	0	0
Hebron	6	0	30	0	0	0	0
Mansfield	7	0	24	0	0	0	0
Somers	7	0	47	0	0	0	0
Stafford	9	0	45	0	0	0	0
Tolland	0	0	0	0	0	0	0
Union	1	0	7	0	0	0	0
Vernon	10	0	51	0	0	0	0
Willington ...	0	0	0	0	0	0	0
	82	4	451	9	7	2	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Windham County							
Ashford	4	0	39	0	0	0	0
Brooklyn	6	0	214	0	0	0	0
Canterbury ..	3	0	25	0	0	0	0
Chaplin	3	0	15	0	0	0	0
Eastford	6	0	13	0	0	0	0
Hampton	6	0	30	0	0	0	0
Killingly	15	0	65	0	0	0	0
Plainfield	6	0	28	0	0	0	0
Pomfret	9	0	61	0	0	0	0
Putnam	4	0	26	0	0	0	0
Scotland	9	0	41	0	0	0	0
Sterling	4	0	8	0	0	0	0

[1] One bee paralysis.

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul brood American	Foul brood European	Sacbrood
Windham County—*Cont.*							
Thompson ...	6	0	39	0	0	0	0
Windham	17	0	94	0	0	0	0
Woodstock ..	15	0	117	0	0	0	0
	113	0	805	0	0	0	0

Summary

County	No. towns	Apiaries In-spected	Apiaries Dis-eased	Colonies In-spected	Colonies Dis-eased	Foul brood American	Foul brood European	Sacbrood
Fairfield ...	14	74	12	897	34	34	0	0
New Haven	19	84	15	882	41	35	0	6
Middlesex ..	14	84	6	1,270	18	18	0	0
New London	16	81	1	1,366	2	2	0	0
Litchfield[1] ..	23	175	5	1,542	5	3	1	0
Hartford[2] ..	30	297	3	2,346	18	16	0	0
Tolland ...	11	82	4	451	9	7	2	0
Windham ..	15	113	0	805	0	0	0	0
	142	990	51	9,559	127	115	3	6

	No. apiaries	No. colonies
Inspected	990	9,559
Infested with European foul brood	2	3
Per cent infested	.02	.003
Infested with American foul brood	46	115
Per cent infested	4.64	1.2
Infested with sacbrood	1	6
Infested with bee paralysis	3	3
Average number of colonies per apiary		9.55
Cost of inspection		$2,169.10
Average cost per apiary		$2.19
Average cost per colony		.227

Registration of Bees: New Legislation

Though the law requiring beekeepers to register with the town clerk of the town in which the bees are kept, was first enacted in 1919, there has never been anything like a complete registration of all apiaries. There have been few prosecutions for failing to register. In other words, the law has not been enforced.

The General Assembly of 1923 passed an amendment to this law requiring the town clerks to report to the State Entomologist in case bees had been registered as of October 1, and to send a list of such registrations on or before the next February 1. This law did not require them to report in case no bees were registered, and as many failed to report, it was difficult to ascertain whether they were complying with the law or violating it. Though notices were sent repeatedly in certain cases, the needed information could be obtained only by making a personal visit to the office of the town clerk, which is, of course, expensive.

[1] One bee paralysis.
[2] Two bee paralysis.

The General Assembly of 1929 further amended this law requiring town clerks to report to the State Entomologist on or before December 1, and the report does not depend upon registrations. They are supposed to report whether registrations have been made or not. The text of this amendment is as follows:

PUBLIC ACTS OF 1929

CHAPTER 50

AN ACT AMENDING AN ACT CONCERNING THE REGISTRATION OF THE OWNERS OF BEES

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section two of chapter 174 of the public acts of 1919 as amended by chapter 129 of the public acts of 1923 is amended to read as follows: A record of such registration and of the name and place of residence of the registrant and the definite location in the town where bees are kept by him shall be kept in a separate book in the office of the town clerk, which record shall be accessible to the public. Each town clerk shall, on or before December first, report to the state entomologist whether or not any such owners have been registered by him, and file with said state entomologist a complete list of such registrations.

Approved April 10, 1929.

During 1929, 712 apiaries and 6,752 colonies were registered with the town clerks. This is slightly more than two-thirds the number of apiaries and colonies that were inspected during the season, and in 27 towns no inspections were made.

The number of apiaries and colonies in Connecticut has been a matter of speculation. In 1929, 990 apiaries and 9,559 colonies were inspected and 712 apiaries and 6,752 colonies were registered with the town clerks. After checking the lists carefully and deducting those counted twice, definite figures are obtained and shown in the following table:

1929	Apiaries	Colonies
Inspected	990	9,559
Registered but not inspected	396	2,787
Total	1,386	12,346

There were eight towns in which no bees were registered and 27 towns in which no bees were inspected. As there are probably a moderate number of apiaries which were neither registered nor inspected in 1929, it seems fair to assume that there are at least 15,000 colonies of bees in Connecticut.

The text of the registration law as it now stands on the statute books is as follows:

"SECTION 1. Every person owning one or more hives of bees shall, annually, on or before the first day of October, make application to the town clerk of the town in which such bees are kept, for the registration of such bees, and such town clerk shall issue to such applicant a certificate of registration upon the payment of a recording fee of twenty-five cents, which certificate shall be in the form prescribed and upon blanks furnished by the commissioner of domestic animals and shall be recorded in the office of such town clerk.

SEC. 2. A record of such registration with the name and place of residence of the registrant and the definite location in the town where bees are kept by him shall be recorded in a separate book in the office of the town clerk, which record shall be accessible to the public. Each town clerk shall, on or before December first, report to the state entomologist whether or not any such owners have been registered by him, and file with said state entomologist a complete list of such registrations.

SEC. 3. Any owner of bees who shall fail to register as required by the provisions of this act shall be fined not more than five dollars."

GIPSY MOTH WORK IN CONNECTICUT IN 1929

John T. Ashworth and W. E. Britton

The work of suppressing the gipsy moth is conducted by the State Entomologist in coöperation with the Federal Plant Quarantine and Control Administration. During the year, this work has been continued in the same manner as in former years and there have been no important or unusual developments. No extensive wind-spread has been discovered and no noticeable defoliation

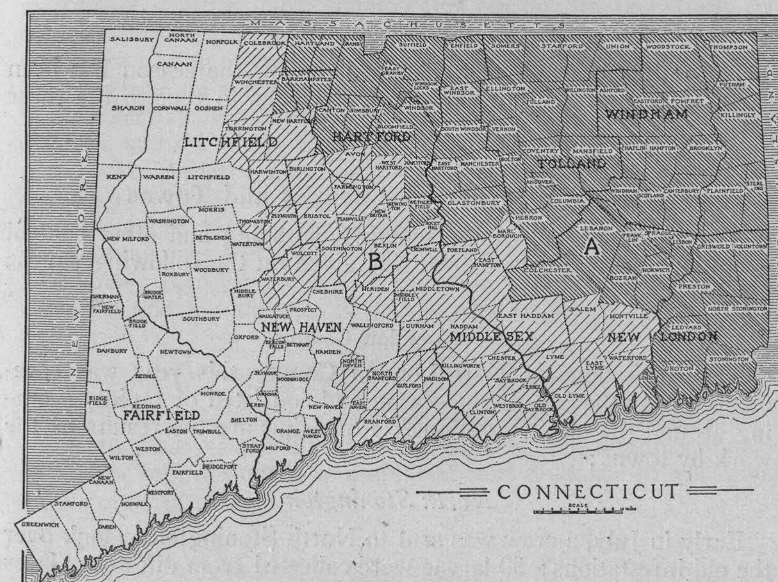

FIGURE 45. Map of Connecticut showing areas at present quarantined on account of the gipsy moth. A, generally infested; B, lightly infested.

such as has taken place in certain portions of Massachusetts, Maine and New Hampshire has occurred in Connecticut. There has been no change in the quarantine and the areas are the same as last year as shown in Figure 45. For the most part, the Federal forces have operated along the western border of the infested area in order to prevent further spread, and the state forces have covered the area further eastward where infestations are known to occur.

The appropriation is inadequate to provide for scouting in all infested towns each season; consequently, they are covered under the plan of a two-year rotation. No parasites were distributed in 1929.

We are greatly indebted to Mr. A. F. Burgess and Mr. H. L. Blaisdell in charge of the Federal Control work for their splendid coöperation, and we here express to them our appreciation and thanks.

Some scouting was done for the satin moth, which will be mentioned on another page of this report.

New Equipment

The only new equipment obtained during the season has been small tools and three new Ford light trucks to replace the three oldest ones.

Details of Work by Counties and Towns

A detailed account of the scouting, spraying and other control operations in the infested towns, is given on the following pages:

New London County

The work done in New London County this year was commenced near the end of the season and consisted of rapidly scouting around the old infestations. Following are the results of the work by towns:

North Stonington

Early in July, a crew was sent to North Stonington to look over the old infestations; 50 larvae were collected from different places in the town, but no heavy feeding was observed or reported.

Stonington

The same procedure was taken in regard to the town of Stonington, where 53 larvae were found. As in the case of North Stonington, no heavy feeding occurred, although larvae were picked up in several places in the village of Stonington.

Groton

25 Infestations — 190 Egg-clusters

Twenty-two miles of roadside scouting was completed in Groton and 25 small colonies were discovered. The largest was one of 17 egg-clusters found on property owned by the Rev. G. Smith of Butler Court; a colony of 16 egg-clusters was found on apple and shade trees owned by Mr. M. Collins, on the New London-Mystic road; another small colony of 16 egg-clusters was discovered on three maple and one apple tree in West Mystic, on property owned by the Sea Sled Corporation. The other colonies ranged from one to 15 egg-clusters each. Seventeen of these colonies were sprayed by state men during the early part of June. In a check-up of these colonies after the spraying season, 132 larvae and pupae were found and killed.

New London

14 Infestations — 490 Egg-clusters

Two large colonies of gipsy moth egg-clusters were found by state men while scouting New London this season; in fact, these two colonies contained 411 of a total of 490 egg-clusters found within the limits of the town. The largest was one of 327 egg-clusters in oak grove on estates owned by Messrs. Sackett and Rayburn, located on Glenwood Avenue. The other was one of 84 egg-clusters, at 67 Federal Street, on elm and maple trees owned by Mr. F. M. Butler. The other twelve colonies were all small, 17 egg-clusters being the largest. This colony was on pine and pear trees owned by Mr. J. Chamberlain at 69 Howard Street. Ten of these 14 colonies were sprayed by state men on June 6. Later in the summer men were sent to New London to check the results of spraying and a total of 283 larvae and pupae were found and destroyed.

East Lyme and Old Lyme

Work in these towns this year consisted of scouting around places that have been infested. A considerable territory outside of all the infestations was examined and no trace of the gipsy moth found in these towns.

Tolland County

Bolton

1 Infestation — 1 Egg-cluster

Before Tolland County could be scouted this year, egg-clusters were hatching and larvae feeding; however, while waiting for the foliage to get out so that spraying would be effective, a crew was sent to last year's woodland infestation in Bolton on land owned by Mr. Samuel Alvord. Between seven and eight acres of woodland and three and a half miles of roadside were scouted around this colony. A total of 87 egg-clusters were discovered on 29 trees scattered throughout the woodland. This colony was sprayed on June 12 by state men, 6,400 gallons of liquid spray being used.

Stafford and Willington

The spraying of colonies discovered during the winter scouting was completed by June 20. It was thought advisable to scout for larvae in the towns of Stafford and Willington and to spray wherever the pest was found. This could be done to good advantage as the larvae had not at this time passed the heavy feeding stage; therefore, a crew was started in Willington on June 22. Three colonies were found and sprayed; then this crew moved to Stafford where they worked until June 29, using the same procedure as in Willington. Eleven colonies were discovered and sprayed. This was all the work that time, money, and men would permit in Tolland County this season. More work is planned to be done in this county next year.

Hartford County

Avon

1 Infestation 382 Egg-clusters

One large new infestation of 382 egg-clusters was found by the state men scouting Avon this season, in a pasture owned by Mr. W. R. Hodge on the west slope of Talcott Mountain. This colony is considered a very dangerous one, on account of the high elevation, as an easterly wind in the spring would spread the young larvae far westward. Approximately 11 acres of woodland were sprayed by state men about the middle of June.

Berlin

3 Infestations 163 Egg-clusters

One large colony of 154 egg-clusters was discovered in the northern end of the town near Webster Brook, extending from Berlin over the line into the southwest corner of Newington; 64 trees in mixed woodland were found to be infested and scattered over this area. This property is owned by Messrs. Sebastian and Furgerson of New Britain and Newington respectively. Another small colony was found in East Berlin on an apple tree in an orchard owned by Mr. George Dowd, where eight egg-clusters were found. The third infestation was a single egg-cluster on a roadside maple near the Stiles and Reynolds Brick Company property. The two first infestations were sprayed by state men between June 13 and June 17.

Burlington

2 Infestations 4 Egg-clusters

No new egg-clusters were found in this town this year. Three old egg-clusters were found at the 1926 infestation in the northwest corner of Burlington in woodland owned by Mr. Scheuster and another old egg-cluster was found on property owned by Mr. S. W. Coy near the Harwinton town line. No spraying was thought necessary and no further work was done in the town.

Canton

11 Infestations 323 Egg-clusters

State men started scouting in Canton on August 28 and stopped work in the town on September 18. The town was then turned over for use by the Federal men as a school for training new men. The scouting in Canton was completed by Federal forces. One large colony of 150 egg-clusters was found in woodland owned by Mr. Walter Freytag in the northern end of the town. The next largest was one of 88 egg-clusters and was found about a mile further south in pasture growth owned by Mr. Mike Bilitzke. The other nine colonies were small. Two colonies were sprayed by state men in the latter part of June.

East Granby

1 Infestation 80 Egg-clusters

One colony of 80 egg-clusters was found near the west border of the town about a mile north of Granby station. About 13 acres of woodland were sprayed at this colony between June 10 and 13 by state men.

Farmington

1 Infestation 15 Egg-clusters

A small woodland colony of 15 egg-clusters was found on property owned by the Hartford Gun Club in the northeastern corner of the town. About two acres of woodland were sprayed on June 15 by state men.

Granby

8 Infestations 115 Egg-clusters

The scouting in Granby this year consisted of scouting in the territory around last year's infestations. This was thought necessary, as the time for hatching was drawing very near and several towns were yet to be looked over. Eight infestations were found. The largest was one of 58 egg-clusters in pasture woodland margin owned by Mr. Andrew Boris of Canton, in the southwest corner of the town. Another of 15 egg-clusters also in pasture land, owned by Mr. Selden Hayes, about a mile east of the West Granby post-office, was found. These two colonies were the largest found in the town this year.

Glastonbury

1 Infestation 11 Egg-clusters

In Glastonbury, as in Granby, the work consisted of scouting around the old infestations. One colony of 11 egg-clusters was found in one oak tree and a stone wall on land owned by Mr. John Scaroni, in the eastern end of the town near the Hebron town line. This colony was sprayed by state men on June 8.

Hartland

5 Infestations 24 Egg-clusters

In Hartland the work also was confined to the territory around last year's infestations. Five small infestations with a total of 24 egg-clusters were found. The largest was one of 10 egg-clusters in a stone wall and on a fence line in the state forest north of the East Hartland postoffice.

Hartford

2 Infestations 31 Egg-clusters

The largest of these two colonies was one of 20 egg-clusters found in maple and oak trees in the northeast corner of the city; the other was one of 11 egg-clusters found on a white oak tree in the rear of 50 Forest Street, owned by Prof. L. B. Paton. Both of these colonies were sprayed on June 13 by state men.

New Britain

5 Infestations 189 Egg-clusters

The old infestation on Bassett Street was found to be re-infested again this year; 139 egg-clusters were found on 26 trees in yards along this street. Another colony of 33 egg-clusters was discovered in a block of woodland owned by Mr. Peter Soring, in the western part of the town near the Plainville town line. Four of the five colonies were sprayed by state men on the 13th and 14th of June.

Newington

1 Infestation 1 Egg-cluster

One new egg-cluster was found in Newington this year in an apple orchard in the southwestern corner of the town. This is supposed to be a natural spread from the Berlin colony which, however, reached across the line into the town of Newington. No spraying was thought necessary in this case.

Simsbury

4 Infestations 134 Egg-clusters

While scouting around old infestations, state men found four infestations in Simsbury this year. One colony of 107 egg-clusters was found on apple and hickory trees in a pasture owned by Mr. J. L. Brown just north of the West Simsbury postoffice, another of 14 egg-clusters on a white oak tree owned by the Ensign-Bickford Company about a mile south of the Simsbury postoffice, and a third colony of eight egg-clusters in woodland owned by the Ethel Walker School, were the three largest. These three colonies were later sprayed by state men.

Suffield

1 Infestation 4 Egg-clusters

The scouting in Suffield this year, as in several other towns in Hartford County, consisted of scouting around last year's infestations. This was necessary because of the fact that the scouting season was drawing to a close and we did not have the funds sufficient to carry enough men through the year to scout these towns completely. One colony of four egg-clusters was found in Suffield in elm and willow trees on land owned by Mr. Newton Lewis of Springfield, Mass., and Dr. J. A. Gibbs, of Suffield, Conn., about two miles north of West Suffield village.

Southington

1 Infestation 212 Egg-clusters

One large woodland colony of 212 egg-clusters was found on land owned by Mr. S. T. Gridley in the southeastern corner of Southington, about two miles from Milldale postoffice. Approximately four acres of woodland were sprayed at this colony by state men on June 3.

West Hartford

2 Infestations 486 Egg-clusters

Two large colonies were found in West Hartford by state men scouting the town. The largest was found in woodland owned by the Hartford Water Works on the east slope of Talcott Mountain. Here 375 egg-clusters were found on oak, maple, hemlock and walnut trees scattered over several acres. The other was a colony of 111 egg-clusters found on one willow tree, in the southern end of the town near the Newington line. Approximately 16 acres of woodland were sprayed about the middle of June by state men.

Wethersfield

1 Infestation 791 Egg-clusters

Last year a large colony was found in Wethersfield on the banks of the Connecticut River, but owing to weather conditions it was impossible to spray this colony. Again this year it was found infested, 791 egg-clusters being creosoted on poplar, willow and maple trees owned by Mr. E. Isaacson. About 10 acres of woodland were sprayed during the early part of June by state men.

In the towns of East Hartford and Manchester, work was confined for the most part to territory known to have been infested in previous years, but no trace of the gipsy moth was found in these towns. Other towns in Hartford County where scouting was completed and no infestations found were Bloomfield, Plainville and Rocky Hill.

Middlesex County

Cromwell

1 Infestation 47 Egg-clusters

A colony of 47 egg-clusters was found in Cromwell this season by state men. This colony was in apple and white oak trees in a pasture owned by Mr. Hoffman in the northwestern section of the town, and was sprayed on June 19, 2,200 gallons of spray mixture being used.

Middletown

1 Infestation 10 Egg-clusters

A colony of 10 egg-clusters was found on one maple and one pear tree in the yard on property owned by Mr. E. H. Longworth in the southern part of Middletown, near the Durham and Haddam line. This colony was sprayed on June 6 by state men.

Middlefield

1 Infestation 418 Egg-clusters

The Middlefield colony was found in woodland owned by Mr. C. E. Lyman on the east side of the railroad where it crosses the Durham town line. About five and one-half acres of woodland were sprayed at this place on June 5 by state men.

The towns of Chester, Durham, Essex, Saybrook and Westbrook were scouted in Middlesex County, and no traces of the gipsy moth were found in any of them.

New Haven County

Meriden

3 Infestations 36 Egg-clusters

A cluster of three small colonies was discovered by state men while scouting Meriden this season. They were situated in the central part of the town. One of 23 egg-clusters on Center Street was in cherry and plum trees on property owned by Mr. Jacob Rupenthal and Mr. Majesky, and the second was on Miller Street on roadside trees containing 12 egg-clusters. The third was a single egg-cluster found in a black oak tree on property owned by the Rev. G. L. Barnes, 26 Pleasant Street. Spraying was done in this town on June 4 by state men.

Wallingford

1 Infestation 298 Egg-clusters

Last year's colony in Wallingford was found to be re-infested again this year and 298 egg-clusters were found scattered over quite a large area of woodland in the northwestern corner of the town. About 108 acres of woodland were sprayed in this vicinity; about three and a quarter tons of arsenate of lead were used. All work in this town was done by Federal men.

Other towns in New Haven County where scouting was completed were Waterbury and Wolcott. State crews did the work in these towns; no trace of the gipsy moth was found.

Litchfield County

Barkhamsted

3 Infestations 119 Egg-clusters

While scouting Barkhamsted this season, state men discovered three colonies. One of 67 egg-clusters was found in maple and oak woodland owned by Mr. C. Le Geyt, near the Granby town line about two and one-half miles east of the Barkhamsted postoffice. The second was one of 30 egg-clusters found in oak and pine woodland owned by the Hartford Water Works, about one mile south of the Barkhamsted postoffice. The third colony was also in oak and pine woodland owned by Mr. H. P. Birden and situated near the postoffice. It contained 22 egg-clusters. All three infestations were sprayed in late June by state men.

Canaan

6 Infestations 312 Egg-clusters

One colony containing 274 egg-clusters was found in woodland owned by Mr. E. D. Tracy, on the western slope of Canaan Mountain near the North Canaan town line. The other five colonies were all small, the largest containing 22 egg-clusters found in woodland owned by Mr. A. W. Krouse, about one mile southeast of the colony mentioned above. The large colony was sprayed, both scouting and spraying being done by Federal men.

Colebrook

4 Infestations 33 Egg-clusters

The work in this town was done by state men. Four small colonies were found, all of them in pastures. Two of the colonies were in the northeastern corner of the town on property owned by the Pinehurst Lakes Company and Mr. Joseph Tilles, where 22 and eight egg-clusters, respectively, were found. Another infestation of two egg-clusters was discovered in the southwestern corner of the town in a stone pile on property owned by Mrs.

H. T. Matheson. The fourth infestation was a single egg-cluster found on a pasture apple tree owned by Mr. Gus Guest, in the southeastern corner of the town just north of the Robertsville postoffice. Spraying in this town was completed June 27.

Cornwall

4 Infestations 85 Egg-clusters

All work in Cornwall was done by Federal men. The four colonies found were on land owned by Dr. W. C. Clark. Three of these infestations were on Coltsfoot Mountain; the other was in the valley between South and Howland Mountains. About 26 acres of woodland were sprayed in the early part of June at these infestations.

Goshen

When Federal men were sent to the town of Goshen to scout, they found egg-clusters hatched and larvae crawling at the infestation found last year in the woodland owned by the Waterbury Water Company. This place was scouted for larvae, but no other work was done.

Harwinton

1 Infestation 2 Egg-clusters

A small infestation of two egg-clusters was found by the state men scouting Harwinton this season. It was in an apple orchard owned by Mr. David Mansfield, about one mile north of the Campville postoffice. As both egg-clusters were whole and were creosoted, no spraying was thought necessary at this place.

New Hartford

2 Infestations 108 Egg-clusters

Two colonies were discovered in the south central part of the town about two and one-half miles south of Nepaug village. The largest was one of 91 egg-clusters found in mixed growth woodland owned by Mr. R. Surdan. The other was one of 17 egg-clusters in apple and birch growth owned by Mr. J. Perry. About two acres of woodland were sprayed at Mr. Surdan's place and one-half acre at the other colony. All work done in this town was performed by state men.

Norfolk

10 Infestations 301 Egg-clusters

One large woodland colony was found in Norfolk on land owned by Mr. James Torrant, in the northwestern corner of the town. There were three other small colonies in the same section of the town within a radius of two miles. Another cluster of colonies was found in the northwestern corner of the town, the two largest of which contained 21 egg-clusters each; one was an orchard infestation and the other woodland, both on property owned by Mr. F. H. Toros. About 20 acres of woodland were sprayed at three of these colonies, all work being done by Federal men.

North Canaan

5 Infestations 243 Egg-clusters

Two large colonies were found in North Canaan by a Federal crew this season. One of 191 egg-clusters was in a pasture owned by Mrs. E. B. Tracy, about two miles directly south of the Canaan postoffice. Another of 42 egg-clusters was found in woodland owned by Mr. Adam Noble in the southwestern corner of the town. The other three infestations were all small, containing altogether 11 egg-clusters. About 26 acres of woodland were sprayed at two of the infestations during the middle of June, scouting and spraying being done by Federal men.

Salisbury

4 Infestations 244 Egg-clusters

Federal men while scouting Salisbury this year found a cluster of three infestations in the northeastern corner of the town on the ridge composed of Miles and Toms Mountains; all three were woodland colonies and on land owned by Mr. J. C. Roraback. The largest colony contained 54 egg-clusters; the other two 48 and 35 egg-clusters each. The fourth was a colony of 107 egg-clusters in woodland owned by Mr. J. Barkett, about one and one-half miles west of Chapinville station. Approximately 277 acres of woodland were sprayed by Federal men.

Warren

3 Infestations 124 Egg-clusters

One woodland colony of 82 egg-clusters and an orchard colony of 12 egg-clusters were discovered about a mile east of Warren village on land owned by Marshepaug Forest Club, and a third colony of 30 egg-clusters was found in woodland owned by Warren Land Company in the northwestern corner of the town. These colonies were all found by Federal men while scouting the town of Warren this season. A Federal crew in June sprayed 72 acres of woodland and 30 of apple trees in and around these three colonies.

The following four towns were scouted by state men and no infestations found: Plymouth, Thomaston, Torrington and Winchester. Towns scouted by Federal men in Litchfield County with no infestations found were the following: Bethlehem, Bridgewater, Kent, Morris, New Milford, Roxbury, Sharon, Washington, Watertown and Woodbury.

Fairfield County

Fairfield

1 Infestation 1 Egg-cluster

All the work in Fairfield County was done by Federal scouts. Only one town was found to be infested, namely, Fairfield. One new egg-cluster was found in this town on a shade tree at 74 Roanoke Avenue on property owned by Mr. A. Sewell. No spraying was done, as it was not thought necessary.

The following towns in Fairfield County were scouted and no trace of the gipsy moth was found: Bethel, Bridgeport, Brookfield, Danbury, Darien, Easton, Greenwich, Monroe, New Fairfield, Newtown, New Canaan, Norwalk, Redding, Ridgefield, Shelton, Sherman, Stamford, Stratford, Trumbull, Weston, Westport and Wilton.

Statistics of these infestations are given in tabular form on the following pages:

STATISTICS OF INFESTATIONS, 1928-29

Towns	No. infestations found	No. egg clusters creosoted	No. colonies sprayed	No. lbs. poison used	No. larvae and pupae killed	No. miles roadway scouted
New London County						
North Stonington*	0	0	0	0	50	0
Stonington*	0	0	0	0	53	0
Groton	25	190	17	403	132	22
New London	14	490	10	417	283	13
East Lyme*	0	0	0	0	0	6
Old Lyme*	0	0	0	0	0	5
	39	680	27	820	518	46
Tolland County						
Stafford*	11	hatched	11	598	0	0
Willington*	3	"	3	250	0	8
Bolton*	1	"	1	400	0	3
	15		15	1,248	0	11
Middlesex County						
Cromwell	1	47	1	137	0	42
Middletown	1	10	1	20	10	130
Middlefield	1	418	1	180	12	36
Durham	0	0	0	0	0	27
Chester	0	0	0	0	0	38
Saybrook	0	0	0	0	0	36
Essex	0	0	0	0	0	33
Westbrook	0	0	0	0	0	36
	3	475	3	337	22	378

* Scouted around old infestations.
† Scouted by Federal men.

Towns	No. infestations found	No. egg clusters creosoted	No. colonies sprayed	No. lbs. poison used	No. larvae and pupae killed	No. miles roadway scouted
Hartford County						
Hartland*	5	24	0	0	42	12
Granby*	8	115	0	0	427	2
East Granby*	1	80	1	625	0	13 acres
Suffield*	1	4	0	0	0	3
Simsbury*	4	134	3	100	21	2
Canton†	11	323	2	125	152	68
Burlington	2	4	0	0	39	73
Avon	1	382	1	450	2	58
Farmington	1	15	1	75	20	116
West Hartford	2	486	1	775	90	93
Hartford	2	31	2	175	0	40
New Britain	5	189	4	231	25	39
Newington	1	1	0	0	0	27
Wethersfield	1	791	1	950	233	40
Bristol	0	0	0	0	0	62
Plainville	0	0	0	0	0	32
Southington	1	212	1	120	63	112
Berlin	3	163	2	712	39	77
Rocky Hill	0	0	0	0	0	46
Bloomfield	0	0	0	0	0	80
East Hartford*	0	0	0	0	0	12
Manchester	0	0	0	0	0	70
Glastonbury*	1	11	1	12	0	16
	50	2,965	20	4,350	1,153	1,080
New Haven County						
Wolcott	0	0	0	0	0	55
Waterbury	0	0	0	0	0	157
Wallingford†	1	298	1	6,600	0	131
Meriden	3	36	1	70	64	109
	4	334	2	6,670	64	452
Litchfield County						
Colebrook	4	33	1	25	34	70
Barkhamsted	3	119	3	1,025	299	60
Winchester	0	0	0	0	0	115
New Hartford	2	108	2	125	146	107
Torrington	0	0	0	0	0	127
Harwinton	1	2	0	0	0	86
Plymouth	0	0	0	0	0	74
Thomaston	0	0	0	0	0	56
Salisbury†	4	244	3	10,930	0	120
North Canaan†	5	243	2	987	0	56
Canaan†	6	312	1	100	0	67
Norfolk†	10	301	2	740	0	94
Goshen†	0	0	0	0	0	0
Cornwall†	4	85	2	1,335	0	107
Warren†	3	124	3	2,876	0	61
Sharon†	0	0	0	0	0	131
Kent†	0	0	0	0	0	100
New Milford†	0	0	0	0	0	180

Towns	No. infestations found	No. egg clusters creosoted	No. colonies sprayed	No. lbs. poison used	No. larvae and pupae killed	No. miles roadway scouted
Litchfield County—*Cont.*						
Bridgewater†	0	0	0	0	0	52
Roxbury†	0	0	0	0	0	71
Woodbury	0	0	0	0	0	104
Washington†	0	0	0	0	0	107
Morris†	0	0	0	0	0	47
Bethel†	0	0	0	0	0	53
Watertown†	0	0	0	0	0	93
	42	1,571	19	18,143	479	2,138
Fairfield County						
Sherman†	0	0	0	0	0	48
New Fairfield†	0	0	0	0	0	51
Brookfield†	0	0	0	0	0	61
Danbury†	0	0	0	0	0	99
Bethel†	0	0	0	0	0	53
Newtown†	0	0	0	0	0	187
Ridgefield†	0	0	0	0	0	97
Redding†	0	0	0	0	0	92
Monroe†	0	0	0	0	0	74
Wilton†	0	0	0	0	0	71
Weston†	0	0	0	0	0	49
Easton†	0	0	0	0	0	70
Trumbull†	0	0	0	0	0	59
Shelton†	0	0	0	0	0	105
Greenwich†	0	0	0	0	0	144
Stamford†	0	0	0	0	0	95
New Canaan†	0	0	0	0	0	72
Darien†	0	0	0	0	0	47
Norwalk†	0	0	0	0	0	144
Westport†	0	0	0	0	0	84
Fairfield†	1	1	0	0	0	175
Bridgeport†	0	0	0	0	0	201
Stratford†	0	0	0	0	0	80
	1	1	0	0	0	2,158

Summary of Statistics

County	No. towns covered	No. infestations found	No. egg clusters creosoted	No. colonies sprayed	No. lbs. poison used	No. larvae and pupae killed	No. miles roadway scouted
New London	6	39	680	27	820	518	46
Tolland	3	15	....	15	1,248	0	11
Middlesex	8	3	475	3	337	22	378
Hartford	23	50	2,965	20	4,350	1,153	1,080
New Haven	4	4	334	2	6,670	64	452
Litchfield	25	42	1,571	19	18,143	479	2,138
Fairfield	23	1	1	0	0	0	2,158
	92	154	6,026	86	31,568	2,236	6,263

Financial Statement

Receipts

Appropriation for biennial period ending June 30, 1929		$100,000.00	
Rebate on automobile insurance		199.04	
		$100,199.04	
Expended, July 1, 1927, to June 30, 1928		53,043.39	
Balance available July 1, 1928			$47,155.65

Expenditures

Salaries		$ 4,840.00	
Labor		34,938.85	
Stationery and office supplies		30.05	
Sundry supplies		11.31	
Communication service			
Telephone		67.55	
Travel expenses		355.99	
Gasoline		1,451.80	
Oil		476.37	
Express		1.90	
Heat, light, water and power:			
Fuel	$157.00		
Electricity	22.52		
		179.52	
Tools, machinery and appliances:			
Passenger-carrying vehicles, trucks	$1,786.00		
Other equipment	909.29		
Auto repairs	633.29		
Other equipment, repairs	19.50		
		3,348.08	
Buildings and land:			
Rent of office and storehouse and storage of cars		581.00	
Contingent expenses:			
Insurance	$553.87		
Medical services	39.50		
		593.37	
Spray materials		271.50	
			$47,147.29
Balance on hand June 30, 1929			$8.36

THE COST OF SPRAYING WOODLAND IN CONNECTICUT FOR THE CONTROL OF THE GIPSY MOTH

Roger B. Friend and Neely Turner

Woodland spraying for the control of the gipsy moth in New England has been carried on for about 30 years, and when trees can be thoroughly sprayed, the operation is highly successful. The spraying technique has been developed so that few areas are not accessible, and the high-powered pumps and solid stream nozzles make possible the spraying of trees up to 75 feet in height at the end of a hose line 3,000 to 4,000 feet long. The degree of success attained and the cost of the work, however, depend on many factors that vary in different areas. Such factors are: the type of tree growth, the characteristics of the terrain, the extent of the infested area and its accessibility, the use of the land for grazing, and the availability of water. The woodland spraying in this state is done in an effort to prevent further spread of the insect, so many of the areas sprayed are small and isolated. In such instances, the extent of the area sprayed depends on the location of the egg masses found by the scouts.

Some estimates of the cost of spraying have been made in former years. Burgess, in 1910, stated that with the equipment then in use, one outfit and crew should be able to spray 12 acres a day at a cost of $10.00 an acre. Worthley, in 1917, estimated the cost at about five and one-half dollars an acre for large areas where it was not necessary to move the sprayer and re-lay the hose line, and stated that one crew should be able to spray 12 to 15 acres a day under average conditions, the maximum under favorable conditions with trees 60 to 70 feet tall being 21 acres. Inasmuch as the above estimates were made some years ago for areas outside of Connecticut, it was considered advisable to obtain data on the present cost per acre in this state, and to consider the various factors involved in this cost, for no two areas are exactly alike. The writers wish to emphasize the fact that extensive gipsy moth control work involves scouting, spraying, and other necessary operations, and that the work of spraying is confined to the early summer when the larvae are small and involves by no means a majority of the outlay of capital and labor.

Four infested areas in Connecticut have been studied in 1929, each of them differing from the others and each separated from the others by a distance of some miles. The first area studied is in the town of Southington; the second is in Wethersfield; the third in West Hartford; and the fourth in Avon. All were sprayed in June by the same crew of men and with the same equipment. In each case, data were obtained concerning the species of trees and shrubs present, their size, their abundance, and their distribution; the characteristics of the terrain, its slope, evenness, altitude above sea level, and the debris on the ground; the size and shape of the area, its accessibility, the availability of water; and the use of the land for grazing. The cost for each area has been estimated on the basis of actual spraying time, that is, from the time the crew begins to lay the hose until the work is finished and the hose taken up. Any delay caused by the breakdown of the sprayer or similar incident has been deducted from the time. Considerable time was consumed by traveling from one area to another and operations were held up by unavoidable difficulties with the equipment. Time so used is omitted from the cost estimates, but has a bearing on this cost because it affects the total amount of actual spraying done in one season by the crew and equipment.

Equipment

Although Worthley (1917) has described the apparatus used in gipsy moth spraying, some changes have been made since the publication of his bulletin, so a brief description of equipment and supplies used in the 1929 operations is here given. For a detailed description of the pump, hose, and nozzles, the above author may be consulted.

1. *Sprayer*—A Waukesha truck (A22) with an engine rated at 90-110 horsepower, carrying a Fitzhenry-Guptill sprayer with a 400-gallon tank divided into two compartments each of 200 gallons capacity. Power for the sprayer is furnished by the truck motor. This outfit will deliver 1,000 pounds pressure at the pump and 250 pounds at the nozzle with a hose line half a mile or more long under most conditions. One compartment of the tank can be filled while the other is being emptied. Cost, $7,000 in 1918. The latest sprayer of this type is mounted on a lighter truck and may cost slightly less to operate. The machine used was loaned by the United States Bureau of Entomology, which coöperates with the state.

2. *Water pump*—A small portable one and one-half horsepower gasoline engine with a three-cylinder pump, made by the Fitzhenry-Guptil Company. This is used to pump water from a nearby source to the sprayer. Cost, $650 in 1926.

3. *Hose*—A heavy hose capable of withstanding the pressure and rough treatment to which it may be subjected. The couplings are of a special type, designed by the Federal Bureau of Entomology, that becomes tighter with increased pressure. This hose comes in 50-foot lengths and costs 75 cents a foot, couplings included. Twelve hundred and fifty feet are carried on the sprayer.

4. *Nozzle*—A "Worthley" nozzle which can be fitted with tips varying in inside diameter from one-eighth to five-sixteenths of an inch. The most commonly used nozzle for spraying tall trees has a one-fourth inch bore. For low trees, the smaller tips are used, but in any case the nozzle pressure should be maintained at 225 to 250 pounds for efficient work. Cost, $15.

5. *Accessory trucks*—Two Model T light Ford trucks were used to carry extra hose, small tools, supplies, and so forth. These trucks are used throughout the year for gipsy moth control work and no cost is estimated.

6. *Lead arsenate*—Powdered acid lead arsenate of commercial make. Cost, 12.75 cents a pound.

7. *Fish oil*—Pressed menhaden oil. Used in the spray mixture as a sticker.. Cost, 73 cents a gallon. This price was taken from the "Oil, Paint and Drug Reporter" for June 3, 1929, and is not the cost of the oil actually used.

8. *Gasoline*—Seventeen cents a gallon.
9. *Lubricating oil*—12.5 cents a quart.
10. *Crew*—1 general foreman
2 crew foremen
6 hosemen
1 nozzleman
1 mechanic and general assistant
1 truck driver

Total cost of crew per hour, $6.89.

The general foreman supervised three crews so that the cost per hour of this one man is one-third his salary. The depreciation on the sprayer, portable pump, hose, and nozzle are difficult to estimate because of the irregularity of the work, but a depreciation of 20 per cent per year on the sprayer and pump is usually charged. The depreciation on the nozzle is negligible and no charge is made for this item. Hose lasts about three years, and one-third of the cost of 3,500 feet has been charged to the 1929 season. Considering the depreciation in equipment and the fact that 96 hours of spraying were done in one year (1929), the depreciation per hour may be charged as follows:

Sprayer	$1.25
Water pump	.67
Hose	9.11
Total	$11.03

The truck undergoes considerable wear in traveling from one area to another, but this has been charged to the spraying cost. The determination of the extent of the area to be sprayed is accomplished by the scouting crew and does not enter into the cost of spraying.

Description of Areas

The primary purpose of the descriptions of the four areas sprayed is to show what kind of woodland was sprayed and what factors affect the cost of spraying, but it is of some interest to know the conditions under which the gipsy moth may become established and persist. Not only is information given, therefore, on those characteristics of site and tree growth previously mentioned (page 544) which directly bear on the cost of the spraying operation, but the brief history of the infestation from its discovery to the spraying period of 1929 is included. The persistence and intensity of a gipsy moth infestation under natural conditions are largely dependent on the type of tree growth and the climate, and the presence of a relatively small number of trees, or of undergrowth and brush, on which the first two larval instars can develop, may enable this insect to become destructive over a considerable area of woodland in which the majority of economically important trees are not particularly favored as food plants. The suitability of the tree growth for the development of the gipsy moth has been determined according to the results of the work of Mosher (1915).

The areas were measured by pacing and the use of a small hand compass. In order to determine the type of growth in each area, sample plots were laid out at places suitable in size and location, and in these plots trees of one inch or more in diameter breast high were measured, counted, and listed according to species. The presence or absence of undergrowth and brush was noted. The various types of growth have been indicated on the maps of the areas. Because of the great dissimilarity in site and vegetation and the fact that on only one area, West Hartford, was there even an approximately uniform covering of trees, each infestation has been described separately. In Table 3 are the data on the number of species of trees occurring in each area. Although in the course of the investigations, all the trees were measured to the nearest half inch in diameter breast high, in the table the measurements are given in six-inch groups in order to condense the statistics. This gives as close an estimate of the relative size of the crown as can conveniently be made. In Tables 1 and 2 are given the items related to the cost of spraying and the estimated cost per acre.

1. Southington, Figure 46

The infestation in Southington comprises an area of eight acres, approximately 349,546 square feet, of fairly level land bordering the state highway about two and one-half miles south of the center of the town. The elevation drops gently from 180 feet above sea level on the south side to 160 feet on the north side. The ground is fairly wet, but not swampy, so that while spraying, the men frequently sank in water to their shoe-tops. A brook about 500 feet away furnished water. This area has been divided into seven parts, according to the types of vegetation.

(1) Four-tenths of an acre, about 18,135 square feet, rectangular in shape, on the east side of the area. Sample plot III.

All the trees in this area were tabulated. The predominant tree was swamp white oak, with American elm, red cedar, and gray birch in smaller numbers, the relative abundance of these four species being 135, 36, 26, and ten per acre, respectively. Of the trees six inches and more in diameter, 81 per cent were swamp white oaks. In Table 3 this area has been combined with (3), which had the same type of growth.

(2) Two acres, about 83,600 square feet, rectangular in shape, west of (1).

All trees were cut off this area several years ago when an electrical power line was run through, and the land was covered

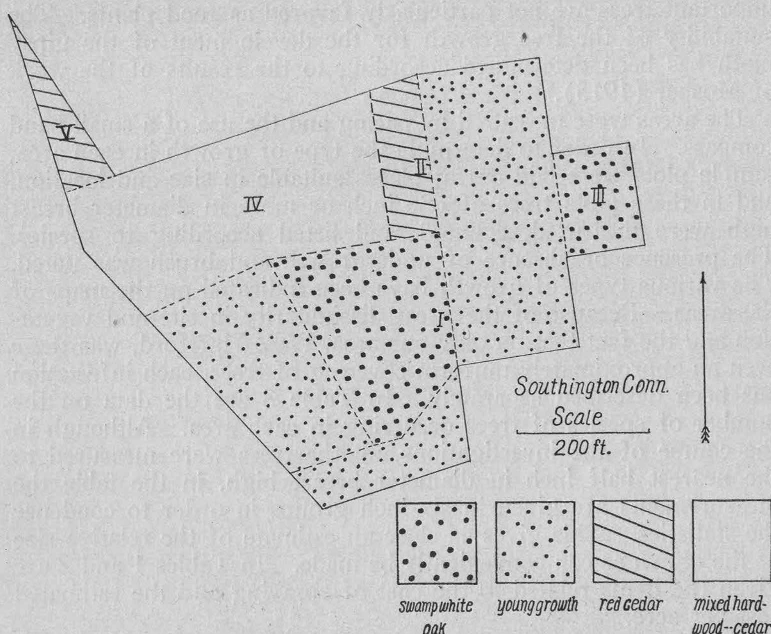

FIGURE 46. Map showing area infested by the gipsy moth in Southington, Conn., in 1929. The Roman numerals indicate the location of the sample plots. See page 547.

with alder, gray birch, red maple, and swamp white oak, growth four to six feet high. This area has been combined with areas (6) and (7), which were similar, in Table 3.

(3) One and four-tenths acres, about 59,600 square feet, irregularly pentagonal in shape, near the center of the infestation. Sample plot I, 248′ x 198′ (4,752 sq. ft.), taken along the eastern edge.

Swamp white oak was the predominating species at 342 trees per acre, followed by red cedar 198 per acre, American elm 135 per acre, gray birch 72 per acre, and apple 18 per acre. In the tabulation, this area has been combined with (1), to which it was similar.

(4a) Two-tenths of an acre, rectangular in shape, comprising 7,125 square feet, north of (3). Sample plot II, 45′ x 95′ (4,275 sq. ft.), taken along the east edge of the area.

This area was covered with red cedar, about 1,000 trees per acre. Underneath was a growth of alder brush up to ten feet in height.

(4b) Two and one-tenth acres, about 95,402 square feet, irregularly pentagonal in shape, on the north side of the infestation. Sample plot IV, 20′ x 337′ (6,740 sq. ft.), taken diagonally through the center.

This area was covered with a mixed growth that merges into overgrown pasture on the north and west. Red cedar was the most abundant species at 388 per acre, followed by gray birch at 245 per acre, swamp white oak 137 per acre, and a few elms and apple trees, but of the trees six inches and more in diameter, swamp white oak comprised 57 per cent and American elm 11 per cent.

(5) One-fourth acre, about 10,647 square feet, triangular in shape, on the northwest corner of the infestation. Sample plot 15′ x 126′ (1,890 sq. ft.), taken through the center.

This area was an old pasture growing up to red cedar that was present at the rate of 558 trees per acre.

(6) One and one-fourth acres, about 54,200 square feet, irregularly pentagonal in shape, on the west side of the infestation, densely covered with red cedar, red maple, and gray birch, up to ten feet in height with a very few scattered larger cedars and one or two large American elms and butternuts. In Table 3 this area has been combined with areas (2) and (7) which it resembled closely.

(7) One-half acre, about 23,681 square feet, irregularly pentagonal in shape, on the south end of the infestation.

This was also covered with red cedar, gray birch, and red maple up to ten feet in height and has been combined with the other areas of similar growth.

Beside the road bordering the west side of the infestation was a row of large shade trees, 67 in number and varying in diameter from three to 19.5 inches. Only thirteen of these trees are less than six inches in diameter and white ash and red cedar made up 50 of the total. These trees were all sprayed, but no area covered is estimated. The time taken to spray such a row is very small and would not appreciably affect the calculated spraying cost per acre.

Of the eight acres in this infested area, one and eight-tenths were covered principally with swamp white oak and two and one-tenth were covered with a mixed growth in which this species predominated among the larger trees. Three and seven-tenths acres were rather densely covered with young growth up to ten feet in height and two-tenths of an acre were old pasture growing up to red cedar. Two-tenths of an acre were covered with a rather dense growth of red cedar. The species of trees and shrubs present and the history of the infestation both indicate that the gipsy moth will persist and be destructive for some time unless eliminated by control measures. Swamp white oak and gray birch, both favorite food plants, were abundant, and the focus of the infestation, as indicated by the location of the egg masses, was in the swamp white oak growth in the center. Red cedar and white ash are practically immune to serious attack. The insect was discovered in this area in the spring of 1924 when five egg masses were found, indicating that the infestation probably originated in 1923 or 1922. The area was sprayed in 1924 and was not scouted again until the spring of 1929, when 202 egg masses were found. Although this area may have been re-infested since 1924, the probability is that a few larvae survived the spraying of that year. If, as suggested by Fitch (1910), the annual increase of this insect in number is about six times, the number of egg masses found in 1929 would indicate that very few, possibly only one, females survived, mated, and oviposited in 1924.

2. Wethersfield, Figure 47

In the town of Wethersfield, the area infested comprised 40.7 acres of bottom land on the west bank of the Connecticut River, about one and one-half miles southeast of the center of the town. The land is level and, according to the height of the water marks on the trees, at times covered with four or five feet of water in the spring. The elevation is not great, being less than 20 feet above sea level. The ground was soft when sprayed but offered no great difficulties beyond the inconvenience of working in two or three inches of mud. The sprayer was able to get up to one corner of the infested area, and water was obtained from the river, which was about eight hundred feet from the machine. The tree growth in this area was of three types, and divisions have been made accordingly.

(1) The strip along the river bank, varying in width from about 114 feet to about 186 feet and comprising seven and eight-tenths acres, about 338,034 square feet, was covered with a dense growth of willows ten or twelve feet high, among which were a few small white maples.

(2) Back farther from the river and merging into the willow young growth was an area covered with white maples, varying in diameter from one to eight inches and growing in clumps of from five to nine trees each with a few elms and large willows and poplars in the northern part. The bases of the trees were covered with sediment to an undetermined depth, and this sediment is being added to each year when the land is flooded. The area covered by this growth comprised 12.2 acres, about 522,266 square feet. Three sample plots were taken: II, 90′ x 405′ (36,450 sq. ft.), along the western border: III, 90′ x 228′ (20,520 sq. ft.), across the center, and VI, 90′ x 351′ (31,590 sq. ft.), near the east end. There were about 385 trees per acre in the area, the growth being more dense and of smaller trees toward the south and opening up toward the north where the trees are larger. Of the trees six inches and more in diameter, 73 per cent were white maples, 19 per cent willows, six per cent Carolina poplars, and two per cent elms. Inasmuch as almost all the willows and poplars were more than 12 inches in diameter, these trees furnished a greater proportion of the foliage to be sprayed than their relative abundance would indicate.

(3) The northern part of the infested area, 20.7 acres, about 901,114 square feet in extent, was covered with large white maples, Carolina poplars, and willows. There were about 88 trees per acre, most of them being more than 12 inches in diameter. Some of the large specimens measured about three feet in diameter and ranged in height from 100 to 135 feet. The three sample plots in this area were continuous with those in (2) and of the same width: I, 90′ x 588′ (52,920 sq. ft.); IV, 90′ x 381′ (34,290 sq. ft.); V, 90′ x 480′ (43,200 sq. ft.). The most abundant species was white maple, 65 per acre, but many of these were small. Carolina poplar, 13 per acre, was next in abundance, followed by willow, seven per acre, and elm, three per acre. Of the trees one to twelve inches in diameter, almost all were white maples, but of those twelve inches and more in diameter, 43 per cent were white maples, 36 per cent Carolina poplars, 19 per cent willows, and two per cent were elms.

In this infested area, the northern half, which was covered with large poplars, willows, and maples, provided suitable conditions for the gipsy moth to maintain itself. The southern half, except for the narrow strip of young willow growth along the river, was almost entirely white maple, and although the insect will feed on this plant, only a small percentage of the larvae develop. Moreover silt is laid down each year in this belt and would cover any egg masses placed close to the ground. The shore strip of willow brush is flooded so frequently that it probably would not constitute a dangerous area for any great length of time.

Control measures in this area have been very difficult. Spraying operations have not been successful because of the height of the trees and the uncertainty of the sudden flooding of the land. The most heavily infested trees, the poplars and willows, were so high that the tops could not be sprayed even with the pumps working at a maximum pressure. The land is so low that a very slight rise of the river floods it and renders spraying at this time impossible. In 1928, the crew had to leave in such a

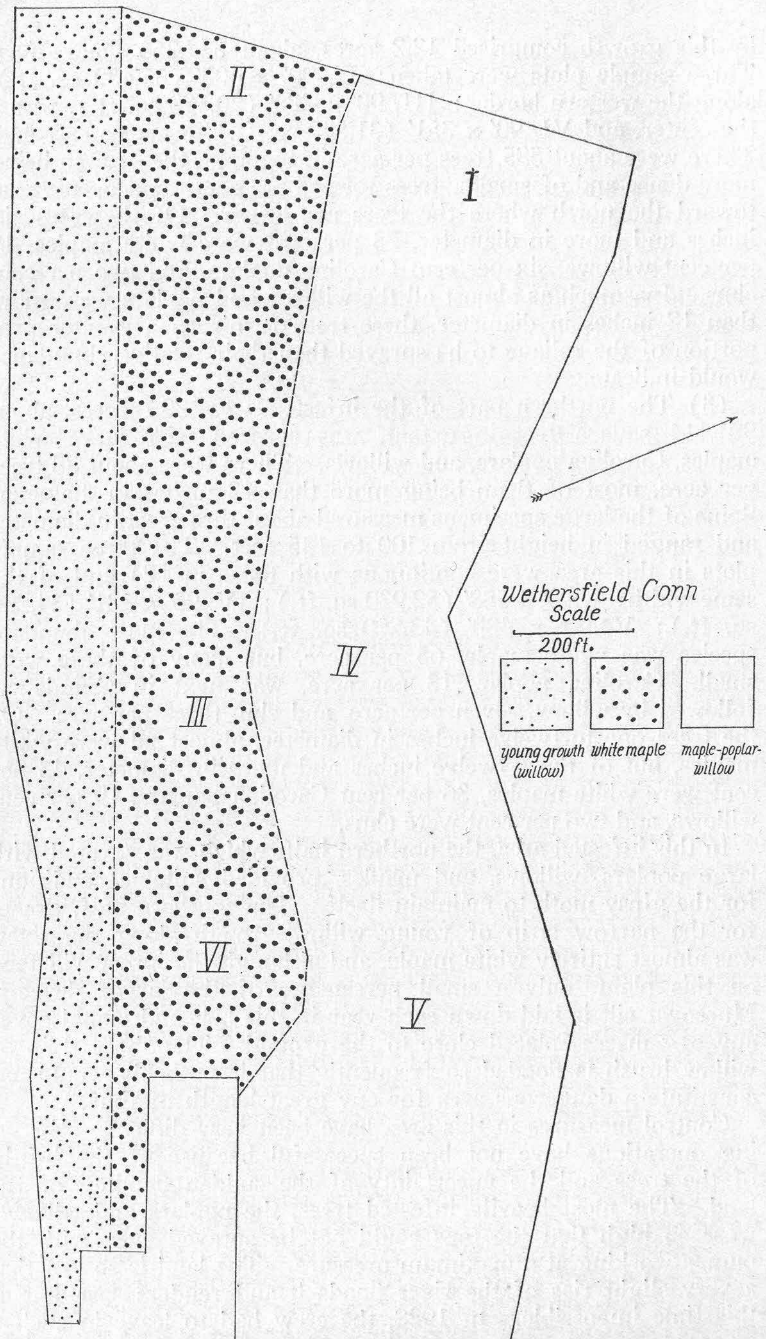

FIGURE 47. Map showing area infested by the gipsy moth in Wethersfield, Conn., in 1929. The Roman numerals indicate the location of the sample plots. See page 551.

short time that some of the hose could not be pulled out. In the fall of 1929, the number of egg masses was large in spite of the early summer spraying, and all of the ground litter, such as fallen trees and branches, was piled and burned.

The gipsy moth was first discovered here in the spring of 1928, and the trees were partly sprayed that year, work being halted because of the rise of the river, as mentioned above. Seven hundred and fifteen egg masses were found in 1928 and 791 in the spring of 1929, but thorough work was impossible in 1928 because of the spring flood. It is doubtful if the insect can ever be controlled by man in this area unless the poplars and willows are removed.

3. West Hartford, Figure 48

In the town of West Hartford, the area infested in 1929 included 22.4 acres, about 976,446 square feet, fairly evenly covered with hardwoods and hemlocks. This area is on the watershed of the Hartford Water Company reservoirs, about one-half mile east of the point where the southeast corner of Avon and the northeast corner of Farmington meet on the west boundary of West Hartford. The land is rough and slopes sharply to the east with two terraces and a deep gully. The altitude drops from 600 feet above sea level on the west to 420 feet on the east.

The tree growth was more or less typical of this part of Connecticut, and this area is the only one of the four studied which can really be considered representative of the woodland of the region. There were no open areas of old fields or pastures, and many of the common hardwood species found in this part of the state were present in more or less abundance. The eastern half of the infested area contained principally hemlock and chestnut oak to the south and chestnut oak and sugar maple to the north. The western half contained principally chestnut oak, sugar maple, white ash, red oak, hemlock and linden. Hemlock was concentrated in the center of the area and diminished in all directions. Sugar maple was rare in the center of the area and chestnut oak was rare in the northwest part. In the western and northern part of the area there was much sugar maple reproduction, and small dogwoods (Cornus), American hornbeams (Carpinus), and hop hornbeams (Ostrya), were more or less abundant. Hickory was fairly well scattered throughout and was the fourth most abundant tree. The three common species of hickory (shagbark, pignut, and mockernut) are here grouped together.

The seven sample plots taken in this area are indicated on the map and were of the following extent: I, 90′ x 129′ (11,610 sq. ft.); II, 90′ x 174′ (15,660 sq. ft.); III, IV, V, VI, and VII each 90′ x 150′ (13,500 sq. ft.). The average number of trees per acre was 392, varying from 283 in the northeast and 320 in the

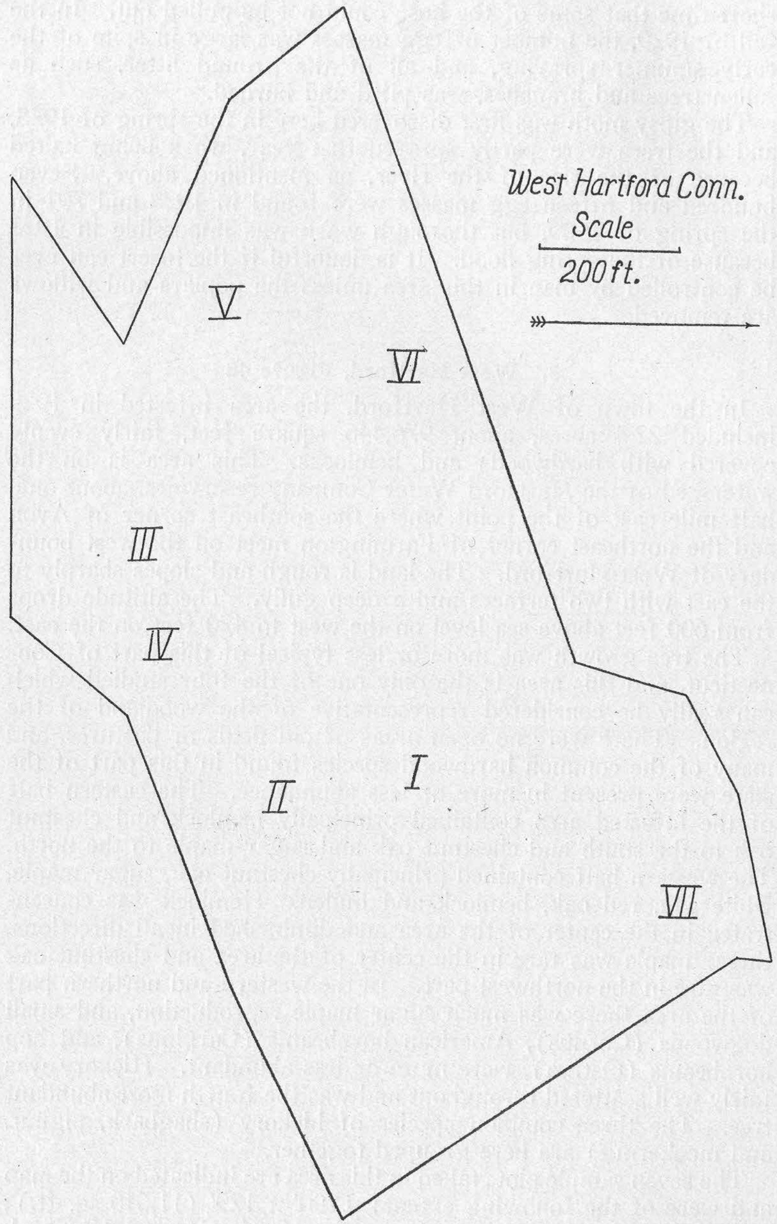

FIGURE 48. Map showing area infested by the gipsy moth in West Hartford, Conn., in 1929. The Roman numerals indicate the location of the sample plots. See page 553.

southwest to 558 in the center. Of the species present, hemlock was the most abundant, representing 24 per cent of the total number, followed by sugar maple 17 per cent, chestnut oak 15 per cent, hickory 11 per cent, white ash seven per cent, red oak five per cent, and linden five per cent. Other species were less abundant. Of the trees six inches or more in diameter, chestnut oak made up 28 per cent, hemlock 20 per cent, hickory 14 per cent, red oak ten per cent, sugar maple ten, white ash, eight, white oak, four, linden, five, and American elm, one. There was an average of 168 trees per acre of this size.

No difficulty was experienced in spraying the trees, and even though one of the men inadvertently stepped on a copperhead, the morale of the crew was excellent. The sprayer was stationed beside a brook about 400 feet away, which furnished water. A good hard road runs almost to the east border of the area.

On the basis of food plants present, this area was certainly favorable to the gipsy moth. The oaks and linden are favorite food plants, and hemlock is favored by the later larval instars. Larvae also feed to some extent on hickory and sugar maple, although if these latter species are not mixed with others more favored, they would not suffer any serious injury. White ash foliage is not eaten by the larvae.

The insect was first discovered in the spring of 1929 when 486 egg masses were found. In the winter of 1929-1930, 205 new egg masses were found. Inasmuch as the removal of the favorite food plants would mean the cutting of about 48 per cent of the best trees, such a procedure cannot be advocated. This site is a watershed for a public water supply, and expensive control measures are therefore justifiable. There is a large area of similar woodland around the infestation, which may make eradication difficult.

4. Avon, Figure 49

The area infested in Avon comprised 23.9 acres of old pasture on the western side of a ridge about one and one-half miles north of the Avon-Farmington line and about one-half mile west of the Avon-West Hartford line. The land slopes to the west, dropping from an altitude of 500 feet above sea level to 400 feet in a distance of one-fourth of one mile. Bordering the eastern edge of the infestation is a bluff about 150 feet high. To the west was overgrown pasture, but on the north, east, and south there was a growth of young hardwoods.

Seven sample plots were taken, one (II) in the brush area on the western side, 90′ x 150′, 13,500 square feet; one in each of the hardwood areas on the northeast side (III and V), 90′ x 150′; one (VIII) in the hardwood area near the western border, 75′ x 150′, 11,500 square feet; three (I, VI, and IX) in the remainder of the area, all of which was uniformly covered with red cedar, each 90′ x 150′.

Most of the infested area, about 19.2 acres, was grassland on which was a growth of small red cedars 10 to 20 feet high, about

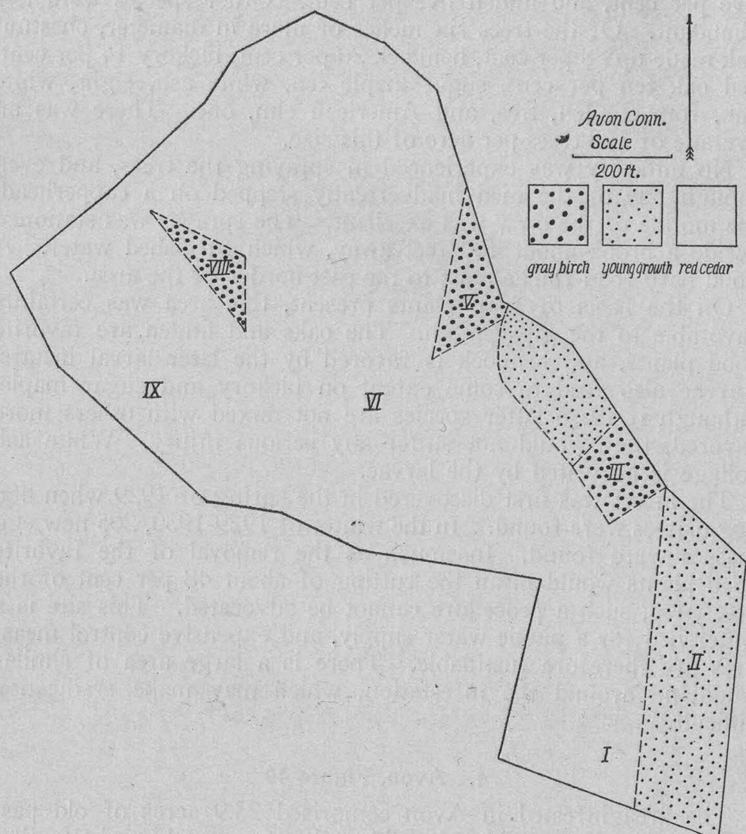

FIGURE 49. Map showing area infested by the gipsy moth in Avon, Conn., in 1929. The Roman numerals indicate the location of the sample plots. See page 555.

348 trees per acre, with a few hardwoods of small size. Along the eastern side were about 2.7 acres of young growth pasture reverting to hardwood growth, with about six large red and white oaks and sugar maples 30 to 35 inches in diameter. On the northeast side was an area of about eight-tenths of an acre of similar character. There were three small areas of young hardwoods, two on the northeast side of about five-tenths and four-tenths of an acre respectively, and one near the center of the western side of three-tenths of an acre. On the hardwood areas, which had

similar types of growth, gray birch was the predominating species, averaging about 405 trees per acre, intermixed with which were red cedars at about 66 trees per acre, hop hornbeam at about 51 per acre, black birch at about 26 per acre, American elm at about 14 per acre, and sugar maple at about 11 per acre. There were also a few red oaks, staghorn sumacs, pitch pines, white pines, hickories, red maples, tupelos, and white ashes present and an undergrowth of witch hazel. This last species was quite abundant, averaging about 139 per acre. The growth in the hardwood areas was small, only four per cent of the total number of trees, including witch hazel, which is really a shrub, being more than six inches in diameter, and only one-third of one per cent of the total number being greater than nine inches in diameter. According to the location of the egg masses, the infestation centered in the hardwood area near the western border.

The spraying of the infested area was somewhat delayed because water had to be hauled from a brook about one-half mile away. The ground was wet, due to seepage, but this did not hamper the crew either in laying the hose or in spraying the trees. The open nature of the cedar growth and the small size of the trees permitted fairly rapid work while the pump was running.

The establishment of a permanent gipsy moth infestation in this area would have to occur in the small areas of hardwoods where favorable food plants are found. The only favored food plants of all larval instars were gray birch and witch hazel, which were moderately abundant and made up much of the stand in these small areas. The red cedars, which constituted most of the growth over the entire area, are fed upon very slightly, and the probability of an infestation being established in a cedar growth is extremely remote. However, the proximity of hardwood growth, much of it favorable to the development of the insect, in the region around the infestation, and the exposure of the infested area to winds renders great the danger of spread.

The gipsy moth was first discovered here in the winter of 1928-1929 when 328 egg masses were found. In the winter of 1929-1930 seven egg masses were found, of which only three were new, that is, contained eggs laid in 1929.

The cost of spraying all four areas, the materials used, and the time necessary are summarized in Tables 1 and 2. For the Avon infestation, gasoline and oil have been computed on the same basis as for the others, even though the water was hauled. The difference between the amount used in this case and that which would have been used had water been pumped is negligible. The cost per acre varies from $11.15 in the Southington area to $21.31 in the West Hartford area. This cost is dependent on the amount of materials and time used and on the depreciation of the equipment and does not indicate the efficiency of the operation. Depreciation of equipment accounts for about 50 per cent of the total cost per acre. This is due to the relatively small part of the year during which the equipment can be used.

The efficiency of the spraying operation, which in this case cannot be measured by the reduction in the number of egg masses found from year to year because the control is partly effected by treating the eggs with creosote, is indicated by the lead arsenate-time ratio in Table 2. The factors causing the variation in cost per acre are brought out in considering this ratio. The amount of foliage covered by the spray should be indicated by the amount of lead arsenate used. This represents work done. If this figure is divided by the time taken to spray the area, the result should give an index of the work accomplished per unit of time, and the higher the figure is, the more is the work accomplished, that is, the greater is the efficiency. This figure represents the facility with which work was done and has no bearing on the skill of the crew.

It is readily seen that although the cost per acre in the Wethersfield area was slightly greater than in the Southington area, nevertheless, the former area was more efficiently and hence more economically sprayed. It is also evident that although the Avon area cost less per acre than the West Hartford area, the Avon area was much less efficiently, and hence less economically, sprayed, and was, in fact, the most expensive of the four. When time alone is considered, the Wethersfield area cost least, and when foliage to be covered, as indicated by the lead arsenate used, is considered, the Southington and Avon areas are both below the Wethersfield area. The West Hartford area, which is the only one of the four covered by a woodland growth "typical" of the region, took the most time and the most lead arsenate per acre, yet the efficiency of the operation was neither the highest nor lowest, being below the Wethersfield area and above the other two.

The reason for the variation in cost per acre and efficiency of operation is due, as has been suggested previously, to the type of tree growth and the character of the site. In view of the fact that the depreciation cost depends on the time taken to spray the area, the facility with which spraying is accomplished affects this cost. At Wethersfield, the terrain was flat and the trees were easily sprayed. The ground was clear, the equipment easily handled, and the sprayer stationed beside the infestation. At West Hartford, the terrain was rough and hilly; there was much small growth under the trees, and the trees were more numerous. It is true that up to a certain extent the increase in trees per acre enables a larger amount of foliage to be sprayed per hour, but after a certain density has been attained, it is also probably true that this gain is more than offset by the difficulty in manipulating the hose line.

TABLE 1. COST OF SPRAYING WOODLAND

Infestation	Acres	Lead arsenate	Fish oil	Gallons spray	Gasoline[1]	Lubricating oil[5]	Feet hose	Time	Depreciation of equipment	Cost (including labor)
Southington	8.0	120 lbs.	none	2,400	12 gals.	1.3 qts.	2,000	4 hrs.	$ 44.12	$ 89.18
Wethersfield	40.7	950	7 qts.	15,200[2]	54.5	5.6	3,400	18.10	200.38	456.65
West Hartford	22.4	775	62	12,400[3]	61.5	6.0	2,800	20.30	226.12	477.39
Avon	23.9	450	none	7,200[4]	55.5	5.7	3,500	18.30	204.06	399.06

[1] Based on three gallons per hour for pumper and sprayer combined.
[2] 38 tanks.
[3] 31 tanks.
[4] Based on 450 pounds lead arsenate at one pound per 16 gallons of water.
[5] Based on 2.5 quarts per day for sprayer and pumper.

TABLE 2. COST OF SPRAYING WOODLAND

Infestation	Time per acre	Labor cost per acre	Lead arsenate per acre	Lead arsenate cost per acre	Per cent cost labor	Per cent cost lead arsenate	Lead arsenate—time ratio	Depreciation per acre	Per cent cost depreciation	Total cost per acre
Southington	30 min.	$3.45	15 lbs.	$1.91	31	17	.50	$ 5.52	50	$11.15
Wethersfield	27	3.00	23.3	2.90	27	26	.86	4.78	43	11.22
West Hartford	55	6.31	34.6	4.41	30	21	.63	10.12	47	21.31
Avon	46	5.33	18.8	2.40	31	14	.41	8.46	51	16.70

TABLE 3. TREE GROWTH

Trees per acre

Infested area	Type	DBH	Alder	Apple	Beech	Birch, gray	Linden	Oak, black	Oak, chestnut	Oak, red	Oak, swamp white	Oak, white
Southington 8 acres	(1)+(3) 1.8 acres	1–5.5″	..	14	..	51	..	..	..	..	73	..
		6–11.5	..	..	..	7	..	..	..	..	200	..
		12–17.5	..	..	..	..	..	..	..	..	23	..
		Total	..	14	..	58	..	..	..	..	296	..
	(4b) 2.1 acres	1–5.5″	..	39	..	192	..	..	..	..	28	..
		6–11.5	..	..	..	53	..	7	..	..	74	..
		12–17.5	..	..	..	..	..	..	..	..	35	..
		Total	..	39	..	245	..	7	..	..	137	..
	(4a) 0.2 acres	1–6″	..	..	..	..	..	..	..	..	..	..
	(5) 0.2 acres	1–4″	..	..	..	..	..	..	..	..	..	..
	(2)+(6)+(7) 3.7 acres	Young growth	..	..	..	..	..	..	..	..	..	..
	Roadside trees	1–5.5″	..	..	..	..	..	..	..	..	2	..
		6–11.5	..	..	..	..	..	2	..	..	1	..
		12–17.5	..	..	1	..	..	2	..	..	..	..
		18–23.5	..	..	..	..	..	..	..	..	..	..
		Total	..	..	1	..	..	4	..	..	3	..
Wethersfield 40.7 acres	(1) 7.8 acres	Young growth	..	..	..	..	..	..	..	..	..	..
	(2) 12.2 acres	1–5.5″	..	..	..	..	..	..	..	..	..	..
		6–11.5	..	..	..	..	..	..	..	..	..	..
		12–17.5	..	..	..	..	..	..	..	..	..	..
		18–23.5	..	..	..	..	..	..	..	..	..	..
		24–29.5	..	..	..	..	..	..	..	..	..	..
		30–35.5	..	..	..	..	..	..	..	..	..	..
		Total	..	..	..	..	..	..	..	..	..	..
	(3) 20.7 acres	1–5.5″	..	..	..	..	..	..	..	..	..	..
		6–11.5	..	..	..	..	..	..	..	..	..	..
		12–17.5	..	..	..	..	..	..	..	..	..	..
		18–23.5	..	..	..	..	..	..	..	..	..	..
		24–29.5	..	..	..	..	..	..	..	..	..	..
		36–41.5	..	..	..	..	..	..	..	..	..	..
		Total	..	..	..	..	..	..	..	..	..	..
West Hartford 22.4 acres		1–5.5″	..	..	..	..	9	..	10	4	..	3
		6–11.5	..	..	1	..	8	..	40	11	..	6
		12–17.5	..	..	..	..	1	..	7	5	..	1
		Total	..	..	1	..	18	..	57	20	..	10
Avon 23.9 acres	(1) 1.2 acres	1–5.5	..	..	..	399	..	..	..	1	..	..
		6–11.5	..	..	..	6	..	..	..	..	..	..
		30–35.5	..	..	..	..	..	..	..	..	..	..
		Total	..	..	..	405	..	..	..	1	..	..
	(2) 19.2 acres	1–5.5″	2	..	..	15	..	..	..	..	..	..
		12–17.5	..	..	..	..	..	..	..	..	..	..
		30–35.5	..	..	..	..	..	..	..	2	..	2
		Total	2	..	..	15	..	..	..	2	..	2
	(3) 3.5 acres	Young growth	..	..	..	..	..	..	..	..	..	..

Infested area	Type	DBH	Poplar, Carolina	Sumac, staghorn	Willow	Witch-hazel	Hemlock	Pine, pitch	Pine, white	Birch, black	Cherry, black	Elm, American	Hickory	Hornbeam, American	Hornbeam, hop	Maple, red	Maple, sugar	Maple, white	Ash, white	Butternut	Cedar, red	Dogwood	Total
Southington 8 acres	(1)+(3) 1.8 acres	1–5.5″	..	..	..	..	..	..	..	..	7	59	..	7	..	..	..	..	..	..	160	..	..
		6–11.5	..	..	..	..	..	..	..	..	..	54	..	..	..	1	..	..	..	..	..	..	..
		12–17.5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	..
		Total	..	..	..	..	..	..	..	..	7	113	..	7	..	1	..	..	7	..	160	..	663
	(4b) 2.1 acres	1–5.5″	..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	381	..	..
		6–11.5	..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	7	..	..
		12–17.5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		Total	..	..	..	..	..	..	..	..	..	42	..	..	..	..	..	..	..	..	388	..	858
	(4a) 0.2 acres	1–6″	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1,000	..	1,000
	(5) 0.2 acres	1–4″	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	558	..	558
	(2)+(6)+(7) 3.7 acres	Young growth	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Roadside trees	1–5.5″	..	..	..	..	..	..	..	..	1	1	1	..	..	..	..	..	3	..	5	..	..
		6–11.5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	13	..	..
		12–17.5	..	..	..	..	..	..	..	..	1	..	..	..	..	4	..	..	6	..	7	..	..
		18–23.5	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	..	..	..	..
		Total	..	..	..	..	..	..	..	..	2	2	1	..	..	4	..	..	25	..	25	..	67
Wethersfield 40.7 acres	(1) 7.8 acres	Young growth	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	(2) 12.2 acres	1–5.5″	..	..	5	..	..	..	..	..	..	13	..	..	..	..	..	259	..	..	..	..	..
		6–11.5	..	..	9	..	..	..	..	..	..	2	..	..	..	..	..	77	..	..	..	..	..
		12–17.5	2	..	9	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..
		18–23.5	1	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		24–29.5	2	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		30–35.5	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		Total	6	..	26	..	..	..	..	..	..	15	..	..	..	..	..	338	..	..	..	..	385
	(3) 20.7 acres	1–5.5″	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	33	..	..	..	..	..
		6–11.5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..
		12–17.5	3	..	3	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..
		18–23.5	6	..	2	..	..	..	..	..	..	..	..	..	..	..	..	5	..	..	..	..	..
		24–29.5	3	..	2	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
		36–41.5	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		Total	13	..	7	..	..	..	..	..	..	3	..	..	..	..	..	65	..	..	..	..	88
West Hartford 22.4 acres		1–5.5″	..	..	..	..	64	..	..	3	..	5	19	10	15	3	50	..	16	..	..	13	..
		6–11.5	..	..	..	..	25	..	1	..	..	1	23	..	..	..	15	..	12	1	..	..	..
		12–17.5	..	..	..	..	8	..	..	..	..	..	..	..	..	..	1	..	1	..	..	..	..
		Total	..	..	..	..	97	..	1	3	..	6	42	10	15	3	66	..	29	1	..	13	392
Avon 23.9 acres	(1) 1.2 acres	1–5.5	..	..	..	139	..	3	1	16	..	11	4	..	50	3	7	..	3	..	63	..	..
		6–11.5	..	1	..	..	..	2	..	10	..	3	1	..	1	..	2	..	..	..	3	..	..
		30–35.5	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	..	..	..	..	..
		Total	..	1	..	139	..	5	1	26	..	14	6	..	51	3	11	..	3	..	66	..	732
	(2) 19.2 acres	1–5.5″	..	..	..	1	2	..	..	1	..	2	..	..	..	..	1	..	..	1	348	2	..
		12–17.5	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
		30–35.5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		Total	..	..	..	1	2	..	..	2	..	2	..	..	..	..	1	..	..	1	348	2	380
	(3) 3.5 acres	Young growth	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Southington was the smallest area and the amount of time consumed in laying and taking up the hose was probably relatively greater than in the other areas. There was considerable undergrowth and the condition of the ground was far less suitable for working than in Wethersfield. This was the first area sprayed by the crew in 1929, and there may have been some delay due to inexperience with the equipment. The small amount of lead arsenate used per acre was due to the large areas of brush. At Avon, conditions were far from favorable for good work. Water had to be hauled about half a mile. The trees were small and scattered, and the hillside was irregular and rough. Although the amount of lead arsenate per acre was only slightly more than at Southington, the time per acre was half again as much. Furthermore, the sprayer was farther from the infestation than in the other areas, necessitating relatively and actually more hose laying. The conditions at Avon were such that efficient work was impossible.

As has been mentioned before, the area at West Hartford is more nearly typical of woodland conditions in this part of Connecticut than are the other areas. The cost, \$21.31 per acre, is probably a good basis for estimating the cost of woodland spraying in this state. Yet conditions under which gipsy moth spraying must be carried on vary, and these conditions cause immense differences in cost. Worthley (1917) has estimated the cost as being about \$5.50 per acre, about 600 gallons of spray per acre being necessary. On this basis, the lead arsenate cost, at his figure of five cents a pound for *paste,* would be \$3.75 per acre and labor and other costs \$1.75. At West Hartford, it cost \$4.41 per acre for lead arsenate, at 12.75 cents a pound for *powder,* and 554 gallons of spray per acre were necessary. The labor cost was \$6.31 per acre. Other costs were \$10.72 per acre. It can be readily seen that the main difference in cost is due to the labor and depreciation charges. The West Hartford area of 22.4 acres took 20.5 hours, or about nine acres per eight hours of actual spraying. Worthley estimated 12 to 15 acres a day as an average for one crew, but does not state just what characterizes an "average acre" nor the number of men per crew and the number of spraying hours in a day. The crew for the West Hartford area is given on page 546. We have attempted to describe the areas here concerned, so that not only can an idea of the cost be ascertained, but also so that some conception of the conditions that affect the cost can be realized.

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THE SPREAD AND CONTROL OF THE EUROPEAN CORN BORER IN CONNECTICUT

W. E. Britton and M. P. Zappe

There was a marked westward spread of the European corn borer in Connecticut in 1928, 34 new towns being found infested. All except Suffield were connected with the large infestation of

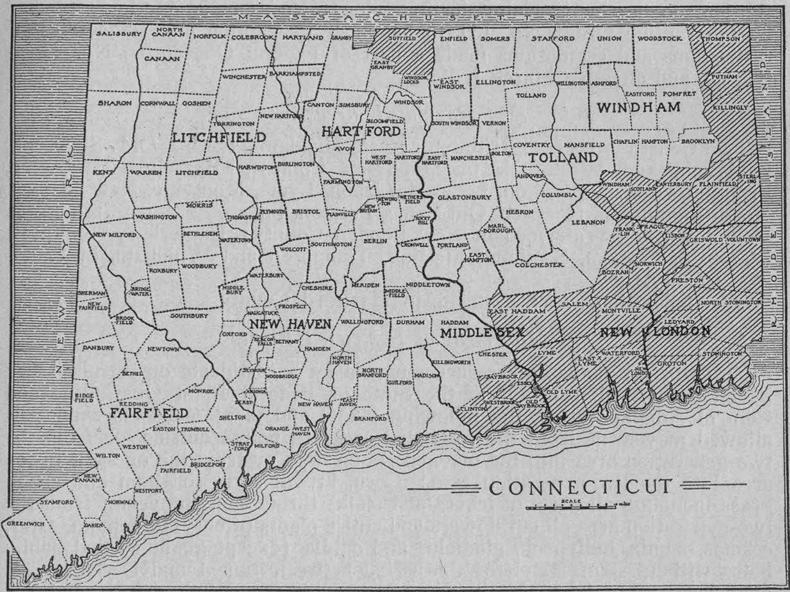

Figure 50. Map of Connecticut showing areas now under State and Federal quarantine on account of the European corn borer.

the double-brooded corn borer, which extends throughout Rhode Island, eastern Massachusetts, southern New Hampshire and southeastern Maine. The town of Suffield was found infested with the one-generation or single-brooded area that reaches into western Massachusetts from New York. These areas are shown in Figure 50.

After due notice and a public hearing at the Station on February 25, 1929, a quarantine order was issued in accord with Federal

Quarantine No. 43, sixth revision, effective March 1, 1929. The state quarantine became effective March 15, 1929. It is as follows:

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.
Quarantine Order No. 21

CONCERNING THE EUROPEAN CORN BORER

The fact has been determined that the European corn borer, *Pyrausta nubilalis* Hubn., has spread to such an extent as to make it necessary to extend the area restricted by State Quarantine Order No. 13, effective June 1, 1927, and likewise to bring it into conformity with Federal Quarantine No. 43, sixth revision, effective March 1, 1929.

Now, therefore, I, Director of the Connecticut Agricultural Experiment Station, do hereby proclaim the following towns (including those affected by Quarantine Order No. 13) to be under quarantine and subject to the restrictions and regulations made a part of Federal Quarantine No. 43, as revised, and effective March 1, 1929:

Regulated Areas

Two-Generation area: Clinton, East Haddam, Essex, Old Saybrook, Saybrook, and Westbrook in Middlesex County; Bozrah, East Lyme, Franklin, Griswold, Groton, Ledyard, Lisbon, Lyme, Montville, New London, North Stonington, Norwich, Old Lyme, Preston, Salem, Sprague, Stonington, Voluntown and Waterford in New London County; Canterbury, Killingly, Plainfield, Putnam, Scotland, Sterling, Thompson and Windham, in Windham County.

One-Generation area: Suffield, in Hartford County.

Movement of Restricted Plants

Until further notice, unless accompanied by a certificate or permit issued by an authorized inspector of the State or Federal Plant Quarantine and Control Administration, the following plants and plant materials cannot be allowed movement from the restricted areas to points outside, or from the two-generation area into the one-generation area or from the one-generation area into the two-generation area: Corn, broom corn, sorghum and sudan grass including all parts of leaves and stalks throughout the year; from the two-generation area all cut flowers and entire plants of chrysanthemum, aster, cosmos, zinnia, hollyhock, gladiolus and dahlia (except gladiolus and dahlia bulbs without stems) and for the period between June 1 and December 31, all celery, green beans in the pod, beets with tops, rhubarb, oat and rye straw as such or when used as packing.

No restrictions are placed on the movement of shelled corn in packages weighing two pounds or less; larger quantities must be certified.

This order shall take effect March 15, 1929.

W. L. SLATE,
Director, Connecticut Agricultural Experiment Station

Approved:
JOHN H. TRUMBULL, *Governor.*

This quarantine order, together with brief information about the corn borer, was published as Bulletin of Immediate Information 63, in an edition of 11,000 copies and was distributed widely

in the infested territory. The accompanying map shows the area quarantined in Order No. 21, and was printed in Bulletin of Immediate Information 63; this publication also contained information and recommendations regarding clean-up and control, as follows:

Methods of Clean-up and Control

For the past five years, the stalks, stubble and weeds have been burned in and around each separate infestation in Connecticut at the expense of the State and Federal governments, and in many cases no borers were found the next season. With the large number of towns infested, appropriations are inadequate to continue this system, and the grower must control the pest in his cultural operations. As the borers pass the winter in corn stalks, stubble and weeds, the following methods of handling the infested crop will greatly reduce the injury next season:

1. Corn stalks should be cut just as early as possible after maturity and put in the silo or fed out to cattle. When fed out, uneaten portions of stalks should be destroyed. If allowed to stand, such stalks furnish a favorable shelter for borers.
2. If cut close to the surface of the ground, very few borers will be contained in the stubble. If cut 6-12 inches high, the stubble may furnish enough borers to ruin the crop the following year, and such stubble should be plowed under cleanly, or pulled and burned.
3. Corn stalks which are not cut and used for silage or fodder should be burned in the field or cleanly plowed under. The larger weeds in the field and around their margins should also be burned.
4. By clean plowing in the fall, a large percentage of the second-brood borers are killed during the winter. Fall plowing is somewhat less effective against the single-brooded borers, but against both one-generation and two-generation borers, early spring plowing, during April, is beneficial, especially if all debris is covered deeply. There are now plows and attachments devised to facilitate the clean plowing under of standing corn stalks, and your county agent can advise you regarding them.
5. Small patches of sweet corn in back yard gardens can perhaps be pulled and burned to best advantage. If not cleaned up, such places will produce enough borers to infest the entire countryside.

Publicity

In scouting in 1928, the Federal scouts in each town worked until an infestation of the European corn borer was found and confirmed by a laboratory identification, then they moved to the next town. Consequently, it was unknown what proportion of the infestations were discovered in any given infested town. If no borers were found, the scouts examined every corn patch in the entire town. But as so many towns were found infested and not completely scouted, it was impossible for the state forces to conduct any clean-up or other control operations such as has been the practice for several years, other than distributing information and other publicity among the corn growers. It was deemed best to do everything possible under the existing conditions to prevent the spread and increase of this destructive insect. Consequently, a publicity campaign was decided upon to warn the growers in the infested towns that the pest was present in their midst and to urge them to carry out the recommended measures of control.

In the town of Suffield and likewise in the towns on the western margin of the infested area, all of the rural districts were visited by Mr. Zappe and two Federal men during April. These men stopped at farms where they saw corn stalks and stubble still in the fields, and personally requested the owners or managers to dispose of this material as soon as possible. A copy of the quarantine and clean-up regulations was given them for reference. Where no corn was found, a copy was left at the house or in the mail box. In the infested towns east of the margin of the quarantined area, by permission of the Postoffice Department the rural mail carriers greatly assisted us by leaving a copy in each mail box along their routes. In all infested towns, the school teachers were requested to inform the children about this pest and ask their parents to dispose of all material that might contain larvae of the European corn borer. This seemed a satisfactory means of publicity as the children could easily explain to their parents the necessity for cleaning up. It was very difficult in some cases for our men to explain the matter to persons not familiar with the English language. All newspapers in the infested area assisted us by calling attention in their pages to the necessity for prompt measures of control.

This work required about 16 days each for three men, or 48 man days.

The Federal authorities had immediate charge of enforcing the quarantine regulations, and maintained a road patrol at 12 different stations on the main thoroughfares leading out of the quarantined area. At these stations considerable infested material was intercepted, containing altogether some 1,581 borers. More than half of these borers were intercepted on the Boston-New York Post Road at Station No. 12 on the Clinton-Madison town line. Illustrations of corn borer injury, plowing demonstrations and road patrol work are shown on Plates XIII, XIV, and XV.

Legislation Providing Compulsory Control

Owing to the recent rapid spread of the corn borer in Connecticut, it was foreseen that the cost of clean-up in such a large territory would be too great to be defrayed by public funds. Consequently it will be necessary for each grower to dispose of his own corn stalks and stubble. A certain proportion of growers will do this voluntarily for their own benefit, but others will not do so except under pressure. In order to make it possible to clean up all fields, the General Assembly of 1929 enacted the following law:

PUBLIC ACTS OF 1929

CHAPTER 171

AN ACT CONCERNING THE CONTROL OF THE EUROPEAN CORN BORER

Be it enacted by the Senate and House of Representatives in General Assembly convened:

SECTION 1. The director of the Connecticut Agricultural Experiment Station shall issue and publish orders, rules and regulations which shall be effective in any town or portion thereof which shall have been quarantined on account of the European corn borer as provided by chapter 31 of the public acts of 1927, which orders, rules and regulations may require that each owner, tenant or manager of land on which corn of any kind has been grown shall, not later than December first of the year of its growth, plow or cause to be plowed the field in which it was grown, so as to bury the stubble to a depth of at least six inches, or pull up and destroy such stubble or cause it to be pulled up and destroyed by burning, and each person having in his possession corn stalks shall, not later than April tenth of the year following that of their growth, completely dispose of such corn stalks by using them as fodder or by burning them, and shall destroy, or cause to be destroyed, on or before April tenth of each year, all weeds in such areas as may be designated by the director of the Connecticut Agricultural Experiment Station.

SEC. 2. Any person who shall violate any provision of this act or any order, rule or regulation issued by authority of any such provision shall be fined not more than one hundred dollars.

Approved June 3, 1929.

Difference Between the European Corn Borer and Other Burrowing Larvae Found in Corn

Each year many specimens are received from growers who find a "worm" feeding upon corn or tunneling in the stalk, and suspect it to be the European corn borer. Usually it proves to be either the stalk borer or the corn ear worm. In order that growers and others may learn to distinguish between these three insects, the brief descriptions and illustrations given below were prepared in the summer and sent to all County Farm Bureau Agents and all newspapers in the state. Many prints of the illustrations were sent in letters to correspondents. Both illustrations and descriptions were also published in *The Rural New-Yorker,* issue of October 5, 1929. Apparently most of the newspapers did not print the illustrations but many printed the descriptions.

The accompanying illustration, Figure 51, shows the European corn borer and two other common insects that are often confused with it in the public mind—all twice natural size, but showing comparative sizes and difference in markings.

The corn ear worm, *Heliothis obsoleta* Fabr., is a native American insect, very common in the southern and western states, where it is called the "cotton boll worm" and the "tomato boll worm" and where it has several generations each season. It is nearly two inches long and is distinctly striped lengthwise but varies in color from light green to dark brown or purple. It feeds upon the silk and kernels at the tip of the ear, but sometimes works downward to the base of the ear. It is not a real borer and does not tunnel in the stalks. It is brought into Connecticut each season on early sweet corn from the south, and flights of the moths occur in September in some years. All attempts to bring it through the winter at outside temperatures in Connecticut have failed.

The stalk borer, *Papaipema nitela* Guen., is also an American species. The full-grown larva is about one and one-half inches long and distinctly striped lengthwise, one of the stripes extending forward upon the side of the head. There is also a dark girdle around the front half of the body. This borer attacks a stalk here and there and usually tunnels up or down, in the stalk,

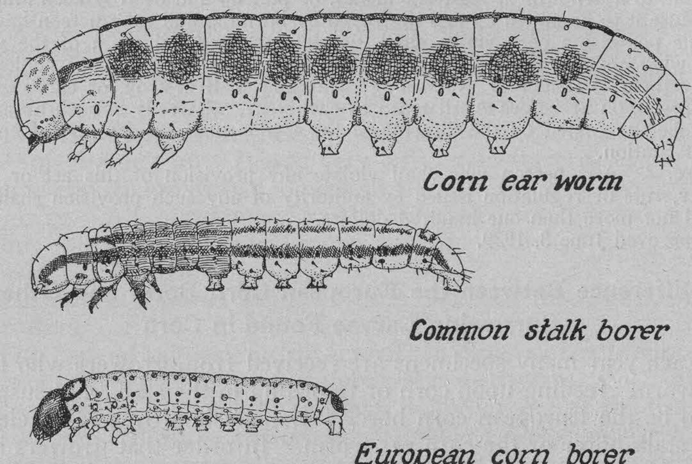

FIGURE 51. Appearance and proportionate sizes of three burrowing larvae found in corn.

but is not limited to corn and may be found in potato, tomato, dahlia, hollyhock, aster, lily, zinnia or any herbaceous stalk, even in weeds.

The European corn borer, *Pyrausta nubilalis* Hubn., has a larva an inch or less in length, white, gray, or pink in color marked with small black dots, but it is not distinctly striped. It burrows crosswise and lengthwise in the stalks, leaf-veins, and ears, including the cob, and when abundant will soon ruin the field. Though primarily a pest of corn, when the infestation becomes severe, the borers enter the stalks of celery, rhubarb, beet, bean, gladiolus, dahlia, aster, zinnia, chrysanthemum, and some of the larger grasses and weeds. This is the insect against which the quarantine was established and is now being enforced in the eastern part of Connecticut by Federal and state forces in coöperation.

TESTS OF VARIOUS APPLE SPRAYS

M. P. Zappe

Some of the fruit growers of Connecticut have been trying in many ways to eliminate the so-called spray injury, which most men believe is due to the use of lime-sulfur in combination with other spray materials. No doubt they are right; this injury to the foliage and indirectly to the fruit has become worse during the later years. Possibly high spraying pressures have contributed their share toward making this injury serious.

Other factors also have an influence on the russetting of fruit. One of these is weather conditions. Some of the fruit from the check plots that had no spray of any kind showed some russetting, though not so much as the same variety in a sprayed plot.

Various chemicals have been recommended from time to time to eliminate or to lessen the russetting and the spray injury. Iron sulfate has been used successfully for this purpose in Michigan.

We tried it last summer at the Experiment Station orchard at Mount Carmel, which contains 96 trees planted in 1911. This orchard was divided into five plots and the following spray combinations were used:

1. Iron sulfate plot:

Liquid lime-sulfur	3 gallons
Iron sulfate	1½ pounds
Black Leaf 40	1 pint
Arsenate of lead	3 pounds
Water	100 gallons

2. Liquid lime-sulfur plot same formula as the iron sulfate, except that the iron sulfate was omitted.

3. Dry lime-sulfur same as liquid lime-sulfur plot, except that six pounds of dry lime-sulfur was substituted for the liquid lime-sulfur.

4. The fourth plot was a combination plot upon which no lime-sulfur of any kind was used. This plot received the following treatment. For the pre-pink and pink sprays:

Scalecide	1 gallon
Sulfocide	½ gallon
Water	100 gallons

The calyx and later sprays were made up as follows:

Sulfocide	½ gallon
Kayso	2 pounds
Arsenate of lead	2 pounds
Water	100 gallons

All plots were given the same number of treatments, beginning with the pre-pink spray, this being followed by the pink, calyx, 7-day, two weeks, and the last spray on July 9. The varieties of apples used in the final check-up of results were Baldwin, Greening, McIntosh, and Roxbury Russet.

Appearance of Foliage During Summer

The leaves showed little injury in the early part of the spraying season. On June 10, the orchard was examined for spray injury. At this time a small amount of injury could be seen on all of the plots, most of it being on the liquid lime-sulfur plots. This examination was made before the last application of spray. Later in the season, the orchard was again examined very carefully. At this time, all plots were somewhat injured. The injury was divided into four classes: very light, light, medium, and heavy.

Iron sulfate plots—Most of the injury was considered moderate, 54%, and light, 33%.

Liquid lime-sulfur plot—Most of the injury was moderate, 50% with eight per cent in the heavy injury class.

Dry lime-sulfur plot—Most of the injury was classed as very light, 54%, to light, 33%.

Sulfocide-scalecide plot—Largest amount of injury was considered light, 50%; in the moderate injury class there was 33% and 16% of the injury was considered heavy.

Results at Harvest Time

All the fruit at time of picking was scored for insect injuries, fungous diseases, and for russetting, however slight. All fruits classed as good were entirely free from any injury except limb bruises or other mechanical injuries. The following table shows the result of the scoring of the fruit expressed in percentages:

	Iron sulfate	Liquid lime-sulfur	Dry lime-sulfur	Sulfocide scalecide	Check
Russet					
Good	75.0	73.0	66.8	48.0	8.6
Cod. moth	3.3	2.6	3.6	10.0	21.1
Curculio	13.0	19.2	24.1	37.9	74.3
Scab	.3	.1	.7	3.1	13.9
Russet	1.4	1.1	1.3	.0	.66
Other	7.6	4.4	3.9	3.8	7.0
Aphis	.0	.4	.5	.7	4.6
Baldwin					
Good	12.1	21.2	22.4	38.8	8.7
Cod. moth	6.9	3.4	2.1	1.4	34.5
Curculio	47.0	47.1	34.5	44.0	81.1
Scab	.2	.1	.2	.3	1.4
Russet	61.9	43.6	50.3	20.8	12.6
Other	4.7	2.3	2.3	2.4	5.4
Aphis	.4	.8	2.0	1.5	.7

	Iron sulfate	Liquid lime-sulfur	Dry lime-sulfur	Sulfocide scalecide	Check
Greening					
Good	37.9	59.0	60.3	68.8	11.7
Cod. moth	4.7	5.4	3.8	2.8	30.0
Curculio	44.9	22.8	31.9	23.4	79.6
Scab	1.0	.3	.7	1.1	3.7
Russet	13.0	10.3	2.1	.8	.4
Other	5.0	3.9	3.5	3.5	5.8
Aphis	.9	.2	.3	1.1	1.1
McIntosh					
Good	47.0	41.9	50.8	45.7	.16
Cod. moth	1.87	3.4	1.3	.8	8.4
Curculio	40.9	44.9	40.5	39.8	69.4
Scab	6.45	8.37	6.55	11.7	97.7
Russet	2.2	2.4	1.7	2.6	.0
Other	4.2	3.1	2.1	4.4	3.7
Aphis	.03	.02	.0	.0	.0

Summary

From a study of these figures, it would seem that the iron sulfate treatment showed no great advantage over either of the other lime-sulfur plots. The dry lime-sulfur and the liquid lime-sulfur were about equal in efficiency, but the fruit from the dry lime-sulfur plot had a better finish. The sulfocide-scalecide treatment was very good, showing a higher percentage of good fruit in three of the four varieties used in the tests. Basing the conclusions on one year's work in Connecticut, the iron sulfate has no advantage over any of the standard sprays, but needs further investigation. We hope to be able to make some further tests of sprays on apples with some modification of the spray formulas next year and to try out other promising spray combinations.

A STUDY OF VARIOUS OILS AND EMULSIONS FOR KILLING THE EGGS OF THE EUROPEAN RED MITE

Philip Garman

Extensive use of oils to control the European red mite (*Paratetranychus pilosus* C. & F.) has brought onto the Connecticut market a number of sprays that vary in composition so much that it has seemed advisable to study in detail the properties of different lubricating oils in order to lay down general principles governing their effectiveness for red mite control.

Several years ago about 20 oils were secured from different sources and submitted to the Department of Chemistry of this

Station for analysis. Mr. H. J. Fisher's report is found in part in Table 4. The oils after analysis were emulsified uniformly and sprayed systematically on marked areas containing red mite eggs, from which the dead and hatched eggs were carefully removed. Even with this procedure considerable variation occurred, so that it has been felt that some other means must be employed if direct comparison of the oils themselves is to have significance. A series of oils were therefore selected, dissolved in gasoline and sprayed upon the eggs. Four per cent oil in gasoline proved too strong, so the percentage was reduced to one per cent. The results showed some striking differences in oils of the same viscosity, which on investigation appeared to be the result of certain properties not listed in the table.

Owing to the small size of the experiment, it was repeated the following year and greater care was used in selection of eggs, spraying and handling, the eggs being subsequently hung in the open. Confirmation of the earlier experiment was not obtained, the two different oils of similar viscosity showing the same mortality within one or two per cent. It thus seems to be established that the main factor affecting kill of red mite eggs in pure oils of the types studied, lies in viscosity and not so much in properties such as sulfonation, cold test or evaporation, although there is probably not enough difference in evaporation to show in the tests outlined. There is no doubt, for instance, that mineral oils, such as kerosene or gasoline, have much less killing power than the lubricating oils of higher viscosity and lower volatility, and it is worthy of note in this connection that successive dilutions of lubricating oils with fuel oil, such as are shown in Table 6, considerably lower the toxicity. With this in mind it seems clear that oils of high evaporation and low viscosity should depend for their killing power largely on other materials contained therein or added thereto, rather than on the oils themselves.

The idea that viscosity is the main factor in the oil composing an emulsion that influences toxicity for red mite eggs, is substantiated by results shown in Table 5. It is difficult to explain the differences in the oils from different sources though it seems probable that differences in emulsifying properties may have played an important part. At any rate it is clear that with oils from the same source, those having higher viscosities were most effective.

Tests were made with two stabilized oil emulsions with lime-sulfur added and these seemed to indicate that the added lime-sulfur slightly increased the toxicity for red mite eggs.

Preliminary tests were also made in 1929 with oils emulsified differently and showing different sized globules when examined microscopically. These data are given in Table 7. The results seem to indicate that those showing the larger oil globules when examined microscopically offer the best killing agent. The more imperfectly an oil is emulsified, the larger the oil globules in general are found to be. Consequently, it seems justifiable to assume that stabilization, which usually reduces the size of the globules, also reduces its killing power. This is substantiated by the performance of commercial stabilized emulsions, which give as a rule no better kill of mite eggs than miscible oils and not so good as the homemade preparations that we have tried. However, in previous experiments where stabilization was accomplished by addition of casein, glue or gum arabic, conflicting results were obtained and further study of this phase of the question seems desirable.

In conclusion, it seems from our experiments that:

1. Heavier oils are more effective than light, when emulsified on the same formula.
2. An emulsion with large oil globules is slightly more effective than one with small globules. The differences obtained are, however, doubtfully important.
3. Fuel oil added to lubricating oils lowers their toxicity for red mite eggs.
4. Oils dissolved in gasoline may be used to compare different oils of the same or different properties.
5. There is some indication that addition of lime-sulfur to stabilized emulsions increases the kill.

TABLE 4. ANALYSES AND PHYSICAL CONSTANTS OF OILS

No.	Name	Unsulfonatable residue %	Sp. Gr. 20° C.	Saybolt Vis. 100° F.	Evaporation 60°-65° C.	Cold test
6710	XCIV (A) Sunoco Golden..	77.8	0.9450	433.8 sec.	1.69%	14° F.
6711	XCV (B) Sunoco Golden ..	75.0	0.9518	652.0	1.58	43°
6713	XCII Sunoco Golden	76.6	0.9395	195.7	2.44	—18°
6714	XCI Sunoco Golden	58.0	0.9254	103.2	5.08	—27°
6715	Aleph Oil	53.4	0.9313	291.2	2.88	21°
6716	No. 776 Oil	55.4	0.9230	704.4	1.93	41°
6717	Altair Oil	54.4	0.9342	463.2	2.05	18°
6718	Nabob Oil	54.0	0.9281	214.4	3.57	19°
6723	XXX Pale Spindle Oil	55.2	0.9257	168.8	3.88	—27°
6724	Socony Motor Oil—Medium	52.4	0.9129	443.3	0.85	16°
6725	Socony Motor Oil—Heavy..	39.6	0.9148	915.4	0.73	18°
6726	Socony Motor Oil—Light...	62.4	0.9073	291.4	1.26	10°
6727	No. 14 Spray Oil	56.0	0.9306	604.0	1.77	27°
6728	No. 910 Spray Oil	56.4	0.9280	472.7	1.69	16°
6729	Alcopol Oil	56.2	0.9201	222.2	3.22	7°
6730	XXV Sun Spindle Oil	51.2	0.9265	168.0	2.71	—20°
8214	Marcol	92.8		90.0	1.38	
8213	Acto	97.8		331.4	1.71	

TABLE 5. TESTS OF VARIOUS OILS EMULSIFIED ON A TWO PER CENT BASIS, FOR KILLING POWER FOR EGGS OF THE EUROPEAN RED MITE

Analytical number of oil	Viscosity	Hatch per cent
Socony lubricating oils, automobile		
6726	291	40.0
6724	443	13.7
6725	915	19.9 (poorly emulsified)
Sun Oil Co., lubricating oils		
6714	103	54.5
6713	195	51.0
6710	433	47.5
6711	652	20.0
Texas Co., oils		
6718	214	31.0
6717	463	17.6
Gulf Refining Co., oils		
6729	222	19.0
6728	472	15.7
6727	604	14.8
Standard Oil Co., white oils		
8213	90	14.9
8214	331	4.8

Formula: 75 cc. oil
25 cc. water
2 gms. sodium oleate powder

Diluted 10.6 to 400 cc. water

TABLE 6. EFFECT OF ADDING FUEL OIL ON THE KILLING POWER OF A LUBRICATING OIL; TWO PER CENT EMULSION

Analytical number of oil used	Per cent fuel oil	Dates of treatment and exam.	Total eggs	Number hatched	Per cent hatched
6715	50	3/1–5/16	123	30	24.6
6715	33	3/1–5/16	259	56	21.6
6717	25	3/1–5/16	507	59	11.8
Check		3/1–3/16	77	43	55.5

TABLE 7. TESTS OF KILLING POWER OF DIFFERENT OILS, DISSOLVED IN GASOLINE, ON THE EGGS OF THE EUROPEAN RED MITE; ONE PER CENT LUBRICATING OIL USED[1]

Analytical number of oils used	Viscosity	Average per cent hatched	Total number counted	Dates of treatment and exam.
6711	652	9.8	322	4/23–5/16
6710	433	4.7	347	4/23–5/16
6714	103	29.7	256	4/23–5/16
6716	704	6.0	292	4/23–5/16
6718	214	6.8	487	4/23–5/16
6723, 6730	168	19.5	739	4/23–5/16

[1] Laboratory tests. Sprayed and kept in jars over saturated salt solution.

TABLE 7—*cont.*

Check—no treatment		81.5	161	4/23–5/16
Gasoline only		58.5	326	4/11–4/23–30
Check—no treatment		70.5		4/11–4/23–30

TABLE 8. COMPARISON OF TWO OILS DISSOLVED IN GASOLINE, THE OILS HAVING THE SAME VISCOSITY BUT SLIGHTLY DIFFERENT PROPERTIES[1]

Viscosity of oil	Total eggs used	Number of tests	Average per cent hatched
168	2153	13	34.0
168	3339	20	32.9
Gasoline only	1204	8	46.4
Check—no treatment	1305	10	61.3

TABLE 9. EFFECT OF VISCOSITY ON KILLING POWER OF OILS, 1929[2]

Analytical number of oil	Viscosity	Number of eggs	Number of tests	Per cent hatched
6714	103	3637	23	15.7
6713	195	851	6	11.8
Check—no treatment		1390	9	35.0

TABLE 10. COMPARISON OF UNSTABLE EMULSION FORMING A FILM ON SURFACE QUICKLY, WITH STABILIZED EMULSION IN WHICH SEPARATION IS DELAYED[1]

Number of eggs used	Number of tests	Per cent hatched	
1423	9	1.6	Unstable: Visc. 200, 2% oil
1520	9	4.1	Stabilized: Visc. 100, 2% oil, April 4
1125	7	8.5	Stable: Visc. 100, 3% oil, March 14
1114	8	7.7	Unstable: Visc. 100, 3% oil, March 14
464	5	59.0	Check—no treatment

TABLE 11. COMPARISON OF EMULSION WITH LARGE OIL GLOBULES WITH ONE HAVING SMALLER GLOBULES[1]

Number of eggs used	Number of tests	Per cent hatched	
990	6	3.9	Unstable: Globules 5-8 μ, few below 5 μ, oil visc. 100
1090	7	4.8	Stabilized: Globules .8 μ-6.8 μ, none above 6.8 μ, mostly below 5, visc. 100
841	5	60.5	Check—no treatment

TABLE 12. SHOWING EFFECT ON RED MITE EGGS OF ADDING LIME-SULFUR TO TWO COMMERCIAL STABILIZED EMULSIONS

Oil	Oil content	Lime-sulfur dilution	Number eggs used	Number tests	Per cent hatched
A	4%	None	1504	10	4.2
A	4%	1-50	1554	10	3.0
B	4%	None	1979	10	3.8
B	4%	1-50	1265	10	.55

[1] Sprayed and hung outside exposed to the weather.
[2] Sprayed and hung outside exposed to the weather. 1.5 per cent oil. Emulsified with sodium oleate plus casein, using the same formula for each. Higher viscosities gave no better results than the 195 sec. oil in this test.

EXPERIMENTS WITH OILS ON A DOUBLE INFESTATION OF APHIDS AND EUROPEAN RED MITES AT THE EXPERIMENT FARM AT MOUNT CARMEL

Philip Garman

An opportunity to try different combinations for control of aphids[1] and red mites was afforded in 1929 by a double infestation of the two species at the Experiment Station Farm. In addition to field tests in which a number of large trees were treated with each material, eggs were clipped from the trees, sprayed in the laboratory and hung outside. Counts were made first of the number of eggs hatching, second of the per cent killed on the trees and finally of the number of colonies of aphids establishing themselves. Counts were also made of red mites and the number of spurs becoming infested. Two brands of oil were used, a heavy miscible oil and a commercial emulsion with ammonium caseinate.

At the time of the application, the leaves of Greening and Baldwin were well advanced, and in consequence some burning occurred, especially with the oil emulsion, though this was not serious with any of the mixtures. In addition to the two oils alone, the emulsion was combined with free nicotine and nicotine sulfate and the count showed considerably improved results with these combinations for aphis control over the oil alone. The oil plus lime-sulfur seemed to increase the leaf burning, although no serious harm resulted and there was a good crop of fruit on these trees. The commercial oil was also combined with freshly made Bordeaux with good success from the standpoint of spray injury, there being little or no injury and the trees recovering promptly. The Bordeaux mixture was made by dissolving copper sulfate, pouring the material into the tank and filling it to about two-thirds capacity, then slaking granular lime[2] on the strainer and washing this into the tank. The oil was then emulsified in a small amount of water and added to the tank. The oil lime-sulfur combination was not so successful and considerable sludge settled to the bottom.

The best control of aphids was obtained with the lime-sulfur and nicotine-sulfate spray, Table 14, the combination of oil and nicotine, either sulfate or free nicotine, ranking next. Very little difference could be seen in the two latter combinations, which differ somewhat from the New Jersey results, but may be explained by the fact that the oil used contains considerable free ammonia, which probably acts on nicotine sulfate to free the nicotine rapidly, thus making this combination essentially the same as the oil and free-nicotine mixture. The miscible oil showed considerably greater kill than the commercial oil emulsion, but less than oils plus nicotine. Unfortunately there were few or no

[1] Mostly green aphids, *Aphis pomi* De G.
[2] Difficult to slake by this method in cold weather.

aphids on the trees sprayed with lime-sulfur and oil or Bordeaux and oil so that corroboration of laboratory results particularly with oil-lime-sulfur, as given in Table 13, could not be obtained. The various oils are ranked in the order of the best kill for aphids in Table 15.

TABLE 13. RESULTS IN CONTROL OF APHIS ON APPLE, 1929[1]
Tests to Kill the Eggs

Materials	Dilution	Per cent killed
Lime-sulfur / Nicotine sulfate	1–10 / 1–400	97.5
Oil (emulsion) / Lime-sulfur	4–100 / 1–100	88.8
Oil / Free nicotine	4–100 / 1–800	67.3
Oil / Nicotine sulfate	4–100 / 1–800	65.2
Oil without nicotine or lime-sulfur	4–100	64.3
Check—no treatment—sprayed clear water		43.3

TABLE 14. COUNT OF APHIDS ON SPRAYED APPLE TREES

Materials used	Dilution	Per cent aphis infested spurs
Lime-sulfur / Nicotine sulfate	12 gals.–100 gals. / 1 pint – 50	7
Oil emulsion / Nicotine sulfate	5 gals.–100 / 1.5 pints–100	22
Oil emulsion / Free nicotine	5 gals.–100 / 1.5 pints–100	26
Miscible oil	4 gals.–100	27
Miscible oil / Bordeaux	4 gals.–100 / 8–8 lbs. –100	39
Miscible oil / Lime-sulfur / Casein lime	4 gals.–100 / 3 gals.–100 / 3 lbs. –100	43
Oil emulsion	5 gals.–100	54
Check	No treatment	58

TABLE 15. VALUE OF SEVERAL DIFFERENT TREATMENTS COMPARED IN ORDER[2] FOR KILL OF APHIDS

	Kill of eggs	Kill of aphids in field	Infestation of fruit spurs	
1	LS—N.S.	LS—N.S.	LS—N.S.	
2	Oil—Free N.	Oil—N.S.	Oil—N.S.	very close in all tests
3	Oil—N.S.	Oil—Free N.	Oil—Free N.	
4	Oil only	Miscible oil	Miscible oil	approximately the same in field tests
5		Oil emulsion	Oil emulsion	
6	Check	Check	Check	

[1] Mostly green apple aphis (*A. pomi*). A few rosy aphis. Eggs treated in laboratory and hung outside.
[2] Omitting oil Bordeaux and oil-lime-sulfur sprays. No. 1, best; 2 next; 3, next, etc.

TABLE 16. SUMMARY OF RESULTS IN SPRAYING EXPERIMENTS FOR CONTROL OF APHIS AND RED MITES IN A COMBINED INFESTATION AT MOUNT CARMEL, 1929

Materials	Dilution	Per cent[1] aphis killed	Per cent[2] spurs infested with aphids	Per cent[3] red mites killed	Per cent[4] spurs infested by red mites
Lime-sulfur ... / Nic. sulfate ...	12 gals.–100 gals. / 1 qt. –100	75	7	Few or no E. red mites on these trees at the beginning	
Oil emulsion .. / Free nicotine ..	5 gals.–100 / 1.5 pints–100	59	26	96.3	33
Oil emulsion .. / Nic. sulfate ...	5 gals.–100 / 1.5 pints–100	64	22	92.4	17
Miscible oil ...	4 gals.–100	44	27	Few or no E. red mites on these trees at the beginning	
Oil emulsion ..	5 gals.–100	44	54	88.1	39
Miscible oil ... / Lime-sulfur ... / Casein lime	4 gals.–100 / 5 gals.–100 / 3 lbs. –100	42	43	91.4	12
Check		35	58	30.5	99

NOTES ON LIFE HISTORY AND CONTROL OF THE PINE LEAF SCALE

Neely Turner

The pine leaf scale, *Chionaspis pinifoliae* Fitch, is a pest of considerable importance on young pine trees in Connecticut. Heavily infested seedlings grow slowly, lose much of their foliage, and are killed if the attack persists. Older trees growing in shaded locations are also very susceptible to attack and are sometimes seriously injured. Infested foliage becomes light in color, and the trees are very sickly in appearance, even when the infestation is comparatively light. The pine leaf scale attacks many species and varieties of pine, and has been recorded as attacking spruce in other states. However, there are no Connecticut records of this insect on spruce. It is also found on hemlock, *Tsuga canadensis,* when grown both as trees and as hedges. Infested hemlock hedges lose foliage badly, and occasionally branches are killed. Illustrations of this insect are shown on Plate XXIV.

Although this is a very common insect, very little work on life history and control has been done. Earlier notes on the subject almost uniformly stated that there were two broods a year, and suggested kerosene emulsion as a control. Later publications call attention to the use of dormant oil and lime-sulfur sprays. The most recent study was published by Herrick, who found that in central New York the pine leaf scale has but one brood a year. He suggested the use of oil sprays applied after the crawlers had hatched, as a control measure.

[1] Counted on twigs removed from the trees and brought to the laboratory.
[2] Counted in the field; more than 1,000 spurs examined for each treatment.
[3] Twigs clipped off and counted in laboratory with microscope.
[4] Counted in field, using only spurs with eggs on them or at their bases.

The following notes on life history and control of this insect were made at New Haven during 1929. All observations were made on young Scotch pines, *Pinus sylvestris,* six years from seed. These seedlings are planted in the open and not shaded.

There were two distinct broods of this insect in 1929. Crawlers from the over-wintering eggs first appeared on May 18 and a majority of the eggs hatched during the succeeding week. Very soon after hatching, the crawlers settled down and started feeding. A few days after feeding began, the young larvae changed in color from the dark red of the newly hatched crawlers to a straw color. The bodies increased in size rapidly, but molting did not begin until June 12. Thus the young larvae remained unprotected for a period of about three weeks. The first brood matured early in July and by July 10 practically all the second brood eggs were laid. Two weeks later, a few second brood crawlers appeared, but all the eggs did not hatch until August 12. At this time, many of the young larvae had already molted. The over-wintering eggs were deposited during the first half of October. There was no indication that any of the first brood eggs carried over until fall.

Control Measures

Dormant applications of liquid lime-sulfur or miscible oil have been recommended frequently for control of this pest. However, the insect is very resistant to sprays at this time, the eggs being well protected by the covering of the old female scale. Oil sprays at two per cent actual oil content applied April 29 failed to give good control. Approximately 40 per cent of the eggs were killed, the natural mortality being about 10 per cent. The oil used was a laboratory preparation—a soap emulsion of a white oil.

The comparatively long period of time between hatching of the first brood eggs and the first molt, first noted by Herrick, suggested contact insecticides for control at this time. Accordingly, tests were made, using oil sprays and commercial 40 per cent nicotine sulfate with soap. The oil spray was a laboratory preparation containing one per cent white oil emulsified with soap. The first application was made May 18, before all the eggs had hatched. Most of the larvae and a few of the eggs were killed by this spray. A second application, May 25, effected a more complete control. Applications of 40 per cent nicotine sulfate, diluted one part to 500 parts water with one per cent soap flakes, were made on May 20 and 25. These sprays also gave good control, killing all of the crawlers, but very few of the eggs.

In both cases, the first application was made before all the over-wintering eggs had hatched and therefore complete control was not obtained by the first spray. It is believed that the second application was much more important than the first. The trees in this experiment remained free from insect injury without further treatment. No injury was noticed from the oil application.

Spray tests were also made on second brood larvae, although the prolonged period of hatching of this brood makes control difficult. A commercial white oil spray was used at one per cent actual oil content. This oil was a low-viscosity white oil, about 60 seconds Saybolt. Application was delayed until July 26, at which time about half the eggs had hatched. This one application gave very good control, all the crawlers being killed and most of the unhatched eggs as well.

Nicotine sulfate was applied at one part to 500 parts water with one per cent soap, July 26 and August 3. These sprays killed the young crawlers, but did not affect the unhatched eggs. A third spray was not applied, but would have been necessary for complete control.

Oil Sprays on Evergreens

Summer oil sprays have not been tested extensively on evergreens, and should therefore be used with caution. No injury resulted from the experimental applications made in this test, but injury to evergreens has been reported from other states. A few precautions should be taken into account in applying oil sprays to evergreens. Only sprays made from highly refined (white) oils should be used during the growing season. Oil sprays should not be applied during excessively hot weather or during drought.

Recommendations for Control

Wherever possible, all sprays to control this insect should be made on the first brood. Nicotine sulfate, one part in 500 parts water with one per cent soap, or white oil at one per cent should be applied about June 1 in southern Connecticut. This date varies with location and seasonal differences. However, the red crawlers are very easily seen, and spraying can be timed about ten days after they first appear. If sprays for the second brood are desired, one application of a white oil at one per cent, or two applications of nicotine sulfate, one part in 500 parts water, with one per cent soap, should be made. In southern Connecticut the oil spray should be applied about August 1, and the nicotine sprays about August 1 and August 15. Based on appearance of the crawlers, the oil spray or first nicotine spray should be applied about a week after the first crawlers appear, and the second nicotine spray two weeks after the first application.

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THE MEXICAN BEAN BEETLE IN CONNECTICUT

***Epilachna corrupta* Mulsant**

A new pest of vegetable crops has appeared in Connecticut in the Mexican bean beetle, *Epilachna corrupta* Muls., which was discovered in July in the western portion of the state by Dr. E. P. Felt, Director of the Bartlett Tree Research Laboratories, at Stamford. The presence of this pest in the state was brought to the attention of the writer in a letter received from Doctor Felt on July 15. On July 23, the writer visited the Bartlett Laboratories in North Stamford and saw specimens of this insect and its injury in a bean patch near the Laboratory.

Present Distribution in Connecticut

Thus far, the insect has been noticed only in the western half of the state; it has been observed in Fairfield, New Haven, Litchfield and Hartford Counties.

The first records were received from Doctor Felt; then specimens were received from correspondents. Members of the department staff observed the insect in two towns and finally Mr. Rodney Cecil, of the Bureau of Entomology, made a hurried trip through a portion of the state and discovered the pest in a half dozen localities. These localities, with date and name of the observer, are given below:

Fairfield County:
- Brookfield, July, E. P. Felt
- Darien, July 26, B. H. Raymond
- Monroe, Aug. 9, R. C. Botsford
- New Canaan, July, E. P. Felt
- Ridgefield, July, E. P. Felt
- Sherman, Aug. 1, C. L. Johnson
- Stamford, July, E. P. Felt
- Westport, July, E. P. Felt
- Wilton, July, E. P. Felt

Litchfield County:
- Canaan, Sept., R. Cecil
- Salisbury, Sept., R. Cecil
- Washington, July, E. P. Felt

New Haven County:
- Meriden, Sept., R. Cecil
- New Haven, Sept., R. Cecil
- Orange, Aug., R. B. Friend
- Wallingford, Sept., R. Cecil

Hartford County:
- Hartford, Sept., R. Cecil

In all the localities mentioned above, the infestations were light with only slight feeding upon the leaves. Mr. Cecil expressed his opinion in a letter to the effect that these "infestations originated from a few scattered egg-masses probably from migrating adults this Spring."

Mr. Zappe and his men were requested to watch for this insect on bean patches when traveling about the state inspecting nursery stock, but the pest was not discovered in any other towns in Connecticut.

History in the United States

Mexico is believed to be the original home of the Mexican bean beetle, but the insect has been known to be present in the southwestern part of the United States for more than 75 years. It now exists in Arizona, Colorado, New Mexico, western Texas, and Utah. In 1920 this insect was discovered in northern Alabama, and is thought to have been introduced in shipments of alfalfa hay from the West during the World War.

From Alabama, the Mexican bean beetle has spread chiefly northward and eastward until it now occupies Tennessee, Kentucky, Indiana, southern Michigan, southern New York, and all territory between these and the Atlantic Ocean. Southward it has spread more slowly; and now covers the upper two-thirds of both Alabama and Georgia, nearly all of South Carolina and the northeastern corner of Mississippi. Isolated infestations have been discovered in southern Georgia near the Florida line and at six points in Ontario, Canada, north of Lake Erie and Lake Ontario.

Injury to Plants

The plants are injured because the leaves are partially devoured by both larvae and adults; the feeding is chiefly from the under side. The adults generally feed upon the lower surface in ragged areas, but often eat through the upper surface. The larvae have the habit of feeding in small definite areas, eating narrow, nearly straight, parallel channels close together with a thin ridge of tissue between, and leaving the upper surface intact. These channels and ridges reach across the small area, and may be parallel with, perpendicular to, or at an angle, in relation to adjoining areas. In other words, the ridges do not all run in the same direction; some of them run in the same direction as the principal veins, and others are perpendicular to them. Between, there are all possible gradations in direction. This injury, therefore, presents a very characteristic appearance, as shown on Plate XXII, and could hardly be mistaken for the work of any other insect. Where the insects are abundant, bean plants are soon destroyed.

Food Plants

The Mexican bean beetle feeds upon the leaves of beans, preferring the common garden and field bean and the Lima bean to other plants. It will attack and injure all varieties of pole and bush beans of the genus *Phaseolus*. As a second choice, it will subsist upon the wild beggar-weed or beggar-ticks, *Meibomia* sps., cowpea, soy bean, hyacinth bean, alfalfa, and sweet clover.

Importance as a Pest

This insect is a serious pest of beans in the greater portion of this area in the eastern states. It is possible that the insect has about reached its northern limit; that it may not continue its rapid spread northward, and that it may not multiply as rapidly or do as much damage in Connecticut as in other states further southward. It is reported that the spread of the Mexican bean beetle in Michigan in 1929 was insignificant.

Description and Relationship

The adult beetle is about one-fourth of an inch long, longer than broad, and has the smooth, hard, hemispherical shell characteristic of the lady beetles, family Coccinellidae, to which it belongs. In color it is pale brown or buff and each wing cover bears eight black spots, which vary considerably in size and shape. In certain specimens the spots are so large that they almost coalesce. On emerging, the beetles are lemon yellow, but graduaally darken until they become copper color. In size, they are smaller than the squash lady beetle, *Epilachna borealis* Fabr., and have smaller spots. The thorax of the Mexican bean beetle is unmarked and that of the squash lady beetle is spotted.

The eggs are laid in masses of 40 to 60 on the under sides of the leaves. They are small, about one-twentieth of an inch long and orange in color. The larvae, when fully grown, are about one-third of an inch long, orange in color and covered with long branched spines. The pupae are about the same size as the beetles, yellow, and are attached to the leaf or other object upon which they pupate, the cast larval skin with spines covering the last abdominal segments.

The Mexican bean beetle, *Epilachna corrupta* Muls., and the squash lady beetle, *Epilachna borealis* Fabr., are the only lady beetles in Connecticut that feed upon cultivated plants and are injurious. All other species prey upon small insects and are considered beneficial.

Natural Control Agencies

Several native insects feed upon the eggs and larvae of the Mexican bean beetle. One of these is the spotted lady beetle, *Ceratomegilla fuscilabris* Muls., which eats both the young larvae and eggs. The "anchor bug," *Stiretrus anchorago* Fabr., in both the nymph and adult stages, feeds upon the larvae, pupae and adults. The spined soldier bug, *Podisus maculiventris* Say., attacks the bean beetle in all its stages. The insects mentioned above all occur in Connecticut and are the chief insects that prey upon the Mexican bean beetle, though there are other lady beetles and other bugs which sometimes feed upon it.

Two species of two-winged flies occurring in Connecticut have been reared in Alabama as parasites of the Mexican bean beetle, *Phorocera claripennis* Macq., and *Helicobia (Sarcophaga) helicis* Towns., and a third species, *Paradexodes epilachnae* Ald., is a prevalent parasite in certain sections of Mexico.

Artificial Control Measures

As a means of control for the Mexican bean beetle, spraying or dusting has proven the most successful. Calcium arsenate seems to be more effective than lead arsenate and has been generally recommended by those who have gained experience in controlling the pest. One of the most satisfactory remedies is to dust the plants with calcium arsenate or magnesium arsenate, using one pound of the dry poison in four pounds of hydrated lime. Another formula is calcium arsenate, one pound, fine dusting sulfur, one pound, and hydrated lime, four pounds, using from 12 to 15 pounds per acre. Sodium fluosilicate, one part in two parts of lime, may also be used as a dust. As a spray, magnesium arsenate, one pound in 50 gallons water, has given good results when applied at the rate of about 100 gallons per acre. On string or snap beans where the pods are to be eaten, it is advisable to spray with a pyrethrum-soap preparation, following the directions on the package.

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FULLER'S ROSE BEETLE IN CONNECTICUT

***Pantomorus godmani* (Crotch) = *Aramigus fulleri* Horn**

On September 5, Mr. Johnson of this department brought to the office some weevils from a greenhouse in Norwalk. These beetles were upon the blossoms of *Acacia,* and were said to have eaten notches in the leaves of the *Camellia,* several varieties of which were growing there.

These beetles were identified by Mr. Walden as Fuller's rose beetle, *Pantomorus godmani* (Crotch), a species formerly listed as *Aramigus fulleri* Horn, and considered a pest of roses and some other plants. Some of the books and bulletins of a generation ago contain accounts of this insect. Smith's "Insects of New Jersey" in reference to this insect contains the following statement: "An imported species, which was for a time a serious pest in rose-houses in Union County and elsewhere. It was never abundant outdoors and is rarely found now, even in greenhouses, where they have learned to deal with it."

Later, some curculionid larvae were dug from the soil in the same greenhouse in Norwalk and brought to the Station, but at this writing, no adults of Fuller's rose beetle have been reared from them. The only adults so far obtained are the black vine weevil, *Brachyrhinus sulcatus* Fabr.

Distribution, Food Plants and Habits

According to Doctor Chittenden,[1] this insect occurs over the greater portion of the United States and Canada. In the northern range it appears in greenhouses, but in California it is known to live out of doors. The food plants recorded are as follows: abutilon, achyranthes, alfalfa, apple, apricot, azalea, common and Lima beans, begonia, blackberry, camellia, canna, cape jasmine, carnation, cissus, citron, chrysanthemum, currant, deutzia, dracaena, fuschia, geranium, golden glow, grapefruit, hibiscus, leadwort, lilies, lemon, oaks, orange, palms, peach, pear, pentstemon, persimmon, plum, plumbago, prune, primrose, potato, raspberry, roses, scabiosa, strawberry, sugar cane, tangerine and vinca.

Apparently roses, especially tea roses, are preferred with geranium a second choice. In California it occasionally causes injury to lemon groves, and the larvae feed upon the roots of blackberries, loganberries, raspberries, roses and strawberries.

The beetles feed at night, and during the day rest in places where they are not readily observed, usually among the leaves of their food plants, but sometimes clinging to the twigs or hiding under the plants. They are active at night, but they have no wings and cannot fly; hence, they must crawl up the stems to reach the leaves. When disturbed, they fold their legs and antennae and drop to the ground after the manner of the plum curculio and many other weevils. As they do not move for some time and are inconspicuous in color, they readily escape notice.

Life History

The female lays eggs in crevices or under the edges of loose bark near the ground, in flattened batches containing from 10 to 60 eggs arranged in several contiguous rows. Sometimes the eggs are deposited between the soil and the main stem. These eggs adhere together firmly. They hatch in about a month, and the larvae live in the soil, where they feed upon the roots of plants. The length of the larval stage has not been definitely determined but probably occupies a month or more and varies considerably, according to the conditions under which the insect exists. In fact, it is said that all stages may be found during the winter and early spring, but that the individuals are most noticeable in December.

Description

The adult beetle varies from a quarter to three-eighths of an inch in length. The snout is short and scarred at the sides of the mandibles. Head, thorax and abdomen are brown, more or less covered with gray scales. These scales are somewhat lighter on

[1] F. H. Chittenden, Division of Entomology, Bull. 27 (new series), 88. 1901.

the head and thorax and browner on the abdomen. The abdomen is oval, longitudinally ribbed or striated, and with a diagonal patch of light gray scales near the outer margin of each wing-cover, about half-way between the base and apex. Legs and antennae are nearly uniform in color with the thorax and abdomen. See Plate XXVI, a.

Methods of Control

It is said that the beetles live a long time and are very resistant to the usual insecticides. Even hydrocyanic acid gas has little effect on them at a concentration that is safe for the plants. Persistent searching for the beetles and killing them, during the months of November and December, greatly reduces the number of the insects and has practically eradicated the pest from many greenhouses. Another measure of control is to kill the larvae and pupae by treating the soil with carbon disulfide or an emulsion of carbon disulfide. As the beetles are wingless, they must necessarily crawl up the stems to gain access to the leaves, and this fact may be taken advantage of to protect the plants by placing around the stems, barriers of cotton, card collars, or tanglefoot to prevent the beetles from ascending the plants.

Essig recommends spraying the foliage with lead arsenate, two pounds of the dry powder in 50 gallons of water, where the bands cannot be used.

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AN OUTBREAK OF SMALL AQUATIC FLIES IN A FILTER PLANT

B. H. Walden

At the request of Mr. C. P. Prann, city engineer of Meriden, a visit was made July 30 to the filter plant of the Meriden Water Company at South Meriden, where swarms of small non-biting flies were causing trouble in the control room. The plant was operated at night because the electrical power could then be obtained at a reduced rate. The insects were attracted to the lights and had badly spotted the black panels of the instrument boards, as well as the white walls of the room. They were also very annoying to the operator in charge of the plant. In the morning, a pint or more of these flies could be swept from the floor under the lights. Screens had been put in the windows, but the flies readily came through the mesh and many that would naturally fly out again were held in by the screens, so that there were probably more flies inside in the morning than there were before the screens were put on.

A few larvae and pupae were present in the water in the filter beds and adults were emerging in the coagulating tanks where the water was received before it passed to the filter beds. It was evident from the method of handling the water that it did not remain long enough for the flies to breed in either place.

The reservoir, about 1,000 feet away, was then examined. Many larval and pupal skins were floating on the surface of the water near the edges. Although it was quite evident that the flies were breeding in the reservoir, it was not determined why they were so much more abundant than in any preceding season. There had been a lack of rain, but the water level was within a foot of normal. It was suggested to try suction fans near the electric lights to rid the control room of them.

Some of the flies were collected and found to represent two species; these were sent to Professor O. A. Johannsen, of Cornell, who determined the species as *Chaoborus punctipennis* Say. and *Chaoborus trivittatus* Loew, of the family Culicidae. The former, a spotted species, was very abundant, but the latter formed only about four or five per cent of the total number of flies.

THE JAPANESE BEETLE: SCOUTING AND QUARANTINE ENFORCEMENT

W. E. Britton and J. Peter Johnson

In 1929, the work of controlling the Japanese beetle in Connecticut has been carried on as a coöperative project by this department and the Federal Plant Quarantine and Control Administration. This work has consisted of (1) soil treatment to kill the grubs, (2) trapping and scouting for beetles, and (3) quarantine enforcement.

Mr. Johnson has been in immediate charge of all this work and the report in detail has, for the most part, been prepared by him.

Soil Treatment

From numerous diggings in the localities where Japanese beetles were found in 1928, it was ascertained that grubs were present in the soil. Therefore, it was deemed best to treat these areas both in Hartford and New London in an attempt to kill the grubs before they could transform and emerge as beetles. With Federal coöperation, this work was carried out between May 31 and June 8. A quantity of prepared standard carbon disulfide emulsion was purchased. This emulsion was diluted at the rate of 1.2 quarts in 50 gallons water and applied by means of an automobile truck spray outfit. Treated areas are shown on Plate XVIII.

In Hartford eight men working six days treated an area of 107,200 square feet of lawn surface, using 40,200 gallons of diluted emulsion. In New London, seven men in two days treated 27,200 square feet, using 10,200 gallons. These figures are shown in the following:

Place	Date	Diluted emulsion applied (gallons)	Area treated sq. ft.	No. men
Hartford	May 31–June 6	40,200	107,200	8
New London ..	June 7–8	10,200	27,200	7
Total		50,400	134,400	

Scouting

The scouting activities in Connecticut began on July 8, 1929, when 29 men reported at the Shelton office ready for work; in the next few days, five more men reported, making 34 men in all, in addition to the scout supervisor. These men were taken to Bridgeport, where they were trained by the supervisor and two other men who are permanently connected with the project. They remained there for several days until the supervisor was satisfied that they were qualified for scouting. They were then divided into seven field scouting crews of four men each, and two greenhouse scouting crews of three men each. Each crew was then assigned a definite territory and work began in the following localities: a crew each in Hartford, Manchester, Meriden, New Britain, New London, Wallingford and Willimantic. The state had been divided into approximately 16 areas, each area being of such a size that it was possible for the field scouting crews to cover the entire ground without being removed from their headquarters. Upon completing one area, the crew was moved to another and in this way the work was carried on more efficiently and with the minimum waste of time in travel. The supervisor visited the crews daily, assigning the areas to be scouted and checking over the work performed. It was also his duty to see that all records of scout work were completed properly, and he kept close contact between the headquarters office and the various crews.

The greenhouse scouts inspected all classified establishments within the regulated area. In order to do this, the men were divided into two crews of three men each and a motor car was assigned to each crew. One crew was sent to the regulated area in Fairfield County, and the other to that area within New Haven County. The classified establishments and the routes were so arranged that each establishment was scouted twice every week during the entire season.

Throughout the season, scouting was also performed at various times in Bridgeport, Norwalk, New Canaan, New Haven and Stamford by farm products inspectors. This was done to enable the department to keep informed as to the increase in the degree of infestations at these places, also as to the possible spread of beetles from these established infestations.

There were 290 crew hours lost on account of rainy weather, though the rainfall was below normal, causing a dry and dusty condition throughout the season.

The areas scouted during the 1929 season included the following towns, villages and cities:

Berlin	Lakeville	Saybrook
Branford	Litchfield	Southington
Bridgeport	Lyme	Stafford Springs
Bristol	Madison	Stamford
Canaan	Meriden	Stratford
Cheshire	Middletown	Stonington
Clinton	Milldale	Suffield
Colchester	Manchester	South Manchester
Collinsville	Naugatuck	Terryville
Cromwell	Norfolk	Thomaston
Danbury	Norwich	Thompsonville
Danielson	New Britain	Torrington
Deep River	New Haven	Wallingford
East Hampton	New London	Waterbury
East Hartford	New Milford	Watertown
East Windsor Hill	Oakville	Warehouse Point
Enfield	Plainville	Westbrook
Forestville	Plantsville	Westerly, R. I.
Guilford	Pomfret	West Hartford
Groton	Portland	Willimantic
Hartford	Putnam	Windsor
Hazardville	Salisbury	Windsor Locks
		Winsted

In addition to the daily scouting for *Popillia japonica* Newn., *Anomala orientalis* Waterhouse, and *Aserica castanea* Arrow, night scouting was carried on for the *Aserica castanea* Arrow by the foremen of each crew. This work was carried on between the hours of 7:00 P. M. and 10:00 P. M., two and three nights a week as the weather permitted, each man carrying a flashlight. However, in this scouting no beetles were found.

The areas scouted at night during the 1929 season included the following towns and cities:

Bridgeport, Bristol, Canaan, Cromwell, Fairfield, Hartford, Middletown, Meriden, New Britain, New Haven, North Manchester, Putnam, Stafford Springs, Stamford, Torrington, Wallingford, Willimantic, Winsted.

Japanese beetle traps furnished by the Federal men were placed around the infestations of 1928, in Hartford and New London before the beetles emerged, and allowed to remain until September 15. Traps were placed in Willimantic and in additional localities in Hartford, as soon as possible after the beetles were discovered. The number of traps used in each place and the number of men required to attend them is shown in the following table:

City	No. of traps	No. of men
Hartford	750	3
New London	250	1
Willimantic	250	1
Total	1,250	5

Asiatic and Japanese beetles were found at the following places outside of the 1928 generally infested area.

HARTFORD

Address		Beetles found	Dates found
70 Fairfield Avenue	1	*Popillia japonica*	July 31
88 Fairfield Avenue	1	" "	July 31
603 Farmington Avenue	1	" "	July 31
107 Grandview Terrace	1	" "	July 31
115 Grandview Terrace	1	" "	July 31
125 Beacon Street	1	" "	Aug. 13
Ford and Asylum Streets	12	" "	Aug. 13
36 Bodwell Street	1	" "	Aug. 27
Total Hartford	19		

WILLIMANTIC

Address		Beetles found	Dates found
49 Maple Street	2	*Popillia japonica*	Aug. 5
7 Turner Street	1	" "	Aug. 5
17 Turner Street	1	" "	Aug. 3
13 Turner Street	2	" "	Aug. 3
13 Turner Street	3	" "	Aug. 5
Total Willimantic	9		

HARTFORD

In traps	413	*Popillia japonica*	June 9 to Sept. 14
Near traps	450	" "	June 9 to Sept. 14
Total Hartford	863		

New London

In traps	95	*Popillia japonica*	June 9 to Sept. 14
Near traps	73	" "	June 9 to Sept. 14
Total New London	168		
In trap	1	*Aserica castanea*	June 9 to Sept. 14

Willimantic

In traps	4	*Popillia japonica*	June 9 to Sept. 14
Near traps	8	" "	June 9 to Sept. 14
Total Willimantic ..	12		

Total number of towns in which beetles were found 3

Total number of beetles found outside of generally infested area of 1928: *Popillia japonica,* 1,043; *Aserica castanea,* 1.

In all, 80 classified nurseries and greenhouses were scouted twice a week in the summer of 1929.

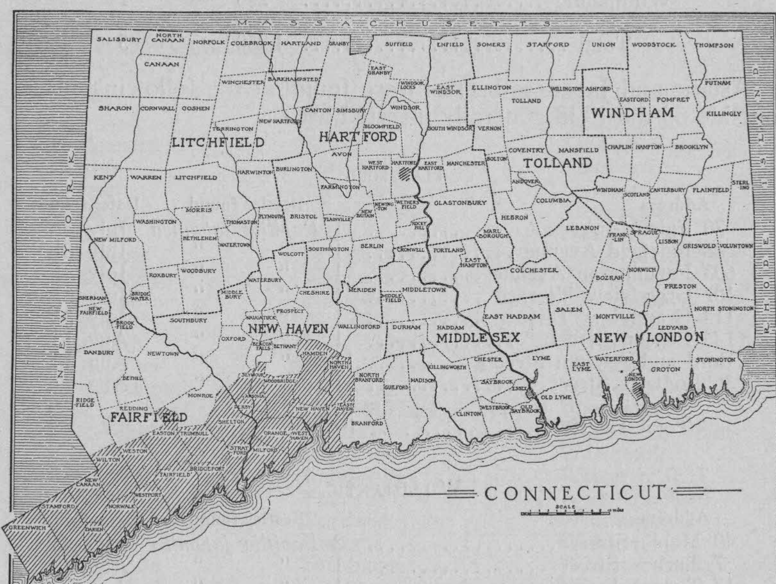

Figure 52. Map of Connecticut. Shaded areas indicate territory quarantined on account of Japanese beetle.

Quarantines

On account of the distribution of the beetle, Federal Quarantine No. 48 (Fifth revision) extends the Bridgeport area to include New Haven and surrounding towns. The state quarantine coincides with the Federal Quarantine (Figure 52), but places additional restrictions on certain areas in Hartford and New London, as shown in Figures 53 and 54. The quarantine order follows:

State of Connecticut
Agricultural Experiment Station
New Haven, Conn.

Quarantine Order No. 20

CONCERNING THE JAPANESE BEETLE

The fact has been determined that the Japanese beetle, *Popillia japonica* Newman, has been found in the cities of New Haven, New London and Hartford, and to prevent the further spread of this pest it is necessary to extend the quarantine restrictions over certain additional areas regarding which a public hearing was held in New Haven, February 25, 1929. Federal Quarantine No. 48 has also been revised, effective February 15, 1929, to include eleven additional towns in New Haven County.

Now, therefore, I, William L. Slate, Director of the Connecticut Agricultural Experiment Station, under authority conferred by Chapter 31, Public Acts of 1927, do hereby proclaim the regulated area fixed by State Quarantine Order No. 16, and by the rules and regulations supplemental to Federal Quarantine No. 48 (Fifth Revision), effective on and after April 1, 1927, as amended effective on and after November 1, 1927, namely, the towns of Bridgeport, Darien, Easton, Fairfield, Greenwich, New Canaan, Norwalk, Shelton, Stamford, Stratford, Trumbull, Weston, Westport, and Wilton, in *Fairfield County,* to be extended to include the eleven towns of Ansonia, Derby, East Haven, Hamden, Milford, New Haven, North Haven, Orange, Seymour, West Haven and Woodbridge, in *New Haven County.*

Also, that that portion of the City of Hartford bounded by Farmington Avenue, Spring Street, Walnut Street, Sargeant Street, and Sigourney Street, is hereby quarantined.

Also, that that portion of the City of New London bounded by Huntington Street, Bristol Street, Williams Street, Manwaring Street, Hempstead Street, Franklin Street, Cottage Street, and Broad Street, is hereby quarantined.

The rules and regulations supplemental to Federal Quarantine No. 48 (Sixth Revision), effective on and after February 15, 1929, or any subsequent amendments thereto, restricting the interstate movement of quarantined articles from the regulated areas, are hereby declared to be in full force and effect with respect to the intrastate movement of quarantined articles from the herein designated regulated areas of Connecticut to unregulated portions thereof.

This order shall be effective on and after April 1, 1929.

W. L. Slate,
Director, Connecticut Agricultural Experiment Station.

Approved:
John H. Trumbull, *Governor.*

The foregoing quarantine order with maps and brief information about the Japanese beetle was published as Bulletin of Immediate Information 64, April 15, 1929, in an edition of 6,250 copies.

Inspection of Farm Products

In making a preliminary survey as to the market conditions in the shipping centers that would be affected by the Farm Products Quarantine, it was necessary to erect platforms in Bridgeport and

New Haven. It was also necessary to station a man in Norwalk, one in Stamford and have one ready at the Shelton office to take care of inspections. The platform at Bridgeport was located on Water Street, near the center of the market, and approximately ten by thirty feet, while the one in New Haven was located at 21 Lafayette Street, being similar in size. The New Haven platform was also located to advantage in the market. It was found,

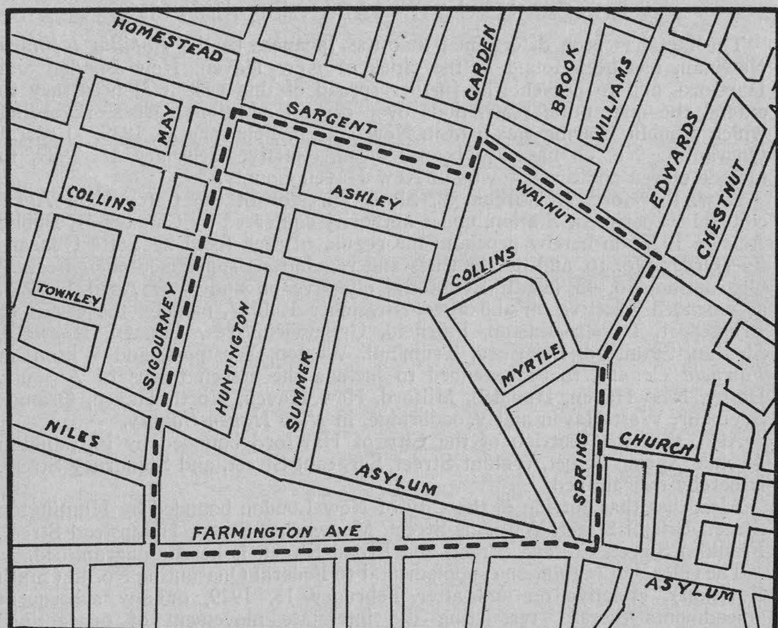

FIGURE 53. Map of section of Hartford. The dotted line surrounds area under State quarantine on account of Japanese beetle.

however, as the season progressed, that the size was inadequate and if conditions are similar in the coming year, it will be necessary to enlarge it somewhat.

The one foreman located at New Haven, in addition to his duties at the inspection platform, also took care of miscellaneous inspections that were made at other points from that section. Six inspectors were employed and the platform was open throughout the week from Sunday afternoon, 3 P. M. through Saturday until 5 P. M. As the New Haven market carried on most of its own business at night, it was necessary to have the majority of the men present at those hours. Only one man was at the platform during the daytime, from 7 A. M. to 3 P. M. Another inspector reported at 3 o'clock and was on duty until 11 P. M. At 8 P. M., a second

inspector reported and he made inspections at chain store headquarters for two or three hours every night because it was found to work out more efficiently. He generally returned to the platform about 10:30 or 11:00 o'clock and remained there until 4 A. M. At 11 P. M. two inspectors reported for work. Thus three men were present at the platform at the rush hours. These were from 11:45 P. M. to 2 A. M. and from about 4:30 A. M. until 7 A. M. The sixth man reported at 1 A. M. and worked

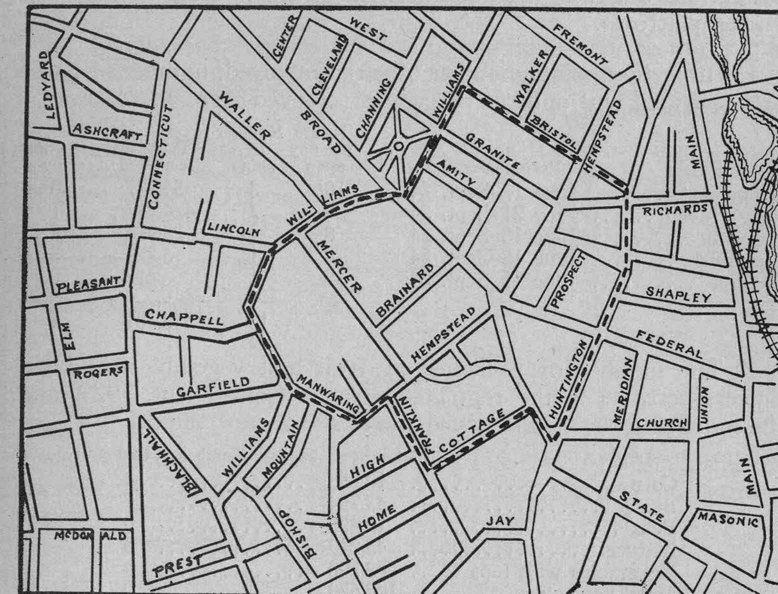

FIGURE 54. Map of section of New London. The dotted line surrounds area under State quarantine on account of Japanese beetle.

until 9 A. M. It was found that this schedule of the inspectors reporting for work took care of the inspections in an excellent manner.

The Bridgeport platform was open from 6:30 A. M. until 5 P. M. with the exception of Saturday afternoons and Sundays. One man reported at 6:30 A. M. and worked his eight hour shift; the other man reported at 9 A. M. On the busy mornings, which occurred Mondays, Thursdays and Fridays, the foreman reported at 6:30 A. M., thus giving adequate service to the shippers. When periods were slack during the day he checked the inspectors at Norwalk and Stamford and took care of miscellaneous inspections elsewhere.

One man was stationed at the Berman and Steinberg commission house, Norwalk, while the other man was located at the S. Cohen and Co. commission house at Stamford, by arrangement. These men reported at 6 A. M. and worked eight hours. All inspections requested in those sections were referred to one of the two men. On quiet days these inspectors scouted the known infestations and the area surrounding them, to determine the increase in number of beetles present and their possible spread.

The inspector at the Shelton office took care of all miscellaneous inspections and was used as an extra on heavy days at the New Haven platform.

1. Inspection points, number of men employed, number of packages certified and number of beetles removed were as follows:

Place	Period operated	Hours per day open	Number of men	Packages certified	Beetles removed
Bridgeport	June 17–Sept. 24	10½	3	54,577	0
New Haven	June 21–Sept. 24	24	7	474,297	1
Norwalk	June 18–Sept. 24	8	1	23,996	0
Stamford	June 18–Sept. 24	8	1	3,299	3
Shelton	June 15–Sept. 24	8	1	412	0
			13	556,581	4

2. The number of packages of fruit and vegetables, and cut flowers certified in the regulated area of Connecticut, 1929, and the number of beetles removed were:

Article	Number of packages	Number of beetles removed
Corn	10,853	0
Beans	43,794	1
Peas	12,475	0
Lettuce	43,049	0
Vegetables with tops	88,790	0
Misc. vegetables	142,670	0
Misc. fruit	180,934	3
Bunches bananas	34,016	0
Boxes cut flowers	827	0
Total packages	557,408	4

3. The number of bales of hay, straw and sphagnum moss certified for shipment from the regulated area of Connecticut during 1929 were:

Office	Bales hay	Bales straw	Bales moss	Total bales
Shelton	178	80	0	258

4. Roads posted with quarantine signs, 1929, 66.

5. During the farm products quarantine, a total of 22 men were employed in patroling the roads at the quarantine boundaries. See Plate XVII.

6. Number of vehicles carrying quarantined articles without certification.

Roads	June	July	August	September	Totals
Post Road at Branford	51	111	92	40	294
Middletown at North Haven	..	16	16	1	33
Meriden at North Haven	3	37	21	9	70
College Highway at Hamden	17	30	32	..	79
Bethany at Woodbridge	2	28	12	5	47
Waterbury at Seymour	9	14	26	13	62
Bethel-Easton	5	22	12	..	39
Wilton-Ridgefield	4	1	..	..	5
	91	259	211	68	629

7. Number of vehicles bearing quarantined articles intercepted at the quarantine line each month and the season total.

Roads	June 18-30	July 1-31	August 1-31	September 1-14	Totals
Post Road at Branford	242	1,558	1,597	403	3,800
Middletown at North Haven	..	98	69	12	179
Meriden at North Haven	8	962	1,153	249	2,372
College Highway at Hamden	48	500	641	114	1,303
Bethany at Woodbridge	22	387	295	77	781
Waterbury at Seymour	67	468	430	123	1,088
Bethel-Easton	53	280	292	..	625
Wilton-Ridgefield	..	123	91	18	232
	440	4,376	4,668	996	10,380

Inspection of Nursery and Ornamental Stock

1. Within the quarantined area are 119 classified establishments having 642,280 square feet of glass and 1,333 acres of nursery stock.

2. Plants certified for shipment each month.

Jan.	Feb.	Mar.	Apr.	May	June	July
70	299	85,812	110,082	89,952	155,270	48,162

Aug.	Sept.	Oct.	Nov.	Dec.	Total
15,536	19,738	18,630	37,162	4,888	585,601

3. Diggings to determine grub infestations in fields, frames, or treated plots.

During the spring and fall of 1929, men were employed in making diggings to establish the fact whether or not any of the Asiatic beetle grubs were present in nurseries within the state.

Grubs were found in nurseries in the following towns:

Township	No. of grubs, *Aserica castanea*
Cromwell	25
Manchester	10
Mansfield	1
New Canaan	2
Southport	2
Total grubs found	40

4. During the season of 1929, 28 classified concerns decided to drop their classification because all of their business was within the regulated area.

Sand, Soil, Earth, Peat, Compost and Manure

1. Car loads of sand and manure certified for shipment out of the regulated area of Connecticut, 1929.

Sand	Manure	Total
360.5	136	496.5

2. The number of certificates issued on shipments of sand and manure.

Material	'A'	'F'	'G'	Total
Sand	609	3	51	663
Manure	84	..	..	84
	693	3	51	747

Summary

1. Average number of men employed in each different branch of the quarantine work at Connecticut office, each month, during the year 1929.

Shelton Office

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Scouting	0	0	0	0	0	0	20	29	8	0	0	0
Farm products	0	0	0	0	0	20	34	31	12	0	0	0
Nursery and greenhouse	2	2	2	4	20	17	8	10	8	21	20	5
Administrative	2	2	2	2	2	3	1	1	1	1	1	1
	4	4	4	6	22	40	63	71	29	22	21	6

2. Total number of each kind of certificates used on shipments of (A) nursery and ornamental stock, (B) sand, soil, peat, marl, etc., (C) manure, (D) hay and straw, (E) fruit and vegetables, and (F) cut flowers, in State of Connecticut from January 1 to December 31, 1929.

Kind	Farm produce	Cut flowers	Hay and straw	Nursery and ornamental	Sand, soil peat, etc.	Manure	Total
'A'	....	....	24	1,218	609	84	1,935
'B'	11,931	....	....	....	....	....	11,931
'C'	58	....	....	....	....	....	58
'D'	....	....	....	1,036	....	....	1,036
'E'	....	526	....	11,729	3	....	12,258
'F' blanks	....	....	....	193	....	....	193
'G'	....	301	....	489	51	....	841
'H'	5,678	....	....	....	....	....	5,678
	17,667	827	24	14,665	663	84	33,930

3. Articles certified, and number of beetles removed, in the State of Connecticut, January 1 to December 31, 1929.

Total packages farm produce	556,581	Beetles removed 4
" boxes cut flowers	827	
" bales hay and straw	258	
" plants certified	585,601	
" C. L. sand, soil, etc.	360.5	
" C. L. manure	136	

4. Total certificates lost or unaccounted for, 116.

5. Violation of Federal regulations totalled 26 in 1929; one case was prosecuted. The state prosecuted and obtained convictions in two cases, one for moving soil and the other for taking farm products out of the quarantine area without having the articles inspected or certified.

THE ASIATIC BEETLE: QUARANTINE AND INSPECTION

The discovery and spread of the Asiatic beetle, *Anomala orientalis* Waterhouse, has been described in preceding reports of this Station as follows: 1922, page 345, Plate XIV; 1923, page 291, Plate XX; 1924, page 294, Plates XXIV and XXV; 1925, page 309, Plate XI; 1926, page 252, Plates VII-XII; 1927, page 288; 1928, page 743; Bulletin 304; Bulletins of Immediate Information, Numbers 52, 53, 62 and 65. Bulletin 304 is the most complete account of this insect ever published, and the reader is referred to it for information regarding structure, habits and life history. Bulletin of Immediate Information No. 62 is more convenient if one desires information concerning treatment of lawns to prevent injury from the grubs.

A Federal quarantine, No. 66, was established and made effective March 15, 1929, on account of the Asiatic beetle, *Anomala orientalis* Waterhouse, and the Asiatic garden beetle, *Aserica castanea* Arrow. At this time the latter was not known to occur in Connecticut, but the former was known to be present in New Haven and West Haven. After the required legal notice, a public hearing was held at the Station on February 25, 1929, and the following quarantine order was issued. It became effective April 1, 1929:

State of Connecticut

Agricultural Experiment Station

New Haven, Conn.

Quarantine Order No. 22

CONCERNING THE ASIATIC BEETLE

The fact has been determined that the Asiatic beetle, *Anomala orientalis* Waterhouse, now occurs in the towns of New Haven and West Haven and it seems advisable to revise the regulations and the restricted areas. A public hearing regarding the matter was held in New Haven, February 25, 1929.

Now, therefore, I, William L. Slate, Director of the Connecticut Agricultural Experiment Station, under authority conferred by Chapter 31, Public Acts of 1927, do hereby proclaim the towns of New Haven and West Haven subject to the restrictive regulations of this quarantine.

Also, the movement of all quarantined articles designated in the regulations

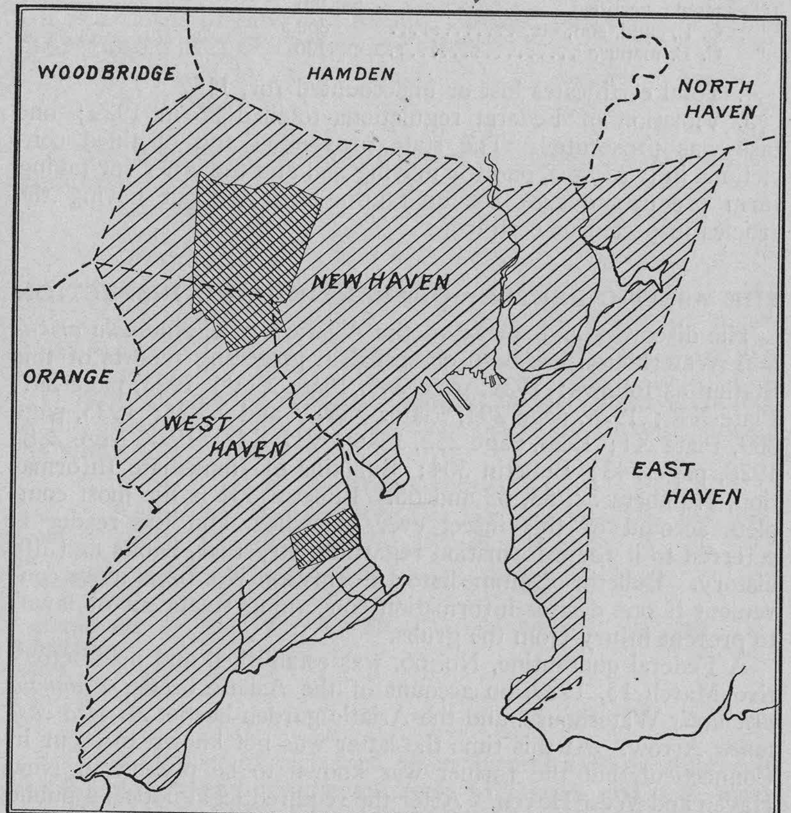

FIGURE 55. Map of New Haven and West Haven now under quarantine on account of Asiatic beetle. Darker shaded sections show infested areas, upon which additional restrictions have been placed by State quarantine.

supplemental hereto are further restricted from any point within the hereinafter designated control areas to other portions of the towns of New Haven and West Haven or to points outside thereof.

The following control areas are hereby designated:

Westville Area:—Bounded by Whalley Avenue, Blake Street, Ruby Street, Moreland Road, Ellsworth Avenue, Derby Avenue, Boulevard, Oak Street, Forest Road, Florence Avenue from a point about 400 feet west of Forest Road, in a straight line northward to West Prospect Street to Whalley

Avenue, and all territory within these boundaries, being partly in New Haven and partly in West Haven.

West Haven Area:—Bounded by Center Street, New Haven Harbor, Brown Street, and Campbell Avenue.

Until further notice the movement of certain articles and materials as designated below will not be permitted except where inspection or treatment is practicable and permits are issued by duly authorized agents of the State or the United States Department of Agriculture.

The articles and materials restricted during the entire year are as follows:

1. Sand, soil, earth, peat, compost and manure;
2. Nursery, ornamental and greenhouse stock, and all other plants;
3. Turf or sod trimmings, lawn or shrub clippings, ground litter, and weeds.

The articles and materials restricted only between June 15 and October 15, inclusive, are as follows:

1. Cut flowers.
2. Hay and straw (freshly cut).

The rules and regulations supplemental to Federal Quarantine No. 66, effective on and after March 15, 1922, or any subsequent amendments thereto, restricting the interstate movement of quarantined articles from the regulated areas, are hereby declared to be in full force and effect with respect to the intrastate movement of quarantined articles from the herein designated areas of Connecticut to portions thereof.

This order shall be effective on and after April 1, 1929.

W. L. SLATE,
Director, Connecticut Agricultural Experiment Station.

Approved:
JOHN H. TRUMBULL, *Governor.*

It should be noted that the state quarantine, like the Federal quarantine, covers the entire towns of New Haven and West Haven, but the state quarantine places additional restrictions upon the particular areas in those towns that are known to be infested. These areas are shown approximately in Figure 55 and specifically in Figures 56 and 57.

On May 17, 1929, the Asiatic beetle was discovered in a small lawn at 57 Ford Place, Bridgeport. Later, infestations were discovered at 685 Orange Street, and at 45 Glen Road, in New Haven, and at the corner of Main Street and Second Avenue in West Haven, all three being outside the special areas formerly known to be infested, though within the towns of New Haven and West Haven, both of which are under state and Federal quarantine. The Bridgeport infestation is, of course, wholly outside any area quarantined on account of this insect.

During November and December, Mr. B. W. McFarland visited 50 towns and cities in the central and western portion of the state, outside of the area quarantined on account of the Japanese beetle, to ascertain whether any lawns in public parks, golf courses, or on private estates, had been injured during the season by white grubs. Mr. McFarland made inquiries of town officers, park superintendents, managers of large estates, and superintendents of golf courses. He also drove through the principal streets of these towns and cities and observed the condition of the lawns. Where any such injury had been reported or observed, he visited the localities and examined the soil for grubs. In a few places,

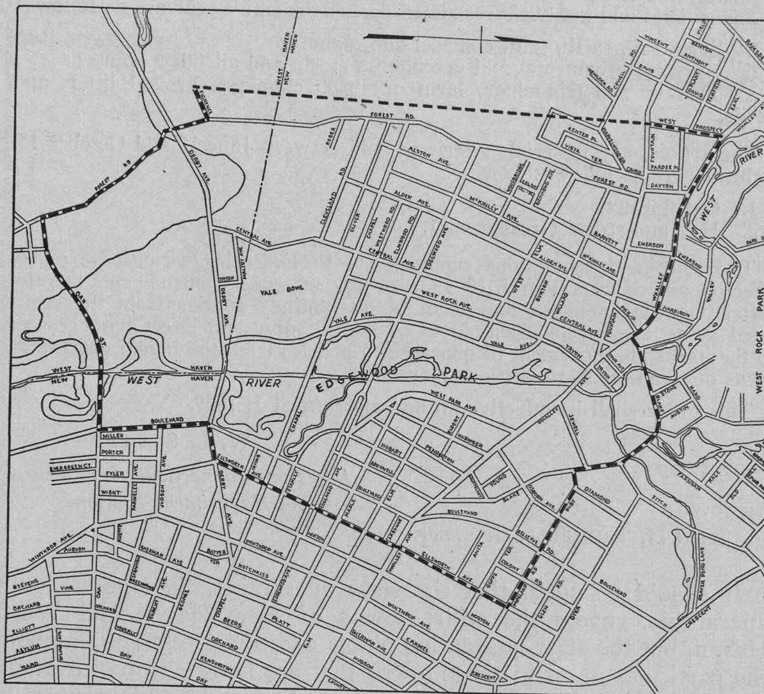

FIGURE 56. Map of the Westville section of New Haven. The area enclosed by dotted line is infested and under special State quarantine restrictions.

the grubs of May or June beetles, *Phyllophaga* sp., were found, but no evidence was secured of the presence of the Asiatic beetle.

The cities and villages visited by Mr. McFarland in this work are as follows:

Bantam	East Berlin	Marble Dale
Berlin	East Morris	Meriden
Bethel	Gaylordsville	Middlebury
Bethlehem	Georgetown	Middletown
Bridgewater	Hawleyville	Milldale
Brookfield	Hotchkissville	Morris
Brookfield Center	Kensington	New Britain
Cheshire	Kent	Newington
Cromwell	Litchfield	New Milford

New Preston	Ridgefield	Wallingford
Newtown	Rocky Hill	Washington
Northville	Roxbury	Watertown
North Woodbury	Sandy Hook	Wethersfield
Oakville	Sherman	Woodbury
Oxford	South Britain	Woodville
Redding	Southbury	Yalesville
Redding Ridge	Southford	

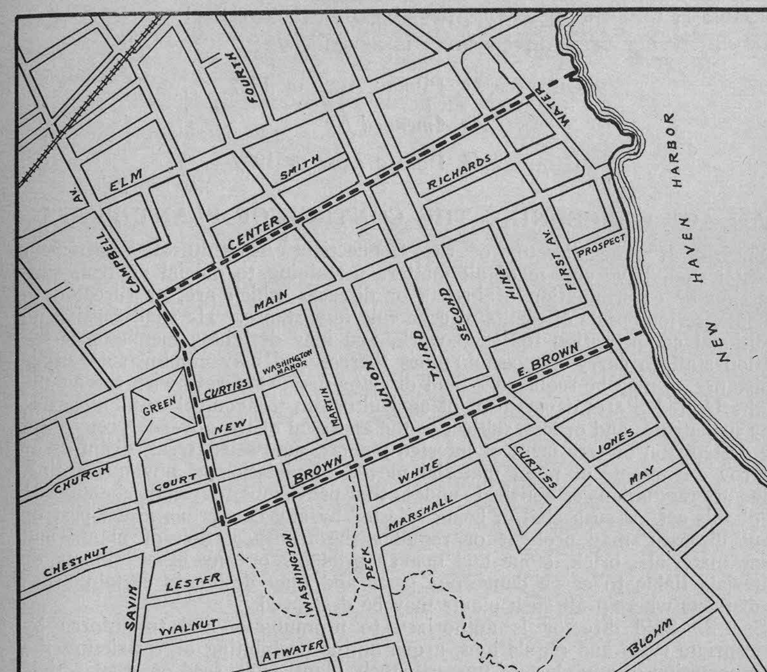

FIGURE 57. Map of section of West Haven. The area enclosed by dotted line is infested and under special State quarantine restrictions.

Mr. McFarland made 34 examinations on request, as follows:

Town	Number of examinations	Asiatic beetles found
New Haven	26	15
West Haven	6	2
Hamden	1	0
Milford	1	0
Total	34	17

Nearly all of these 17 places where Asiatic beetles were found were within the infested area. The first adult was found on June 22, and the last one on August 23. It is our plan to treat all of the outlying infestations with lead arsenate in order to kill the greatest possible number of beetles at the earliest possible date.

THE REVISED INSECT PEST LAW

At the 1927 session of the General Assembly, the insect pest law was revised in order to clarify its provisions and to give increased authority. In making the revision, the penalty clause was somehow omitted. Consequently, the law was again revised by the General Assembly of 1929. Slight changes were made in Section 1, and the penalty provisions were restored as Section 6. The entire act as it now stands is as follows:

CHAPTER 31, PUBLIC ACTS OF 1927

As Amended By

CHAPTER 45, PUBLIC ACTS OF 1929

AN ACT CONCERNING THE CONTROL OF PLANT PESTS

SECTION 1. The director of the Connecticut Agricultural Experiment Station shall have charge of all matters pertaining to official control, suppression or extermination of insects or diseases which are, or threaten to become, serious pests of plants of economic importance. He shall receive no additional compensation for such work, and may designate members of the station staff to carry out certain lines thereof and may employ such other assistance as may be required. Said director may coöperate with the agents of the United States department of agriculture in the control of plant pests; may make rules and orders, subject to the approval of the governor, regarding the destruction or treatment of infested plants; may seize, treat, disinfect or destroy any plants or plant material moved in violation of any quarantine, rule or regulation established under the provisions of said chapter 31 or of this act, or suspected of being infested by any dangerous insect pest or plant disease; may prohibit or regulate the transportation of plants and plant materials, brick, stone and quarry products or any other objects or materials liable to carry dangerous pests and may designate certain areas or districts wherein all such plants may be destroyed.

SEC. 2. Said director is authorized to promulgate, and to enforce by appropriate rules and regulations, a quarantine prohibiting or restricting the transportation of any class of nursery stock, plant, fruit, seed or other article capable of carrying any dangerous plant disease or insect infestation with reference to which the secretary of agriculture of the United States has not determined that a quarantine is necessary and established such quarantine, into or through this state or any portion thereof from any other state, the District of Columbia or any part of such state or said district in which said director shall have found such plant disease or insect infestation to exist.

SEC. 3. Said director is authorized to make rules and regulations for the seizure, inspection, disinfection, destruction, or other disposition of any nursery stock, plant, fruit, seed or other article capable of carrying any dangerous plant disease or insect infestation, a quarantine with respect to which shall have been established by the secretary of agriculture of the United States, and which have been transported to, into or through this state in violation of such quarantine.

SEC. 4. Said director may establish and maintain a quarantine against any premises, district, town or group of towns in this state, provided, before any quarantine shall be established within the state, a public hearing shall be held, of which a five days' notice shall be given to the parties affected, either by mail or by publishing such notice in two newspapers having a circulation in the part of the state affected by such quarantine. Said director, or any person authorized by him to enforce the provisions of this act, may, at any reasonable time, enter any public or private premises in the performance of his duty.

SEC. 5. Any person aggrieved by any order of quarantine issued under the provisions of this act may appeal to the superior court, or to any judge thereof if said court shall not be in session, and said court or such judge may grant such relief or issue such order or judgment in the premises as to equity may appertain.

SEC. 6. Any person interfering with any person in the performance of his duty under the provisions of said chapter 31 or of this act or violating any quarantine or any other rule or regulation established under said provisions shall be fined not less than five dollars nor more than one hundred dollars.

SEC. 7. This act shall take effect from its passage.

Approved April 10, 1929.

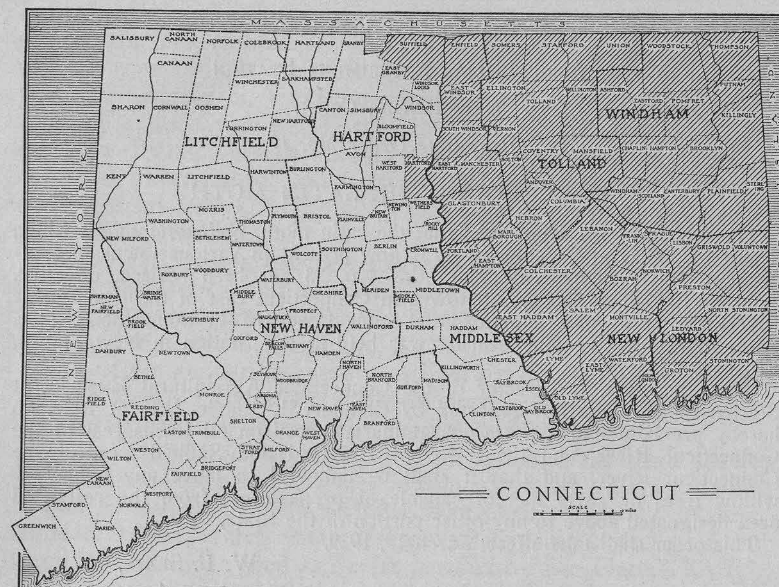

FIGURE 58. Map of Connecticut. Shaded portion is now under State and Federal quarantine on account of the satin moth.

SPREAD OF THE SATIN MOTH

In the report of this Station for 1926, page 264, is a brief account of the satin moth, *Stilpnotia salicis* Linn., and its occurrence in Connecticut. At that time it had been discovered in the towns of Stonington and Thompson, which had been placed under Federal quarantine. Illustrations showing the caterpillars and winter cases of the satin moth may be found on Plate XXI.

This insect feeds chiefly upon willows, but also attacks poplars, sometimes defoliating them. The caterpillars are often seen feeding with gipsy caterpillars and the writer observed such conditions in southeastern New Hampshire last June.

During the winter of 1928-29, state men examined trees in different parts of the state while scouting for gipsy moth eggs, and found the pest to be well scattered over the eastern portion of Connecticut. Also the towns of Hartford and Suffield, west of the Connecticut River, were found infested. Federal Quarantine No. 53 was therefore revised to include these two towns and all territory east of the Connecticut River, effective January 1, 1929. A public hearing regarding a state quarantine was held at the Station February 25, 1929, and the following quarantine order issued:

STATE OF CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Quarantine Order No. 19

CONCERNING THE SATIN MOTH

The fact has been determined that the satin moth, *Stilpnotia salicis* Linn., a pest of poplar and willow trees, is now present in various towns in Connecticut, and that Federal Quarantine No. 53 has been revised, effective, January 1, 1929, to include all towns in Connecticut east of the Connecticut River, and the towns of Hartford and Suffield, west of the Connecticut River. After due notice a public hearing was held at the Station in New Haven, February 25, 1929.

Now, therefore, I, Director of the Connecticut Agricultural Experiment Station under authority conferred by Chapter 31, Public Acts of 1927, do hereby proclaim that a State quarantine is placed on all towns east of the Connecticut River, and the towns of Hartford and Suffield west of the Connecticut River, and that it shall be unlawful to move any poplar or willow trees or parts thereof capable of propagation, from the restricted area designated above to any other portion of the State.

This order shall take effect March 15, 1929.

W. L. SLATE,
Director, Connecticut Agricultural Experiment Station.

Approved:
JOHN H. TRUMBULL, *Governor.*

The quarantined area is shown in Figure 58. Late in 1929, state scouts reported that the satin moth had been observed in the following additional five towns: Burlington, Farmington, New Britain, Newington and West Hartford. These towns have not yet been placed under quarantine. The satin moth quarantine really amounts to an embargo and shipments of willow and poplar out of the quarantined area are prohibited, it being almost impossible to detect the winter cases. Consequently inspection and certification are not attempted.

THE ASIATIC GARDEN BEETLE IN CONNECTICUT

***Aserica castanea* Arrow**

In the summer of 1928, Mr. Harold C. Hallock of the Federal Bureau of Entomology, stationed at Westbury, Long Island, N. Y., visited New Haven and while walking with Dr. R. B. Friend across the Yale College campus, picked up a dead beetle, which he identified as *Aserica castanea* Arrow. Of course the origin of this beetle was unknown.

A Federal quarantine was established, effective March 15, 1929, covering certain portions of New York, Pennsylvania, and Virginia, and the entire State of New Jersey. Connecticut was not affected by this quarantine because no infestation of living insects of this species had then been discovered in Connecticut. Mr. McFarland was detailed to scout for this beetle evenings around lights on the Yale campus and on August 6, he collected two adults. Another found in New Haven, July 17, was sent in. Mr. Johnson's men carried on similar scouting for beetles in Bridgeport, Bristol, Canaan, Cromwell, Fairfield, Hartford, Middletown, Meriden, New Britain, North Manchester, Putnam, Stafford Springs, Stamford, Torrington, Wallingford, Willimantic, and Winsted and found no beetles. One adult was found in a Japanese beetle trap in New London.

During 1929, Japanese beetle scouts made diggings for grubs in various nurseries, and *Aserica castanea* grubs were found in the following towns: Cromwell, 25; Manchester, 10; Mansfield, 1; New Canaan, 2; and Southport, 2.

Both adults and grubs were identified by Mr. R. J. Sim, of the Japanese Beetle Laboratory at Moorestown, New Jersey. Hence, it is certain that this insect now occurs within the state.

In superficial appearance, this beetle resembles the other species of the genus *Serica,* from which it was separated. *Serica sericea* Ill. and *S. parallela* Casey perhaps most closely resemble *Aserica castanea* Arrow, which when discovered injuring lawns on Long Island was first identified as *Serica parallela*. See Plate XXVI, b.

The beetle is about three-eighths of an inch long, cinnamon brown, dull, the wing-covers well-marked with shallow grooves or striae. The beetles fly at night and are attracted to electric lights; they also feed at night and hide in the soil around the bases of the plants or under rubbish, where they pass the daytime.

The grubs live in the soil and feed upon grass roots, much like the grubs of the Japanese beetle and the Asiatic beetle. The beetles feed upon many kinds of plants, including aster, barberry, bean, cherry, chrysanthemum, currant, dahlia, geranium, catalpa and coniferous seedlings.

Control measures are: Spray with lead arsenate, three pounds in 50 gallons water, plus two pounds of flour, to kill the beetles;

lawns should be treated with lead arsenate, using about three pounds per 100 square feet mixed in the upper three inches of soil, to prevent injury from the grubs.

MOSQUITO CONTROL IN CONNECTICUT IN 1929

R. C. Botsford

The General Assembly, at its last meeting, increased the budget for mosquito control from $7,500 per year to $12,500 per year. This became necessary on account of the addition of about 3,000 acres of ditched salt marsh acceptable for maintenance by this Station. Our estimate showed that $15,000 per year was necessary to maintain properly all acceptable areas, but our request for this amount was not granted. It was therefore impossible to clean up all areas this season.

The new appropriation became available on July 1, and at this time a new plan of maintenance was put into practice. This plan was described in Bulletin 305 of this Station, which contained the report of mosquito control work for the season of 1928. The western district crew was supervised by Nicholas Matiuck; the central district by C. F. Johnson; and the eastern district by Albert Lindquist. Auto transportation was provided for each crew on a mileage basis. Areas under state maintenance were inspected by the Deputy in Charge, and all new ditching was laid out under his direct supervision.

All salt marsh areas that had been newly ditched or completely overhauled within the past five years were patrolled, and all necessary cleaning and spur ditching was done to prevent mosquito development. There remain some areas in Branford, Guilford, and Madison where reditching is necessary. This is being done as rapidly as funds will allow.

Twenty-seven towns in Connecticut contain salt marsh areas; 10 are completely ditched, nine partly ditched, and in eight no ditching has been done.

Work done under contract by Mr. John F. Ross consisted of ditching on Great Island, Old Lyme, in the spring. This utilized a $5,000 appropriation made by the town in 1928.

The town of Old Lyme appropriated another $5,000 in 1929. Work stopped December 24 after cutting 68,366 feet, making the total footage in Old Lyme 214,581 feet. The town of Hamden appropriated $2,500 and 68,357 feet of ditches were cut before freezing weather stopped the work. The large salt marsh at East River in Madison, which has been in bad condition for some time, was completely recut on contract, 148,506 feet of 10 x 24 ditches being remade.

In reviewing the activities of the past five years, we find 11 towns have expended a total of $50,000, representing a total of 2,000,000 feet of new ditching. In the towns of Stamford, East Haven, Branford, and Norwalk, the work was an expansion of ditched area. Westport, Hamden, Westbrook, Saybrook, Old Lyme and East Lyme were new in mosquito elimination work.

For data concerning all towns, the reader is referred to the following tabulation:

Status of Connecticut Salt Marsh Areas, 1929

Town	Salt marsh areas	Salt marsh ditched	Maintained by State	Total cost of ditching	Labor, cost maintenance, 1929	Labor, cost to complete ditching
Greenwich	200	200	none	$22,000.00	......	......
Stamford	300	300	300	3,245.80	$231.20	......
Darien	300	300	none	3,800.00	......	......
Norwalk	600	600	600	7,500.00	427.86	......
Westport	400	400	400	5,913.82	340.30	......
Fairfield	1,200	1,200	1,200	8,400.00	842.46	......
Bridgeport	173	....	....	......	......	$ 3,000.00
Stratford	1,315	....	....	......	......	20,000.00
Milford	630	....	....	......	......	9,500.00
West Haven	463	222	222	......*	891.46	3,500.00
New Haven	750	750	675	12,000.00	264.53	750.00
Hamden	571	250	250	4,210.17	......	1,000.00
North Haven	310	....	....	......	......	3,100.00
East Haven	545	300	300	3,747.52	119.92	1,300.00
Branford	895	895	895		304.21	......
Guilford	1,085	1,085	1,085	20,000.00	1,208.78	......
Madison	1,315	1,315	1,315		5,233.97	......
Clinton	785	677	500	10,000.00	215.60	2,000.00
Westbrook	500	500	500	7,428.14	136.30	......
Old Saybrook	1,373	186	186	2,000.00	448.00	13,000.00
Lyme	493	....	....	......	......	7,500.00
Old Lyme	1,393	300	300	5,364.52	296.25	7,700.00
East Lyme	424	130	130	1,480.60	176.60	4,000.00
Waterford	204	....	....	......	......	3,500.00
New London	34	....	....	......	......	500.00
Groton	304	50	50	1,000.00	10.35	4,000.00
Stonington	555	....	....	......	......	8,500.00
Totals	17,117	9,660	8,908	$118,098.57	$11,147.79	$92,850.00

Mosquito Control in New Canaan

In New Canaan, an inland town, effective anti-mosquito operations were carried out this year. This movement started on September 27, 1922, when a Red Cross Mosquito Committee was formed, composed of Prof. W. H. Burr, and Messrs. W. E. Swift, G. A. Suter and W. T. Cox, secretary. A preliminary report on mosquito breeding conditions around New Canaan was made by Mr. Walden of this Station in May, 1923, at the request of this committee. From time to time inspections were made and reports submitted concerning mosquito breeding conditions within a radius of one and one-half miles of New Canaan center.

* Ditched with New Haven.

In 1927, a local committee, composed of Messrs. Merrill F. Clarke, Wilmot T. Cox, George A. Suter and Archibald E. Stevenson requested and received an appropriation of $1,000 from the town of New Canaan and the best of coöperation from the town officers, especially Mr. George T. Smith, First Selectman.

This fund was used for oiling the worst breeding places within the central area. The results were so gratifying that a larger sum was appropriated late in 1928, to be expended the following season. In 1929, the committee requested the Station to appoint an expert on mosquito control, who would also be a special deputy with some authority, to supervise the treatment work, study all local mosquito breeding conditions, collect and identify mosquitoes, and submit a complete report. In other words, the committee wished to set an example which might be followed with profit by other towns having similar problems. New Canaan was to be considered an outdoor laboratory for the study of the local mosquito problem and this deputy was expected to inaugurate tests and trials, and make recommendations looking toward its solution. To this special position the Station appointed Mr. Raymond F. Hart, who had served for two summers as a mosquito inspector of the Health Department of the City of New Haven. The report of Mr. Hart follows.

To Dr. W. E. Britton, State and Station Entomologist of the Connecticut Agricultural Station; and to Mr. George T. Smith, First Selectman of the Town of New Canaan.

GENTLEMEN:

I submit, herewith, my report of the season's work in mosquito control in New Canaan, conducted under the supervision of the Connecticut Agricultural Experiment Station. This work covered a period from April 13 to September 14.

The number of mosquito breeding places found totals 70. The most important place, because of the heavy breeding there, was the filter beds. Mosquito larvae in extraordinary numbers were found there several times during the summer, and each time the beds were oiled before the larvae could hatch into mosquitoes. In May, a few pupae were found in two of the beds; but these beds were dry in a few days. In June, another bed was found breeding slightly, and this was treated. Then in July, there was heavy breeding in all the beds on two occasions, necessitating oiling. Once again in August and once in September, there was heavy breeding in all the beds, and they were oiled. Once in the latter part of July and again in the early part of August, there was slight breeding in one bed, and oil was applied. In two concrete holes near the chlorination house, heavy breeding was discovered once in June and twice in July, and these were treated similarly. A water pipe near the beds was also oiled in July. The proper way of preventing mosquitoes from breeding in the filter beds would be to run them on a definite schedule, so that each bed would be systematically drained every eight or ten days. Allowing three or four days for each bed to dry out, the bed would have water in it for only five or six days, and this period would not be of sufficient duration to allow the mosquitoes to hatch, the time necessary for a mosquito to pass from the egg to the adult stage being from seven to ten days. Since the limited capacity of the filter beds did not permit this procedure, oiling became necessary.

The place next in importance in breeding was along the edges of the Five Mile River, below the point where it receives the effluent from the filter beds. Very heavy breeding was found in the middle of June, and breeding to a lesser extent in July, August, and September, once each month; each time the edges of the river were oiled.

A description of the 68 remaining breeding places is as follows:

Thirty were ponds and pools, of which 19 were oiled, two were treated with a larvacide, and nine did not require oiling, because they had but few larvae and were in isolated localities; 14 were swamps and marshes, of which eight were oiled, and six did not require oiling; 10 were streams and brooks, of which seven were oiled, two dried up, and one was in an isolated spot; three were the hoofprints made by cattle, and were oiled; two were catch basins in the roadside and were oiled; two were ditches in the road, which were oiled, and later were found dry; one was a hole among the rocks on the edge of a pond; this was oiled; one was an isolated hole in the woods with only a few larvae; one consisted of two wooden tanks, one in the stables of a barn, the other in the ground behind the barn; they were both oiled; one was a tub for catching the overflow water from a well; the water was emptied from the tub; one was a hole in the ground next to a tennis court; this dried up; one was a well with one or two larvae dipped up in the bucket; one consisted of the notches in a wooden beam of a broken-down mill.

Of the 70 breeding places, 26 were Anopheles—malarial—breeding places, evenly distributed about the town. Of these 26 there was heavy breeding in only eight. These eight places were as follows:

The bird sanctuary duck pond. Several Anopheles larvae were found in May, but the hole dried up; heavy Anopheles breeding was found in July, and the pond was oiled; the pond dried up the latter part of July, and remained dry until September.

Swampy land off Ponus Ridge. Several Anopheles larvae were found in hoofprints in June; these were oiled, and drainage ditches dug. In August many Anopheles larvae were found in the stream running through; this also was oiled.

Dickerman pond off River Street. Several Anopheles larvae were found on three occasions in June, July, and August—once each month—and the edges of the pond were oiled.

The smaller Rae pond on Stamford Road. Anopheles larvae were found in July on two occasions, and the edges of the pond oiled; in the latter part of August, the pond dried up, and remained dry until September.

Pinkham pond on Ponus Ridge. Anopheles larvae were found in July and August, and the edges of the pond were dusted with a mosquito larvacide.

A small pool on Jelliff Mill Road, opposite Jelliff's Mill. Many Anopheles larvae were found the last week in July, and the pool was oiled; thereafter, there was no breeding.

A ditch on the Renner property off Marvin Ridge Road. Many Anopheles larvae were found early in August, and the ditch was oiled; thereafter, there was no breeding.

The smaller pond on the Lapham place. Anopheles larvae were found during the middle of August, and the pond was oiled; afterwards it dried up.

Of the remaining 18:

Nine were ponds, of which five were oiled, and four did not require oiling.

Seven were streams, of which five were oiled, one dried up, and one did not require oiling.

Two were small swampy areas, of which one was oiled, and the other did not require oiling.

All but a few of the back yards within a one-mile radius were inspected for breeding. There were 36 back yard breeding places found, 31 of which were within a one-mile radius. All of the breeding places found were eliminated. There are approximately 31 blocks within the one-mile radius, making an average of one breeding place per block. On one side of Summer Street in the same block, there were five different yards with receptacles breeding mosquitoes; on one side of Harrison Street, there were four such yards.

Night catches for the purpose of catching and identifying mosquitoes were made at 17 different places. These night catches were of 15 minutes duration. At eight places, no mosquitoes were caught; at eight, one mosquito was caught; and at the other, eight mosquitoes were caught. Of the 18 mosquitoes caught, seven were *Anopheles punctipennis,* one was *Anopheles quadrimaculatus,* five were *Mansonia perturbans,* the irritating mosquito, one was *Aedes sylvestris,* the swamp mosquito, one was *Culex pipiens,* the house mosquito, and three were imperfect specimens, which could not be identified. *Anopheles punctipennis* were caught at five out of nine places.

Of 30 mosquitoes caught in the day time, 13 were *Culex pipiens,* six were *Orthopodomyia signifer,* the white-lined mosquito, four were *Aedes canadensis,* the woodland pool mosquito, four were *Aedes triseriatus,* the tree-hole mosquito, one was *Aedes sylvestris,* and two were imperfect specimens, which could not be identified.

Of 96 mosquitoes hatched, 57 were *Culex pipiens,* 21 were *Anopheles punctipennis,* 17 *Aedes canadensis,* and one *Aedes sylvestris.*

The results show *Culex pipiens* as the predominating mosquito, with *Anopheles punctipennis* second, and *Aedes canadensis* a close third. *Orthopodomyia signifer* is a fairly rare species in Connecticut; *Aedes triseriatus* is also rare.

Most of the *Anopheles* mosquitoes found were *punctipennis.* One *quadrimaculatus* was taken in a night catch. *Anopheles punctipennis* was the most abundant mosquito in the town next to *Culex pipiens,* as might be expected from the high number of Anopheles breeding places, 26 out of a total of 70.

Towards the latter part of the season, experiments were made with *Fundulus heteroclitus,* the common killifish, which is effective in salt-marsh mosquito control work, to see if it could be used in an inland town. Many of these fish were put into 11 ponds about the town.

Experiments were also made with *Rhinichthys astronasus,* the black-nosed dace, a fish prevalent in New Canaan waters. The purpose was to ascertain whether it would eat mosquito larvae. Larvae put into a barrel with the dace disappeared by the next day. The same results followed with larvae put into a jar with dace. Larvae also disappeared from a barrel that was breeding mosquitoes, after 25 or 30 fresh dace had been put in.

Larvae were also put into a pond with dace, and five days later Anopheles larvae were found in addition, an Anopheles mosquito having laid her eggs in the interval. Leaves found around the edges of the pond, which might shelter the larvae from the fish, rendered this experiment inconclusive.

On the whole, this season's experiments have not disclosed sufficient facts to draw definite conclusions about the usefulness of these fish in the work.

In closing, I wish to express my thanks to the members of the Experiment Station Staff, to the selectmen and other town officials, and to the members of the voluntary committee for their kindly aid and helpful suggestions; and to the people of New Canaan for their splendid spirit and willing coöperation.

Respectfully submitted,

RAYMOND F. HART,
Special State Deputy in Charge.

September 14, 1929

MISCELLANEOUS INSECT NOTES

European Pine Shoot Moth in Hamden: On May 21, Mr. Zappe collected some larvae of the European pine shoot moth, *Rhyacionia buoliana* Schiff., in shoots of the red pine near Lake Whitney. Adult moths emerged on June 14. See Plate XXV. [W. E. Britton]

Leaf Rollers on Rose: On May 27, some leaf rollers were collected from rose in the writer's garden and placed in breeding cages in the Station insectary. Adults emerged on June 12-15, and three species of moths were obtained. These were *Archips rosana* Linn., *Tortrix albicomana* Clem., and *Epiblema suffusana* Zell. See Plate XX. [W. E. Britton]

Strawberry Whitefly: During September, Doctor Garman brought to the office some strawberry leaves from a field in Branford where on several acres considerable injury had been caused by a whitefly. An examination of the leaves showed it to be the strawberry whitefly, *Trialeurodes packardi* (Morrill). The nymphs were all over the under sides of the leaves. It is a question what remedial measures in a large field will prove effective. The leaves are so close to the ground that spraying is impracticable. Possibly a strong nicotine dust or a cyanide dust could be used, but we have not given either a trial. [W. E. Britton]

Lyctus Beetles: On May 21, the writer had occasion to examine an ice-box in a private residence in New Haven from which adults of *Lyctus opaculus* LeConte were emerging in considerable numbers. This occurrence of these beetles was remarkable in that the ice-box had been in the possession of the family for eight years and no insects had been previously noticed. The wood, ash, was well varnished and there were no exit holes other than those being made at the time of the examination. The probability of the infestation having occurred since the ice-box was made is extremely remote. The adults oviposit in pores in wood, and a coat of varnish acts as a deterrent. [R. B. Friend]

Injury to Young Coniferous Trees by White Grubs: During the season of 1929, the young conifers in the nursery of the State Forester at Simsbury were severely injured by white grubs, *Phyllophaga* sp. The beds of Norway spruce were particularly affected, one-fourth to one-third of the trees in one bed being killed. These trees were two years old and had been transplanted once. When the nursery was examined November 5, the brown areas of dead plants were quite conspicuous. The grubs had eaten off all the small roots and the tips of the larger roots from these plants that were killed. At the time the examination was made, no grubs were present around the roots of the plants, but were found at a depth of about two feet in the soil. [R. B. Friend]

Kermes on Black Oak: In response to a request from the park department of the City of New Haven, several black oaks in East Rock Park were examined on August 12. Small branches on several of these trees were injured by a species of *Kermes*, possibly *Kermes galliformis* Riley. The females occurred in groups around the branches, see Plate XXIII, b, killing the plant tissue and causing it to become darkly colored and shrunken. This scale bears a superficial resemblance to a gall and has been frequently mistaken for such. With two exceptions all the species of *Kermes* occur on oaks and are commonly known as oak gall scales. It is the female sex which causes the injury to the trees; little is known about the biology of the males. [R. B. Friend]

Aphids on Ferns: In February, 1929, attention was called to a heavy infestation of aphids on Boston ferns in the Station greenhouse. These aphids proved to be the black fern aphid, *Idiopterus nephrelepidis* Davis. They feed almost entirely on the under surface of the older fronds. The leaflets were not curled and infested plants showed no direct evidence of injury. The species is a native of the tropics, and in this case was found on ferns recently purchased from a local dealer. See Plate XIX, b.

Sprays of nicotine sulfate with soap and pyrethrum soap at the usual dilution easily controlled this aphid. In spraying, care must be taken to cover the under side of the fronds, where the aphids feed. This can be accomplished by turning the pots on the side, or by use of a spray rod, which directs the spray material against the under side of the fronds. [Neely Turner]

Rose Midge in Greenhouse: In the report of this Station for 1922, page 372, is a note concerning the rose midge, *Dasyneura rhodophaga* Coq., which had injured rose plants in greenhouses in Greenwich. On November 26, 1929, Dr. Friend and Mr. Zappe visited a large rose-growing establishment in Guilford, where considerable injury had been caused by this insect on certain varieties in certain sections of the house. The maggots work in the buds, particularly the flower buds and deform the developing flowers, and the result is often a distortion and blackening of the tender shoots. The maggots enter the soil and pupate and the tiny flies or midges emerge later. It is not a destructive pest of roses out-of-doors. One of the best control measures is to cover the surface of the soil with a layer of ground tobacco, one-fourth inch in depth and to fumigate the house each night for a time, by burning tobacco stems or with one of the commercial nicotine preparations. [W. E. Britton]

Stalk Borer Infesting a Corn Field: On June 19, a report was received from the New Haven County Farm Bureau, that a farmer in East Wallingford was having trouble with borers in his corn that might prove to be European corn borers. Upon examining the field of about two acres, it was found that the insect was the common stalk borer, *Papaipema nitela* Guen.

The previous owner had a vineyard on this land, which had not been cultivated the past season. There were probably many large-stemmed weeds that had been infested with stalk borers. The present owner pulled out the grapevines in the fall and planted corn in the spring.

The corn was from four to six inches tall and the leaves were turning yellow with many of the tips curled and drying up as shown on Plate XXVII. A count of the plants in short sections of rows in different parts of the field showed from about 15 per cent to more than 50 per cent of the plants infested. The average infestation was estimated to be between 25 and 30 per cent. It was recommended that the owner pull out and burn the infested plants and replant the field. [B. H. Walden]

Injury to Golf Greens by Crambus Larvae: The grass on several of the golf greens of the Wampanoag Country Club at West Hartford was more or less severely injured by the larvae of a species of *Crambus* in the middle of the summer. When the greens were examined August 6, adults of *Crambus leachellus* Zincken were abundant, and it is assumed that this species was responsible for the damage. The injury consisted of small dead winding "lanes" each of which was caused by a single larva. The greens were in the process of being treated with lead arsenate as recommended for the control of the Japanese beetle, and those which had been treated showed little or no injury.

The injury by species of *Crambus* to sod land may be distinguished from that due to other insects by the presence of a web, which the larva spins as it works its way through the sod on or just below the surface. This injury usually passes unnoticed unless very severe. Fertilization of the land will minimize injury by promoting a vigorous growth of the grass, and the lead arsenate treatment as mentioned above should be effective. The biology and control measures of a closely related species, *Crambus trisectus* Walker, have been published by G. G. Ainslie in the United States Department of Agriculture Technical Bulletin 31, November, 1927. [R. B. Friend]

Grass Injured by White Grubs: On September 11, Mr. Johnson investigated a case of white grub injury at Stafford Springs, Conn. In an area of nearly 100 acres, about half of which was residential, and the rest containing a baseball diamond, a portion estimated at 20 acres had the roots eaten off so that the grass was dead and brown. The turf could be rolled up like a carpet as shown on Plate XVI. Ten specimens of grubs brought to the Station were identified by Doctor Friend as larvae of June beetles. Nine of them were *Phyllophaga fusca* Fröl., and the other was of the same genus though it is doubtful whether or not it is the same species. On September 19, Dr. Friend and Mr. Johnson visited two residences in the Buckingham section of Glastonbury. At one place white grubs had killed the grass on the front lawn and at the other, grass in the backyard had been killed. These grubs were all June beetle larvae, *Phyllophaga* sp. *Phyllophaga* larvae were also received from Salisbury, August 16. In most infestations of this kind, the greatest injury is caused by the nearly mature grubs, which soon transform and emerge as beetles. Three years are required for the complete life cycle, and though some beetles appear and some eggs are laid each season, they may have periods of great abundance and destructiveness, three years apart. It is generally best to cultivate infested fields, and to plow and reseed grass fields and remake lawns where injury occurs. [W. E. Britton]

The Pit-making Oak Scale: The pit-making oak scale, *Asterolecanium variolosum* Ratz., is locally abundant on chestnut oak, *Quercus prinus,* in Connecticut and frequently injures young trees severely. This insect is indigenous to Europe, where it is found on the British Isles and the Continent, but from its native home it has spread to many parts of the world, being reported from South Africa, New Zealand, New South Wales, Argentina, United States and Canada. Except for its occurrence on olive, reported in California by Essig, it confines itself to oaks. In Connecticut, this scale has been found on scarlet oak, chestnut oak, white oak, and English oak. In the woodland areas near New Haven, it is a serious enemy of young chestnut oak reproduction, often killing small branches or even the entire plant. On white oak it occurs frequently, but not usually in injurious numbers. On the imported English oak, an ornamental tree, it may be a serious pest. See Plate XXIII, a.

Certain natural agencies exercise more or less control over this insect. In America and Europe it is parasitized by the encyrtid *Habrolepis dalmanni* Wwd., and an attempt has been made to establish this parasite in New Zealand. In England, according to Newstead (Monograph of the Coccidae of the British Isles, Vol. I, 1901), it is fed upon extensively by the blue titmouse, *Parus caerulens,* during the winter, and to some extent by the long-tailed titmouse, *Acredula caudata,* during the same season. Artificial control measures should be effective where they are practicable. A dormant spray of lime-sulfur or oil emulsion is recommended. [R. B. Friend]

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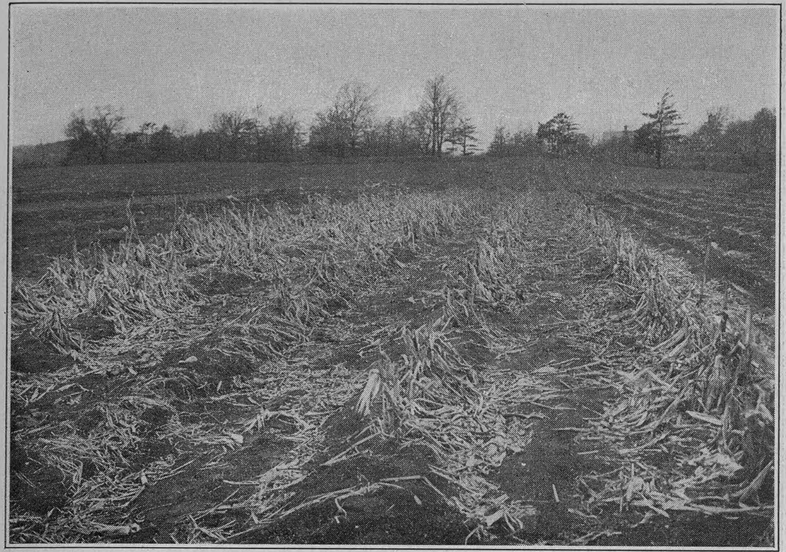
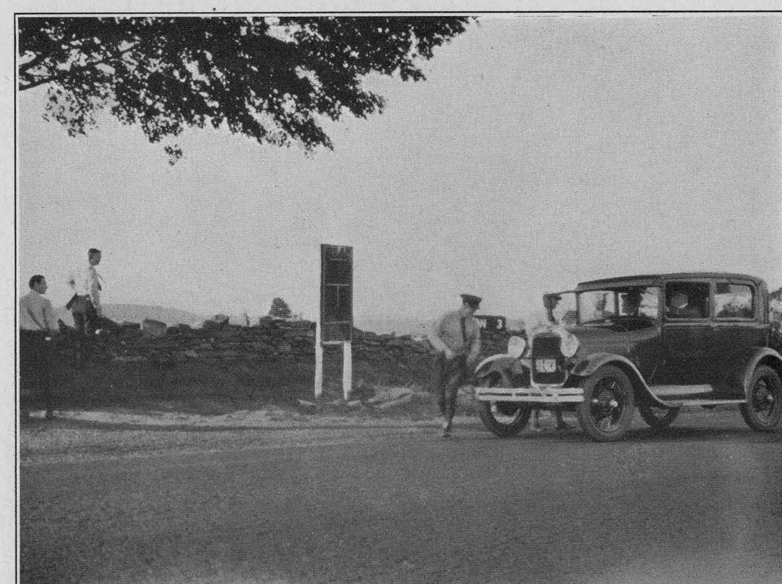


a. Sweet-corn patch in eastern Massachusetts heavily infested with borers. The stalks are so weakened by the feeding of the borers that they soon break over. (After Mass. Dept. of Agric.)

b. European corn borer road patrol station No. 12, Clinton-Madison town line, Post Road.

PLATE XIV

a. European corn borer road patrol station No. 5, Windham-Mansfield town line.



b. European corn borer road patrol station No. 3, Killingly-Brooklyn town line.

PLATE XV

a. European corn borer plowing demonstration, Branford.

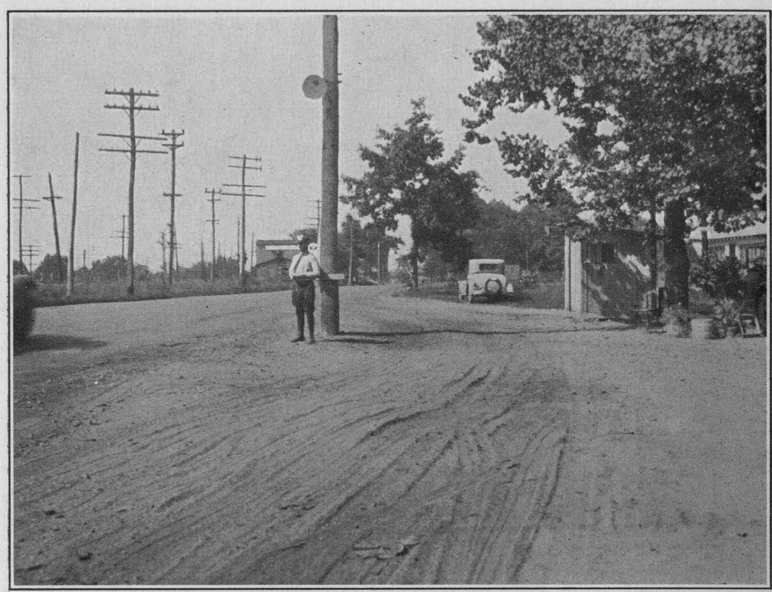
b. European corn borer plowing demonstration, Branford.

PLATE XVI

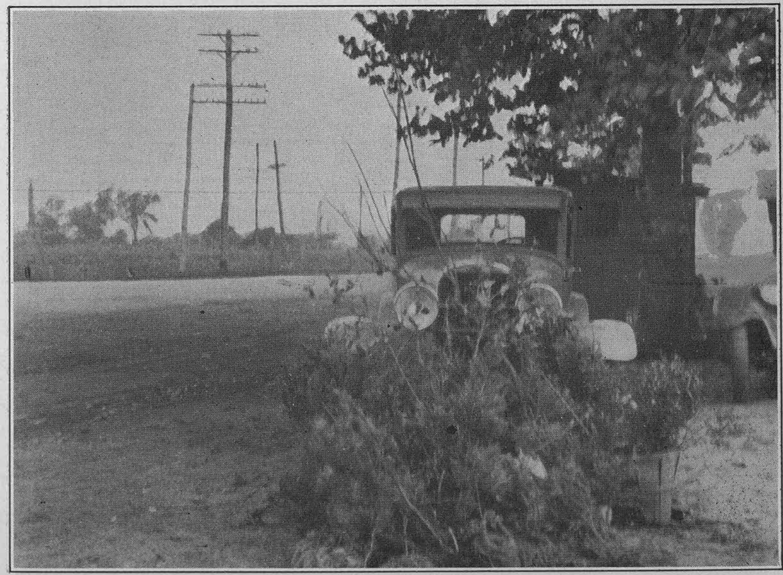
a. Lawn injured by white grubs, Stafford Springs.

b. Lawn injured by white grubs, Stafford Springs.

PLATE XVII



a. Japanese beetle road patrol station, Wallingford-North Haven town line.



b. Japanese beetle road patrol station, Wallingford-North Haven town line; uncertified nursery stock left at station.

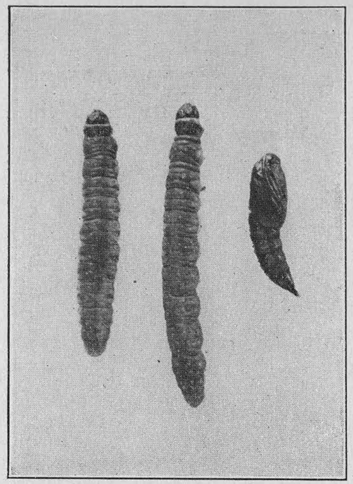
a. Japanese beetle treated area on grounds of Hartford Life Insurance Company, Hartford.

b. Japanese beetle treated area in adjoining yard, Hartford.

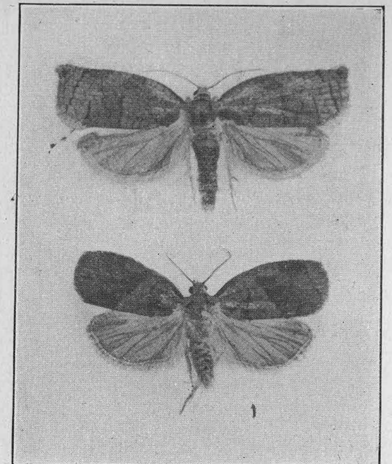
a. Unloading Japanese beetle traps, Hartford.

b. Aphids on fern in greenhouse, twice enlarged.

PLATE XX



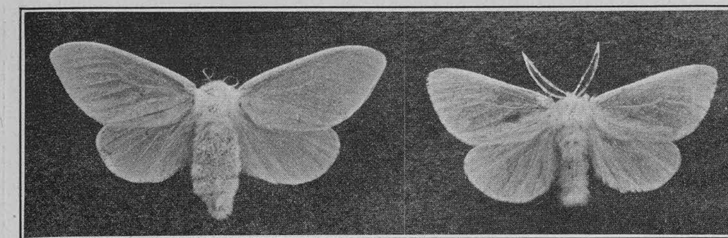
a. Leaf roller, *Archips rosana,* larvae and pupa, twice enlarged.



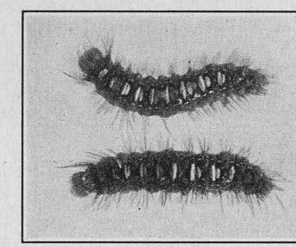
b. Leaf roller, *Archips rosana,* adult moths, twice enlarged.

c. Leaf roller, *Archips rosana,* injury to rose; natural size.

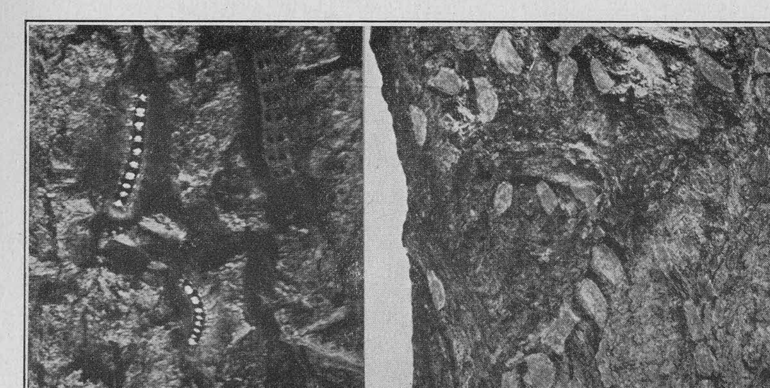
PLATE XXI



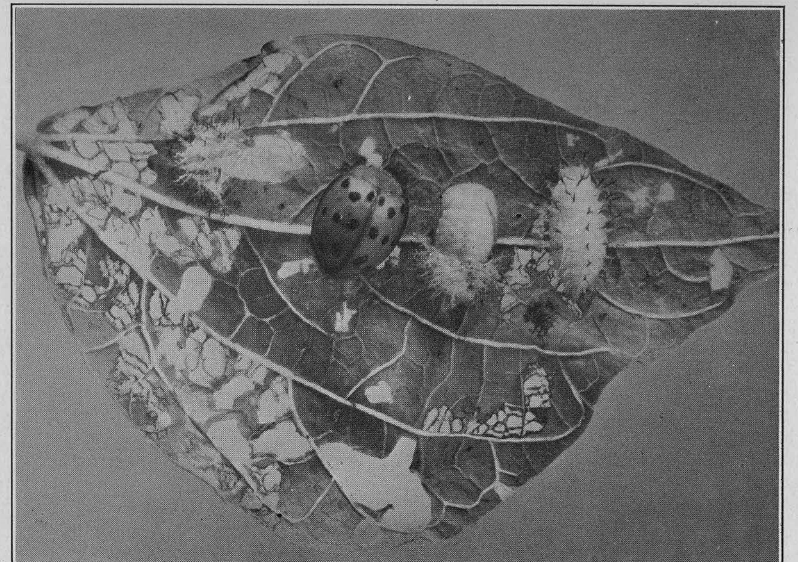
a. Female and male satin moths, natural size. (After Burgess and Crossman, Dept. Bull. 1469, U. S. Dept. of Agric.)



b. Satin moth larvae, natural size.

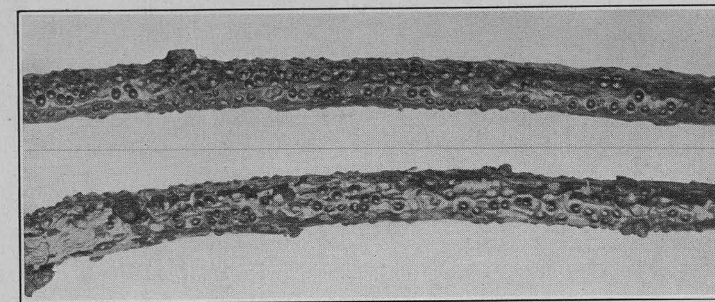


c. The satin moth. At left, caterpillars, and at right, winter cases. (After Burgess and Crossman, Dept. Bull. 1469, U. S. Dept. of Agric.)

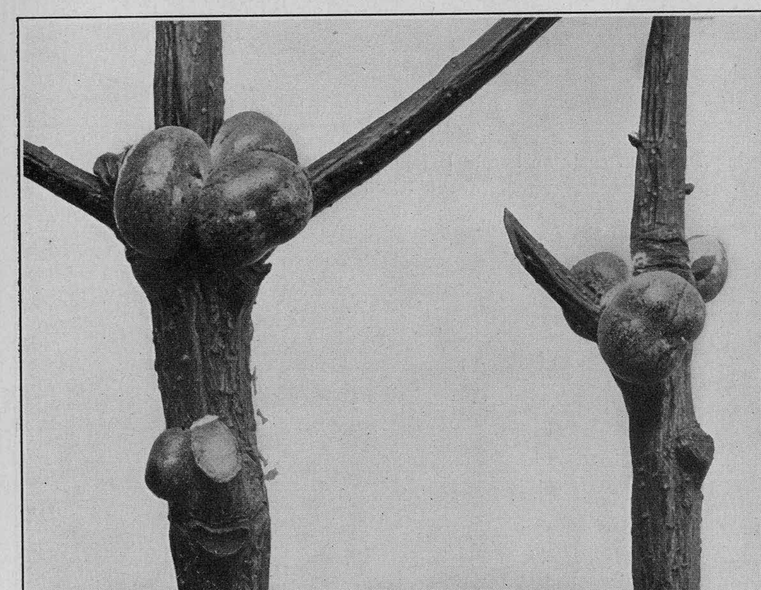


a. Mexican bean beetle, adult, pupa, larva, and injured leaf; twice enlarged.

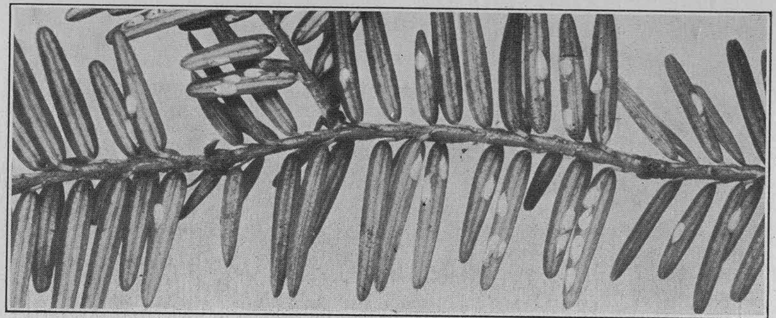
b. Mexican bean beetle adults, pupa, larvae, and injured leaf; natural size.



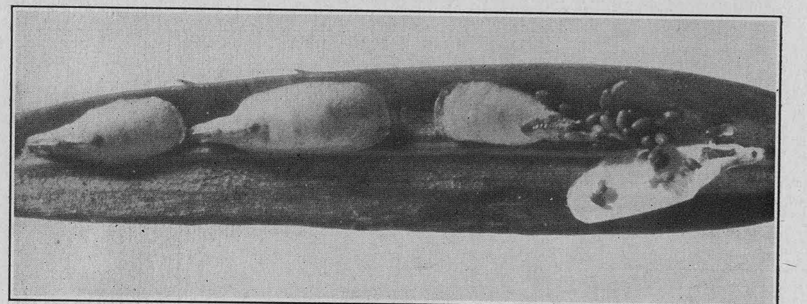
a. Pit-making oak scale, natural size.



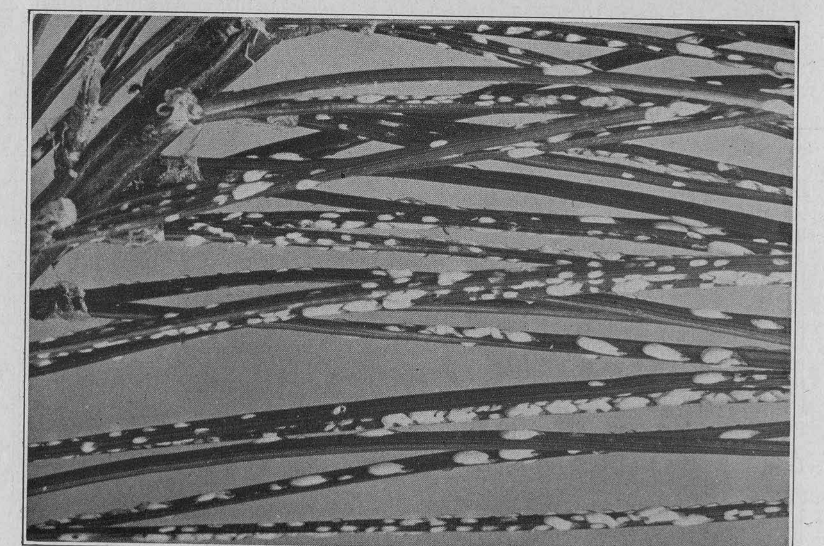
b. Oak gall scale on oak, twice enlarged.



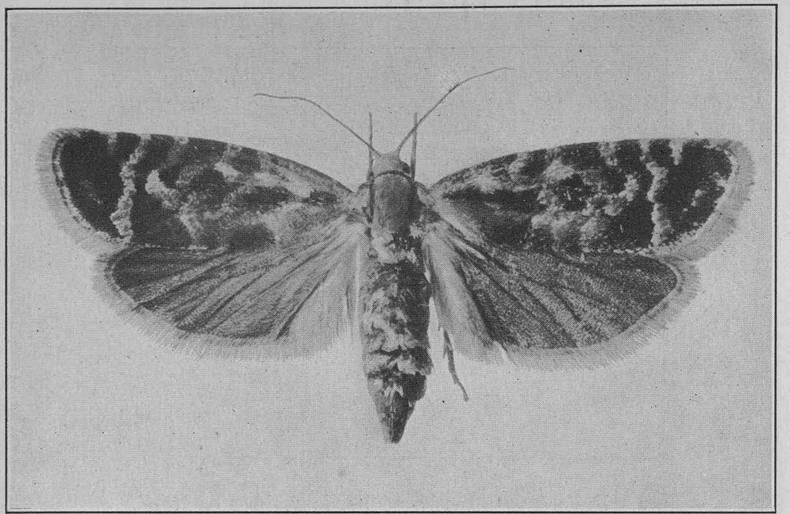
a. Pine leaf scale on hemlock, twice enlarged.



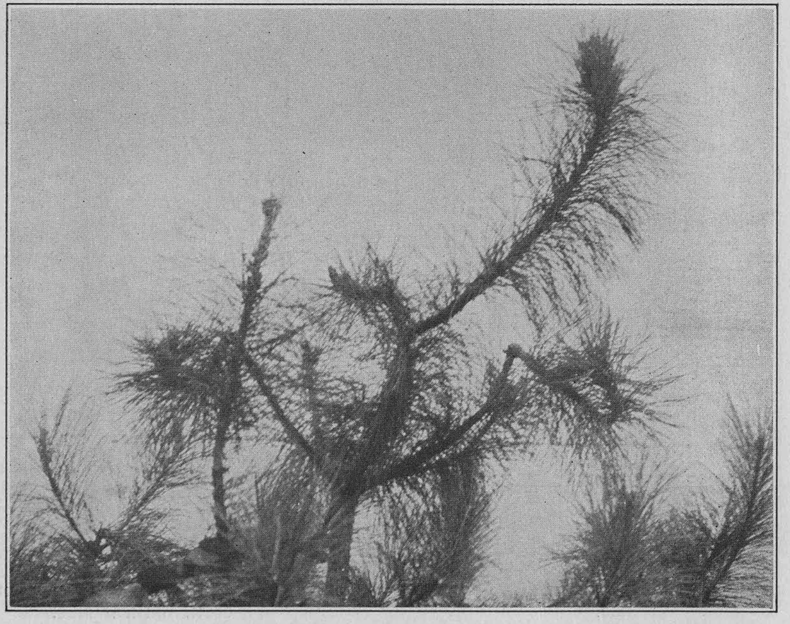
b. Pine leaf scale on hemlock, female shells showing eggs, ten times enlarged.



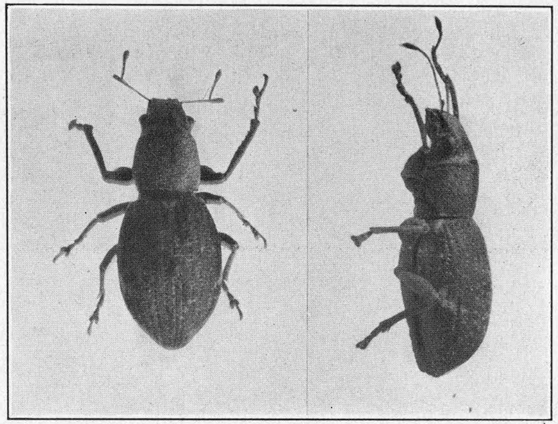
c. Pine leaf scale on pine, twice enlarged.



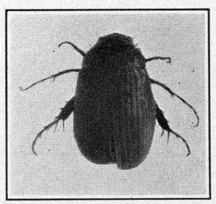
a. European pine shoot moth, adult, four times enlarged.



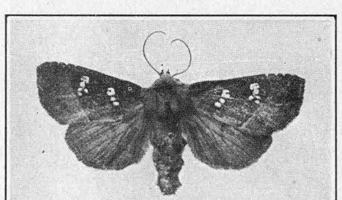
b. European pine shoot moth injury to red pine.



a. Fuller's rose beetle, adults, four times enlarged.

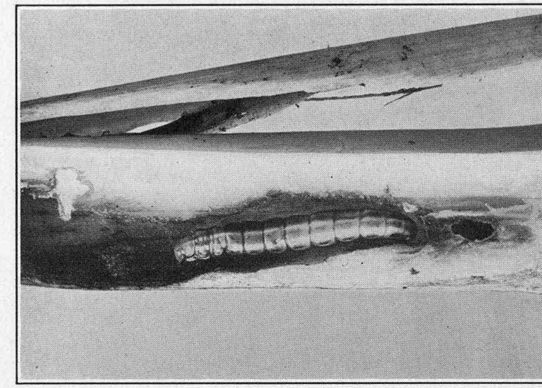


b. Asiatic garden beetle, twice enlarged.



c. Adult of stalk borer, natural size.

d. Immature stalk borer in corn, natural size.



a. Stalk borer larva in corn stalk, natural size.

b. Corn injured by stalk borer.

a. Mosquito breeding area at South End, East Haven, before ditching.

b. Same area after ditching and filling part of the foreground.

Bulletin 316 April, 1930

A MAPLE LEAF DISEASE CAUSED BY CRISTULARIELLA DEPRAEDANS

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FOREWORD

In the last twenty years the writer has paid particular attention to the diseases of trees in Connecticut. These have been of various types. First there was the chestnut blight which, soon after its discovery here in 1907, developed very rapidly and killed all of the chestnut trees, though the seedlings and sprouts from the old stumps continue to exist. Then came the white pine blister rust which requires Ribes for its alternate host but which proves a far more serious enemy to the white pine, especially in its seedling stage needed for natural reproduction in the pine areas. Very recently we have had to deal with the willow scab, which suddenly developed under unusually moist spring conditions, particularly in the northwestern part of the state, and has already killed many of the large shade trees of *Salix alba* var. *vitellina,* its most susceptible host. These diseases, except possibly the last, seem to have been imported.

There has recently been called to the writer's attention another disease, on maple leaves, new to the state and possibly to the country, that developed conspicuously in the fall of 1928. It had previously been reported only in Europe. This disease, however, unlike the others, is not likely to prove a serious trouble, since it has rarely been found and then only under unusually moist conditions and at a time in late summer when the injury is not so important as it would be earlier in the season. Dr. Deuber, of Yale, while working during vacation for the Bartlett Tree Expert Company at North Stamford, became interested in this disease and brought specimens to the writer, who started on its identification. Material was given to Dr. McCormick, of the Station's Botanical Department, and she eventually obtained in pure culture a fungus that has since been identified by Mr. Bowen as the cause of the maple disease. Mr. Bowen had in the meantime been assigned the study of this fungus, as a part of his work for a master's degree at Yale, under the writer and Dr. Deuber. Since part of Mr. Bowen's investigations were carried on at the Station, where he was later employed during the summer, it was decided to publish his results as a Station Bulletin.

G. P. Clinton.

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A MAPLE LEAF DISEASE CAUSED BY CRISTULARIELLA DEPRAEDANS

Paul R. Bowen

INTRODUCTION

On September 3, 1928, Dr. C. G. Deuber of Yale University and Mr. Francis A. Bartlett of the Bartlett Tree Expert Company noticed that the trees and seedlings of the sugar maple, *Acer saccharum* Marsh., in the woods across the road from the High Ridge Country Club at North Stamford, Connecticut, possessed an unusual appearance in their foliage. At first glance it was thought that this phenomenon was a sun-scorch wilt, since the leaves exhibited very soft areas, as if they had been scalded, but observation revealed tiny white fruiting bodies of a parasitic fungus on the under surface of the affected leaves. The attack of the fungus had been very sudden, as evidenced by the color of the foliage, since no yellowing or gradual decomposition had occurred. The wilted leaves, though green, had a grayish tinge in their badly infected portions, which was due to external mycelium. Wilting was so severe at the base of many of the leaf blades that the blades hung limp from the petioles. A slight shaking of the trees caused the infected leaves to fall freely.

Such rapidity of attack by the fungus appeared to be intimately connected with the weather factors during the last week of August and the first few days of September. Weather conditions recorded by Dr. Deuber for this period are as follows: "On August 22, it rained all day and every day for the next week. Foliage of all trees remained in good condition. August 29, 30, and 31, and September 1 and 2, were very hot days with high humidity. On the night of September 2, a cloud-burst occurred at North Stamford, and on September 3, it rained all morning."

It was suspected that the rainy week of August 22-29, followed by extremely hot, humid weather presented excellent conditions for the fungous attack upon the sugar maples. The leaves had

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Author's Acknowledgments. The writer wishes to acknowledge his indebtedness to Dr. G. P. Clinton and Dr. C. G. Deuber, whose direction of the work, constructive suggestions, and kindly criticism have made this publication possible. Thanks are given to Dr. Florence A. McCormick for her willing assistance and suggestions in the culture work; to Dr. H. Castle for his advice in most of the histological work; and also to Dr. A. A. Dunlap and Dr. R. P. Marshall.

become water-soaked, the temperature remained high, and the atmosphere continued to be very moist. Such conditions seemed to prove favorable for fungous activity, since seedlings, surrounded by a heavy overgrowth where the most humid condition existed, were found to be the ones most severely infected. Further discussion of the diseased condition of the sugar maple trees at North Stamford is made in a later section of this report.

HISTORICAL REVIEW

REVIEW OF LITERATURE

The organism causing the disease has been studied very little, and references to it in the literature are extremely few. This scarcity of knowledge is probably due to the fact that the malady is not of widespread occurrence, being recorded abroad in only England and Germany, and apparently never being reported before in the United States. The writer understands, however, that one or two botanists have recently observed it here, although no published accounts by these have been made. In the succeeding paragraphs the writer quotes in detail from the more important publications that have been made concerning its occurrence in Europe.

The disease was first described by Cooke (1) in 1885, in a group of short articles entitled, "Some Remarkable Moulds," read before the Quekett Microscopical Club. About six years before the reading of these articles Dr. Cooke had noticed, when in Norfolk, that several young trees of *Acer pseudo-platanus* L., growing in a damp plantation, presented an unusual appearance, from the flabbiness and decoloration of the leaves. He wrote, as follows: "The green leaves had become flaccid and rotten whilst still attached to the tree; the whole surface blotched with grayish spots, which were in many cases confluent over a great portion of the leaf. The under surface, under a pocket lens, was spotted with minute white points, like the head of a small pin. These points were most numerous on, and almost confined to, the veins of the leaf. Under the microscope, these minute points were found to be the globose capituli, or heads, of a small parasitic mould, scattered over the under surface of the leaf, with its delicate mycelium penetrating into the substance. The heads were loosely scattered, and not collected in tufts, almost wholly confined to the venation. The hyphae, or threads, were short, slender, flexuous, septate and swollen at the apex, where one, or three to four larger cells formed the basis of the globular head; around these large cells were clustered a number of smaller, elliptical cells, which again were surmounted by somewhat triangular, obtuse-cornered cells, and these divided at the apex in a furcate manner, each fork divided off as a globose hyaline spore. Each capitulum was, in its entirety, about one-tenth of a millimetre in diameter, and the spores 12 micromillimetres.

"Some leaves were placed under glass and kept moist for weeks, when a very peculiar phenomenon was presented, the formation of small black round sclerotia on the spots occupied previously by the mould . . . The parasite is undoubtedly an injurious one, extending speedily to every leaf on young trees, ..." To this parasite Cooke gave the name of *Polyactis depraedans* Cooke.

In 1886 Saccardo (7) made reference to the article cited above from Cooke, renamed the fungus under the genus Botrytis, and gave the following (translated) description for *Botrytis depraedans* (Cooke) Sacc.: "Grayish spots on leaves, determinate to confluent; hyphae white, ascending, septate, flexuous, simple, with oblong basidia-like cells at the apex, surrounded by an outer circle of bilobed cells; with capituli globuse, subcompact; conidia globose, hyaline, 12 micromillimetres in diameter. Discovered at Norfolk, England, infecting the foliage of *Acer pseudo-platanus*, which it destroys."

Cooke (2) in 1906, again referred to the disease as follows: "*Botrytis depraedans* (Cooke). First discovered on living leaves of *Acer pseudo-platanus* in a damp wood. Several young trees had nearly every leaf affected . . . Grayish spots were formed on the leaves, which were sometimes large and confluent. The threads were flexuous and septate, simple, crowned at the apex with elliptical basidia-like cells, ultimately two-lobed. The glomerules of conidia globose and compact. Conidia globose, 12μ diam. After the leaves had fallen to the ground, and lain for a short time, numerous minute black sclerotia were formed, the ultimate development of which was never ascertained. Certainly a most destructive pest, but it does not appear to have been recognized elsewhere, at home or abroad. This parasite has never been thoroughly investigated, and, as it has occurred so seldom, there has been no opportunity for experiment on remedies."

In 1908 Saccardo (8) described a new fungus, *Illosporium Diedickeanum* Sacc. The translation follows: "Leaf spots spreading, oftentimes confluent, grayish, more distinct on the upper surface, without a border; fruiting heads very small, somewhat flattened, compact, transparently white, more numerous on the upper side, loosely scattered, 130-160μ in diam., fastened only by one point, hence easily broken off; basidia spread out from an inner almost globular cell, 30-40μ in diam., oblong cylindrical or somewhat clavate, smooth or somewhat lobed, 30-40μ long and 14μ thick, apex obtuse, conidia occasionally somewhat roughened, globular or somewhat angular, single or clustered, 13-14μ long and 10-14μ

thick, and hyaline. On leaves of *Acer pseudo-platanus,* at Steigerwald near Erfurt, Germany, Oct. 1907 (H. Diedicke).—The small fruiting bodies are quite like insect eggs. The internal structure differs from Illosporium and needs further investigation. Basidia are oftentimes seen somewhat rough at the apex."

In 1912 the following brief (translated) account was given by Sydow (13) concerning *Illosporium Diedickeanum:* "This interesting fungus has hitherto only been known in Steigerwald near Erfurt. It was found on some trees in the park of Hohenschwangau, as well as on the Scharteweg, by Fussen, near the Tyrolean border. In both localities almost all leaves of the infected trees showed the fungus."

In 1916 von Höhnel (3) showed that *Illosporium Diedickeanum* was the same as *Botrytis depraedans.* He wrote (translated) as follows: "The author (Saccardo) in Ann. Mycol., 1908, **VI**, Bd., p. 563, Taf. XXIV, Fig. 9, described and showed this fungus, of which he had seen only the small fruiting heads (capituli), and has therefore erroneously understood and incorrectly characterized the same. It seems, therefore, that the fungus was already correctly described and classified by Cooke in 1885 as *Polyactis depraedans* [Journ. Quekett Microscop. Club, 2, Ser., II, Bd., 1885, p. 138 ff., Taf. X, Fig. 4, and Journ. Roy. Hortic. Soc., London, 1905, XXIX, Bd., p. 201 ff., Taf. XIX, Fig. 4 (n.g.)]. The fungus is, according to the original example in Sydow Mycoth. Germ. Nr. 950 and Nr. 1150 (from upper Bayern) neither an Illosporium nor a Polyactis, but a new Hyphomyceten genus which I call Cristulariella, and therefore name it *Cristulariella depraedans* (Cooke) v. H.

"This was found only on the under side of half decayed sycamore maple leaves. It appears only in such places, mostly in pallid spots, where the under leaf epidermis has been destroyed by other influences. On such places one finds in the spongy parenchyma, hyaline, thin-walled, septate, 4 to 8μ wide hyphae, mostly upright, some turned in all directions.

"Some of the hyphae ends appear on the surface and develop there straight, hyaline, 100 to 270μ long sporophores which above are 8-9, in the center 11, and on the swollen base 16μ thick The same are thin-walled and show mostly five septa, of which two are found underneath and the others more or less above. The sporophore develops above an almost round, up to 28μ wide, cell separated by a transverse wall, on which near the center, arranged in a circle, sit ten short single-celled, thin-walled, two-lobed cells, 15 to 20μ high and 12 to 15μ wide, with somewhat contracted bases.

"These bilobed cells grow in part into short and thick branched, coral-like formations, which separate further into two or three-

lobed side branches, which similarly branch. Sometimes they are rounded to about 20μ wide secondary cells, which behave in a manner quite similar to the central cell, only less plentifully. These develop also a coral-like, compressed, branch-system, which may, however, develop a pair of third lobes, which develop two to three-lobed outgrowths. From the last rounded lobes of the third and fourth orders arise finally the rounded, about 10μ large, hyaline, single-celled spores, which, as do all the branches and cells of the entire head, rest on a broad base and are separated only with difficulty.

"One understands this complicated structure of the spore head most readily when one places the same on a slide heated with caustic potash solution and subjects it to slight pressure. The branch system of the head then separates and lies in a circle around the large central cell. There is seen then mostly 10 secondary cells, each with its circle of one to two, two or three-lobed branched cell carriers with some smaller tertiary lobes surmounted by a few flaccid cells, which are cordate. The lumen of the individual cells and branches are separated from one another by transverse walls.

"The fungus cannot be considered as Cristularia (Syll. Fung. **IV**, p. 134), although it is nearly related thereto, on account of the little constricted base of the outgrowing spores, which are detached with difficulty, and the compact condition of the peculiarly constructed head."

Von Höhnel, following his description of *Illosporium Diedickeanum,* placed the fungus, as stated above, in a new genus. Cristulariella, and gave a brief description, which we translate as follows: "Cristulariella v.H. *n.g.* (Botrytidee). Parasitic Mucedineen, nutrient hyphae growing in the substratum. Fruiting hyphae upright, septate. Terminal cell large, spherical, with partially spherical, partially one to two short, two to three-lobed compact branched outgrowths, the branches of which are in part saccate. All the sac-like cells similar to the chief cell, have lobate outgrowths. Branches and cells are separated by cell walls. Spores spherical, single-celled, separated with difficulty, with a slightly narrowed base, sessile, borne singly on the tips of the ultimate branches."

SYNONYMY AND EXSICCATI

Von Höhnel in his article gave the synonymy of the fungus so completely that the writer has been unable to add others. The accepted name with synonyms and places of publication are as follows:

Cristulariella depraedans (Cooke) v. Höhn. Sitzungsber. Kais. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. I, **125**: 124. 1916.

Polyactis depraedans Cooke. Jour. Quek. Micr. Club. S. II, **2**: 141-142. 1885.

Botrytis depraedans Sacc. Sacc. Syll. Fung. **4**: 134. 1886.

Illosporium Diedickeanum Sacc. Ann. Mycol. **6**: 563. D 1908.

Discussion of the synonymy follows later. Apparently only two exsiccati specimens have been issued, as follows: *Illosporium Diedickeanum* Sacc. Syd. Mycoth. Germ. Fasc. **19**, Nr. 950. 1910. Ibid. Fasc. **23**, Nr. 1150. 1912.

These few references, which were the most important of those found, were mostly of a taxonomic character, describing the fungus that caused the disease. There were even differences of opinion among the writers, concerning the description and the placing of the species in the proper genus. Very little research on the life history of the fungus has been done, so that there lies open this new field of investigation, which the writer has undertaken to unfold in the short amount of time at his disposal.

MYCOLOGICAL INVESTIGATION

LEAF STUDIES

On September 28, Dr. Clinton and the writer visited the region where the disease was first discovered, in order to observe the infected trees and seedlings, and to collect diseased leaves to be used for study. When Dr. Deuber and Mr. Bartlett discovered the fungous disease on September 3, leaves exhibiting the beginning stage showed circular, flaccid, grayish spots about one millimeter in diameter. Activity of the fungus influenced by favorable environmental conditions caused these spots to increase in size and finally merge, thus producing large, irregular, wilted portions, which covered quickly the entire area of many of the leaf blades.

By the last of September, due to much drier weather, activity of the pathogene had practically ceased. The flaccid, grayish areas of the leaves had now become grayish-brown and withered. Many of the blades cracked or were broken away from their points of attachment to the petioles. Infection had invariably followed the veins. A dropping out of the holonecrotic areas in time was common. Premature defoliation was distinctly evident, being most obvious among the tender seedlings.

On the surface of the leaves were scattered white, ball-like structures, scarcely visible to the naked eye, which resembled very much in appearance insect eggs. These structures appeared sessile, but under the microscope they proved to be fruiting heads, each borne on a short, minute stalk or sporophore. The heads were irregularly globular, somewhat flattened, and composed of rather compact cells. The sporophores were attached to very delicate mycelial threads scantily growing on the surface. Some of the fruiting bodies appeared on the dorsal side of the leaves, but the majority were situated on the ventral side. They were sparse on some leaves and quite abundant on others, depending upon the degree of infection. Most of the fruiting bodies were located in the holonecrotic areas, but occasionally a few appeared on the adjoining green portions, which indicated that these portions were infected, but not badly enough to show plesionecrosis.

At Hurd Park, Conn., on October 10, leaves of the silver maple, *Acer saccharinum* L., were found having the same pathological condition. The blades contained grayish-brown, parched areas, but in the majority of leaves these areas were small, circular, and single, in contrast to the great number of large splotches found on the sugar maple leaves. The fruiting bodies in the necrotic regions were abundant on the top side of the leaves and rare underneath, a dissimilar condition to that of the sugar maple leaves. Adjoining green areas showed a few fruiting bodies. It seemed that the silver maple leaves were more resistant to the disease, because infection in general was neither so serious nor as widespread as it was on the leaves of sugar maples.

On October 17, at the Cathedral Pines in Cornwall, Conn., leaves of *Acer saccharum* were also found exhibiting pathogenic characteristics like those observed on the trees at North Stamford. On the same host in a ravine of the Tunxis Forest at Hartland, Conn., the disease was seen again on October 24, but the fungus was rarely in fruit on the infested leaves.

The abundance of fruiting bodies found in the grayish-brown areas and in adjoining green areas of the leaves of both species collected, and also their prominence on the dorsal and ventral surfaces for the two kinds of infected areas, are as follows:

Acer saccharum: Fruiting bodies more abundant in grayish-brown areas, few on dorsal surface, several on ventral surface; less abundant in adjoining green areas, less on dorsal surface, more on ventral surface.

Acer saccharinum: Fruiting bodies very abundant in grayish-brown areas, many on dorsal surface, very few on ventral surface; few in adjoining green areas, few on dorsal surface, very few on ventral surface.

The character of the region in which this disease was first seen at North Stamford is shown in Plate XXIX, made from a photograph by Dr. Deuber. Plate XXX illustrates the early stages of infection of the leaves of both *Acer saccharinum* and *A. saccharum,* while the later stages of injury to *A. saccharum* are seen in Plate XXXI. Through the courtesy of the officials of the Kew herbarium, Cooke's type specimen of this disease was loaned to the Experiment Station, and a photograph made of it by Dr. Marshall is shown in Plate XXXII.

CULTURE STUDIES

In order to study the organism causing the disease an attempt was made to obtain pure cultures. Sections of leaves of *Acer saccharum* approximately .5 centimeter square, each having a fruiting body on its surface, were washed in a 4 per cent formaldehyde solution and plated on oat and malt agars. Within two or three days each leaf section was covered with a copious growth of fine, downy mycelium. Transfers were made to slants of oat, potato, malt, and peptone agars, and rapid growths of the fungus resulted.

In the many transfers, vegetative growth was always rapid and abundant, consisting of fine, long, hyaline hyphae of variable but narrow widths, and exhibiting Y-shaped branching, and very few septa. All cultures were repeatedly studied in an attempt to find spores, but these rarely appeared. Later it was found that these were cultures of a Pestalozzia and, although apparently not connected with the disease, usually readily appeared in the attempts to isolate the real fungus, *Cristulariella depraedans,* which was usually crowded out by the Pestalozzia and so difficult to obtain.

At the time the disease was discovered at North Stamford, Dr. Deuber at the Bartlett Tree Research Laboratories had attempted to get cultures of the fungus. Small pieces of infected leaves were placed on agar media, and in a very few days fungal growths appeared. These cultures were sent to the Botanical Department of the Connecticut Agricultural Experiment Station for examination. There was present in all the Petri dishes the same rapidly growing fungus, exhibiting large, fluffy mycelial masses, as was obtained by the writer and previously described. Dr. Florence A. McCormick, plant pathologist of the experiment station, on examination of the cultures made by Dr. Deuber, found in one of the Petri dishes a different fungus that had previously been overlooked. This fungus was exceedingly delicate in contrast to the rapidly growing organism previously obtained, and it appeared to be very weak in mycelial production and extremely slow in growing. Dr. McCormick attempted to get this delicate, slow-growing fungus in pure culture. Failure to obtain a culture was probably due to the fact that the Petri dish cultures, made by Dr. Deuber, were rather old and the media on which they were growing had become somewhat dry. However, from diseased leaves collected at the Cathedral Pines in Cornwall, October 17, Dr. McCormick obtained cultures of the slow-growing parasite, which she kept growing during the time the writer was studying the rapidly growing fungus that he had obtained from infected leaves collected at North Stamford. The cultures of the writer and those secured by Dr. McCormick were compared, and were found to be entirely different. The mycelium of Dr. McCormick's cultures in contrast to that of the mycelium of the other cultures was larger in width, shorter in length, and formed a more limited growth.

Since it was unknown at the time which of the two fungi had caused the infection of the sugar maple leaves, pure cultures of both were kept in active growth throughout the winter. This was done not only to study the two fungi, but with the object of using each for inoculation purposes in the spring on newly developed leaves, in order to ascertain which was the causal organism. It was thought, at this time, that perhaps one was parasitic on the other. The writer was given cultures of the slow-growing organism (Plate XXXIIIa) by Dr. McCormick,[1] and the following experiments with them were begun.

Fungous growths in Petri dishes from cultures B were produced, in which a very small number of spores was found. Thinking that perhaps differences in the degree of thickness or thinness of the media might have something to do with the formation, location, and appearance of the spores, the writer inoculated another group of Petri dishes containing media of various depths. Results indicated that the degree of thickness or thinness had no apparent effect on the cultures, only that the ones growing on the thicker media produced better vegetative growths that lasted for a longer period of time, due probably to the fact that more food was available. Eventually, an abundance of spores was produced in both groups of Petri dishes. Spore production was slow in starting in all cases.

The mycelium in the surface of the agar, in Petri dishes inoculated with cultures B, developed a very interesting but singular activity in all the media used. Very characteristic eight-sided crystals, ranging in width from 8-15 microns, were produced in the agar. Plate XXXIVb.

Other Petri dishes with media of different depths were each inoculated with cultures A and B, to see whether the presence of the two fungi had any influence on each other. The fact that neither organism produced any effect upon the other seemed to indicate that no parasitism existed between them.

Further tests were made by inoculating test tubes of the various kinds of media used with cultures B. After several days all colonies had formed spores, production being greatest on potato agar, malt agar, and green bean pods. Growth of mycelium was best on potato agar, oat agar, and green bean pods, and was always more rapid and abundant on media having a high moisture content, indicating that the natural condition for infection in nature was probably a very humid atmosphere. On agar with a low water content vegetative growth was small, but spore production was hastened. Growth appeared sooner in the tubes kept in the

[1] For convenience the first cultures studied by the writer will be called cultures A (Pestalozzia), and those procured from Dr. McCormick will be designated as cultures B (*Cristulariella depraedans*).

dark than it did in those placed in the light, and seemed to be a little better. More spores were produced in the cultures left in the dark. The presence of the fungus caused the media to harden. In the older cultures black sclerotia were formed. Plate XXXIIIb, c. Potato and peptone agars were darkened by the fungus.

Externally, the fungus, cultures B, on culture media consisted at first of small, thick, rather compact, oval bunches of short, ascending, delicate hyphae. These circular, convex bunches on converging formed a dense, cottony mass whose surface was irregularly bulbous.

Microscopically, the mycelium of cultures B was hyaline, thin walled, 4-7 microns in width, sparingly branched, abruptly sinuous, with many septa. The numerous fruiting heads appeared different from those found on the surface of diseased leaves. Plate XXXIVa. They were smaller, loosely compact, composed of a cluster of basidia-like cells, from which was borne on the upper extremity of each, a small, globular conidium, 2-3 microns in diameter. Plate XXXIVb. The entire cluster rested on a larger, somewhat globular cell-like structure which was the enlarged end of the short fruiting hypha, that had become divided off by a transverse wall. The fungus, therefore, when produced on artificial media appeared to belong to the section Cristularia of the genus Botrytis as given by Saccardo.

HISTOLOGICAL STUDIES

Besides studying the two fungi, designated as cultures A and B, the writer decided to study the internal anatomy of infected leaves to help him determine which of the two fungi caused the infection. In order to do this, it was necessary to prepare and study permanent slides of diseased leaf tissues. At the time the writer collected diseased leaves at North Stamford, Hurd Park, and the Cathedral Pines, he prepared leaf sections, and the procedure for those made from diseased leaves of *Acer saccharum* from North Stamford is given below.

Pieces of the diseased leaves about .25 centimeter square were cut in the following manner: 50 from the necrotic, grayish-brown regions, each containing a fruiting body; 50 from areas where the infected portions came in contact with green areas that in all respects seemed healthy except for the presence of a few fruiting bodies; and 50 from areas that looked perfectly normal, taken far from the visibly infected portions. Fifty sections were also made from leaves of trees of the same species having no infection.

These leaf blade sections were killed and fixed in chromo-acetic acid and imbedded in paraffin. Sections, cut 10 and 16.6 microns in thickness, were stained with Pianeze IIIb, according to Vaughan (20). A study of the prepared slides of the four different groups of sections was made. Results for the groups are as follows:

1. Necrotic, grayish-brown regions. Differential staining was not at all pronounced. This was due to the fact that infected host cells reacted differently to the dye than did the cells of healthy leaf tissues, in the fact that they did not become green, but took on a more or less pink appearance, which was very similar to the color of the stained fungous mycelium.

The delicate mycelium was found mostly on the surface, which had given the grayish appearance to the infected areas. In the majority of sections fungous activity had partially disintegrated the epidermis; whereas in others the epidermal layer was completely missing. The small number of hyphae that penetrated the leaf was, for the most part, directly under the epidermis and had caused the epidermis to split off or to become loosened from the adjoining tissues. Mycelial threads, short and slightly undulating, were thin walled, septate, 4-7 microns wide, and appeared mostly curved upright, but a few strands wandered in various directions, and had broken down some of the palisade and spongy cells.

The sporophores, each bearing a single fruiting head, were turned upright to the surface of the leaf. They were simple and varied in height, the average length being 150 microns. The fruiting heads irregularly globose, somewhat flattened, 100-150 microns in diameter, presented on longitudinal section a complex structure. Plate XXXIVa. At the end of the sporophore there was a large cell, which was the swollen end of the hypha that had become divided off by a transverse wall. Produced on this basal structure was a dense ring of somewhat smaller, irregularly elliptical to club-shaped cells, which were slightly and irregularly short branched; four to six of these rings, with more or less bilobed cells terminating the upper and outermost ring, made up the compact head.

2. Infested portions in contact with green areas. The necrotic, grayish-brown areas here appeared like those described in the slides that contained leaf blade sections cut from these only. It was thought that the few fruiting bodies appearing on the green surface that adjoined the dead areas indicated that these seemingly healthy-appearing areas had mycelium from which the fruiting bodies came. The slides showed this to be true, for a few hyphae were found. Some of the tissues were slightly broken down. The fruiting bodies were like those described above. Staining appeared a little more differentiated. Host cells which were not affected as yet took on a green color, characteristic of normal leaf cells. It would seem that probably further growth of the mycelium, along with the possible secreting of acids or enzymes by the fungus, caused the tissues in these green regions to disintegrate, thus producing eventually necrotic areas.

3. Normal appearing areas on infected leaves. The normal appearing areas taken far from visibly infected portions were healthy, the leaf tissues stained green, all parts of the leaf were intact, and no mycelium was present.

4. Areas from healthy leaves. In the leaf sections made from healthy leaves all cells stained green, and were normal in position and arrangement.

Slides made with leaf sections cut from the infected sugar maple leaves obtained from the Cathedral Pines and from infected silver maple leaves collected at Hurd Park showed the same conditions as those from North Stamford.

CONCLUSION FROM STUDY OF LEAF SECTIONS AND CULTURES

A study of the prepared slides indicated that the mycelium of the organism that had injured the leaf tissues, appeared very much like that in cultures B and not at all like that of cultures A. Mycelial growth was usually scanty in the leaf tissues, and also rather sparse on the surface, which indicated a similarity in vegetative growth to that of cultures B. The hyphae appearing short, slightly undulating, thin-walled, septate, 4-7 microns wide, were also like those found in cultures B.

The fruiting bodies on the surface of the leaves, however, were different from those found in cultures B. The sporophores bearing the fruiting heads on the leaves were longer and wider than the fruiting hyphae bearing the spore heads in cultures B; those on the leaves being 100-150 microns long and 8-10 microns wide, and the fruiting hyphae in cultures B being of much shorter, variable lengths and practically the same width as that given for the mycelium in general, 4-7 microns.

The fruiting heads in the leaf sections, when under the low power of the microscope, in general appeared about as large as did those of cultures B under the high power. Those on the leaves (Plate XXXIVa) were globular, somewhat flattened, and subcompact, while those in cultures B (XXXIVb) assumed an irregular, more or less spherical form, and were loosely compact. The subcompact heads on the leaves were much more complicated than were the loosely compact ones in culture, in the fact that they were composed of more different kinds of cells and of a greater number. The clusters of cells making up both kinds of heads were produced on swollen ends of the fruiting stalks that had been partitioned off by cross walls. The cells composing the basal cluster of both kinds of heads were elongated, rather elliptical or club-shaped, but on those in the heads produced on the leaves was another cluster of irregularly branched, elongated cells, which in turn bore other similarly shaped cells, making four to six rings of cells to each head. The basal cells of the heads in cultures B did not bear other similar cells but produced globular conidia, 2-3 microns in diameter. The terminal cells on the heads found in the leaves were not strictly globular and not 2-3 microns in diameter, but were rather heart-shaped, measuring 10-12 microns in diameter.

A comparison of cultures B with the fungus found in the prepared slides of diseased leaf sections seemed to indicate that the organism in cultures B was the fungus that had caused the infection of *Acer saccharum* and *A. saccharinum* the previous fall. The fruiting heads of cultures B with their basidia-like, basal cells bearing conidia looked like those produced in Botrytis cultures; but because of the slow and scanty growths produced, and the kind of fruiting bodies appearing on the leaves, the writer hesitated to place the organism in the genus Botrytis.

COMPARISON WITH STATEMENTS OF OTHERS

At this time a review of the literature was made. From this it seemed that the fungus that had caused the disease of our maples was the fungus described by Cooke (1) in 1885 under the name of *Polyactis depraedans,* which was later changed to *Botrytis depraedans* by Saccardo.

Saccardo, at the time of the discovery of the disease in Germany, called the fungus *Illosporium Diedickeanum.* The exsiccati specimens of *Illosporium Diedickeanum* on *Acer pseudoplatanus* examined by the writer looked like the disease on the leaves collected in Connecticut, but according to the generic description of Illosporium and other species of Illosporium observed and studied, the writer does not see how it could be called an Illosporium. Saccardo, himself, makes a statement somewhat to the effect that it differed from a true Illosporium and needed further investigation.

Von Höhnel (3), who in 1916 was the last investigator of this fungus, according to the writer's knowledge, thought that it was neither an Illosporium nor a Polyactis (Botrytis), and placed it in a new genus Cristulariella. Description by von Höhnel of the fungus under the name of *Illosporium Diedickeanum,* which he changed in this same article to *Cristulariella depraedans,* agreed better than did the other descriptions with the fungus found in the leaf tissues by the writer. It seemed evident that the fungus in the diseased tissues of the infected leaves was the same as that described by von Höhnel.

Cooke's first description of the fungus indicated that he probably had as clear an idea as any of the early workers concerning the fruiting heads. However, von Höhnel better understood their complex structure. The conidia mentioned by Cooke were given as 12 microns in diameter. The spores produced in cultures B were 2-3 microns in diameter. Cooke, and von Höhnel as well, evidently mistook the outermost cells of the fruiting heads for spores. Apparently the true spores are rarely seen on these spore heads on the leaves.

To see whether spores were formed from the terminal cells of the fruiting heads, fruiting bodies were removed from leaves and placed in sterilized water in Van Tieghem cells. Within a few hours these terminal cells budded small conidia that were in size and shape like the spores produced in fungous growths in cultures B. Some of the conidia became detached and moved away from the terminal cells producing them, but in a short time other buds were formed, developing into conidia that were like the first ones produced. Some remained attached, and due to successive budding, short chains of conidia were formed on the fruiting cells. Many of the spores germinated while on the fruiting heads, since within a few days mycelium was found connected to the fruiting heads and extending in all directions from them. Measurements showed that the terminal fruiting cells were 10-12 microns in diameter, and that the spherical conidia were 2-3 microns in diameter. It appears from this that previous investigators were mistaken in calling the terminal cells conidia. In deciding on a name for the fungus the writer has called it *Cristulariella depraedans*. There is some doubt, however, as to whether a new genus should be made for it.

Further verification concerning the identity of the fungus was made. Cooke's type specimen of *Acer pseudo-platanus* (Plate XXXII), bearing on its lower surface a large number of fruiting bodies, was sent upon request from the herbarium of the Royal Botanical Gardens at Kew, London. This specimen was compared with the writer's diseased leaves of *Acer saccharum* and *A. saccharinum*, also with Sydow's exsiccati specimens, and the infected tissues and fruiting bodies were found to be identical. Two of the fruiting bodies were carefully removed from the English specimen, placed in a two per cent solution of potassium hydroxide to soften them and mounted in glycerin. Fruiting bodies were also removed from our pressed leaves of *Acer saccharum* and *A. saccharinum*. They were mounted in the same way as were those from the *Acer pseudo-platanus* specimen. All the heads examined appeared the same under the microscope.

It seemed certain then that the fungus found here in the diseased leaf sections was *Cristulariella depraedans*. The next step toward positive determination of its parasitic nature was to try inoculations with cultures B on growing maple leaves.

CHEMICAL TREATMENT FOR SHORTENING THE REST PERIOD OF POTTED MAPLE TREES

FORCING TREATMENTS

Work upon cultures B during the fall and early winter had progressed to a point where it was desirable to try inoculations upon growing maple leaves. Since the writer wished to make these inoculations before the regular spring leafing, forcing methods were tried in order to shorten the rest period of potted maple trees. The results of these forcing methods have been briefly reported by Deuber and Bowen (19). More complete methods and the results are given in this paper.

On October 13, the infested area at North Stamford was visited to observe the condition of the diseased trees, and to collect small trees for inoculation purposes. At this time defoliation of the infected trees was largely complete, as can be seen in Plate XXIX. Fifty small, diseased sugar maple trees from this area were secured, and transplanted to three to six inch pots in the greenhouse of the Marsh Botanical Garden, Yale University. On October 24, 50 small, healthy sugar maple trees were collected at Hartland, and potted in the same manner. Some of the transplanted diseased and healthy trees were placed outside. Others of both groups were left in the greenhouse. Complete defoliation of all the potted trees, both in the greenhouse and outside, occurred within a few weeks. From all appearances the trees had entered their normal rest period.

In order to break this dormant period and induce leafing, so that inoculations might be tried on living leaves, a series of chemical stimulation experiments was started on December 1. Ethylene chlorhydrin treatments, as used by Denny and Stanton (17, 18) for breaking the rest period of pot-grown woody plants, were followed in these investigations.

The trees were subjected to the vapors of ethylene chlorhydrin in an air tight galvanized iron can of 121.5 liters in volume. This can was kept in the preparation room of the greenhouse at temperatures of 10-18 degrees centigrade. Two concentrations of the ethylene chlorhydrin were employed, 10 and 20 milliliters for the 121.5 liter can, or one and two parts per 12,150 parts of air. A piece of cheese-cloth placed at the top of the can was moistened with the liquid ethylene chlorhydrin to provide for the volatilization of the vapors around the trees. The length of exposure of the trees varied from one to twelve days.

Trees subjected to the vapor treatments were of both the healthy and diseased groups of those kept in the greenhouse and out of doors. Checks or control plants of each were maintained. After exposure to the gas the trees were removed to the greenhouse at a temperature of 16-22 degrees centigrade, and observations were made of the time required for the leaves to unfold. The appearance of some of the trees several weeks from the time of vapor treatments with untreated checks is shown in Plate XXXVa. Plants left out of doors and not treated were placed in the greenhouse at the time that those of the same group were removed from their vapor treatments.

RESULTS OF FORCING TREATMENTS

Data for the various groups, from December 1 to March 1, concerning the number of check plants, the number of plants exposed to the gas, the time and periods of treatment, and the date of leafing were recorded. Results were tabulated to March 1 to see whether an actual forcing had been obtained. From the middle of March untreated trees left outside and in the greenhouse began to leaf. Tables 1-3 give condensed data concerning the treatments and the results obtained.

TABLE 1.[1] RESULTS OF THE FIRST AND SECOND TREATMENTS WITH ETHYLENE CHLORHYDRIN IN FORCING HEALTHY TREES OF *Acer saccharum* INTO LEAFING. LEAFING NOTED TO MARCH 1, 1929

No. of trees	Days of treatment	Date of treatment	No. of trees leafing	Date of leafing	Trees leafing per cent
First treatment					
Trees left in greenhouse					
6	1	Dec. 8–9	0		0
6	3	Dec. 9–12	2	Dec. 25	33
6	2	Dec. 13–15	0		0
Trees placed out of doors					
8	2	Dec. 13–15	0		0
12	1	Dec. 17–18	0		0
38			2		5
Second treatment					
Trees left in greenhouse					
4	5	Jan. 12–17	1	Feb. 24	25
3	5	Jan. 12–17	1	Feb. 22	33
4	5	Jan. 12–17	1	Feb. 23	25
1	12	Jan. 19–31	0		0
Trees placed out of doors					
4	5	Jan. 12–17	4	Feb. 13–23	100
2	12	Jan. 19–31	0		0
8	5	Jan. 12–17	3	Feb. 16–19	38
2	12	Jan. 19–31	2	Feb. 14–15	100
28			12		43

[1] Since none of the checks produced leaves before March 1, they are not listed in the Tables 1-3.

TABLE 2. RESULTS OF THE FIRST AND SECOND TREATMENTS WITH ETHYLENE CHLORHYDRIN IN FORCING DISEASED TREES OF *Acer saccharum* INTO LEAFING. LEAFING NOTED TO MARCH 1, 1929

No. of trees	Days of treatment	Date of treatment	No. of trees leafing	Date of leafing	Trees leafing per cent
First treatment					
Trees left in greenhouse					
3	1	Dec. 17–18	0		0
Trees placed out of doors					
4	1	Dec. 1–2	0		0
6	1	Dec. 2–3	0		0
4	2	Dec. 3–5	1	Feb. 26	25
4	3	Dec. 5–8	0		0
14	1	Dec. 12–13	1	Feb. 26	7
15	2	Dec. 13–15	0		0
50			2		4
Second treatment					
Trees left in greenhouse					
2	5	Jan. 12–17	0		0
Trees placed out of doors					
3	5	Jan. 12–17	2	Feb. 14, 26	67
3	5	Jan. 12–17	2	Feb. 15, 23	67
1	12	Jan. 19–31	1	Feb. 12	100
3	5	Jan. 12–17	2	Feb. 16, 19	67
3	5	Jan. 12–17	3	Feb. 11–13	100
4	5	Jan. 12–17	3	Feb. 12–19	75
6	12	Jan. 19–31	3	Feb. 11–24	50
3	5	Jan. 12–17	3	Feb. 12–17	100
8	12	Jan. 19–31	4	Feb. 10–24	50
36			23		64

The results of the chemical stimulation experiments to March 1, as given in Tables 1 and 2, show that the ethylene chlorhydrin was very effective in shortening the rest period of the potted maple trees. Taking all treated trees into account, more than 25 per cent leafed before March 1. None of the check trees produced leaves by that time.

The first treatment of one, two and three days' exposure to the ethylene chlorhydrin vapors did not appear to be long enough nor of sufficient concentration for shortening the rest period of sugar maple trees. Consequently, the second treatments were of five and 12 days' duration, and the concentration of the gas was doubled. The longer periods of exposure and higher concentration of gas proved to be more effective, causing some trees to unfold leaves as early as 10 days after subjection to the gas. With the five day treatment 56 per cent of the trees so treated produced leaves, while 50 per cent of those subjected to a 12 day treatment leafed in the same period. The summarized results of the five day treatment are set forth in Table 3.

Table 3. Results of the Five Day Treatments with Ethylene Chlorhydrin in Forcing Trees of *Acer saccharum* into Leafing. Leafing Noted to March 1, 1929

No. of trees	Date of treatment	No. of trees leafing	Date of leafing	Trees leafing per cent
Trees left in greenhouse				
Healthy				
11	Jan. 12–17	3	Feb. 22–24	27
Diseased				
2	Jan. 12–17	0		0
13		3		23
Trees placed out of doors				
Healthy				
12	Jan. 12–17	7	Feb. 13–23	57
Diseased				
19	Jan. 12–17	15	Feb. 11–26	79
31		22		71

Two explanations for the greater effectiveness of the chemical treatments in January than in December can be suggested: first, a longer period of dormancy, and, second, the increased length of exposure and increased concentration of the ethylene chlorhydrin gas. The fact that the trees kept outside showed a higher per cent of leafing than those kept in the greenhouse, indicated that the subjection to a period of low temperatures was very helpful in breaking the rest period of sugar maple trees. The trees with diseased leaves placed out of doors showed a higher percentage of leafing than the healthy trees kept outside, due, it was thought, to the earlier potting of the diseased trees, which allowed the root systems to become better established than those of the later transplanted, healthy trees. Records of the leafing of the check trees were kept. The dates ranged from March 13 to May 4. In most cases the trees kept out of doors during the winter months leafed sooner than those kept in the greenhouse.

Most of the new leaves produced on the trees whose old leaves had been diseased, were normal in size and shape, but some were slow in growing after the buds had burst. This condition indicated that, due to the premature defoliation the previous autumn, these trees had not been able to store enough food, which must be present in the new twigs in sufficient quantity for normal development of new leaves. None of the new leaves, however, produced on these trees having infected leaves the previous fall, showed any signs of the disease. This indicated that the disease was only a leaf infection, and that it was not carried over in the trees from one growing season to the next.

By means of the forcing experiments with ethylene chlorhydrin, an abundance of new leaves on the potted maples was available for inoculation experiments 30 to 60 days before the check trees leafed out.

INOCULATION OF POTTED MAPLE TREES

MYCELIAL INOCULATION AND INFECTION

Trees were inoculated on March 7 with the mycelium of the slow-growing fungus, *Cristulariella depraedans* (cultures B), secured by Dr. McCormick. In some cases a little agar along with the mycelium was transferred. It was thought that this would prevent too much drying out of the mycelium prior to its penetration of the host tissues. Some leaves were inoculated only on the dorsal surface, some on the ventral side, and others on both surfaces. Punctures with the inoculating needle were made in some leaves which, it was thought, would help to give the mycelium a better chance for more immediate penetration of the leaves.

Before inoculations were made, an abundance of wet sphagnum moss was placed on the surface of the soil in and around the pots. After inoculations, large bell jars were placed over the pots and pushed down in the moss, care being taken to leave a few openings for air to enter. The wet moss made the atmosphere around the plants very humid. It was hoped that such a moist environment would keep the surfaces of the leaves in a damp condition, would prevent the mycelium from desiccating too much before its attack on the leaves, and would stimulate growth of the fungus afterwards, since the disease was in a very damp wood when discovered, and during a rainy period in late summer. Large strips of cheese-cloth were placed over the bell jars to diffuse the light. Paper was spread over the cheese-cloth during the brightest part of the day to assure a more or less equal degree of shading. Plants placed under the same conditions but not inoculated were used as checks.

The activity of the fungus was very rapid, for on March 11, within four days after inoculation, grayish-brown spots formed on the leaves, and on March 12, characteristic white fruiting bodies appeared, some in the necrotic areas, and some in the adjoining green portions. The infected leaves continued to show all the symptoms found on diseased leaves collected the preceding autumn. Activity of the fungus was much more rapid on the leaves, its natural host, than on the artificial media, where growth generally did not appear earlier than eight to ten days.

Since cultures B had produced the infection, no inoculations were made with cultures A. The examination of permanent slides made from the infected areas of the new leaves showed that the fungus was *Cristulariella depraedans*. The diseased conditions of the leaves produced by artificial infection are shown in Plates XXXVb and XXXVI.

The infection of the leaves of the potted maples was found to differ with the various ways in which inoculations were made. When the mycelium was transferred along with a portion of the culture media, larger and more abundant infected areas were produced than when inoculations were made with mycelium alone. Probable reasons for this were that the presence of the media as food kept the mycelium growing before its attack on the leaf tissues, and prevented it from drying out. The ruptures made by puncturing the surface layers of the leaves also aided the hyphae to penetrate a little more readily. Leaves that were inoculated on both sides showed greater infection than leaves inoculated on only one side. On these leaves whose inoculations had been on both sides, infection in every case occurred earlier on the ventral surface than on the dorsal surface. Inoculations made only on the ventral surface produced earlier ventral infection than dorsal infection. Likewise inoculations made on the dorsal side alone produced earlier dorsal than ventral infection. Ventral infection, however, was always more serious than dorsal. This was probably due to more moisture and less light on the ventral surface.

The results of the inoculations were almost 100 per cent infection. There were, however, a few inoculated leaves on three trees that did not become infected. Also a few leaves that were not inoculated became diseased from infected leaves. Due to the very humid atmospheric condition, produced to favor the development of the disease, molds such as Botrytis and Penicillium in a few cases appeared on the leaves whose inoculations were made along with a bit of the culture media, the media chiefly being attacked by those organisms. The leaves thus attacked were early removed. Trees badly infected with the disease were defoliated.

SPORE INOCULATION AND INFECTION

Spores secured from cultures B were placed in sterilized test tubes, each containing five cubic centimeters of sterilized tap water. These solutions were kept at ordinary room temperature. Within a day the spores had germinated. Loopfuls of the spore liquid were then transferred to the leaves of potted plants, and infection took place. Symptoms were slower in appearing than they were when the inoculation with mycelium was made.

ENVIRONMENTAL FACTORS IN INFECTION

After the infection of the inoculated trees had taken place, further observations and study were made to see whether moist conditions were necessary for the infection to take place, and for the continued progress of the disease. A group of the potted trees was inoculated and exposed to the ordinary atmospheric conditions of the greenhouse. No signs of infection occurred, which seemed to indicate that a moister atmosphere than that in the greenhouse had to be present for the infection to start. Another group of the potted trees, in which infection was advancing, was removed from the humid atmosphere of the bell jars and placed in the customary environment of the greenhouse. The infected areas, instead of remaining flaccid and increasing in size, became dry and brittle and stopped spreading. These conditions seemed to indicate that more moisture had to be present for the activity of the fungus.

Some of the trees not inoculated were placed on the same bench with the inoculated and infected trees, with the result that they did not become infected. Others, not inoculated, were placed under bell jars containing infected plants. The majority of their leaves became infected. The chief difference in the environment of the last two groups was the difference in humidity of the greenhouse and the bell jars.

CONCLUSION

The disease of sugar maple trees found at North Stamford, September 3, 1928, and later elsewhere in the state, is definitely identified with *Cristulariella depraedans* as the causal organism. This conclusion is arrived at from pure cultures obtained from diseased leaves, from histological examination of diseased leaves, from comparison of our fungus with European descriptions and specimens of the above fungus, and by actual inoculation experiments with this organism upon healthy leaves.

SUMMARY

1. A disease of maple leaves apparently previously unknown in the United States, was found at North Stamford, Conn., in early September, 1928.
2. Collections of diseased leaves and small trees were made at several places in Connecticut during the autumn.
3. Pure cultures of two fungi occurring on the diseased leaves were obtained and grown on a variety of culture media and under different environmental conditions.
4. A histological study of diseased maple leaves was made. This phase of the investigation, as well as examination of typical fruiting bodies on the necrotic areas, indicated that the causal organism was *Cristulariella depraedans,* as identified by European specimens.
5. Potted sugar maple trees were forced into leafing by treatments with ethylene chlorhydrin from 30 to 60 days before leafing

of check trees, and from 60 to 90 days before leafing occurred in the field.

6. Inoculation experiments with pure cultures of *Cristulariella depraedans* on the leaves of the potted sugar maple trees produced the characteristic symptoms of the disease, as found in the field the previous autumn.

7. A condition of high humidity and warm temperatures surrounding the leaves was most satisfactory for artificial infection. This simulated the field condition of warm temperatures and the high humidity noted at the time the disease was first observed in Connecticut.

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GENERAL

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17. **Denny, F. E.,** and **Stanton, E. N.** Chemical treatment for shortening the rest period of pot-grown woody plants. Amer. Jour. Bot. **15**: 327-336, pl. 19-20. My 1928.
18. **Denny, F. E.,** and **Stanton, E. N.** Localization of response of woody tissues to chemical treatments that break the rest period. Amer. Jour. Bot. **15**: 337-344, f. 1-8. My 1928.
19. **Deuber, C. G.,** and **Bowen, P. R.** Chemical treatment to shorten the rest period of sugar maple trees. Science **70,** N. S.: 102. 26 Jl 1929.
20. **Vaughan, R. E.** A method for the differential staining of fungous and host cells. Ann. Mo. Bot. Gard. **1**: 241-242. My 1914.

Photograph of the locality at North Stamford where the maple leaf disease caused by *Cristulariella depraedans* was first seen.

a. *Acer saccharinum,* showing leaf in the early stage of the disease.

b. *Acer saccharum,* showing leaf in the early stage of the disease.

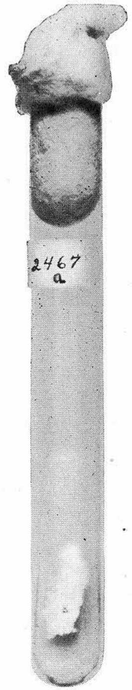
a. *Acer saccharum* leaf showing disease in fairly advanced condition.

b. *Acer saccharum* leaf in final stage of disease.

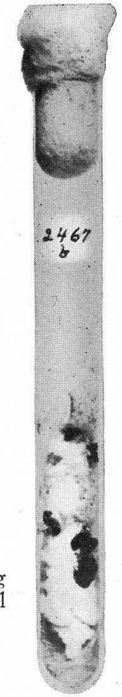
PLATE XXXII

Photograph of herbarium sheet, loaned by Kew herbarium, of Cooke's type specimen of the maple leaf disease.

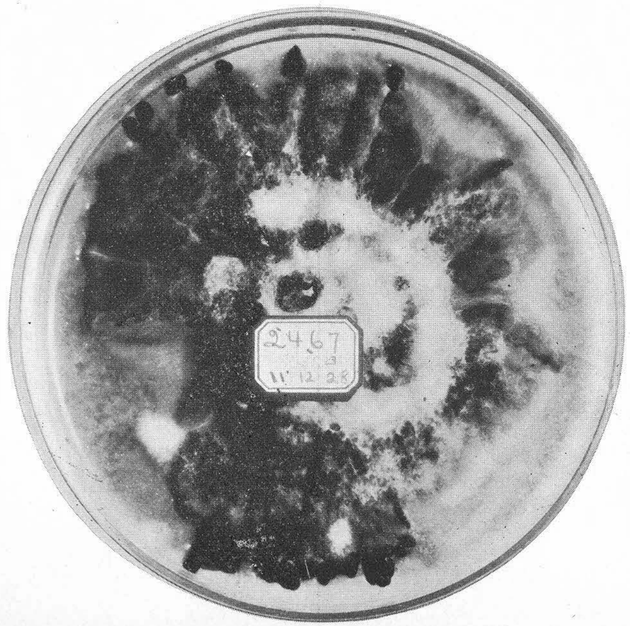
PLATE XXXIII



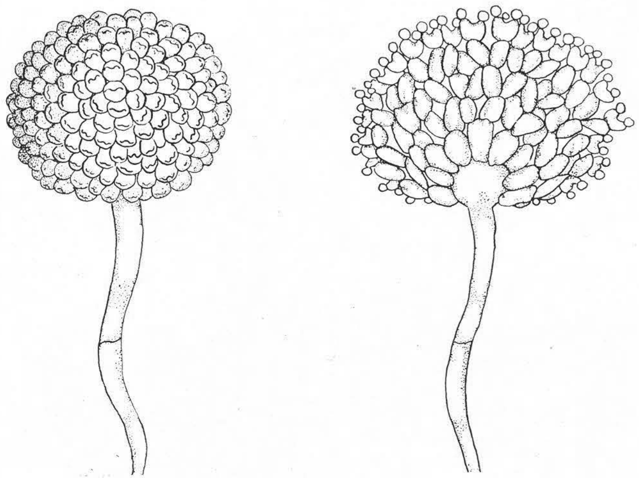
a. Young culture of the fungus *Cristulariella depraedans.*



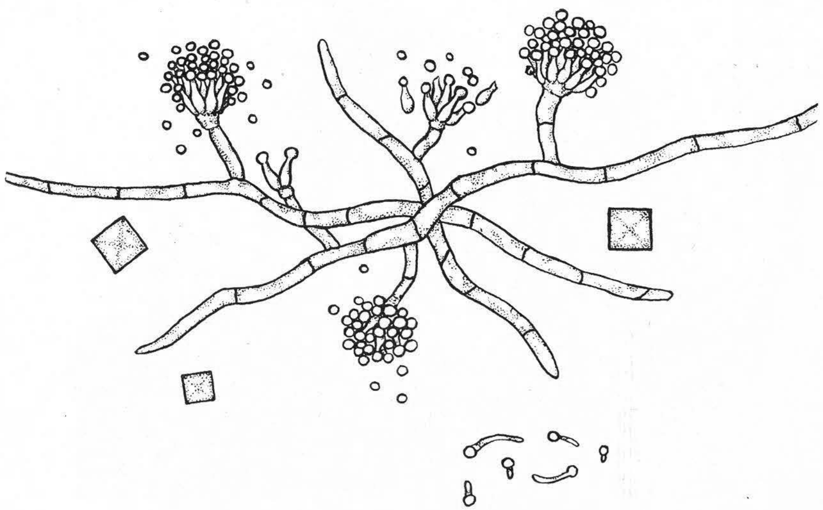
b. Older culture showing the beginning of sclerotial development.



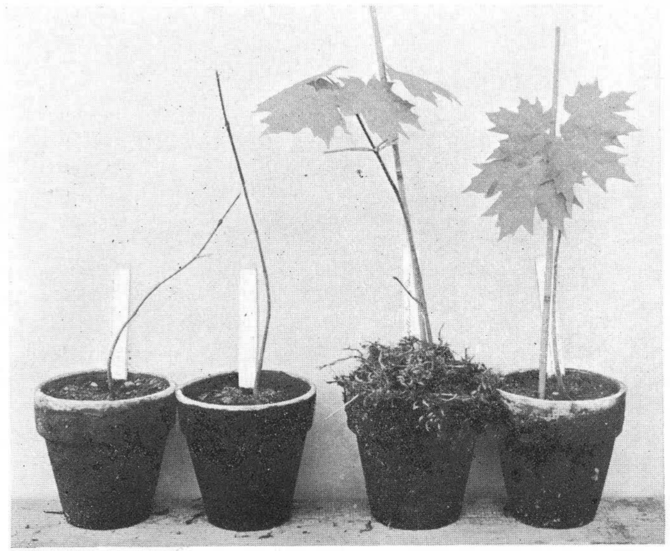
c. Old Petri dish culture with an abundant development of black sclerotia merging together in a mat.



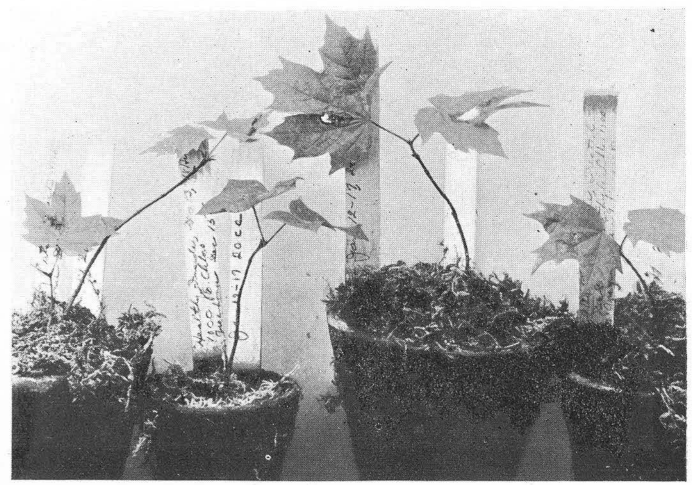
a. Characteristic fruiting bodies as seen on the leaves in nature.



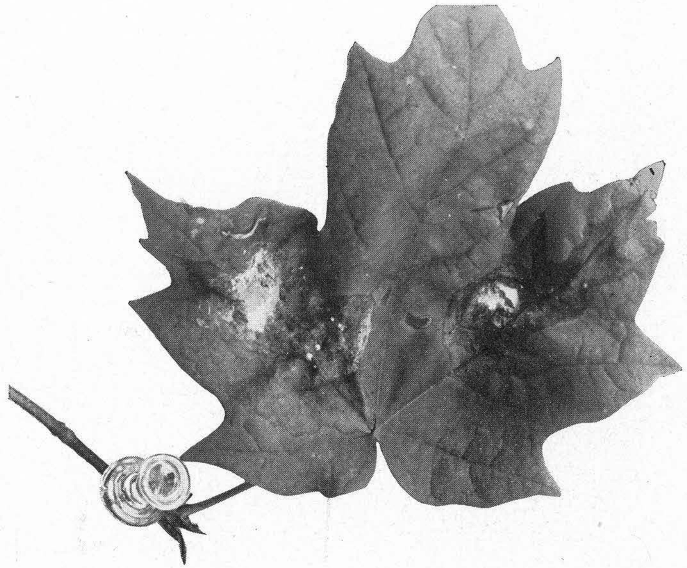
b. Mycelium, fruiting bodies, germinating spores, and crystals as seen in the artificial cultures.



a. Effect of ethylene chlorhydrin in forcing premature foliage development. First two plants, untreated checks; second two, forced plants. *Acer saccharum.*



b. General view of artificially infected plants in pots in greenhouse experiments. *Acer saccharum.*



a. *Acer saccharum* leaf artificially infected with mycelium in agar, showing mycelium growing on infected spots.

b. *Acer saccharum* leaf artificially infected with mycelium only; no external evidence of the mycelium, but the diseased areas more extended.

Bulletin 317 May, 1930

REPORT ON INSPECTION COMMERCIAL FEEDING STUFFS 1929

Connecticut
Agricultural Experiment Station
New Haven

The bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY, NEW HAVEN, CONN.

CONTENTS

REGISTRATION OF FEEDS

Manufacturers, jobbers or individuals outside the State who ship concentrated commercial feeding stuffs into Connecticut are expected to register the brands so shipped and to pay the necessary fees thereon, and they generally do so. However, under the provisions of our law, if manufacturers or others outside the State neglect or refuse to register, the local dealer who handles such feeds is responsible for such registrations, registration fees and other legal requirements.

In the course of trade, feeds manufactured in another State frequently pass through the hands of several middlemen, none of whom is within the immediate jurisdiction of our law, before they reach the local distributor. This Station makes reasonable investigation to find out the source of shipment of feeds found to be unregistered, but the law imposes no obligation upon it to do so. It is the plain duty therefore of local dealers who purchase feed for resale and distribution to assure themselves that the brands they purchase are registered, or else be prepared to assume that responsibility themselves.

REPORT ON INSPECTION COMMERCIAL FEEDING STUFFS

E. M. Bailey

THE FEED LAW

The text of the law relating to concentrated commercial feeding stuffs and of regulations made jointly by the Dairy and Food Commissioner and the Director of this Station for carrying out its provisions, are given in a special bulletin, No. 60.[1]

Some essential provisions of the law and the regulations may be briefly restated here.

Exemptions. It is held that the law exempts from classification as concentrated commercial feeding stuffs, and therefore from registration, (1) roughages such as hays, straws, corn stover, ensilage and all materials containing over 60 per cent of water; (2) whole grains and mixtures thereof; (3) meals made from whole grains when not mixed with other materials or with each other; (4) feed ground from whole grains and sold by the manufacturer directly to the consumer; (5) feed ground from materials furnished by the consumer; or (6) feed mixed according to a formula furnished by the consumer, for his own use.

Under the provision of clause 6 above, a feed must be sold as a formula only, without a private brand name and without analysis. But a feed cannot be offered for general trade as a formula in order to avoid registration and the registration fee.

Labelling. All concentrated commercial feeding stuffs must be labelled either by a statement printed on the bag or upon a properly attached tag; except that in the case of cottonseed meal sold for fertilizer, or of any concentrated feeding stuff sold in bulk, a certificate, which shall contain the information otherwise required to appear upon the bag or upon the tag, may be issued by the dealer in lieu thereof.

The law requires a statement of (1) the net weight of the feed contained in the package; (2) the name, brand or trademark under which the feed is sold; (3) name and address of the manu-

NOTE: Analyses were made by Messrs. Nolan, Mathis and Walden; microscopic examinations by Mr. Shepard and Miss Yale; inspection and sampling by Mr. Churchill; and the compilations largely by Mrs. Vosburgh.

[1] Bull. Imm. Inf. 60, June, 1927.

facturer or importer; (4) the minimum percentages of (a) crude protein and (b) crude fat, and the maximum percentage of (c) crude fiber contained in the feed; and (5) the separate ingredients of which the feed is composed.

While the law requires only a statement of the items enumerated above, no objection will be raised to more complete statements of chemical composition.

Affixing tags. The use of wire or any metal in affixing tags to feed packages is prohibited by law.

Registration and registration fee. The law requires an annual registration of all concentrated feeds sold or offered for sale in this State. Registrations are to be made with the Connecticut Agricultural Experiment Station and beginning January 1, 1928, the registration period is for the duration of the calendar year. The registration fee is fifteen dollars ($15), for each brand, a distinct brand name or a distinct analysis constituting a distinct brand.

Duties of manufacturers, jobbers and dealers. All concentrated commercial feeding stuffs must be registered annually on January 1, or before they are offered for sale.

Manufacturers, jobbers or individuals shipping feeds into Connecticut will be expected to register their brands and pay the necessary fees thereon. Connecticut dealers should assure themselves that the brands they handle are properly registered and labelled. In case the manufacturer or jobber outside the State neglects or refuses to register, the dealer who handles such feeds will be held responsible for such registrations, registration fees and other legal requirements.

Dealers within the State who mix their own brands are responsible for the registration and proper labelling thereof.

Cottonseed meal. Cottonseed meal sold as a fertilizer is required to be registered under the terms of the fertilizer law; if sold also as a feeding stuff it is required also to be registered under the provisions of the feed law; if sold exclusively for one or the other of these purposes, it may be registered only under that law which applies.

EXPLANATION OF TERMS USED IN AN ANALYSIS OF FEEDING STUFF

In registering feeding stuffs the law requires that the minimum percentages of crude protein and crude fat, and the maximum percentage of crude fiber, shall be given; that is, the registrant must guarantee that the feeds registered will contain *not* less than the stated percentages of crude protein and of crude fat and *not more* than the stated percentage of crude fiber.

The term *crude protein* denotes those nutrients that contain nitrogen, and is obtained by multiplying the percentage of total nitrogen in the feed by the factor 6.25.

The term *crude fat* denotes those substances that are soluble in ether and includes, besides fat, such non-fatty materials as chlorophyll and coloring matter.

The term *crude fiber* denotes the coarse, woody tissues characteristic of all forms of roughage and that are present in the outer coats of cereal and other fodder grains.

While the law requires only a statement of the three nutrients just defined, no objection is taken to more complete statements of composition, but such further statements, if given, must be correct. Thus, tags sometimes bear guaranties for nitrogen-free-extract and for carbohydrates.

The term *nitrogen-free-extract* denotes those nutrients of the starch and the sugar types. This group is never determined directly but is obtained by subtracting from 100 per cent the sum of the percentages of moisture, ash, crude protein, crude fiber and crude fat.

The term *carbohydrates* denotes the combined percentages of crude fiber and nitrogen-free-extract.

REGISTRATIONS

For the period January 1, 1929, to December 31, 1929.

One hundred and seventy-two firms and individuals have registered 876 brands of feeding stuffs. As required by Statute these registrations are listed as follows:

American Agricultural Chemical Co., New Haven Sales Dept., New Haven, Conn.

"Capital Meat and Bone Scrap"
"Protox Meat and Bone Scrap"

American Maize-Products Co., 41 East 42d St., New York City.

Cream of Corn Gluten Feed

American Milling Co., Peoria, Ill.

Amco Calf Meal
Amco Corn Feed Meal
Amco Cracked Corn
Amco Egg Mash
Amco Egg Mash with Dried Buttermilk
Amco 18% Dairy Ration (Flexible Formula)
Amco Hog Profit Feed
Amco Horse Feed
Amco June Pasture Alfalfa and Molasses
Amco Laying Mash with Alfalfa Leaf Meal
Amco Provender Pure Ground Corn and Oats ½ and ½
Amco Scratch Grains No. 1 Formula

Amco Scratch Grains No. 2 Formula
Amco Starting and Growing Mash with Dried Buttermilk
Amco 24% Batch Mix
Amco 20% Dairy Ration (Flexible Formula)
Amco 24% Dairy Ration (Flexible Formula)
Amco 12% Fitting Ration
Amco 28% Supplement Pig Meal

Arcady Farms Milling Co., 223 W. Jackson Blvd., Chicago, Ill.
Advanced Registry Dairy
Arcady Besbet Laying Mash
Arcady Scratch Grains
Arcady Stock Feed
Milkers Ready Ration
Old Colony Feed
Peerless Milk Ration
Producers Ready Ration
Sweet 16 Dairy Feed
Wonder Dairy Ration
Wonder Horse and Mule Feed
Wonder Sweet Lasses Feed

Archer-Daniels Midland Co., Minneapolis, Minn.
Pure Old Process Linseed Meal, 32%
Pure Old Process Linseed Meal, 34%

Ashcraft-Wilkinson Co., Atlanta, Ga.
Helmet Brand—Prime Cottonseed Meal
Monarch Brand—Prime Cottonseed Meal
Paramount Brand—Prime Cottonseed Meal

Atlantic Coast Fisheries Corp. of New York, 16 Exchange Place, New York City.
"Atco Fish Meal"

E. W. Bailey & Co., Montpelier, Vt.
Bailey's Open Formula 20% Dairy Feed
Bailey's Open Formula 24% Dairy Feed
Capital Dairy Ration
Capital Dairy Ration, Sweetened
Capital Mixed Feed
Favorite Dairy Ration
Favorite Dairy Ration, Sweetened
"Our Own" Dairy Ration
Pennant Scratch Feed
Pennant Stock Feed

Bay State Milling Co., Winona, Minn.
Wingold Diamond G Pure Hard Wheat Reddog
Wingold Fancy Pure Hard Wheat Mixed Wheat Feed
Wingold Pure Hard Wheat Bran
Wingold Pure Hard Wheat Flour Middlings
Wingold Rye Middlings and Rye Screenings
Wingold Standard Hard Wheat Middlings and Wheat Screenings

Beach Soap Co., Lawrence, Mass.
Beach's Star Brand Beef Scraps

Beacon Milling Co., Inc., Cayuga, N. Y.
Auburn Dairy Feed
Auburn Scratch Feed
Beacon Breeders Mash with Buttermilk
Beacon Broiler Feed
Beacon Calf Meal
Beacon Chick Feed
Beacon Complete Starting Ration
Beacon Dairy Ration
Beacon Developer Feed
Beacon Duck Fattener
Beacon Duck Starter
Beacon Egg Mash with Buttermilk
Beacon Growing Mash
Beacon Hog Feed
Beacon Horse Feed
Beacon Laying Mash
Beacon Scratch Grains
Beacon Special Scratch Grains
Beacon Starting Mash
Beacon Sweet "24"
Beacon Turkey Growing Mash
Be-Co-Lass
Cayuga Growing Mash
Cayuga Laying Mash with Buttermilk
Cayuga Stock Feed
Chariot Chick Feed
Chariot Developer Feed
Chariot Horse Feed

Ira W. Beers, Hamden, Conn.
Beers' Laying Mash
Beers' Scratch Feed

Blatchford Calf Meal Co., Waukegan, Ill.
Blatchford's Calf Meal

Amos D. Bridge's Sons, Inc., Hazardville, Conn.
Success Dairy Ration

Bristol Grain and Supply Co., Bristol, Conn.
Bristol Mash
Bristol Scratch Feed

F. W. Brode Corp., Memphis, Tenn.
"Owl Brand" 41 Cottonseed Meal
"Owl Brand" 43 Cottonseed Meal
"Owl Brand" 36 Cottonseed Meal

L. Broder Grain Store, Colchester, Conn.
L. B. Milk Ration

C. Buckingham & Co., Southport, Conn.
C. B. Dairy Feed
C. B. Growing Mash
C. B. Mash
C. B. Scratch Feed

C. E. Buell, Inc., 131 State St., Boston, Mass.
Buell-Boston Dried Skim Milk

Buffalo Flour Mills Corp., Buffalo, N. Y.
Wheat Bran

C. W. Burckhalter, Inc., 233 Broadway, New York City.
Burck-Brand Powdered Skim Milk

California Hawaiian Milling Co., San Francisco, Calif.
Chicken Greens

C. W. Campbell Co., Stonington, Conn.
Egg-O Dry Mash
Egg-O Scratch Feed
No-Botheration Dairy Ration
Provender
Xtra Vim Molasses Horse Feed

The Canada Linseed Oil Mills, Ltd., Montreal, Can.
"Maple Leaf" Linseed Oilcake Meal, 34%

A. B. Caple Co., Oregon Road, Toledo, Ohio.
Alfalfa Meal

Chapin & Company, Hammond, Ind.
Ajax Dairy Ration 16%
Ajax Dairy Ration 20%
Ajax Dairy Ration 24%
Ajax Horse Feed
Ajax Egg Mash
Ajax Scratch Feed
Centaur Fitting Ration
Chapin Kernels Grow-All
Chapin Kernels Lay-All
Chapin Kernels Start-All
Unicorn Chick Starter (with Buttermilk)
Unicorn Coarse Chick
Unicorn Dairy Ration
Unicorn Egg Mash (with Buttermilk)
Unicorn Fine Chick
Unicorn Scratch Feed

Clinton Corn Syrup Refining Co., Clinton, Iowa.
Clinton Corn Gluten Feed

Clyde Renco Milling Corp., Clyde, N. Y.
Grange Sweetened 16% Dairy Feed
Renco Farmer's Special Sweetened Feed
Renco Makempay Sweetened Feed

Coles Company, Middletown, Conn.
Fortune Chick Starter
Fortune Egg Mash with Dried Buttermilk
Fortune Growing Feed
Fortune Intermediate Scratch
Fortune Scratch Feed
Fortune Stock Feed
Fortune 20% Molasses Dairy Feed
Fortune 24% Molasses Dairy Feed

Collis Products Co., Clinton, Iowa.
Collis Process Pure Dried Buttermilk
Collis Process Pure Dried Skim Milk

The G. E. Conkey Co., Cleveland, Ohio.
Conkey's All Grain Horse and Mule Feed
Conkey's Chick Grains
Conkey's Dairy Ration 24% Protein
Conkey's Easy-Mix Rabbit Ration with Y-O
Conkey's Gecco Chick Grains
Conkey's Gecco Dairy Ration 20% Protein
Conkey's Gecco Egg Mash
Conkey's Gecco Egg Mash with Y-O
Conkey's Gecco Growing Grains
Conkey's Gecco Growing Mash
Conkey's Gecco Growing Mash with Buttermilk and Y-O
Conkey's Gecco Scratch Grains
Conkey's Growing Grains
Conkey's (The Original) Laying Mash with Buttermilk
Conkey's Scratch Grains
Conkey's (The Original) Starting Feed with Buttermilk and Y-O
Conkey's Red Seal Dairy Ration 16% Protein
Conkey's Red Seal Scratch Grains
Superior Scratch Grains

Conn. Fat Rendering and Fertilizer Corp., West Haven, Conn.
Conn. Fat Rend. & Fertz. Corp. Meat Trimmings

Consolidated By-Product Co., 30th and Race Sts., Philadelphia, Pa.
Consolidated Beef and Bone Scrap

Consolidated Rendering Co., Boston, Mass.
Corenco Bone Meal, An All Animal Feed for Cattle, Hogs and Poultry

Coöperative GLF Exchange, Inc., Peoria, Ill.
GLF Super Exchange Dairy
GLF Super Milk Maker

Copeland Flour Mills, Ltd., Midland, Ont.
Copeland's Dandy Bran
Copeland's Dandy Shorts

Corn Products Refining Co., 17 Battery Place, New York City.
Buffalo Corn Gluten Feed
Diamond Corn Gluten Meal

C. A. Cowles, Plantsville, Conn.
C. A. Blue Seal Mash
Cowles Scratch
Cowles 20% Dairy Ration
Cowles 24% Dairy Ration

Charles M. Cox Co., Boston, Mass.
Linseed Meal (Sherwin Williams Co. of Canada, Ltd.)
Rex Wheat Middlings (Maple Leaf Milling Co., Ltd., Toronto, Ont.)
Wheat Bran (Maple Leaf Milling Co., Ltd., Toronto, Ont.)

Crosby Milling Co., Brattleboro, Vt.
Crosby's Balanced Ration
Crosby's Buttermilk Baby Chick Food
Crosby's Egg Mash
Crosby's Gritless Chick Feed
Crosby's Growing Feed
Crosby's Intermediate Chick Feed
Crosby's Mixed Feed
Crosby's Ready Ration
Crosby's Scratch Feed
Crosby's Stock Feed
Crosby's Sweetened Ready Ration
Crosby's 22% Dairy Feed

R. G. Davis and Sons, Inc., New Haven, Conn.
Basic Dairy Ration
Davis Buttermilk Mash
Davis Horse Feed
Davis No. 1 Provender
Davis Scratch Feed
Davis Stock Feed
20% Open Formula

Decatur Milling Co., Decatur, Ill.
Homco Hominy Feed

Delaware Mills, Inc., Deposit, N. Y.
Delaware Chick Grains
Delaware Chick Starting Mash
Delaware Dairy Feed
Delaware Growing Mash (with Dried Buttermilk)
Delaware Laying Mash (with Dried Buttermilk)
Delaware Scratch Grains
Delaware Stock Feed
Delco 20% Dairy Feed
Double Circle Scratch Grains
Indian Laying Mash (with Dried Buttermilk)
Indian Scratch Grains

Denver Alfalfa Milling and Products Co., Lamar, Colo.
Alfalfa Leaf Meal (Leafalfa Brand)
Alfalfa Meal

Dewey Bros. Co., Blanchester, Ohio.
Corn Distillers Dried Grains

The Dominion Flour Mills, Ltd., Montreal, Que.
Wheat Bran
Wheat Shorts

Dry Milk Co., 15 Park Row, New York City.
Chikora

Duluth-Superior Milling Co., Duluth, Minn.
Boston Mixed Feed
Duluth Imperial Wheat Bran

Eastern Grain Co., Bridgewater, Mass.
Pure Dried Skim Milk Powder

Eastern States Farmers' Exchange, Springfield, Mass.
Eastern States Calf Ration
Eastern States Cottonseed Meal 41%
Eastern States Egg Mash Open Formula
Eastern States Fitting Ration Open Formula
Eastern States Fulpail Dairy Ration Open Formula
Eastern States Horse Feed Open Formula
Eastern States Milk Egg Mash Open Formula
Eastern States Milkmore Dairy Ration Open Formula
Eastern States Scratch Grains W/Coarse Cracked Corn Open Formula
Eastern States Sixteen Open Formula Dairy Ration
Eastern States Starting and Growing Mash Open Formula

S. T. Edwards and Co., Inc., Chicago, Ill.
Yankee Dried Buttermilk
Butterfly Dried Skimmed Milk

Elmore Milling Company, Inc., Oneonta, N. Y.
Chixsaver
Elmore Egg Mash
Elmore's Hog Ration
Elmore Horse Feed with Molasses
Elmore (Storrs' Formula) Laying Mash
Elmore's Makemgrow Little Pig Ration
Elmore Milk Grains
Elmore Scratch Feed
Elmore Stock Feed
Elmore's Sweet Digesto Dairy Feed
Elmore "Three Point" Calf Meal
Elmore-Waldorf Formula
Elmore's "Xtragood" Wheat Feed
Emco Feed
Emco Scratch Feed
Granger Open-Formula Ration
Otsego Economy Ration

John W. Eshelman and Sons, Lancaster, Pa.
Eshelman's Baby Chick Starter
Eshelman's Chick Feed
Eshelman Certified Fitting Ration
Eshelman Certified 20% Dairy Ration
Eshelman Certified 24% Dairy Ration
Eshelman's Conestoga 18 Dairy Feed
Eshelman's Fattening Mash
Eshelman's Golden Rod 25 Dairy Feed
Eshelman's Growing Mash
Eshelman's Lancaster 20 Dairy Feed
Eshelman's Lancaster 60 Horse Feed
Eshelman's Laying Mash
Eshelman's Open Formula 20 Dairy Feed
Eshelman's Pennsy 16 Dairy Feed
Eshelman's Red Rose 24 Dairy Feed
Eshelman's Red Rose 85 Horse Feed
Eshelman's Scratch Feed
Eshelman's Stock Feed

Eshelman's Thorobred Horse Feed
Eshelman's Wheat Flour Middlings
Eshelman's Wheat Red Dog
Eshelman Sack of Silage
Eshelman's Susquehanna Dairy Feed
Imperial Scratch Feed
Lancaster Scratch Feed
Liberty Horse Feed
Pennsy Laying Mash
Pennsy Scratch Feed

Evans Milling Co., Indianapolis, Ind.
Emco Hominy Feed

Fairchild Milling Co., Cleveland, Ohio.
Special Fine Middlings
Standard Middlings
Wheat Bran

Fairmont Creamery Co., Omaha, Neb.
Fairmont's Better Pure Flake Buttermilk

Farmers Feed Co., 532 East 76th St., New York City.
"Bull Brand" Dried Brewers Grains

Flory Milling Co., Inc., Bangor, Pa.
Cream-O-Milk Dairy Feed
Flory's Baby Chick Feed
Flory's Chick Starter
Flory's Egg Mash
Flory's Horse Feed
Flory's Scratch Feed
Golden Egg Laying Mash
National Cow Feed
Record Dairy Feed
Special Stock Feed
Sunray Scratch Feed

A. W. Forbes, East Haven, Conn.
R-Own Dairy Ration
R-Own Laying Mash
R-Own Scratch Feed

The L. T. Frisbie Co., New Haven, Conn.
Frisbie's Poultry Feed 45%
Frisbie's Poultry Feed 50%
Frisbie's Poultry Feed 55%

General Mills, Inc., Minneapolis, Minn.
Gold Medal Corn and Oat Feed No. 2
Gold Medal Hominy Feed (Guaranteed Pure)
North Star Scratch Feed—No Grit
Sonny South Hominy Feed (Louisville Milling Co., Inc.)
Washburn's Gold Medal Chick Feed—No Grit
Washburn's Gold Medal Chick Starter (with Dried Buttermilk)
Washburn's Gold Medal Developing Feed—No Grit
Washburn's Gold Medal Fancy Mixed Feed
Washburn's Gold Medal Growing Mash (with Dried Buttermilk)
Washburn's Gold Medal Hard Wheat Bran and Wheat Screenings

Washburn's Gold Medal Hard Wheat Flour Middlings and Wheat Screenings
Washburn's Gold Medal Hard Wheat Standard Middlings and Wheat Screenings
Washburn's Gold Medal Pure Hard Wheat Adrian Red Dog
Washburn's Gold Medal Scratch Feed—No Grit
Washburn's Gold Medal Vitamin Dairy Ration, containing Wheat Germ (Embryo)
Washburn's Gold Medal Vitamin Dairy Ration (24% Protein)
Washburn's Gold Medal Vitamin Egg Mash, containing Wheat Germ (Embryo)

D. H. Grandin Milling Co., Jamestown, N. Y.
Grandin's Baby Chick Feed
Grandin's Baby Chick Starter with Buttermilk
Grandin's Growing Feed
Grandin's Intermediate Chick Feed
Grandin's Laying Mash with Buttermilk
Grandin's Screened Scratch Feed
Grandin's Stock Food
Grandin's Sweetened 12 Twin Six 12 Dairy Feed
Grandin's Sweetened 20% Dairy Feed
Grandin's Sweetened 24% Dairy Feed

Gorton-Pew Fisheries Co., Ltd., Gloucester, Mass.
Gorton's Codfish Meal

Hafleigh & Company, Philadelphia, Pa.
Pure Raw Edible Bone Meal

Hales and Hunter Co., 327 So. LaSalle St., Chicago, Ill.
College Horse Feed
H & H Dairy Ration
Kingfalfa Horse Feed
Pioneer Hog Feed
Red Comb Chick Starter with Dried Buttermilk
Red Comb Duck Fattener
Red Comb Duck Grower
Red Comb Egg Mash with Dried Buttermilk
Red Comb Growing Mash with Dried Buttermilk
Red Comb Scratch Feed

William Hamilton & Son, Inc., Caledonia, Livingston Co., N. Y.
Wheat Bran
Wheat Middlings

The Hecker H-O Company, Inc., Buffalo, N. Y.
Re-Ground Oat Feed

Hecker-Jones-Jewell Milling Co., 40 Corlears St., New York City.
Choice Wheat Bran
H Wheat Middlings
Red Dog Flour
(Buffalo Mill)
Choice Wheat Bran
Extra Heavy Wheat Mixed Feed
Wheat Flour Middlings
Wheat Red Dog Flour
Wheat Standard Middlings

The J. C. Hubinger Bros. Co., Keokuk, Iowa.
Ke Ok uk Corn Gluten Feed

L. W. Hudson, Windsor, Conn.
"Hudson's" Cow Feed
"Hudson's" Developing Mash
"Hudson's" Laying Mash

Humphreys-Godwin Co., Memphis, Tenn.
Bull Brand Cottonseed Meal
Danish Brand Cottonseed Feed
Dixie Brand Cottonseed Meal

Imperial Grain and Milling Co., Toledo, Ohio.
Imperial Steam Cooked Feed

International Milling Co., Minneapolis, Minn.
Blackhawk Pure Wheat Bran
Blackhawk Wheat Flour Middlings
Blackhawk Wheat Low Grade Flour
Blackhawk Wheat Standard Middlings

Jersee Co., Minneapolis, Minn.
Just Right Calf Meal
Just Right Egg Mash
Just Right Growing Mash

Judith Milling Company, Lewistown, Mont.
Wheat Mixed Feed

The Kansas Flour Mills Corp., Kansas City, Mo.
Big Flake Pure Wheat Bran

Kasco Mills, Inc., Waverly, N. Y.
Apex Milk Maker
Beatsall Milk Grains

Kellogg Co., Battle Creek, Mich.
White Hominy Feed

Kelloggs and Miller, Inc., Amsterdam, N. Y.
Pure Old Process Linseed Oil Meal

Spencer Kellogg and Sons, Inc., Buffalo, N. Y.
Kellogg's Pure Old Process Linseed Meal 32%
Kellogg's Pure Old Process Linseed Meal 34%

H. H. King Flour Mills Co., Minneapolis, Minn.
"Gold Mine" Feed

Chas. A. Krause Milling Co., Milwaukee, Wis.
Badger Corn Meal (Corn Feed Meal)
Badger Horse and Mule Feed
Badger 16½% Sweet Dairy
Badger Stock Feed
Badger White Hominy Feed
Badger Yellow Hominy Feed
Blue Top Chick Feed
Blue Top Egg Mash
Blue Top Scratch Feed
Cream City Scratch Feed

S. F. Labieniec, Kensington, Conn.
Dry Mash

Land O'Lakes Creameries, Inc., Minneapolis, Minn.
Land O'Lakes Dried Buttermilk
Land O'Lakes Dried Skimmilk

The Larabee Flour Mills Co., Kansas City, Mo.
Pure Winter Wheat Bran
Winter Wheat Bran and Wheat Screenings

The Larrowe Milling Co., Box 68, North End Station, Detroit, Mich.
California Dried Beet Pulp
Dried Beet Pulp
Dried Molasses Beet Pulp
41% Protein Cottonseed Meal Prime Quality
Larro Brand Choice Cottonseed Meal
Larro Chick Grains
Larro Chick Starter
Larro Egg Mash
Larro Growing Grains
Larro Growing Mash
Larro Hog Feed
Larro Scratch Grains
Larro—The Ready Ration for Dairy Cows

C. W. Lines Co., 173 Chestnut St., New Britain, Conn.
Homestead Dry Mash
Homestead Scratch Feed
Mill Pride Dairy Ration
Mill Pride Fancy Scratch Feed
Mill Pride Milk Mash

Litchfield County Coöp. Asso., Torrington, Conn.
Common Sense Dairy[1]
Common Sense Growing Mash
Common Sense Laying Mash

Long Hill Feed Store, Long Hill, Conn.
Square Deal Buttermilk Laying Mash
Square Deal Dairy Ration

L. B. Lovitt and Co., Memphis, Tenn.
"Lovit Brand" 36% Cottonseed Meal
"Lovit Brand" 41% Cottonseed Meal
"Lovit Brand" 43% Cottonseed Meal

E. Manchester & Sons, Winsted, Conn.
Huntington Red Star Egg Mash
Red Star Dairy Feed
Red Star Egg Mash
Red Star Flour Middlings
Red Star Mixed Feed
Red Star Scratch Feed
Red Star Special Dairy Feed
Red Star Starting and Growing Mash

[1] Substituted for Common Sense Scratch Feed.

The Mann Bros. Co., Buffalo, N. Y.

The Mann Bros. Co., Pure Old Process Linseed Meal 32%
The Mann Bros. Co., Pure Old Process Linseed Meal 34%

Maritime Milling Co., Inc., Buffalo, N. Y.

Bull Brand All Mash Chick Starter Ration with Dried Buttermilk and Cod Liver Oil
Bull Brand All Mash Growing Ration with Dried Buttermilk and Cod Liver Oil
Bull Brand Chop Feed
Bull Brand Chick Feed
Bull Brand Chick Starter with Dried Buttermilk and Cod Liver Oil
Bull Brand Dairy Ration
Bull Brand Dairy Ration, Sweetened
Bull Brand Daisy Scratch Feed
Bull Brand Developing Feed
Bull Brand Growing Mash with Dried Buttermilk and Cod Liver Oil
Bull Brand Heavy Mixed Feed
Bull Brand Hi-Test Dairy Feed, Sweetened
Bull Brand Horse Feed with Molasses
Bull Brand Laying Mash with Dried Buttermilk
Bull Brand Marmico Dairy Feed with Molasses
Bull Brand Red-E-Mixt Dairy Feed, Sweetened
Bull Brand Red-E-Mixt Egg Mash
Bull Brand Scratch Feed
Bull Brand Stock Feed
Bull Brand Wheat Flour Middlings
Jersey Dry Mash

A. G. Markham and Co., Springfield, Mass.

Cooked Meat and Bone Scrap 45%
Cooked Meat and Bone Scrap 50%

The Geo. E. Marsh Co., Lynn, Mass.

Marsh's Diamond Special Scraps for Poultry
Marsh's Pure Ground Scraps for Poultry

C. J. Martinis Grain Co., L-3 Produce Exchange, New York City.

Alco Dried Brewers Grains
Alco Dried Distillers Grains

Meader Milling Co., Inc., Hoboken, N. J.

Green Velvet Feed
Purifine Linseed Oil Meal

Meech and Stoddard, Inc., Middletown, Conn.

Red Wing Dairy Ration
Red Wing Dairy Ration 20% with Brewers Grains
Red Wing Dairy Ration 24% with Brewers Grains
Red Wing Mixed Feed
Red Wing Molasses Horse Feed
Red Wing Special Buttermilk Chick Starter
Red Wing Special Buttermilk Growing Feed
Red Wing Special Buttermilk Laying Mash
Red Wing Special Chick Feed
Red Wing Special Dairy Ration
Red Wing Special Intermediate Chick Feed
Red Wing Special Scratch Feed
Red Wing Stock Feed

Memphis, Cottonseed Products Co., Memphis, Tenn.

Durham Thirtysix Cottonseed Meal
Durham Fortyone Cottonseed Meal
Durham Fortythree Cottonseed Meal

Mennel Milling Co., Toledo, Ohio.

Corn Feed Meal
Memo All Grain Horse Feed
Memo All Mash Ration
Memo Chick Scratch
Memo Dairy Feed
Memo Egg Mash
Memo 16% Sweet Dairy Feed (with Molasses)
Memo 22% Milk Ration
Mennel's Fancy Bran
Mennel's Mixed Grains[1]

Middleport Flour Mills, Inc., Middleport, N. Y.

Angelus Wheat Bran
Angelus Wheat Middlings

Milmine, Bodman & Co., Inc., 115 Produce Exchange, New York City.

Dried Beet Pulp

Miner-Hillard Milling Co., Wilkes-Barre, Pa.

No. 1 Scratch Feed
Rye Middlings
"1795" Steam Cooked Corn and Oats
Steam Cooked Hominy Feed

Geo. Q. Moon & Co., Inc., Binghamton, N. Y.

Moon's Baby Chick Grains
Moon's Baby Chick Starter Mash
Moon's Developing Grains
Moon's Fresh Ground Mixed Feed
Moon's Fresh Ground White Middlings
Moon's Hominy Feed
Moon's Laying Mash with Dried Buttermilk
Moon's Scratch Feed
Moon's Special A Laying Mash with Dried Buttermilk
Moon's Stock Feed
Moon's 20% Dairy Feed with Molasses
Moon's 24% Dairy Ration
Moon's Wheat Bran
Moon's X Dairy Ration

Moran-Patton Co., 234 Cedar St., New Haven, Conn.

C-B Mash

Fred C. Morse, Guilford, Conn.

Old Mill Dairy Feed
Old Mill Fitting Feed
Old Mill Growing Mash
Old Mill Horse Feed
Old Mill Laying Mash
Old Mill Laying Mash with Milk
Old Mill Provender
Old Mill Scratch Feed
Old Mill 20% Dairy Feed

[1] Substituted for Memo Scratch Grains.

Jas. F. Morse and Co., Somerville, Mass.
Morse's Meat Scraps 40%
Morse's Meat Scraps 50%

Mt. Vernon Milling Co., Mt. Vernon, Ind.
Poco Hominy Feed

National Milling Co., Toledo, Ohio.
National Feed
Osota
Pure Wheat Bran

Nebraska Consolidated Mills Co., Omaha, Neb.
Pure Wheat Bran
Pure Winter Wheat Midds

New England By-Products Corp., 20 West St., Lawrence, Mass.
Blue Seal Meat Scraps
Gold Seal Dried Skim Milk
White Seal Meat Scraps

Newman Bros. Grain Co., Rochester, N. Y.
Corn Feed Meal
Genesee Scratching Grains
Mystic Chick Feed
Mystic Chick Starter with Buttermilk
Mystic Growing Mash with Buttermilk
Mystic Intermediate Feed
Mystic Laying Mash
Mystic Stock Feed, Sweetened

Newsome Feed and Grain Co., Carson Station, Pittsburgh, Pa.
Palmo Midds

Newton Feed Co., Milwaukee, Wis.
Newtrio Growing and Fitting Ration
Newtrio 20% Dairy Ration

Niagara Falls Milling Co., Niagara Falls, N. Y.
Niagara Choice Wheat Bran
Niagara Choice Wheat Middlings

The Northwestern Consolidated Milling Co., Minneapolis, Minn.
Planet Feed
Pure Wheat Bran
Wheat Flour Middlings
Wheat Mixed Feed
Wheat Standard Middlings
XXX Comet

Nowak Milling Corp., Hammond, Ind.
Domino Developing Feed
Domino Laying Mash with Buttermilk
Domino Scratch Feed
Domino 24½% Dairy Feed
Domino Vim-O-Lene Horse Feed
Fidelity Stock Feed
Marathon Chick Feed

Ogilvie Flour Mills Co., Ltd., Montreal, Que.
Ogilvie's Oat Feed
Ogilvie's Wheat Bran
Ogilvie's Wheat Shorts

Ontario Milling Co., Inc., Oswego, N. Y.
Aunt Mary's Chick Starting Mash with Dried Buttermilk
Aunt Mary's Coarse Chick Feed
Aunt Mary's Egg Mash with Dried Buttermilk
Aunt Mary's Fine Chick Grains
Aunt Mary's Scratch Feed
Aunt Mary's Special Growing Mash with Dried Buttermilk[1]
Big Value Dairy Feed
Big Value Dairy Feed with Molasses
Big Value Horse Feed with Molasses
Butterfat Dairy Feed with Molasses
Oswego Egg Mash with Meat and Fish
Oswego Scratch Feed
Oswego 16% Dairy Feed with Molasses
Uncle John's Stock Feed with Molasses
Uncle John's 24% Cream Pot Ration

S. V. Osborn Est., Branford, Conn.
Osborn Mash
Osborn Provender
Osborn Scratch

Park & Pollard Co., Buffalo, N. Y.
Belmont Horse Feed
Bet-R-Milk 20% Ration
Bidwell Dry-Mash (Black Rock Milling Corporation)
Bidwell Scratch Feed (Black Rock Milling Corporation)
Bison Stock Feed, Sweetened
Chelsea Horse Feed
Claco Dairy Ration (C. L. Adams Co.)
Corn and Oats ½ and ½
Feed Meal
Fitting Ration
Go Tu It Pig and Hog Ration
Growing Feed
Herdhelth 16% Ration
Intermediate Chick Feed
Lay or Bust Dry-Mash
Leghorn Special Dry-Mash
Milkade Calf Meal
Milk-Maid 24% Sweetened Dairy Ration
Overall 24% Dairy Ration
Over the Top Scratch
Park & Pollard Chick Scratch
Park & Pollard Chick Starter
Park & Pollard Stock Feed
Park & Pollard Horse Feed
Red Ribbon Chick Feed
Red Ribbon Scratch Feed
Top Notch 16% Ration
Wheat Flour Middlings

[1] Substituted for Aunt Mary's Growing Mash with Dried Buttermilk.

The Patent Cereals Co., Geneva, N. Y.
Hominy Feed

Pecos Valley Alfalfa Mills Co., Hagerman, N. M.
Velvet Meal

Pillsbury Flour Mills Co., Minneapolis, Minn.
Palisade Scratch Feed
Pillsbury's Dairy Ration
Pillsbury's Durum Wheat Bran and Screenings
Pillsbury's Fancy Mixed Feed and Screenings
Pillsbury's Hard Wheat A Middlings and Screenings
Pillsbury's Hard Wheat Bran and Screenings
Pillsbury's Hard Wheat Standard B Middlings and Screenings
Pillsbury's Rye Middlings and Screenings
Pillsbury's Wheat Bran
Pillsbury's Wheat Gray Shorts
Pillsbury's XX Daisy

Pittsburgh Plate Glass Co., Newark, N. J.
Red Wing Linseed Meal

The Frank S. Platt Co., New Haven, Conn.
Platco Laying Mash
Platco Perfection Grain Mixture

Postum Co., Inc., Battle Creek, Mich.
Burt's Dairy Feed
Burt's Hominy Feed

W. N. Potter and Sons, Inc., Greenfield, Mass.
A. D. P. 24% Dairy Ration
Puritan Dry Mash
Puritan Growing Feed
Puritan Scratch Feed

Pratt Food Co., Hammond, Ind.
Pratt's Baby Chick Food with Buttermilk
Pratt's Circle A Chick Scratch Feed
Pratt's Circle A Large Scratch Feed
Pratt's Supreme Dairy Feed
Pratt's Supreme Fattening Mash with Buttermilk
Pratt's Supreme Growing Mash with Buttermilk
Pratt's Supreme Laying Mash with Buttermilk
Pratt's Supreme Stock Feed
Pratt's Sweet 24% Dairy Feed
Pratt's Utility Horse Feed
Pratt's Utility Large Scratch Feed
Pratt's Victory Intermediate Scratch Feed
Pratt's Victory Chick Scratch Feed
Pratt's Victory Large Scratch Feed
Pratt's Victory Laying Mash with Buttermilk
Pratt's White Hominy Feed (Buffalo Mill)

H. C. Puffer Co., Springfield, Mass.
Egg-Em-On Growing Feed
Egg-Em-On Laying Mash
Egg-Em-On Scratch Feed
Producer Dairy Feed
Sweetened Producer Dairy Feed

The Quaker Oats Co., 80 East Jackson St., Chicago, Ill.
Banner Feed
Bell Cow Bran
Bell Cow Shorts
Big Egg Scratch Grains, No Grit
Buckeye Feed
Hominy Feed
Horse Power Feed
Quaker Ful-O-Pep Chick Starter
Quaker Ful-O-Pep Coarse Chick Feed
Quaker Ful-O-Pep Egg Mash
Quaker Ful-O-Pep Fine Chick Feed
Quaker Ful-O-Pep Growing Mash
Quaker Ful-O-Pep Scratch Grains
Quaker Ful-O-Pep Station Grade Fattening Feed
Quaker Green Cross Horse Feed
Quaker Schumacher Feed
Quaker 16% Protein Dairy Ration
Quaker Sugared Schumacher Feed
Quaker 20% Protein Dairy Ration
Quaker 24% Protein Dairy Ration
Richford Provender
Richford White Diamond Stock Feed
Schumacher Calf Meal
Schumacher Little Chick Feed, No Grit
Schumacher Scratch Grains, No Grit
Sugared Vim Feed
Vim Feed
White Hominy Feed
White Star Stock Feed, Fine
Yellow Hominy Feed

Ralston Purina Co., St. Louis, Mo.
Buffalo Purina Bulky Las Feed
Corn Feed Meal
Fine Ground Poultry Alfalfa Meal
Protena Dairy Feed
Protena 20% Dairy Feed
Purina Baby Chick Chow Feed
Purina Blue Checker Cow Chow Feed
Purina Blue Checker Grainola Feed
Purina Calf Cow Feed containing Mineral
Purina Checkerboard Rolled Oats (steam cooked)
Purina Chicken Chowder Feed containing Mineral
Purina Chicken Fat Chow Feed containing Mineral
Purina Chicken Fatena Feed containing Mineral
Purina Chick Grow Chow Feed containing Mineral
Purina Chick Growena Feed containing Mineral
Purina Chicken Startena Feed containing Mineral
Purina Cow Chow Feed
Purina Fitting Chow Feed
Purina Hen Chow Feed
Purina Intermediate Hen Chow Feed
Purina Hog Fatena Feed containing Charcoal
Purina Lamb Chow Feed containing Charcoal
Purina Lay Chow Feed containing Mineral
Purina Omolene Feed
Purina Orange Checker Cow Chow Feed

Purina Pig Chow Feed containing Charcoal
Purina Red Checker 34% Cow Chow Feed
Purina Red Checker Grainola Feed
Purina Steer Fatena Feed containing Charcoal
Purina Stock Feed
Winner Scratch Feed

John Reardon and Sons Co., Cambridge, Mass.
Register Brand Meat and Bone 45%
Register Brand Meat and Bone 55%

The Red Wing Milling Co., Red Wing, Minn.
Red Wing Special Wheat Bran

Robin Hood Mills, Ltd., Moose Jaw and Calgary, Canada.
Superior Pure Wheat Bran
Superior Pure Wheat Shorts

Rockville Grain and Coal Co., Rockville, Conn.
Diamond Dairy Ration
Diamond Horse Feed
Diamond Intermediate Chick Feed
Diamond Laying Mash
Diamond Scratch Feed

The Rogers and Hubbard Co., Portland, Conn.
Edible Bone Flour for Cattle and Poultry
Edible Steamed Bone

Fred H. Rolf, Inc., Guilford, Conn.
Hubbard's Egg Producer
Rolf's Chic Grains
Rolf's Chic Mash
Rolf's Scratch Grains

Royal Milling Co., Great Falls, Mont.
Dependable Rex Hard Wheat Bran
Dependable Rex Hard Wheat Mixed Feed

Russell-Miller Milling Co., Minneapolis, Minn.
Alta Hard Wheat Middlings
Hard Wheat Occident Bran
Hard Wheat Occident Mixed Feed

Russia Cement Co., Gloucester, Mass.
Chic-Chuk, "The Ideal Concentrated Poultry Food"

A. W. Scott Co., San Francisco, Calif.
Atlas Poultry Greens

Seymour Grain and Coal Co., Seymour, Conn.
See More Egg Mash Buttermilk
See More Egg Scratch Feed
See More Milk Dairy Feed

Shelton Feed Co., 73 Bridge St., Shelton, Conn.
Nelson's Laying Mash
Nelson's Mixed Chicken Feed

M. L. Shoemaker and Co., Inc., Philadephia, Pa.
Shoemaker's "Swift Sure" 50% Meat and Bone Scrap

W. G. Slugg, Milwaukee, Wis.
Slugg's Pure Dried Skimmilk

Winchell Smith, Inc., Farmington, Conn.
Mill Streams "Boomerang" Dairy Feed
Mill Streams "Fortune Hunter" Scratch Grains
Mill Streams "Lightnin" Laying Mash
Mill Streams "Twenty Per Cent" Dairy Ration

Ike Sovitsky, Ansonia, Conn.
Ansonia Dairy Ration
Ansonia Egg Mash with Buttermilk
Ansonia Scratch Feed
Ansonia Stock Feed

Spratt's Patent (Am.) Limited, Newark, N. J.
Spratt's Chicgrain
Spratt's Mash Food with Buttermilk

Springfield Rendering Co., Springfield, Mass.
Springfield Poultry Feed

A. E. Staley Mfg. Co., Decatur, Ill.
Staley's Corn Gluten Feed

Standard Milling Co. of Canada, Ltd., 67 Yonge St., Toronto, Ont.
Bran
Shorts

John T. Stanley Co., Inc., 642 West 30th St., New York City.
Stanley's Meat and Bone Scrap

St. Albans Grain Co., St. Albans, Vt.
Brewers' Dried Grains
Charlestock
Hygrade 16 Sweetened Milk Ration
Hygrade 20 Sweetened Milk Ration
Hygrade 24 Sweetened Milk Ration
King Baby Chick Food (containing Cod Liver Meal-Buttermilk)
King Chick Feed
King Dairy Feed with Beet Pulp, Sweetened
King Growing Feed (containing Buttermilk)
King Horse Feed
King Intermediate Chick Feed
King Mash Feed (containing Buttermilk)
King Scratch Feed
King Stock Feed
King 22 Milk Ration, Sweetened
Paragon Dairy Feed
Paragon Dairy Feed, Sweetened
Paragon Hominy Feed
Paragon Scratch Feed
Wirthmore All Grain Chick Feed (Fine Chick Scratch)
Wirthmore Baby Chick Starter (containing Cod Liver Meal-Buttermilk)
Wirthmore Calf Meal

Wirthmore Dairy Feed with Beet Pulp
Wirthmore Dairy Feed with Beet Pulp, Sweetened
Wirthmore 14 Fitting Ration
Wirthmore Flour Middlings
Wirthmore Growing Feed (containing Buttermilk)
Wirthmore Hog Feed
Wirthmore Horse Feed
Wirthmore Intermediate Chick Feed (Coarse Chick Scratch)
Wirthmore Laying Mash (containing Buttermilk)
Wirthmore Pig Feed
Wirthmore 16 Dairy Ration
Wirthmore 16 Dairy Ration, Sweetened
Wirthmore Scratch Feed
Wirthmore Stock Feed
Wirthmore 20 Dairy Feed
Wirthmore 20 Dairy Feed, Sweetened
Wirthmore 25 Balanced Ration
Wirthmore 25 Balanced Ration, Sweetened
Wirthmore Turkey Starter (containing Cod Liver Meal-Buttermilk)
Wirthmore Wheat Feed

St. Lawrence Flour Mills Co., Ltd., Montreal, Que.
Bran

Chas. M. Struven and Co., Baltimore, Md.
Struven's Fish Meal

Syracuse Milling Co., Syracuse, N. Y.
Jordan Horse Feed with Molasses
Onondaga Dairy Feed
Onondaga Scratch Grains
Symco Scratch Grains
Syragold Chick Feed
Syragold Chick Starter
Syragold Dairy Feed
Syragold Egg Mash
Syragold Feed Meal
Syragold Flour Middlings with Mill Run Screenings
Syragold Ground Corn and Oat Feed
Syragold Growing Mash
Syragold Horse Feed with Molasses
Syragold Laying Mash with Buttermilk
Syragold Milk Ration
Syragold Scratch Grains
Syragold Stock Feed

D. L. Talcott, Torrington, Conn.
Economy Dairy Ration

Thomaston Supply Co., Thomaston, Conn.
Thomaston Dairy Ration
Thomaston Egg Mash
Thomaston Scratch

Tioga-Empire Feed Mills, Inc., Waverly, N. Y.
Chicatine
Colonel's Ration
Derby Corn and Oat Feed
Derby-E-Gee Scratch Feed
Derby Meal
Egatine
E-Gee Dairy Feed
E-Gee Laying Mash
E-Gee Stock Feed
Neverfail Horse Feed
Or-Co Feed
Red Brand Ti-O-Ga Dairy Feed
Ti-O-Ga Calf Food
Tioga-Chick and Growing Mash
Ti-O-Ga Laying Food
Tioga-Neverfail Chick Grains
Tioga-Neverfail Growing Grain
Tioga-Neverfail Poultry Grain
White Brand Tioga Dairy Feed

Trader's Feed and Grain Co., Inc., Buffalo, N. Y.
Bonny Hard Wheat Bran and Screenings

Ubiko Milling Co., Cincinnati, Ohio.
Crusader Horse Feed
Ubiko All-Mash Complete Laying Ration
Ubiko All-Mash Developer
Ubiko Union Grains 20% Sweet Dairy Ration
Ubiko Union Grains 24% Sweet Dairy Ration
Union Grains Ubiko Biles Ready Dairy Ration

United Mills Co., Inc., Grafton, Ohio.
U. M. C. Wheat Middlings

Union Sales Corp., Columbus, Ind.
Union Corn Gluten Feed

Upper Hudson Rye Flour Mills, Inc., Troy, N. Y.
Rye Feed

Vitality Mills, Inc., 166 West Jackson Blvd., Chicago, Ill.
Advance 16% Dairy Feed with Molasses
Advance 20% Dairy Feed
Special Rosebro Horse Feed
Vitality Chick Starter
Vitality Egg Mash
Vitality Fine Chick Scratch
Vitality Scratch Feed (No Grit)
Vitality 20% Dairy Feed with Molasses
Vitality 22% Dairy Feed with Molasses
Vitality 24% Dairy Feed with Molasses
Will-Pay Dairy Ration

Wadsworth Feed Co., Warren, Ohio.
Wadfeeco Dairy Ration
Wadsworth's Special Dairy Ration

Wayne Feed Mills, Fort Wayne, Ind.
Jumbo Dairy Feed
Wayne All Mash Chick Starter
Wayne Calf Meal
Wayne Dairy Feed
Wayne Egg Mash
Wayne Scratch Feed
Wayne Supreme Horse Feed
Wayne 20% Dairy Feed

F. S. Wertz and Son, Reading, Pa.
Colonial Mixed Grains for Poultry
Wertz's Horse Feed with Alfalfa and Molasses

Wolverton Flour Mills Co., Ltd., St. Mary's, Ont.
Wolmacs Pure Wheat Bran

Worcester Rendering Co., Auburn, Mass.
P. W. Meat Scrap
P. W. Special Meat Scrap

Yantic Grain and Products Co., Norwich, Conn.
Abington Dairy Feed
Almo
Big (Y) Dairy Ration
Big (Y) Flour Middlings
Big (Y) Growing Feed
Big (Y) Horse Feed[1]
Big (Y) Laying Mash
Big (Y) Laying Mash with Buttermilk
Big (Y) Mixed Feed
Big (Y) Scratch Feed[1]
Uncas Dairy Feed
Uncas Scratch Feed
Uncas Stock Feed
Uncas Sugared Stock Feed[1]

INSPECTION

The inspection herein reported upon covers the calendar year of 1929.

The Station inspector visited 146 dealers in 97 towns of the State and took 700 samples, including all of the registered brands that could be found on sale. Because some were second samples of brands already examined, not all of these official samples were analyzed.

A total of 947 samples of feeding stuffs and other fodder materials were examined, of which number 646 were for purposes of official inspection, 178 for the Storrs Agricultural Experiment Station in connection with field experiments and feeding trials, and 123 were submitted by individuals. Results of the analyses made for the Storrs station are not included in this report.

[1] Takes the place of one of three feeds discontinued during the year, namely, Echo Dairy Feed, Perfection Dairy Feed and Ging'm Gal Scratch Feed.

The tabulated summary of inspection shows that of the total number of official samples examined 85 per cent met the guaranteed analyses under which they were sold. This is a gain over last year when the corresponding percentage was 78. Considering individual guaranteed items, there being three (protein, fat and fiber) for each sample, there were 1938 guaranties and 117 deficiencies were found, which shows that 94 per cent of these guaranties were met as compared with about the same figure last year, 92 per cent.

Our law makes it illegal to affix tags to sacks of feed by means of wire or other metallic device. Only two instances of violation of this requirement were found in the inspection two years ago, and during the past year no violations of this provision were discovered.

Microscopic examinations have revealed no instance of serious contamination with weed seeds or other deleterious materials. In the main the declarations of ingredients have been substantiated by our examinations. Conclusions as to the presence of undeclared ingredients or the absence of declared ingredients are often complicated by revisions of formulas made from time to time subsequent to original registrations.

Analyses of official samples are given in Table I, page 678, and those of unofficial samples submitted for the usual analysis in Table II, page 744.

Summary of Inspection

Feed	Samples examined	Samples deficient	Deficiencies in Protein	Deficiencies in Fat	Deficiencies in Fiber	Total deficiencies
Cottonseed meal	5	1	1	1	0	2
Linseed meal	9	0	0	0	0	0
Wheat bran	28	0	0	0	0	0
Wheat middlings	12	0	0	0	0	0
Wheat red dog	3	0	0	0	0	0
Wheat feed (mixed feed)	14	0	0	0	0	0
Corn gluten feed	7	2	1	1	0	2
Hominy feed	15	0	0	0	0	0
Rye products	2	0	0	0	0	0
Brewers' & distillers' grains	4	1	1	0	0	1
Dried beet pulp	3	0	0	0	0	0
Horse feed	58	6	1	2	3	6
Dairy feeds	148	39	11	33	6	50
Stock feeds	34	4	0	3	2	5
Calf feed, etc.	18	4	1	4	0	5
Poultry feeds	245	35	6	25	7	38
Beef scrap, etc	41	8	5	3	0	8
Total	646	100	27	72	18	117

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein (N x 6.25) Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
	OIL SEED PRODUCTS		%	%	%	%	%	%	%	%	%
	Cottonseed Meal										
2512	*Helmet.* Ashcraft-Wilkinson Co., Atlanta, Ga.	*Westerly:* C. W. Campbell Co.	6.80	6.59	41.00	41.00	9.65	10.00	29.63	6.33	5.50
1187	*Owl 36%.* F. W. Brode Corp., Memphis, Tenn.	*Colchester:* P. Cutler, Inc.	5.75	6.75	35.38	36.00	13.40	14.00	33.42	5.30	4.00
2704	*Owl 41%.* F. W. Brode Corp., Memphis, Tenn.	*Simsbury:* Woods-Chandler Co.	8.00	6.83	39.94	41.00	10.60	10.00	28.48	6.15	10.00
2633	*Danish.* Humphreys-Godwin Co., Memphis, Tenn.	*Seymour:* Seymour Grain & Coal Co.	6.40	6.20	37.25	36.00	12.83	15.00	29.94	7.38	5.00
2585	*Dixie.* Humphreys-Godwin Co., Memphis, Tenn.	*Ansonia:* I. Sovitsky Grain & Coal Co.	6.48	7.43	51.63	41.00	8.93	10.00	28.30	7.23	5.00
	Linseed Meal										
2452	*Pure Old Process.* Archer-Daniels-Midland Co., Minneapolis, Minn.	*Branford:* S. V. Osborn Est.	9.85	6.36	31.88	32.00	8.35	9.00	38.56	5.00	5.00
2599	*Maple Leaf 34%.* Canada Linseed Oil Mills, Montreal, Canada	*Lebanon:* Berkman Grain Co.	8.80	6.38	33.75	34.00	7.85	9.00	37.49	5.73	5.00
2579	Chas. M. Cox, Boston, Mass.	*Shelton:* Wolf Savitsky	7.35	8.10	35.88	35.00	7.20	7.50	32.97	8.50	6.50
1092	*Pure.* Kellogg & Miller, Amsterdam, N. Y.	*Southbury:* H. R. Stone	7.45	6.28	34.75	34.00	8.40	9.00	37.12	6.00	5.00
1037	*Old Process.* Spencer Kellogg & Sons, Edgewater, N. J.	*Guilford:* Fred C. Morse & Son	8.65	6.86	32.00	32.00	8.00	10.00	38.09	6.00	5.00
1039	*Old Process.* Spencer Kellogg & Sons, Buffalo, N. Y.	*East Haven:* F. A. Forbes	8.00	5.44	34.50	34.00	8.15	10.00	38.53	5.38	5.00
2842	*The Mann Bros. Co. Pure Old Process.* Mann Bros. Co., Buffalo, N. Y.	*Danielson:* Young Bros. Co.	10.75	6.06	32.25	32.00	7.83	10.00	35.78	7.33	6.00
2841	*The Mann Bros. Co. Pure Old Process.* Mann Bros. Co., Buffalo, N. Y.	*Stamford:* Clapboard Hill Feed Co.	8.83	5.81	33.50	34.00	7.96	10.00	37.55	6.35	6.00
2885	*Red Wing.* Pittsburgh Plate Glass Co., Pittsburgh, Pa.	*Long Hill:* Long Hill Feed Store	8.73	5.63	35.63	32.00	7.68	9.00	36.03	6.30	5.00
	WHEAT PRODUCTS										
	Wheat Bran										
1004	Chas. M. Cox, Boston, Mass.	*Hamden:* Ira W. Beers	9.05	6.09	16.81	13.50	9.60	11.50	52.30	6.15	3.50
2589	Dominion Flour Mills, Montreal, Canada	*Rockville:* Rockville Grain & Coal Co.	9.75	6.34	14.50	14.50	10.25	11.50	53.68	5.48	3.50
2795	*Duluth Imperial.* Duluth Superior Milling Co., Duluth, Minn.	*Windsor:* L. W. Hudson	11.18	6.24	16.25	14.00	8.38	13.00	52.52	5.43	3.75
2490	*Washburn's Gold Medal.* General Mills, Inc., Minneapolis, Minn.	*Colchester:* Red Wing Feed & Lumber Co.	11.33	6.72	15.44	14.00	9.13	12.00	52.60	4.78	4.00
1086	*Choice.* Hecker-Jones-Jewell Milling Co., Buffalo, N. Y.	*East Bridgeport:* J. Simon	9.20	6.92	15.50	13.50	10.15	11.50	52.70	5.53	3.50
2673	*Choice.* Hecker-Jones-Jewell Milling Co., New York City	*Southington:* Southington Lumber Co.	11.18	6.60	14.19	14.00	9.78	14.00	53.07	5.18	3.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	WHEAT PRODUCTS—*Continued*		%	%	%	%	%	%	%	%	%
	Wheat Bran—Concluded										
2475	*Black Hawk, Pure.* International Milling Co., Minneapolis, Minn.	*Guilford:* F. H. Rolf, Inc.	11.35	6.93	16.00	15.00	9.68	12.00	50.64	5.40	3.20
2664	*Pure.* Larabee Flour Mills, Kansas City, Mo.	*Meriden:* Raymond Ives	12.23	6.85	15.69	15.00	8.53	10.00	52.35	4.35	3.50
2445	*Winter.* Larabee Flour Mills, Kansas City, Mo.	*East Haven:* F. A. Forbes	11.90	7.07	15.06	15.00	9.82	10.00	51.80	4.35	3.50
2568	*Moon's.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Stratford:* Z. C. Ingersoll	11.45	5.28	15.56	13.00	7.90	10.00	54.53	5.28	3.00
1136	*Pure.* Nebraska Consolidated Mills Co., Omaha, Neb.	*East Winsted:* Leonard Grain Co.	10.68	6.36	16.69	15.50	8.01	11.00	53.91	4.35	3.50
2834	*Niagara Choice.* Niagara Milling Co., Niagara Falls, N. Y.	*New Haven:* Moran-Paton Co.	10.25	7.03	15.63	14.00	10.46	11.00	51.28	5.35	3.50
2448	*Ogilvie's.* Ogilvie Flour Mills Co., Montreal, Canada	*Branford:* S. V. Osborn Est.	11.60	5.51	14.63	14.50	10.35	11.50	52.46	5.45	4.00
2595	*Pillsbury.* Pillsbury's Flour Mills, Minneapolis, Minn.	*Bethel:* Morrison & Dunham	11.10	6.95	15.00	14.00	10.18	12.00	51.22	5.55	4.00
2520	*Superior Pure.* Robin Hood Mills, Calgary, Canada	*Colchester:* J. Buratz	10.20	5.28	16.13	15.00	9.90	11.50	53.41	5.08	3.50
2956	*Dependable Rex.* Royal Milling Co., Great Falls, Montana	*Danielson:* Young Bros. Co.	11.20	5.07	16.81	15.00	8.53	10.00	53.21	5.18	4.00
2777	*Occident.* Russell-Miller Milling Co., Minneapolis, Minn.	*Granby:* R. L. Forsyth	9.83	6.29	15.56	14.00	10.30	11.50	52.44	5.58	4.00
2883	St. Lawrence Flour Mills, Montreal, Canada	*Shelton:* Wolf Savitsky	11.08	5.73	15.13	14.50	10.45	11.50	51.73	5.88	4.00
	Wheat Middlings, etc.										
1003	*Rex.* Chas. M. Cox, Boston, Mass.	*Hamden:* Ira W. Beers	9.40	3.77	17.25	16.00	6.30	7.50	57.33	5.95	5.00
2587	*Wheat Shorts.* Dominion Flour Mills, Montreal, Canada	*West Cheshire:* Cheshire Grain & Coal Co.	10.28	4.00	16.88	16.00	6.28	8.00	57.08	5.48	5.00
1085	*Eshelman's.* John W. Eshelman & Sons, Lancaster, Pa.	*Devon:* Devon Coal & Ice Co.	10.38	2.96	16.00	16.00	4.13	6.00	62.28	4.25	4.00
2811	*Washburn's Gold Medal.* General Mills, Inc., Minneapolis, Minn.	*Willimantic:* Willimantic Grain Co.	10.73	3.72	17.81	16.00	3.68	6.00	59.26	4.80	4.00
2476	*Washburn's Gold Medal.* General Mills, Inc., Minneapolis, Minn.	*Guilford:* F. H. Rolf, Inc.	10.75	4.77	16.13	15.00	7.75	9.50	54.22	6.38	4.00
2588	H. Hecker-Jones-Jewell Milling Co., New York City	*Plantsville:* Atwater Mills	9.85	5.13	16.94	15.00	7.53	9.50	55.02	5.53	5.00
2741	*Black Hawk Wheat Flour.* International Milling Co., Minneapolis, Minn.	*Suffield:* Spencer Bros.	10.20	2.60	17.50	16.00	2.40	4.00	63.57	3.73	3.50
2478	*Black Hawk Wheat Standard.* International Milling Co., Minneapolis, Minn.	*Guilford:* Fred C. Morse & Son	10.73	4.81	16.75	16.00	6.83	8.50	55.03	5.85	4.50
2845	*Red Star Flour.* E. Manchester & Sons, Winsted	*East Winsted:* Leonard Grain Co.	10.83	2.86	17.25	15.00	3.65	6.00	60.98	4.43	4.00
2850	*Bull Brand Wheat Flour.* Maritime Milling Co., Buffalo, N. Y.	*Brookfield:* S. A. Smith & Son	10.55	3.18	15.00	15.00	5.35	6.00	61.67	4.25	4.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred								
			Water	Ash	Protein (N x 6.25) Found	Protein (N x 6.25) Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
	WHEAT PRODUCTS—*Continued*										
	Wheat Middlings, etc.—Concl.		%	%	%	%	%	%	%	%	%
2831	*Moon's Fresh Ground White.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Higganum:* Felix Petrofsky	10.28	4.68	16.13	15.00	6.82	7.50	57.46	4.63	3.50
2746	*Niagara Choice.* Niagara Falls Milling Co., Niagara Falls, N. Y.	*Waterbury:* Spencer Grain Co.	9.48	5.13	17.31	15.50	7.73	9.50	54.67	5.68	4.00
2695	*Wheat Flour.* Northwestern Consolidated Milling Co., Minneapolis, Minn.	*Farmington:* Winchell Smith Grist Mill	9.90	3.68	17.88	15.00	5.38	6.00	57.96	5.20	4.00
2819	*Ogilvie's Wheat Shorts.* Ogilvie Flour Mills Co., Winnepeg, Canada	*Danielson:* Young Bros. Co.	10.38	3.82	16.75	16.00	6.60	8.00	57.50	4.95	5.00
2529	*Flour.* Park & Pollard Co., Buffalo, N. Y.	*Lebanon:* Berkman Grain Co.	10.68	3.98	16.25	16.00	5.08	6.00	59.51	4.50	4.00
2859	*Pillsbury's Hard Wheat A.* Pillsbury Flour Mills Co., Minneapolis, Minn.	*Canaan:* Ives & Pierce	10.55	3.40	17.63	16.00	4.28	6.00	59.31	4.83	4.00
2686	*Pillsbury's Hard Wheat Standard B.* Pillsbury Flour Mills Co., Minneapolis, Minn.	*Kensington:* S. F. Labieniec	10.50	5.08	15.88	15.00	8.55	9.50	54.86	5.13	4.00
2517	*Superior Pure Wheat Shorts.* Robin Hood Mills, Calgary, Canada	*Norwich:* A. E. Shedd	10.38	3.38	16.75	17.00	5.98	8.00	58.76	4.75	5.00
2756	*Shorts.* Standard Milling Co., Toronto, Canada	*Thomaston:* Thomaston Grain & Coal Co.	10.10	4.98	18.13	16.00	7.25	8.00	53.86	5.68	5.00
2575	*Wirthmore Flour.* St. Albans Grain Co., St. Albans, Vt.	*Shelton:* Shelton Feed Co.	10.50	4.13	16.31	15.00	5.75	6.00	58.88	4.43	4.00
2779	*Syragold Flour.* Syracuse Milling Co., Syracuse, N. Y.	*Granby:* E. H. Rollins	10.10	4.03	16.75	15.00	6.00	6.00	58.32	4.80	4.00
2488	*Big (Y) Flour.* Yantic Grain & Products Co., Norwich, Conn.	*Jewett City:* Big Y Feed Store	10.55	3.86	16.63	17.00	5.50	5.00	58.71	4.75	5.00
	Wheat Red Dog										
1090	*Washburn's Gold Medal Adrian.* General Mills, Inc., Minneapolis, Minn.	*Norwalk:* Frank Libner & Sons	10.83	2.39	16.31	16.00	2.07	4.00	64.42	3.98	3.50
2535	Hecker-Jones-Jewell Milling Co., Buffalo, N. Y.	*Colchester:* L. Broder	10.30	2.83	17.00	15.00	2.95	3.75	62.29	4.63	4.25
2904	Hecker-Jones-Jewell Milling Co., New York City	*Norwalk:* Frank Libner & Sons	10.00	3.36	17.25	15.75	3.73	4.00	59.96	5.70	4.50
	Wheat Feed (Mixed Feed)										
2860	*Crosby's.* Crosby Milling Co., Brattleboro, Vt.	*Kent:* Kent Grain & Coal Co.	11.03	4.41	14.94	15.00	6.78	9.50	57.99	4.85	4.50
2797	*Boston.* Duluth Superior Milling Co., Duluth, Minn.	*Hartford:* N. Y. Feed & Grain Co.	10.93	4.81	15.75	14.00	7.33	9.50	55.78	5.40	4.00
2571	*Washburn's Gold Medal Fancy.* General Mills, Inc., Minneapolis, Minn.	*Derby:* Peterson-Hendee Co.	12.40	4.70	15.38	15.00	5.48	7.50	58.01	4.03	4.00
2708	*Gold Mine.* H. H. King Flour Mills, Minneapolis, Minn.	*Thompsonville:* Geo. S. Phelps & Co.	10.60	5.20	19.31	15.00	8.85	9.50	50.46	5.58	4.50
1139	*Red Star.* E. Manchester & Sons, Winsted	*Winsted:* E. Manchester & Sons	10.65	5.33	15.50	16.00	7.44	7.50	56.60	4.48	4.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein (N x 6.25): Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	WHEAT PRODUCTS—*Continued* *Wheat Feed (Mixed Feed)—Concluded*		%	%	%	%	%	%	%	%	%
2662	*Red Wing.* Meech & Stoddard, Inc., Middletown	*East Hartford:* Meech Grain Co.	10.35	3.93	16.13	15.00	6.90	10.00	57.84	4.85	4.50
1047	*Osoto.* National Milling Co., Toledo, Ohio	*Bloomfield:* Bloomfield Farmers' Exchange	10.15	5.67	16.50	15.00	7.13	10.00	56.07	4.48	4.50
2693	*Planet.* Northwestern Consolidated Milling Co., Minneapolis, Minn.	*Farmington:* Winchell Smith Grist Mill	10.93	4.58	18.00	15.00	5.38	8.00	56.36	4.75	4.00
1048	*XXX Comet.* Northwestern Consolidated Milling Co., Minneapolis, Minn.	*Bloomfield:* Bloomfield Farmers' Exchange	10.20	2.93	18.38	16.00	2.10	4.00	60.61	5.78	4.00
2684	*Pillsbury's Fancy Mixed.* Pillsbury Flour Mills, Minneapolis, Minn.	*Kensington:* S. F. Labieniec	10.93	4.48	17.69	15.00	5.40	8.50	56.42	5.08	4.00
2447	*Pillsbury's XX Daisy.* Pillsbury Flour Mills, Minneapolis, Minn.	*East Haven:* F. A. Forbes	11.73	2.66	17.06	16.00	2.19	4.00	61.98	4.38	4.00
2649	*Occident.* Russell Miller Milling Co., Minneapolis, Minn.	*Wallingford:* A. E. Hall	11.33	4.83	17.00	15.00	7.78	9.50	53.18	5.88	4.50
2451	*Wirthmore.* St. Albans Grain Co., St. Albans, Vt.	*Branford:* S. V. Osborn Est.	12.00	4.31	14.81	15.00	8.05	8.00	55.55	5.28	4.50
2489	*Big Y Mixed.* Yantic Grain & Products Co., Norwich	*Norwich:* Yantic Grain & Products Co.	10.28	5.45	16.88	16.00	6.88	8.00	55.68	4.83	4.50
	MAIZE PRODUCTS *Corn Gluten Feed, etc.*										
968	*Clinton Gluten Feed.* Clinton Corn Syrup Refining Co., Clinton, Iowa	*Guilford:* F. H. Rolf, Inc.	9.20	7.38	22.00	23.00	8.25	8.50	49.12	4.05	2.00
2635	*Clinton Gluten Feed.* Clinton Corn Syrup Refining Co., Clinton, Iowa	*Seymour:* Seymour Grain & Coal Co.	8.20	5.88	23.31	23.00	8.13	8.50	51.15	3.33	2.00
1146	*Buffalo Gluten Feed.* Corn Products Refining Co., New York City	*Farmington:* Winchell Smith Grist Mill	10.33	8.09	23.31	23.00	8.58	8.50	48.04	1.65	2.00
2454	*Buffalo Gluten Feed.* Corn Products Refining Co., New York City	*Branford:* S. V. Osborn Est.	9.00	6.98	23.75	23.00	7.32	8.50	50.70	2.25	2.00
2525	*Diamond Gluten Meal.* Corn Products Refining Co., New York City	*Norwich:* Yantic Grain & Products Co.	7.65	1.70	41.25	40.00	3.43	4.00	43.74	2.23	1.00
2477	*Staley's Gluten Feed.* A. E. Staley Mfg. Co., Decatur, Ill.	*Guilford:* Fred C. Morse & Son	10.08	6.30	28.13	23.00	5.75	8.00	48.11	1.63	1.00
2573	*Union Gluten Feed.* Union Sales Corp., Columbus, Ind.	*Derby:* Peterson-Hendee Co.	10.15	7.63	26.31	23.00	7.25	8.00	46.03	2.63	1.00
	Hominy Feed, etc.										
2619	*Amco Corn Feed Meal.* American Milling Co., Peoria, Ill.	*Danbury:* C. S. Barnum & Son	11.75	2.10	9.88	9.00	3.08	5.00	68.24	4.95	4.00
2685	*Emco.* Evans Milling Co., Indianapolis, Ind.	*Kensington:* S. F. Labieniec	10.25	2.45	10.06	10.00	3.78	5.50	67.03	6.43	6.00
2697	*White.* Kellogg Co., Battle Creek, Mich.	*Collinsville:* Lawton-Miner Co.	9.18	2.35	10.25	10.00	3.85	5.00	67.54	6.83	6.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred								
			Water	Ash	Protein (N x 6.25)		Fiber		Nitrogen-free extract (starch, gum, etc.)	Fat	
					Found	Guaranteed, not less than	Found	Guaranteed, not more than		Found	Guaranteed, not less than
	MAIZE PRODUCTS—*Concluded* *Hominy Feed, etc.—Concluded*		%	%	%	%	%	%	%	%	%
1131	*Badger White.* Chas. A. Krause Milling Co., Milwaukee, Wis.	*Torrington:* Litchfield Co-op. Assoc.	8.95	2.85	11.06	10.00	5.07	5.00	64.92	7.15	6.00
2650	*Steam Cooked.* Miner-Hillard Milling Co., Wilkes-Barre, Pa.	*Wallingford:* A. E. Hall	10.85	2.15	10.44	10.00	3.38	5.00	68.70	4.48	4.00
2837	*Moon's.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Torrington:* F. W. Wadhams	10.15	2.13	10.13	10.00	5.58	6.00	66.63	5.38	5.00
2792	*Poco.* Mt. Vernon Milling Co., Mt. Vernon, Ind.	*Windsor:* L. W. Hudson	9.08	3.00	11.31	10.00	5.15	6.00	63.81	7.65	7.00
2788	Patent Cereal Co., Geneva, N. Y.	*Bloomfield:* Bloomfield Farmers' Exchange	10.90	2.66	10.50	10.00	5.08	5.00	65.43	5.43	5.00
2480	*Burt's.* Postum Company, Inc., Battle Creek, Mich.	*Lyme:* Lyme Grain Co.	10.28	2.74	10.63	10.00	4.67	5.00	64.55	7.13	6.00
1158	*Pratt's White.* Pratt Food Co., Buffalo, N. Y.	*Norwalk:* Frank Libner & Sons	11.05	2.06	9.50	10.00	3.08	6.00	69.38	4.93	4.00

2498	Quaker Oats Co., Chicago, Ill.	*New London:* New London Grain Co.	10.45	2.97	10.75	10.00	5.30	8.00	64.78	5.75	5.00
2522	*White.* Quaker Oats Co., Chicago, Ill.	*Colchester:* J. Buratz	9.50	2.13	10.00	10.50	4.78	6.00	67.89	5.70	5.00
2584	*Yellow.* Quaker Oats Co., Chicago, Ill.	*Ansonia:* I. Sovitsky Grain & Coal Co.	10.40	2.65	10.25	10.50	4.10	6.00	67.17	5.43	5.00
2868	*Corn Feed Meal.* Ralston Purina Co., St. Louis, Mo.	*Danbury:* H. E. Meeker	11.40	1.53	8.88	8.50	3.50	5.00	71.06	3.63	3.00
2443	*Paragon.* St. Albans Grain Co., St. Albans, Vt.	*East Haven:* F. A. Forbes	11.10	4.02	9.88	10.00	5.04	7.00	62.16	7.80	6.00
	RYE PRODUCTS										
2765	*Rye Middlings.* Miner-Hillard Milling Co., Wilkes-Barre, Pa.	*Higganum:* Felix Petrofsky	9.73	3.08	16.19	12.00	2.68	5.00	65.39	2.93	2.50
2928	*Rye Feed.* Upper Hudson Rye Flour Mills, Troy, N. Y.	*Middletown:* Meech & Stoddard, Inc.	9.95	3.60	17.13	13.50	5.03	6.00	60.76	3.53	3.00
	BREWERS' AND DISTILLERS' GRAINS										
2710	*"Bull Brand" Dried Brewers' Grains.* Farmers Feed Co., Buffalo, N. Y.	*Thompsonville:* Geo. S. Phelps & Co.	7.25	3.83	22.88	22.00	15.30	15.00	43.46	7.28	6.00
2634	*Alco Dried Brewers' Grains.* C. J. Martenis Grain Co, New York City	*Seymour:* Seymour Grain & Coal Co.	7.73	4.20	23.56	21.00	14.15	20.00	43.53	6.83	6.00
1091	*Alco Dried Distillers' Grains.* C. J. Martenis Grain Co, New York City	*Seymour:* Seymour Grain & Coal Co.	5.98	2.38	21.69	25.00	12.00	15.00	47.82	10.13	8.00
1118	*Brewers' Dried Grains.* St. Albans Grain Co., St. Albans, Vt.	*New Milford:* Geo. T. Soule	7.03	3.32	20.69	21.00	12.55	15.00	49.98	6.43	5.00
	DRIED BEET PULP										
2444	The Larrowe Milling Co., Detroit, Mich.	*East Haven:* F. A. Forbes	11.50	3.70	7.94	8.00	19.01	22.00	56.90	0.95	0.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	DRIED BEET PULP—*Concluded*		%	%	%	%	%	%	%	%	%
963	*Dried Molasses Beet Pulp.* Larrowe Milling Co., Detroit, Mich.	*Wallingford:* A. E. Hall	9.05	4.99	10.00	8.00	18.28	20.00	56.93	0.75	0.50
2711	*Dried Beet Pulp.* Milmine Bodman & Co., Inc., New York City	*Thompsonville:* Geo. S. Phelps & Co.	9.28	3.25	8.25	7.00	17.70	20.00	60.97	0.55	0.25
	PROPRIETARY MIXED FEEDS *Horse Feed*										
2605	*Amco.* American Milling Co., Peoria, Ill.	*Danbury:* C. S. Barnum & Son	10.80	2.83	10.25	9.00	6.28	9.00	66.59	3.25	3.50
2618	*Amco June Pasture Alfalfa and Molasses.* American Milling Co., Peoria, Ill.	*Danbury:* C. S. Barnum & Son	8.15	10.48	12.13	10.00	16.50	21.00	51.94	0.80	0.50
2665	*Wonder Horse and Mule.* Arcady Farms Milling Co., Chicago, Ill.	*Meriden:* Raymond Ives	12.98	4.08	9.81	9.00	7.80	10.00	62.00	3.33	3.00
2739	*Wonder Sweet Lasses.* Arcady Farms Milling Co., Chicago, Ill.	*New Britain:* S. P. Strople	9.08	9.48	11.88	9.00	16.35	25.00	51.88	1.33	1.00
2749	*Beacon Hog Feed.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Bethlehem:* A. T. Minor	9.30	8.73	19.38	18.00	6.20	7.00	50.89	5.50	5.00
2604	*Beacon.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Danbury:* C. S. Barnum & Son	12.33	3.68	10.50	9.00	5.53	11.00	65.46	2.50	2.50
2865	*Be-Co-Las.* Beacon Milling Co., Inc., Cayuga, N. Y.	*New Milford:* W. L. Richmond	11.05	7.11	13.31	11.00	13.35	12.00	53.65	1.53	1.00
2994	*Chariot.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Shelton:* Shelton Feed Co., Inc.	9.25	4.50	10.81	8.00	7.13	10.00	65.73	2.58	2.00
2505	*Extra Vim Molasses.* C. W. Campbell Co., Westerly, R. I.	*Groton:* C. W. Campbell Co.	11.33	4.60	10.00	10.00	10.15	12.00	60.19	3.73	2.00
2506	*Provender.* C. W. Campbell Co., Westerly, R. I.	*Groton:* C. W. Campbell Co.	11.08	2.43	10.63	10.00	5.63	10.00	67.10	3.13	4.00
2979	*Provender.* C. W. Campbell Co., Westerly, R. I.	*Groton:* C. W. Campbell Co.	11.10	2.78	10.50	10.00	6.05	10.00	64.57	5.00	4.00
2624	*Ajax.* Chapin & Co., Hammond, Ind.	*Danbury:* F. C. Benjamin	10.78	5.90	10.94	9.00	9.10	12.00	60.10	3.18	3.00
2626	*Davis.* R. G. Davis & Sons, New Haven	*Westville:* R. G. Davis & Sons	10.85	3.35	8.38	9.00	7.18	10.00	66.66	3.58	3.00
2832	*Davis No. 1 Provender.* R. G. Davis & Sons, New Haven	*New Haven:* R. G. Davis & Sons	10.85	2.37	10.06	10.00	5.41	8.00	66.01	5.30	3.50
2621	*Alfalfa Meal.* Denver Alfalfa Milling & Products Co., Lamar, Colorado	*Danbury:* C. S. Barnum & Son	8.58	8.23	11.44	13.00	33.28	33.00	37.04	1.43	1.00
6817	*Alfalfa Leaf Meal (Leafalfa Brand).* Denver Alfalfa Milling & Products Co., Lamar, Colorado	*Putnam:* Dayville Grain Co.	8.28	14.16	21.13	20.00	14.78	18.00	39.07	2.58	2.50
2487	*Eastern States Open Formula.* Eastern States Farmers' Exchange, Springfield, Mass.	*Norwich:* A. E. Shedd	11.45	3.41	11.38	10.50	5.78	6.50	63.75	4.23	3.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Horse Feed—Continued		%	%	%	%	%	%	%	%	%
2645	*Elmore, with Molasses.* Elmore Milling Co., Oneonta, N. Y. ..	*Hazardville:* A. D. Bridge's Sons	12.13	4.15	10.25	9.00	6.60	11.00	63.37	3.50	2.50
2902	*Eshelman's Lancaster 60.* John W. Eshelman & Sons, Lancaster, Pa.	*Norwalk:* Frank Libner & Sons	11.23	4.82	10.00	9.00	9.98	10.00	60.57	3.40	2.50
2896	*Liberty.* John W. Eshelman & Sons, Lancaster, Pa.	*Southport:* C. Buckingham & Co.	8.30	6.71	9.00	7.00	11.88	10.00	61.53	2.58	2.00
2567	*Eshelman's Red Rose 85.* John W. Eshelman & Sons, Lancaster, Pa.	*Stratford:* Farmers' Flour & Grain Co.	10.78	3.00	9.50	9.00	7.10	10.00	65.69	3.93	3.00
2991	*Eshelman's Thorobred.* John W. Eshelman & Sons, Lancaster, Pa.	*New Britain:* Wm. Cohen	7.05	1.88	10.13	9.00	4.38	6.00	72.33	4.23	4.00
2706	*Imperial Steamed Cooked.* Imperial Grain & Milling Co., Toledo, Ohio	*Hazardville:* A. D. Bridge's Sons	10.00	2.13	10.13	9.50	4.78	4.60	68.43	4.53	4.00
2849	*Bull Brand, with Molasses.* Maritime Milling Co., Buffalo, N. Y.	*Brookfield:* S. A. Smith & Son	11.50	3.23	9.50	8.00	7.93	10.00	63.89	3.95	2.00
2554	*Red Wing Molasses.* Meech & Stoddard, Inc., Middletown ..	*Colchester:* Red Wing Feed & Lumber Co.	10.85	3.63	10.75	9.00	7.58	10.00	63.16	4.03	3.00
2514	*"1795" Steamed Cooked Corn & Oats.* Miner-Hillard Milling Co., Wilkes-Barre, Pa.	*Westerly:* C. W. Campbell Co..	8.75	2.18	9.75	9.50	5.15	5.00	69.84	4.33	4.00
969	*Old Mill.* Fred C. Morse & Son, Guilford	*Guilford:* Fred C. Morse & Son	11.33	3.89	11.75	12.00	5.75	9.00	63.23	4.05	4.00
1035	*Old Mill Provender..* Fred C. Morse & Son, Guilford	*Guilford:* Fred C. Morse & Son	12.58	2.14	10.00	10.00	4.75	7.00	67.15	3.38	4.00
2780	*Domino Vim-O-Lene.* Nowak Milling Corp., Hammond, Ind.	*Bloomfield:* Bloomfield Farmers' Exchange	11.20	3.34	9.25	9.50	5.85	9.00	66.91	3.45	3.00
2836	*Big Value Molasses.* Ontario Milling Co., Oswego, N. Y. ..	*Collinsville:* Rourke - Robotham Co.	11.60	5.65	11.25	8.50	10.86	12.00	58.36	2.28	2.00
2450	*Osborn's Provender.* S. V. Osborn Est., Branford	*Branford:* S. V. Osborn Est. ..	12.83	2.28	10.13	10.00	5.72	8.00	65.06	3.98	4.00
2910	*Belmont.* Park & Pollard Co., Buffalo, N Y.	*Greenwich:* T. Loughlin & Son	9.03	3.87	9.94	10.00	7.75	12.00	65.33	4.08	2.00
1069	*Corn & Oats ½ & ½.* Park & Pollard Co., Buffalo, N. Y. ..	*Shelton:* Shelton Feed Co.	11.85	2.50	9.88	10.00	7.95	8.00	63.92	3.90	1.50
2648	*Chelsea.* Park & Pollard Co., Buffalo, N. Y.	*Naugatuck:* Spencer Grain Co..	9.30	6.80	9.06	8.00	14.38	12.00	58.00	2.55	2.00
2572	*Park & Pollard.* Park & Pollard Co., Buffalo, N. Y.	*Derby:* Peterson-Hendee Co. ...	11.45	3.58	10.38	10.00	6.50	9.00	64.59	3.50	3.50
2616	*Velvet Meal.* Pecos Valley Alfalfa Milling Co., Hagerman, New Mexico	*Guilford:* F. H. Rolf, Inc.	9.48	11.15	17.13	17.00	20.73	23.00	39.41	2.10	1.50
2691	*Pratt's Utility.* Pratt Food Co., Hammond, Ind.	*Bristol:* Bristol Grain & Supply Co.	12.18	4.20	8.50	6.50	8.35	12.00	64.02	2.75	1.50
2630	*Banner Feed.* Quaker Oats Co., Chicago, Ill.	*Seymour:* Seymour Grain & Coal Co.	7.70	5.80	14.13	13.00	16.90	18.00	49.94	5.53	4.50
2492	*Horse Power Feed.* Quaker Oats Co., Chicago, Ill.	*Chester:* Leete Bros.	11.60	5.15	11.56	10.00	9.05	11.00	59.89	2.75	2.80

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Horse Feeds—Concluded		%	%	%	%	%	%	%	%	%
2594	*Quaker Green Cross.* Quaker Oats Co., Chicago, Ill.	*Bethel:* Morrison & Dunham ...	11.55	5.78	10.13	10.00	11.25	12.00	58.36	2.93	2.50
1052	*Sugared Vim Feed.* Quaker Oats Chicago, Ill.	*Branford:* S. V. Osborn Est. ...	6.60	6.63	6.25	5.00	23.95	25.00	54.44	2.13	1.50
2655	*Buffalo Purina Bulky Las.* Ralston Purina Co., St. Louis, Mo.	*Meriden:* H. Grulich	9.35	8.73	11.25	9.00	14.15	15.00	54.32	2.20	1.30
1109	*Purina Checkerboard Rolled Oats (steam cooked).* Ralston Purina Co., St. Louis, Mo.	*Stamford:* Clapboard Hill Feed Co.	8.00	1.94	15.88	16.00	1.07	2.00	67.21	5.90	6.00
2513	*Purina Omoline Feed.* Ralston Purina Co., St. Louis, Mo. ...	*Westerly:* C. W. Campbell Co..	11.30	3.93	10.25	9.70	7.73	9.00	62.16	4.63	3.20
2433	*Diamond.* Rockville Grain & Coal Co., Rockville	*Manchester:* Manchester Grain Co.	11.83	3.29	10.00	9.00	7.38	10.00	63.27	4.23	3.00
2647	*Charlestock.* St. Albans Grain Co., St. Albans, Vt.	*Thompsonville:* Geo. S. Phelps & Co.	9.23	7.43	9.75	9.00	10.88	14.00	57.68	5.03	4.00
2784	*King.* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	10.93	2.73	9.69	9.50	6.78	9.00	65.94	3.93	3.00
2493	*Wirthmore.* St. Albans Grain Co., St. Albans, Vt.	*Centerbrook:* W. J. Prann	12.20	3.90	9.75	9.80	5.83	9.00	64.54	3.78	3.25
2889	*Syragold, with Molasses.* Syracuse Milling Co., Syracuse, N. Y.	*East Bridgeport:* J. Simon	8.55	3.68	8.69	8.00	10.83	12.00	65.80	2.45	2.50
1010	*Colonel's Ration.* Tioga-Empire Feed Mills, Waverly, N. Y. ..	*Guilford:* F. H. Rolf, Inc.......	11.70	6.75	14.00	12.00	11.60	15.00	52.82	3.13	2.50
2851	*Derby Corn & Oat Feed.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Hawleyville:* W. A. Honan, Inc.	11.30	2.40	10.38	9.20	5.78	8.00	65.61	4.53	4.00
2843	*Derby Meal.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Torrington:* Litchfield Co-op. Assoc.	12.00	1.55	9.56	9.02	2.46	3.50	70.25	4.18	3.06
2676	*Neverfail.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Plainville:* W. S. Eaton	12.35	3.40	10.06	10.00	5.43	9.00	64.86	3.90	3.50
2533	*Crusader.* Ubiko Milling Co., Cincinnati, Ohio	*Lebanon:* Berkman Grain Co. ..	12.05	6.49	10.69	9.00	8.98	10.00	58.36	3.43	3.00
856	*Wayne Supreme.* Wayne Feed Mills, Fort Wayne, Ind.	*New Britain:* New Britain Bird Store	8.68	2.95	9.88	9.50	6.53	7.00	68.11	3.85	3.50
2888	*Wertz's Horse Feed with Alfalfa and Molasses.* F. S. Wertz & Son., Reading, Pa.	*Long Hill:* Long Hill Feed Store	9.90	4.43	9.69	9.00	9.20	10.00	62.55	4.23	2.00
1276	*Al-Mo.* Yantic Grain & Products Co., Norwich	*New London:* New London Grain Co.	11.93	9.12	12.25	11.00	12.97	15.00	52.03	1.70	1.50
2877	*Big (Y) Horse Feed.* Yantic Grain & Products Co., Norwich	*New London:* New London Grain Co.	11.30	4.28	11.50	10.00	6.18	7.00	63.24	3.50	3.00
	Dairy Feeds										
2563	*Amco 20% (Flexible Formula).* American Milling Co., Peoria, Ill.	*Danbury:* C. S. Barnum & Son ..	9.65	8.23	21.19	20.00	7.78	9.00	49.55	3.60	4.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred								
			Water	Ash	Protein (N x 6.25)		Fiber		Nitrogen-free extract (starch, gum, etc.)	Fat	
					Found	Guaranteed, not less than	Found	Guaranteed, not more than		Found	Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Dairy Feeds—Continued		%	%	%	%	%	%	%	%	%
2620	*Amco 24% (Flexible Formula).* American Milling Co., Peoria, Ill.	*Danbury:* C. S. Barnum & Son	9.03	7.86	25.13	24.00	7.65	9.00	46.05	4.28	4.00
2666	*Advanced Registry.* Arcady Farms Milling Co., Chicago, Ill.	*Meriden:* Raymond Ives	8.95	8.23	24.38	25.00	8.88	10.00	45.03	4.53	5.00
2988	*Advanced Registry.* Arcady Farms Milling Co., Chicago, Ill.	*New Britain:* S. P. Strople	8.50	7.48	25.38	25.00	9.03	10.00	44.71	4.90	5.00
2524	*Milkers Ready Ration.* Arcady Farms Milling Co., Chicago, Ill.	*Norwich:* A. E. Shedd	9.60	9.39	21.25	22.00	9.80	11.00	44.98	4.98	4.00
2737	*Old Colony Feed.* Arcady Farms Milling Co., Chicago., Ill	*Meriden:* Raymond Ives	8.48	9.53	20.50	20.00	8.55	12.00	48.79	4.15	3.50
2821	*Peerless Milk Ration.* Arcady Farms Milling Co., Chicago, Ill.	*Danielson:* Kennedy Corp.	8.90	9.48	20.69	20.00	11.83	12.00	44.65	4.45	4.00
2820.	*Sweet 16.* Arcady Farms Milling Co., Chicago, Ill.	*Danielson:* Kennedy Corp.	10.20	8.91	17.19	16.00	12.58	12.00	46.99	4.13	4.00
2678	*Wonder.* Arcady Farms Milling Co., Chicago, Ill.	*New Britain:* S. P. Strople	10.28	8.18	23.19	24.00	9.75	10.00	44.02	4.58	5.20
2981	*Wonder.* Arcady Farms Milling Co., Chicago, Ill.	*Norwich:* A. E. Shedd	9.85	9.27	25.00	24.00	8.30	10.00	43.10	4.48	5.20
2977	*Capital Dairy Feed, Sweetened.* E. W. Bailey & Co., Montpelier, Vt.	*New London:* B. J. McCarthy	10.20	8.03	22.38	24.00	7.43	9.00	47.66	4.30	5.00
2701	*Favorite Dairy Ration, Sweetened.* E. W. Bailey & Co., Montpelier, Vt.	*Lebanon:* Berkman Grain Co.	10.23	7.35	19.81	20.00	6.90	7.50	51.78	3.93	4.50
2810	*"Our Own."*. E. W. Bailey & Co., Montpelier, Vt.	*Mansfield Depot:* M. M. Hansen	10.10	8.04	18.31	16.00	8.18	9.00	50.54	4.83	5.00
2574	*Auburn.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Shelton:* Shelton Feed Co.	9.13	8.50	23.00	20.00	8.15	10.00	46.87	4.35	4.00
2603	*Beacon.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Danbury:* C. S. Barnum & Son	8.93	8.10	24.50	24.00	8.88	10.00	44.76	4.83	4.50
2617	*Beacon Sweet "24."* Beacon Milling Co., Inc., Cayuga, N. Y.	*Danbury:* C. S. Barnum & Son	9.33	7.13	25.25	24.00	8.08	9.00	46.91	3.30	4.00
2705	*Success.* A. D. Bridge's Sons, Hazardville	*Hazardville:* A. D. Bridge's Sons	8.88	5.68	21.13	20.00	11.00	9.50	48.61	4.70	5.00
2534	*L. B. Milk Ration.* L. Broder, Colchester	*Colchester:* L. Broder	9.50	7.78	19.63	20.00	7.38	8.50	50.41	5.30	5.50
1248	*C. B.* C. Buckingham & Co., Southport	*Southport:* C. Buckingham & Co.	10.10	7.94	23.63	22.75	8.93	9.50	44.90	4.50	4.50
2507	*No-Botheration.* C. W. Campbell Co., Westerly, R. I.	*Mystic:* C. W. Campbell	10.30	6.59	19.63	20.00	6.43	8.00	52.05	5.00	5.00
2631	*Ajax 20%.* Chapin & Co., Hammond, Ind.	*Plantsville:* C. A. Cowles	10.43	9.23	20.00	20.00	7.83	12.00	47.88	4.63	4.50
2622	*Ajax 24%.* Chapin & Co., Hammond, Ind.	*Danbury:* F. C. Benjamin	10.23	8.75	24.00	24.00	8.83	12.00	43.56	4.63	4.50
2625	*Unicorn.* Chapin & Co., Hammond, Ind.	*Danbury:* F. C. Benjamin	8.98	9.80	24.94	24.00	9.03	10.00	42.75	4.50	5.00
2922	*Grange Sweetened 16%.* Clyde Renco Milling Corp., Clyde, N. Y.	*Canaan:* Ives & Pierce	11.03	8.10	18.00	16.00	6.15	12.00	52.52	4.20	4.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Dairy Feeds—Continued										
			%	%	%	%	%	%	%	%	%
2921	*Renco Farmers' Special Sweetened Feed.* Clyde Renco Milling Corp., Clyde, N. Y.	*Canaan:* Ives & Pierce	10.33	7.63	22.38	20.00	8.38	9.00	46.78	4.50	3.50
2923	*Renco Makempay Sweetened Feed.* Clyde Renco Milling Corp., Clyde, N. Y.	*Canaan:* Ives & Pierce	9.65	8.63	25.63	24.00	8.28	9.00	42.93	4.88	4.00
2770	*Fortune 20% Molasses.* The Coles Co., Middletown	*Middletown:* The Coles Co.	10.30	7.73	19.38	20.00	7.45	9.00	50.51	4.63	4.00
2769	*Fortune 24% Molasses.* The Coles Co., Middletown	*Middletown:* The Coles Co.	9.10	7.80	23.00	24.00	7.53	9.00	47.54	5.03	4.50
2745	*Conkey's 24% Protein.* G. E. Conkey Co., Cleveland, Ohio	*Ansonia:* A. Hodos & Son	9.55	6.38	25.25	24.00	8.23	9.00	46.54	4.05	5.00
2744	*Conkey's Gecco 20% Protein.* G. E. Conkey Co., Cleveland, Ohio	*Ansonia:* A. Hodos & Son	8.88	8.38	20.75	20.00	8.20	9.00	49.26	4.53	4.50
2878	*Conkey's Red Seal 16%.* G. E. Conkey Co., Cleveland, Ohio	*Ansonia:* A. Hodos & Son	8.58	7.77	16.25	16.00	8.28	10.00	54.52	4.60	3.50
2668	*Cowles 20%.* C. A. Cowles, Plantsville	*Plantsville:* C. A. Cowles	9.63	5.90	22.00	20.00	8.90	10.00	48.49	5.08	5.00
2669	*Cowles 24%.* C. A. Cowles, Plantsville	*Plantsville:* C. A. Cowles	9.23	5.70	24.38	24.00	8.60	10.00	46.51	5.58	6.00
2986	*Cowles 24%.* C. A. Cowles, Plantsville	*Plantsville:* C. A. Cowles	8.73	6.58	23.88	24.00	8.88	10.00	46.65	5.28	6.00
1073	*Crosby's Balanced Ration.* Crosby Milling Co., Brattleboro, Vt.	*Shelton:* Wolf Savitsky	8.28	7.23	24.75	25.00	8.35	9.00	45.99	5.40	5.50
2798	*Crosby's Ready Ration.* Crosby Milling Co., Brattleboro, Vt.	*Manchester:* O. E. Bailey	9.23	6.04	20.50	20.00	7.85	8.50	61.48	4.90	5.00
2580	*Crosby's Sweetened Ready Ration.* Crosby Milling Co., Brattleboro, Vt.	*Shelton:* Wolf Savitsky	9.98	5.88	20.25	20.00	7.98	8.50	50.86	5.05	5.00
1682	*Basic.* R. G. Davis & Sons, New Haven	*Clintonville:* John Carlson	10.57	7.11	19.75	20.00	7.58	9.00	50.45	4.54	4.50
2627	*Basic.* R. G. Davis & Sons, New Haven	*Westville:* R. G. Davis & Sons	10.20	6.53	19.75	20.00	7.90	9.00	50.92	4.70	4.50
2736	*20% Open Formula.* R. G. Davis & Sons, New Haven	*Ansonia:* Ansonia Flour & Feed Co.	9.33	6.73	20.38	20.00	6.93	8.00	51.80	4.83	4.00
2602	*Delaware.* Delaware Mills, Inc., Deposit, N. Y.	*Danbury:* C. S. Barnum & Son	8.80	8.68	24.13	23.00	7.70	10.00	46.01	4.68	5.00
2551	*Delco 20%.* Delaware Mills, Inc., Deposit, N. Y.	*Colchester:* Red Wing Feed & Lumber Co.	9.88	6.48	20.50	20.00	8.23	11.00	50.71	4.20	4.00
2758	*Eastern States Fulpail (Open Formula).* Eastern States Farmers' Exchange, Springfield, Mass.	*North Haven:* Ridgewood Farm	9.80	6.33	21.88	20.00	7.33	8.00	50.06	4.60	4.00
2982	*Eastern States Milkmore (Open Formula).* Eastern States Farmers' Exchange, Springfield, Mass.	*Norwich:* A. E. Shedd	9.98	6.90	25.69	24.00	7.30	8.00	45.43	4.70	4.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Dairy Feeds—Continued										
			%	%	%	%	%	%	%	%	%
2879	*Eastern States 16 (Open Formula).* Eastern States Farmers' Exchange, Springfield, Mass.	*North Haven:* Ridgewood Farm	9.58	6.53	16.88	16.00	7.45	8.00	55.13	4.43	4.00
2549	*Elmore Milk Grains.* Elmore Milling Co., Inc., Oneonta, N. Y.	*Norwich:* A. E. Shedd	9.73	5.25	23.38	25.00	9.90	11.00	46.86	4.88	5.00
2980	*Elmore Milk Grains.* Elmore Milling Co., Inc., Oneonta, N. Y.	*Norwich:* A. E. Shedd	9.10	5.20	25.19	25.00	11.05	11.00	44.53	4.93	5.00
2636	*Elmore Waldorf Formula.* Elmore Milling Co., Inc., Oneonta, N. Y.	*Naugatuck:* Naugatuck Fruit & Produce Co.	10.28	9.15	19.63	20.00	8.25	10.00	48.59	4.10	4.00
2814	*Granger Open-Formula Ration.* Elmore Milling Co., Inc., Oneonta, N. Y.	*Willimantic:* Windham Grain Store	9.60	9.66	23.94	24.00	7.45	9.00	43.90	5.45	4.00
2544	*Ostego Economy Ration.* Elmore Milling Co., Inc., Oneonta, N. Y.	*Hazardville:* A. D. Bridge's Sons	10.00	6.68	19.63	20.00	8.88	11.00	50.13	4.68	4.00
2643	*Sweet Digesto.* Elmore Milling Co., Inc., Oneonta, N. Y.	*East Hartford:* Stowe & Rondeau	9.28	6.65	14.38	16.00	14.00	12.00	51.29	4.40	4.00
2591	*Eshelman's Certified 20%.* John W. Eshelman & Sons, Lancaster, Pa.	*Rockville:* Rockville Grain & Coal Co.	9.08	6.43	22.13	20.00	7.13	8.00	51.40	3.83	4.00
2590	*Eshelman's Certified 24%.* John W. Eshelman & Sons, Lancaster, Pa.	*Rockville:* Rockville Grain & Coal Co.	8.83	6.65	26.88	24.00	7.43	8.00	45.98	4.23	4.50
2564	*Eshelman's Conestoga 18.* John W. Eshelman & Sons, Lancaster, Pa.	*Devon:* Devon Coal & Ice Co.	10.95	9.25	17.63	18.00	8.65	11.00	48.04	5.48	3.50
2565	*Eshelman's Lancaster 20.* John W. Eshelman & Sons, Lancaster, Pa.	*Devon:* Devon Coal & Ice Co.	10.40	8.45	21.06	20.00	8.48	11.00	46.86	4.75	4.00
2906	*Eshelman's Pennsy 16.* John W. Eshelman & Sons, Lancaster, Pa.	*South Norwalk:* Roodner Feed Co.	1125.	7.19	16.44	16.00	8.63	11.00	52.99	3.50	3.00
2652	*Eshelman's Red Rose 24.* John W. Eshelman & Sons, Lancaster, Pa.	*Wallingford:* A. E. Hall	10.73	7.35	25.00	24.00	8.33	11.00	44.61	3.98	4.00
2909	*Eshelman's Susquehanna.* John W. Eshelman & Sons, Lancaster, Pa.	*Greenwich:* Johnson's Feed Store	9.03	6.33	22.06	20.00	8.83	12.00	48.27	5.48	3.00
2429	*R Own.* F. A. Forbes, East Haven	*East Haven:* F. A. Forbes	9.83	10.17	19.75	20.00	8.42	9.00	47.08	4.75	4.00
2442	*R Own.* F. A. Forbes, East Haven	*East Haven:* F. A. Forbes	11.73	6.44	20.13	20.00	9.18	9.00	49.12	3.40	4.00
2930	*R Own.* F. A. Forbes, East Haven	*East Haven:* F. A. Forbes	11.10	4.57	19.50	20.00	8.30	9.00	52.15	4.38	4.00
2880	*Cream-O-Milk.* Flory Milling Co., Bangor, Pa.	*Granby:* E. H. Rollins	8.48	9.25	19.69	20.00	11.80	12.00	46.88	3.90	4.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Dairy Feeds—Continued		%	%	%	%	%	%	%	%	%
2881	*Record.* Flory Milling Co., Bangor, Pa.	*Granby:* E. H. Rollins	9.20	8.57	22.00	20.00	7.65	9.00	48.63	3.95	5.00
2809	*Washburn's Gold Medal Vitamin, containing Wheat Germ (Embryo).* General Mills, Inc., Minneapolis, Minn.	*Stafford Springs:* Dennis Grain Mill	9.68	7.15	20.00	20.00	6.50	8.50	51.34	5.33	5.00
2932	*Grandin's Sweetened 24%.* D. H. Grandin Milling Co., Jamestown, N. Y.	*Falls Village:* H. E. Dean	10.03	8.45	25.13	24.00	7.18	10.00	44.46	4.75	4.00
2793	*Hudson's.* L. W. Hudson, Windsor	*Windsor:* L. W. Hudson	10.00	5.17	16.75	19.00	7.35	8.00	55.48	5.25	5.75
1253	*Apex Milk Maker.* Kasco Mills, Inc., Waverly, N. Y.	*East Winsted:* Leonard Grain Co.	10.13	7.00	19.69	20.00	9.42	11.00	48.67	5.09	4.50
1252	*Beatsall Milk Grains.* Kasco Mills, Inc., Waverly, N. Y.	*East Winsted:* Leonard Grain Co.	10.00	7.09	22.38	22.00	8.88	10.00	46.67	4.98	4.50
2926	*Badger 16½ Sweet.* Chas. A. Krause Milling Co., Milwaukee, Wis.	*Thomaston:* I. Levy	10.48	6.88	16.13	16.50	11.73	13.00	48.98	5.80	5.00
1046	*Larro Ready Ration.* Larrowe Milling Co., Detroit, Mich.	*Collinsville:* Lawton-Miner Co.	7.95	6.84	20.50	20.00	11.40	12.00	49.01	4.30	4.00
2471	*Larro Ready Ration.* Larrowe Milling Co., Detroit, Mich.	*Norwich:* A. E. Shedd	9.50	7.61	21.31	20.00	10.55	12.00	46.88	4.15	4.00
2688	*Mill Pride.* C. W. Lines Co., New Britain	*New Britain:* C. W. Lines Co.	9.03	7.03	23.81	24.00	7.98	10.00	47.67	4.48	5.00
2963	*Common Sense.* Litchfield Cooperative Association, Torrington	*Torrington:* Litchfield Co-op. Assoc.	8.95	7.56	20.25	20.00	8.07	9.00	49.89	5.28	4.50
2886	*Square Deal.* Long Hill Feed Store, Long Hill	*Long Hill:* Long Hill Feed Store	7.68	7.78	21.88	20.00	10.35	10.00	48.28	4.03	5.00
2847	*Red Star.* E. Manchester & Sons, Winsted	*Winsted:* E. Manchester & Sons	9.05	8.10	23.00	23.00	8.03	10.00	46.97	4.85	4.00
2848	*Red Star Special.* E. Manchester & Sons, Winsted	*Winsted:* E. Manchester & Sons	9.13	8.15	20.13	20.00	7.45	9.00	50.19	4.95	4.00
2846	*Bull Brand Sweetened.* Maritime Milling Co., Buffalo, N Y.	*Riverton:* L. A. Coe	9.75	6.63	23.31	24.00	8.09	12.00	48.07	4.15	5.00
2657	*Red Wing.* Meech & Stoddard, Inc., Middletown	*Meriden:* Meriden Grain & Coal Co.	8.93	8.38	21.88	20.00	9.20	9.00	45.76	5.85	5.50
2553	*Red Wing 20%, with Brewers' Grains.* Meech & Stoddard, Inc., Middletown	*Colchester:* Red Wing Feed & Lumber Co.	8.85	7.38	20.13	20.00	10.28	12.00	47.78	5.58	5.00
2656	*Red Wing 24%, with Brewers' Grains.* Meech & Stoddard, Inc., Middletown	*Meriden:* Meriden Grain & Coal Co.	8.45	4.70	24.88	24.00	8.90	12.00	47.24	5.83	5.50
2552	*Red Wing Special.* Meech & Stoddard, Inc., Middletown	*Colchester:* Red Wing Feed & Lumber Co.	8.38	9.14	22.63	24.00	7.98	9.00	46.29	5.58	5.50
2675	*Memo.* Mennel Milling Co., Toledo, Ohio	*Plainville:* W. S. Eaton	9.75	5.25	20.00	20.00	9.33	12.00	51.34	4.33	4.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein (N x 6.25) Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Dairy Feeds—Continued										
			%	%	%	%	%	%	%	%	%
2953	*Memo 16% Sweet, with Molasses.* Mennel Milling Co., Toledo, Ohio	*Plainville:* W. S. Eaton	10.30	5.97	15.44	16.00	8.08	12.00	56.21	4.00	3.50
2955	*Memo 22% Milk Ration.* Mennel Milling Co., Toledo, Ohio	*Putnam:* Dayville Grain Co.	9.73	6.55	19.31	22.00	7.85	10.00	53.08	3.48	3.50
3016	*Moon's 20%, with Molasses.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Plainville:* F. B. Newton	8.50	9.03	19.81	20.00	9.90	11.00	47.78	4.98	4.50
2569	*Moon's 24%.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Stratford:* Z. C. Ingersoll	9.55	7.04	24.00	24.00	7.85	10.00	46.46	5.10	5.00
2830	*Moon's X.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Higganum:* Felix Petrofsky	9.90	9.56	15.06	16.00	12.55	16.00	48.93	4.00	4.00
971	*Old Mill 20%.* Fred C. Morse & Son, Guilford	*Guilford:* Fred C. Morse & Son	9.65	8.46	21.88	20.00	7.23	9.00	48.55	4.23	4.50
2760	*Old Mill.* Fred C. Morse & Son, Guilford	*Guilford:* Fred C. Morse & Son	10.18	7.65	23.75	24.00	7.58	9.00	45.89	4.95	5.00
2781	*Domino 24½%.* Nowak Milling Corp., Hammond, Ind.	*Bloomfield:* Bloomfield Farmers' Exchange	8.50	8.27	25.44	24.50	8.43	10.00	44.81	4.55	5.00
2835	*Big Value.* Ontario Milling Co., Inc., Oswego, N. Y.	*Collinsville:* Rourke - Robotham Co., Inc.	9.13	6.98	20.25	20.00	10.81	10.00	48.10	4.73	4.50
2773	*Big Value, with Molasses.* Ontario Milling Co., Inc., Oswego, N. Y.	*Middletown:* P. Levson & Son	10.65	6.89	21.44	20.00	7.18	10.00	48.89	4.95	4.50
2774	*Butterfat Molasses.* Ontario Milling Co., Inc., Oswego, N. Y.	*Middletown:* P. Levson & Son	10.35	6.94	24.31	24.00	7.10	10.00	45.80	5.50	5.00
2536	*Uncle John's 24% Cream Pot.* Ontario Milling Co., Inc., Oswego, N. Y.	*Colchester:* L. Broder	8.68	7.05	24.25	24.00	8.13	9.00	46.21	5.68	5.50
2528	*Bet-R-Milk 20% Ration.* Park & Pollard Co., Buffalo, N. Y.	*Lebanon:* Berkman Grain Co.	10.45	8.60	23.13	20.00	7.60	9.00	46.19	4.03	4.00
2586	*Claco.* Park & Pollard Co., Buffalo, N. Y.	*West Cheshire:* Cheshire Grain & Coal Co.	10.65	6.68	20.44	20.00	7.28	9.00	50.72	4.23	4.50
2985	*Claco.* Park & Pollard Co., Buffalo, N. Y.	*West Cheshire:* Cheshire Grain & Coal Co.	10.53	7.12	20.25	20.00	7.03	9.00	50.72	4.35	4.50
2558	*Milk Maid 24%, Sweetened.* Park & Pollard Co., Buffalo, N. Y	*West Cheshire:* Cheshire Grain & Coal Co.	9.85	8.75	25.56	24.00	8.15	11.00	43.24	4.45	4.50
2638	*Overall 24%.* Park & Pollard Co., Buffalo, N. Y.	*Naugatuck:* Spencer Grain Co.	8.83	8.16	24.50	24.00	8.53	9.00	45.10	4.88	4.50
2796	*Top Notch 16%.* Park & Pollard Co., Buffalo, N. Y.	*Windsor:* Farmers' Grain & Hardware Co.	10.03	7.79	16.69	16.00	11.28	12.00	50.51	3.70	3.50
2862	*Pillsbury's.* Pillsbury Flour Mills, Minneapolis, Minn.	*New Milford:* Geo. T. Soule	9.03	7.88	20.81	20.00	8.50	10.00	48.75	5.03	5.00
2901	*Pratt's Sweet 24%.* Pratt Food Co., Buffalo, N. Y.	*Norwalk:* Frank Libner & Sons	9.13	8.98	25.13	24.00	8.75	10.00	43.16	4.85	4.00
2699	*Producer.* H. C. Puffer Co., Springfield, Mass.	*Simsbury:* Woods-Chandler Co.	9.13	6.68	25.50	24.00	7.83	8.50	46.06	4.80	4.00
2698	*Sweetened Producer.* H. C. Puffer Co., Springfield, Mass.	*Simsbury:* Woods-Chandler Co.	9.35	7.13	20.63	20.00	11.30	12.50	47.11	4.48	3.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred								
			Water	Ash	Protein (N x 6.25) Found	Protein (N x 6.25) Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued* *Dairy Feeds—Continued*		%	%	%	%	%	%	%	%	%
2511	*Quaker 20% Protein.* Quaker Oats Co., Chicago, Ill.	*Westerly:* C. W. Campbell Co.	8.68	8.64	22.44	20.00	11.80	12.00	43.74	4.70	3 25
2606	*Quaker 24% Protein.* Quaker Oats Co., Chicago, Ill.	*Danbury:* C. S. Barnum & Son ..	8.55	9.03	24.00	24.00	10.75	12.00	43.37	4.30	4.00
2905	*Protena.* Ralston Purina Co., St. Louis, Mo	*New Canaan:* Clap Board Hill Feed Co.	9.95	7.63	18.00	16.50	11.33	12.00	49.86	3.23	2.30
2654	*Purina Cow Chow.* Ralston Purina Co., St. Louis, Mo.	*Meriden:* H. Grulich	9.80	7.20	24.00	24.00	11.15	12.00	43.30	4.55	3.00
2592	*Purina Orange Checker Cow Chow.* Ralston Purina Co., St. Louis, Mo.	*Rockville:* Rockville Grain & Coal Co.	10.05	7.23	17.38	16.00	9.98	12.00	51.96	3.40	3 00
2629	*See-More-Milk.* Seymour Grain & Coal Co., Seymour	*Seymour:* Seymour Grain & Coal Co.	9.78	8.20	21.25	20.00	7.93	9.00	48.16	4.68	4.50
1145	*Millstreams "Boomerang."* Winchell Smith Grist Mill, Farmington	*Farmington:* Winchell Smith Grist Mill	9.45	6.67	22.13	24.00	6.85	10.00	50.20	4.70	6 00
2696	*Millstreams "Boomerang."* Winchell Smith Grist Mill, Farmington	*Farmington:* Winchell Smith Grist Mill	9.10	6.58	24.38	24.00	6.60	10.00	48.49	4.85	6.00
2692	*Millstreams "Twenty Percent."* Winchell Smith Grist Mill, Farmington	*Farmington:* Winchell Smith Grist Mill	9.65	6.70	20.25	20.00	7.78	8.00	51.04	4.58	5.00
2581	*Ansonia.* I. Sovitsky Grain & Coal Co., Ansonia	*Ansonia:* I. Sovitsky Grain & Coal Co.	8.55	7.60	19.69	20.00	11.18	9.70	48.18	4.80	5.90
2578	*Hygrade 20 Sweetened Milk Ration.* St. Albans Grain Co., S. Albans, Vt.	*Shelton:* Wolf Savitsky	9.90	6.58	20.19	20.00	7.13	8.50	51.82	4.38	4.00
2861	*Hygrade 24 Sweetened Milk Ration.* St. Albans Grain Co., St. Albans, Vt.	*Kent:* Kent Grain & Coal Co. ..	9.63	9.08	23.44	24.00	7.03	9.00	47.12	3.70	4.00
2518	*King 22 Milk Ration, Sweetened* St. Albans Grain Co., St. Albans, Vt.	*Norwich:* Norwich Grain Co...	9.88	7.35	22.25	22.00	8.93	9.00	47.19	4.40	4.50
2863	*Paragon Sweetened.* St. Albans Grain Co., St. Albans, Vt. ...	*New Milford:* Geo. T. Soule ...	8.65	14.22	21.94	22.00	10.65	12.00	40.64	3.90	4.00
2639	*Wirthmore 16 Sweetened.* St. Albans Grain Co., St. Albans, Vt.	*Wallingford:* Laden Bros.	10.98	8.33	16.88	16.00	6.70	8.00	52.63	4.48	4.00
2864	*Wirthmore 20%.* St. Albans Grain Co., St. Albans, Vt. ...	*New Milford:* Geo. T. Soule ...	8.95	5.96	20.19	20.00	7.68	8.50	52.37	4.85	5.00
2556	*Wirthmore 20, Sweetened.* St. Albans Grain Co., St. Albans, Vt.	*Hamden:* Ira W. Beers	9.88	8.25	20.38	20.00	7.43	8.00	49.11	4.95	4.75
2641	*Wirthmore 25 Balanced Ration.* St. Albans Grain Co., St. Albans, Vt.	*Kensington:* S. F. Labieniec ...	8.83	7.95	24.50	25.00	8.68	9.00	44.54	5.50	5.00
2453	*Wirthmore 25 Balanced Ration, Sweetened.* St. Albans Grain Co., St. Albans, Vt.	*Branford:* S. V. Osborn Est. ...	10.10	7.11	25.38	25.00	8.40	8.50	43.91	5.10	4.75

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued* *Dairy Feeds—Continued*		%	%	%	%	%	%	%	%	%
2539	*Onondaga.* Syracuse Milling Co., Syracuse, N. Y.	*Colchester:* P. Cutler, Inc.	8.40	5.60	20.75	20.00	12.90	12.00	47.22	5.13	4.00
2538	*Syragold.* Syracuse Milling Co., Syracuse, N. Y.	*Colchester:* P. Cutler, Inc.	8.80	4.98	23.94	24.00	9.55	12.00	47.90	4.83	4.50
2782	*Syragold Milk Ration.* Syracuse Milling Co., Syracuse, N. Y.	*Manchester:* Little & McKinney	9.00	5.47	20.00	20.00	9.20	12.00	51.03	5.30	4.00
1134	*Economy.* D. L. Talcott, Torrington	*Torrington:* D. L. Talcott	8.88	11.13	23.19	23.00	8.93	9.00	42.98	4.89	4.50
2754	*Thomaston.* Thomaston Supply Co., Thomaston	*Thomaston:* Thomaston Supply Co.	9.18	8.30	21.88	20.00	8.90	8.00	46.71	5.03	6.00
2677	*E-Gee.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Plainville:* W. S. Eaton	11.35	7.18	21.19	20.00	7.10	10.00	48.78	4.40	3.50
2593	*Red Brand Tioga.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Bethel:* Morrison & Dunham	9.39	7.88	24.38	24.00	7.48	10.00	45.84	5.03	4.50
1009	*White Brand Tioga.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Guilford:* F. H. Rolf, Inc.	10.00	7.32	22.00	20.00	6.98	10.00	49.10	4.60	4.00
2532	*Ubiko Union Grains 20% Sweet.* Ubiko Milling Co., Cincinnati, Ohio	*Lebanon:* Berkman Grain Co.	9.35	9.84	21.00	20.00	8.23	10.00	46.90	4.68	4.00
2815	*Ubiko Union Grains 24% Sweet.* Ubiko Milling Co., Cincinnati, Ohio	*Lebanon:* Berkman Grain Co.	9.05	9.30	24.88	24.00	8.85	10.00	43.02	4.90	5.00
2530	*Union Grains Ubiko Biles Ready Dairy Ration.* Ubiko Milling Co., Cincinnati, Ohio	*Lebanon:* Berkman Grain Co.	7.20	8.67	23.81	24.00	9.73	10.00	45.74	4.85	5.00
2829	*Advance 16%, with Molasses.* Vitality Mills, Inc., Chicago, Ill.	*Putnam:* Dayville Grain Co.	10.25	9.63	16.50	16.00	11.45	14.00	38.12	4.05	3.50
1220	*Advance 20%.* Vitality Mills, Inc., Chicago, Ill.	*New Britain:* S. P. Strople	9.88	13.09	21.13	20.00	9.15	12.00	40.55	6.20	3.50
2740	*Vitality 20%, with Molasses.* Vitality Mills, Inc., Chicago, Ill.	*Farmington:* Winchell Smith Grist Mill	9.40	10.93	20.00	20.00	9.45	12.00	46.52	3.70	3.50
2827	*Vitality 22%, with Molasses.* Vitality Mills, Inc., Chicago, Ill.	*Putnam:* Dayville Grain Co.	10.05	9.26	20.69	22.00	10.87	12.00	44.90	4.23	4.00
2828	*Vitality 24%, with Molasses.* Vitality Mills, Inc., Chicago, Ill.	*Putnam:* Dayville Grain Co.	9.15	9.34	24.31	24.00	8.28	10.00	44.44	4.48	5.00
1006	*Will Pay.* Vitality Mills, Inc., Chicago, Ill.	*Meriden:* Raymond Ives	9.73	11.33	20.50	20.00	8.80	9.00	44.46	5.18	5.00
2816	*Abington.* Yantic Grain & Products Co., Norwich	*Abington:* Abington Grain Co.	9.15	7.47	18.75	20.00	11.90	13.00	49.03	3.70	4.00
2485	*Big Y Dairy Ration.* Yantic Grain & Products Co., Norwich	*New London:* New London Grain Co.	8.90	7.10	23.44	24.00	8.18	9.00	47.43	4.95	5.00
2481	*Uncas.* Yantic Grain & Products Co., Norwich	*Lyme:* Lyme Grain Co.	9.78	6.65	21.69	20.00	7.40	9.00	49.60	4.88	5.00
1156	*Wadfeeco.* Wadsworth Feed Co., Warren, Ohio	*Shelton:* Shelton Feed Co.	10.10	10.06	23.25	24.00	7.70	9.00	44.44	4.45	5.00
1157	*Wadsworth Special Dairy Ration.* Wadsworth Feed Co., Warren, Ohio	*Shelton:* Shelton Feed Co.	9.48	6.83	21.88	20.00	12.45	12.00	44.81	4.55	5.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Dairy Feeds—Concluded		%	%	%	%	%	%	%	%	%
855	*Jumbo.* Wayne Feed Mills, Fort Wayne, Ind.	*New Britain:* New Britain Bird Store	7.60	8.75	16.63	16.00	11.65	12.00	51.32	4.05	3.50
854	*Wayne 20%.* Wayne Feed Mills, Fort Wayne, Ind.	*New Britain:* New Britain Bird Store	7.80	10.48	22.75	20.00	8.25	11.00	47.09	3.63	4.00
853	*Wayne 24%.* Wayne Feed Mills, Fort Wayne, Ind.	*New Britain:* New Britain Bird Store	6.73	12.97	25.25	24.00	8.08	11.00	42.87	4.10	4 00
	Stock Feeds										
2818	*Amco 12% Fitting Ration.* American Milling Co., Peoria, Ill.	*East Woodstock:* Ralph T. Eddy	10.58	5.98	12.75	12.00	6.40	9.00	60.14	4.15	3.50
2738	*Arcady.* Arcady Farms Milling Co., Chicago, Ill.	*New Britain:* S. P. Strople	8.68	6.38	10.88	9.00	11.65	12.00	58.71	3.70	3.50
2976	*Pennant.* E. W. Bailey & Co., Montpelier, Vt.	*New London:* B. J. McCarthy	10.08	4.52	10.38	9.50	9.68	9.50	60.99	4.35	4.50
2550	*Fortune.* The Coles Co., Middletown	*Colchester:* David Shea	9.60	3.63	10.50	9.00	10.65	11.00	61.47	4.15	3.50
1072	*Crosby's.* Crosby Milling Co. Brattleboro, Vt.	*Shelton:* Wolf Savitsky	7.93	4.70	10.00	9.00	10.88	12.00	61.41	5.08	4.00
2559	*Davis.* R. G. Davis & Sons, Inc., New Haven	*Milford:* Milford Grain Co.	9.43	4.63	11.00	10.00	9.10	14.00	60.34	5.50	2.00
2671	*Delaware.* Delaware Mills, Inc., Deposit, N. Y.	*Southington:* Southington Lumber Co.	10.28	5.93	9.94	9.00	12.85	12.00	57.10	3.90	3.00
2483	*Eastern States Fitting Ration, Open Formula.* Eastern States Farmers' Exchange, Springfield, Mass.	*Clinton:* A. L. Lockwood	11.40	6.65	13.13	12.00	6.38	7.00	58.44	4.00	3.50
2516	*Elmore.* Elmore Milling Co., Oneonta, N. Y.	*Norwich:* A. E. Shedd	8.10	4.54	9.50	10.00	11.20	12.00	62.23	4.43	3.00
2900	*Eshelman's Certified Fitting Ration.* John W. Eshelman & Sons, Lancaster, Pa.	*Norwalk:* Frank Libner & Sons	10.75	5.59	14.06	12.00	6.78	7.00	58.39	4.43	3.50
2651	*Eshelman's Sack of Silage.* John W. Eshelman & Sons, Lancaster, Pa.	*Wallingford:* A. E. Hall	10.63	9.18	11.75	10.00	14.25	15.00	52.26	1.93	1.50
2990	*Eshelman's.* John W. Eshelman & Sons, Lancaster, Pa.	*New Britain:* Wm. Cohen	8.43	4.35	9.94	9.00	10.45	11.00	62.23	4.60	3.00
2663	*Red Wing.* Meech & Stoddard Inc., Middletown	*East Hartford:* Meech Grain Co.	9.85	5.48	8.88	9.00	11.30	12.00	60.14	4.35	3.00
2570	*Moon's.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Stratford:* Z. C. Ingersoll	9.03	4.48	9.13	9.00	10.93	12.00	61.38	5.05	3.00
970	*Old Mill Fitting Feed.* Fred C. Morse & Son, Guilford	*Guilford:* Fred C. Morse & Son	11.08	7.29	13.88	12.00	5.65	8.00	58.02	4.08	4.00
1274	*Newtrio Growing & Fitting Ration.* Newton Feed Co., Milwaukee, Wis.	*Farmington:* Winchell Smith Grist Mill	8.68	9.21	14.06	12.00	7.33	9.00	55.54	5.18	5.00
2775	*Uncle John's Molasses.* Ontario Milling Co., Inc., Oswego, N. Y.	*Middletown:* P. Levson & Son	10.70	5.38	11.94	9.00	9.43	12.00	59.05	3.50	3.00
2766	*Bison, Sweetened.* Park & Pollard Co., Buffalo, N. Y.	*Stafford Springs:* Dennis Grain Mill	11.28	6.98	9.94	10.00	9.95	12.00	59.27	2.58	3.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred								
					Protein (N x 6.25)		Fiber			Fat	
			Water	Ash	Found	Guaranteed, not less than	Found	Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Found	Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Stock Feeds—Concluded		%	%	%	%	%	%	%	%	%
2768	*Fitting Ration.* Park & Pollard Co., Buffalo, N. Y.	*Putnam:* Bosworth Bros.	11.35	7.24	14.13	12.00	6.55	7.00	56.88	3.85	3.50
2755	*P & P.* Park & Pollard Co., Buffalo, N. Y.	*Thomaston:* Thomaston Grain & Coal Co.	9.18	6.15	11.88	8.50	9.45	12.00	58.94	4.40	4.00
2642	*Quaker Schumacher.* Quaker Oats Co., Chicago, Ill.	*Kensington:* S. F. Labieniec	9.03	5.93	10.63	10.00	10.20	12.00	59.88	4.33	3.25
2521	*Quaker Sugared Schumacher.* Quaker Oats Co., Chicago, Ill.	*Colchester:* J. Buratz	9.83	5.15	11.13	10.00	10.40	12.00	60.24	3.25	3.25
2903	*White Star, Fine.* Quaker Oats Co., Chicago, Ill.	*Norwalk:* Frank Libner & Sons	8.45	5.31	9.50	9.00	13.23	14.00	59.21	4.30	3.00
2495	*Purina Blue Checker Cow Chow.* Ralston Purina Co., St. Louis, Mo.	*New London:* New London Grain Co.	10.00	6.97	20.56	20.00	10.50	12.00	47.52	4.45	3.00
2497	*Purina Fitting Chow Feed.* Ralston Purina Co., St. Louis, Mo.	*New London:* New London Grain Co.	11.75	6.41	14.00	13.50	8.83	12.00	54.91	4.10	2.60
2800	*Purina.* Ralston Purina Co., St. Louis, Mo.	*Manchester:* Manchester Grain Co.	9.98	5.59	10.13	7.20	10.23	12.00	61.17	2.90	2.30
2583	*Ansonia.* I. Sovitsky Grain & Coal Co., Ansonia	*Ansonia:* I. Sovitsky Grain & Coal Co.	9.43	5.65	9.25	9.56	11.03	10.39	60.66	3.98	4.67
2519	*King.* St. Albans Grain Co., St. Albans, Vt.	*Norwich:* Norwich Grain Co.	9.15	4.67	9.88	9.00	10.03	10.00	60.02	6.25	4.00
2491	*Wirthmore 14 Fitting Ration.* St. Albans Grain Co., St. Albans, Vt.	*Chester:* Leete Bros.	11,38	6.28	14.75	14.00	6.20	7.00	57.11	4.28	4.00
2561	*Wirthmore.* St. Albans Grain Co., St. Albans, Vt.	*Milford:* Milford Grain Co.	9.20	4.45	9.06	9.00	10.33	9.50	61.91	5.05	4.00
2537	*Syragold.* Syracuse Milling Co., Syracuse, N. Y.	*Colchester:* P. Cutler, Inc.	9.45	4.68	9.44	9.00	9.83	12.00	63.02	3.58	3.00
2548	*Or-Co.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Guilford:* F. H. Rolf, Inc.	11.83	7.10	17.63	15.00	7.50	10.00	52.59	3.35	3.50
2486	*Uncas.* Yantic Grain & Products Co., Norwich	*Mystic:* Mystic Grain Co.	9.90	5.77	9.25	9.00	8.70	12.00	62.78	3.60	4.00
2825	*Uncas, Sugared.* Yantic Grain & Products Co., Norwich	*Mystic:* Mystic Grain Co.	10.15	4.85	8.13	9.00	10.38	12.00	62.51	3.98	4.00
	Calf Feeds, Etc.										
2598	*Eastern States.* Eastern States Farmers' Exchange, Springfield, Mass.	*Norwich:* A. E. Shedd	11.55	4.28	11.00	10.50	5.63	6.50	63.74	3.80	3.50
2750	*Beacon.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Bethlehem:* A. T. Minor	9.25	4.33	24.63	25.00	2.88	6.00	54.86	4.05	3.00
1119	*Blatchford's.* Blatchford Calf Meal Co., Waukegan, Ill.	*New Milford:* Geo. T. Soule	10.00	7.83	24.94	24.00	5.85	6.75	46.70	4 68	5.00
2694	*Blatchford's.* Blatchford Calf Meal Co., Waukegan, Ill.	*Farmington:* Winchell Smith Grist Mill	9.90	7.63	25.00	24.00	5.03	6.75	47.56	4.88	5.00
1017	*Elmore "Three Point."* Elmore Milling Co., Oneonta, N. Y.	*Hazardville:* Amos D. Bridge's Sons	9.88	6.46	16.00	24.00	2.60	4.00	61.46	3 60	4.00
1325	*Elmore "Three Point."* Elmore Milling Co., Oneonta, N. Y.	*Hazardville:* Amos D. Bridge's Sons	10.68	4.65	24.31	24.00	3.83	4.00	52.71	3 82	4.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Calf Feeds, Etc.—Concluded		%	%	%	%	%	%	%	%	%
2957	*Just Right.* Jersee Co., Minneapolis, Minn.	*Guilford:* Fred C. Morse & Son	10.20	4.41	24.75	23.00	4.65	4.00	50.94	5.05	3.80
1045	*Larro Hog Feed.* Larrowe Milling Co., Detroit, Mich.	*Collinsville:* Lawton-Miner Co.	8.43	6.30	19.06	18.00	9.35	10.00	51.08	5.78	5.00
1135	*Milkade.* Park & Pollard Co., Buffalo, N. Y.	*East Winsted:* Leonard Grain Co.	8.75	7.45	24.13	20.00	5.55	7.50	46.22	7.90	7.00
2646	*Schumacher.* Quaker Oats Co., Chicago, Ill.	*Hazardville:* A. D. Bridge's Sons	8.18	5.20	20.38	18.00	3.48	4.00	55.36	7.40	8.00
2660	*Purina Calf Chow Feed containing Mineral.* Ralston Purina Co., St. Louis, Mo.	*Farmington:* Winchell Smith Grist Mill	10.33	5.33	27.69	27.00	4.35	4.50	47.85	4.45	3.20
1188	*Purina Hog Fatena Feed containing Charcoal.* Ralston Purina Co., St. Louis, Mo.	*Norwich:* Norwich Grain Co.	13.38	6.63	15.06	14.00	5.83	6.00	55.65	3.45	3.00
1189	*Purina Pig Chow Feed containing Charcoal.* Ralston Purina Co., St. Louis, Mo.	*Norwich:* Norwich Grain Co.	11.65	8.79	21.88	20.00	6.43	7.00	46.94	4.31	3.20
2560	*Wirthmore.* St. Albans Grain Co., St. Albans, Vt.	*Milford:* Milford Grain Co.	9.48	5.38	23.63	24.00	2.65	4.00	54.13	4.73	5.50
2778	*Wirthmore Hog Feed.* St. Albans Grain Co., St. Albans, Vt.	*Granby:* E. H. Rollins	10.03	7.14	16.63	15.00	6.13	7.00	55.22	4.85	4.50
2783	*Wirthmore Pig Feed.* St. Albans Grain Co., St. Albans, Vt.	*West Willington:* H. M. Hansen	9.95	10.83	20.75	17.00	5.28	9.00	48.01	5.18	4.00
936	*Tioga.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Guilford:* F. H. Rolf, Inc.	9.65	6.59	22.19	21.00	4.60	7.00	51.84	5.13	4.00
937	*Wayne.* Wayne Feed Mills, Ft. Wayne, Ind.	*New Britain:* New Britain Bird Store	8.30	9.12	25.00	24.00	6.78	6.50	45.37	5.43	4.00
	Poultry Feeds										
2607	*Amco Egg Mash.* American Milling Co., Peoria, Ill.	*Danbury:* C. S. Barnum & Son	9.60	8.68	20.06	20.00	4.75	7.00	51.56	5.35	4.00
2658	*Arcady Besbet Laying Mash.* Arcady Farms Milling Co., Chicago, Ill.	*Meriden:* Raymond Ives	9.58	7.93	18.25	20.00	7.15	9.00	52.91	4.18	4.00
2989	*Arcady Besbet Laying Mash.* Arcady Farms Milling Co., Chicago, Ill.	*New Britain:* S. P. Strople	8.70	13.30	19.88	20.00	5.73	9.00	47.84	4.55	4.00
2659	*Arcady Scratch Grains.* Arcady Farms Milling Co., Chicago, Ill.	*Meriden:* Raymond Ives	12.25	1.65	10.50	10.00	2.63	5.00	70.07	2.90	2.50
2807	*Pennant Scratch Feed.* E. W. Bailey & Co., Montpelier, Vt.	*West Willington:* H. M. Hansen	12.15	1.26	9.38	10.00	2.43	6.50	72.25	2.53	3.00
2577	*Auburn Scratch Feed.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Shelton:* Shelton Feed Co.	12.18	1.78	9.94	9.00	2.45	5.00	71.30	2.35	2.50
1078	*Beacon Broiler Feed.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Danbury:* C. S. Barnum & Son	9.85	7.10	16.81	16.00	4.38	6.00	57.06	4.80	4.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Poultry Feeds—Continued										
			%	%	%	%	%	%	%	%	%
2872	*Beacon Complete Starting Ration.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Southbury:* H. R. Stone	9.50	5.68	17.50	16.50	4.03	6.00	57.74	5.55	4.00
1080	*Beacon Developer Feed.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Danbury:* C. S. Barnum & Son	10.05	1.95	12.19	10.00	2.00	5.00	70.26	3.55	2.50
2871	*Beacon Duck Fattener.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Southbury:* H. R. Stone	9.50	6.82	15.50	14.00	4.23	5.50	58.85	5.10	5.00
2870	*Beacon Duck Starter.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Southbury:* H. R. Stone	8.55	7.75	17.75	17.00	5.00	6.00	55.82	5.13	4.50
1075	*Beacon Chick Feed.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Danbury:* C. S. Barnum & Son	11.05	1.92	12.00	10.00	1.60	3.00	69.03	4.40	2.50
1061	*Beacon Egg Mash, with Buttermilk.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Shelton:* Shelton Feed Co.	8.45	12.14	20.69	21.00	6.13	7.00	47.79	4.80	4.50
1076	*Beacon Growing Mash.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Danbury:* C. S. Barnum & Son	8.05	10.20	18.06	17.00	5.43	7.00	53.18	5.08	4.00
1079	*Beacon Laying Mash.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Danbury:* C. S. Barnum & Son	8.58	12.76	20.69	20.00	6.33	8.00	45.84	5.80	5.00
2608	*Beacon Scratch Grains.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Danbury:* C. S. Barnum & Son	12.20	1.48	10.06	9.00	2.60	5.00	71.41	2.25	2.00
2866	*Beacon Special Scratch.* Beacon Milling Co., Inc., Cayuga, N. Y.	*New Milford:* W. L. Richmond	11.70	1.55	10.13	9.00	2.53	3.50	71.89	2.20	2.50
1074	*Beacon Starting Mash.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Southbury:* H. R. Stone	9.20	10.12	15.75	15.00	5.28	6.00	55.22	4.43	4.00
2576	*Beacon Turkey Growing Mash.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Shelton:* Shelton Feed Co.	9.43	11.05	15.25	15.00	6.83	6.00	52.64	4.80	4.00
2995	*Beacon Turkey Growing Mash.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Shelton:* Shelton Feed Co.	9.25	10.79	15.50	15.00	5.88	6.00	53.60	4.98	4.00
1062	*Cayuga Laying Mash, with Buttermilk.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Shelton:* Shelton Feed Co.	8.80	8.58	20.69	20.00	6.33	7.00	50.35	5.25	4.00
1077	*Chariot Chick Feed.* Beacon Milling Co., Inc., Cayuga, N. Y.	*Danbury:* C. S. Barnum & Son	11.88	1.82	10.88	10.00	1.65	5.00	69.82	3.95	2.50
2555	*Beers' Laying Mash.* Ira W. Beers, Hamden	*Hamden:* Ira W. Beers	10.08	6.69	19.00	19.00	6.23	7.00	52.97	5.03	5.50
2983	*Beers' Laying Mash.* Ira W. Beers, Hamden	*Hamden:* Ira W. Beers	10.18	8.09	19.88	19.00	6.28	7.00	50.24	5.33	5.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein (N x 6.25): Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Poultry Feeds—Continued		%	%	%	%	%	%	%	%	%
957	*Beers' Scratch Feed.* Ira W. Beers, Hamden	*Hamden:* Ira W. Beers	12.10	1.72	10.50	9.00	2.73	4.00	70.00	2.95	3.00
1161	*Bristol Mash.* Bristol Grain & Supply Co., Bristol	*Bristol:* Bristol Grain & Supply Co.	9.75	9.03	19.75	18.00	6.25	10.00	50.72	4.50	4.00
1050	*Bristol Scratch Feed.* Bristol Grain & Supply Co., Bristol	*Bristol:* Bristol Grain & Supply Co.	11.55	1.92	10.06	10.00	2.90	4.00	69.29	4.28	3.00
972	*C. B. Growing Mash.* C. Buckingham & Co., Southport	*Southport:* C. Buckingham & Co.	11.20	7.93	15.19	15.00	4.18	6.00	57.32	4.18	4.00
1247	*C. B. Mash.* C. Buckingham & Co., Southport	*Southport:* C. Buckingham & Co.	10.15	8.97	19.50	19.00	6.09	8.00	50.36	4.93	5.00
1249	*C. B. Scratch Feed.* C. Buckingham & Co., Southport	*Southport:* C. Buckingham & Co.	13.63	1.57	10.06	11.00	3.09	3.75	69.36	2.29	2.75
2895	*C. B. Scratch Feed.* C. Buckingham & Co., Southport	*Southport:* C. Buckingham & Co.	11.83	1.57	10.81	11.00	3.25	3.75	69.96	2.58	2.75
2978	*Chicken Greens.* California Hawaiian Milling Co., San Francisco, Cal.	*Groton:* C. W. Campbell Co.	8.20	13.40	20.06	20.00	17.00	18.00	38.69	2.65	....
1192	*Egg-O-Dry Mash.* C. W. Campbell Co., Westerly, R. I.	*Groton:* C. W. Campbell Co.	10.23	8.91	20.13	18.00	6.61	8.00	49.57	4.55	2.00
2504	*Egg-O-Scratch Feed.* C. W. Campbell Co., Westerly, R. I.	*Groton:* C. W. Campbell Co.	12.25	1.68	10.75	10.00	3.00	5.00	69.62	2.70	2.00
1133	*Chapin Kernels Grow-All.* Chapin & Co., Hammond, Ind.	*Torrington:* D. L. Talcott	8.30	10.35	16.44	16.00	4.53	5.50	56.30	4.08	3.50
1011	*Chapin Kernels Lay-All.* Chapin & Co., Hammond, Ind.	*Collinsville:* Rourke - Robotham Co.	7.73	10.91	18.50	16.00	4.50	5.50	54.91	3.45	3.50
1132	*Chapin Kernels Start All.* Chapin & Co., Hammond, Ind.	*Torrington:* D. L. Talcott	8.10	9.25	15.94	15.00	4.10	4.50	58.24	4.37	3.50
2623	*Unicorn Egg Mash (with Buttermilk).* Chapin & Co., Hammond, Ind.	*Danbury:* F. C. Benjamin	9.20	11.53	21.00	20.00	5.53	7.00	47.84	4.90	4.50
959	*Fortune Chick Starter.* The Coles Co., Middletown	*Plantsville:* Mehmel & Sarvi	9.30	9.94	15.94	14.00	5.83	5.00	53.56	5.43	5.00
1194	*Fortune Egg Mash, with Dried Buttermilk.* The Coles Co., Middletown	*Middletown:* The Coles Co.	9.75	11.00	20.50	17.00	5.30	9.00	47.97	5.48	3.50
1193	*Fortune Growing Feed.* The Coles Co., Middletown	*Middletown:* The Coles Co.	9.63	9.10	16.88	10.00	5.92	8.00	53.24	5.23	1.50
958	*Fortune Intermediate Scratch Feed.* The Coles Co., Middletown	*Plantsville:* Mehmel & Sarvi	12.08	1.32	10.56	10.00	1.93	3.00	71.76	2.35	5.00
1195	*Fortune Scratch Feed.* The Coles Co., Middletown	*Middletown:* The Coles Co.	13.75	1.54	9.56	10.00	2.96	5.00	68.99	3.20	2.50
1126	*Conkey's Gecco Chick Grains.* G. E. Conkey Co., Cleveland, Ohio	*Ansonia:* A. Hodos & Son	12.35	2.15	9.63	10.00	1.45	2.50	71.59	2.83	2.00
1125	*Conkey's Gecco Egg Mash, with Y-O.* G. E. Conkey Co., Cleveland, Ohio	*Ansonia:* A. Hodos & Son	9.50	10.98	22.13	20.00	5.13	7.00	45.06	7.20	5.00
2743	*Conkey's Gecco Egg Mash, with Buttermilk.* G. E. Conkey Co., Cleveland, Ohio	*Ansonia:* A. Hodos & Son	9.43	10.00	20.69	20.00	4.33	7.00	49.95	5.60	5.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein (N x 6.25) Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Poultry Feeds—Continued		%	%	%	%	%	%	%	%	%
1199	*Conkey's Gecco Growing Grains.* G. E. Conkey Co., Cleveland, Ohio	*New Haven:* Frank S. Platt Co.	12.15	1.78	10.06	10.50	1.79	3.00	70.07	4.15	2.50
1124	*Conkey's Gecco Growing Mash, with Buttermilk and Y-O.* G. E. Conkey Co., Cleveland, Ohio	*Ansonia:* A. Hodos & Son	9.50	9.67	20.75	18.00	5.82	7.50	48.18	6.08	5.50
1122	*Conkey's Gecco Scratch Grains.* G. E. Conkey Co., Cleveland, Ohio	*Ansonia:* A. Hodos & Son	13.00	1.36	9.63	9.75	2.79	3.00	70.52	2.70	2.50
1123	*Conkey's Scratch Grains.* G. E. Conkey Co., Cleveland, Ohio	*Ansonia:* A. Hodos & Son	12.70	1.41	10.44	9.75	3.06	3.50	69.89	2.50	1.75
1198	*Conkey's (The Original) Starting Feed, with Buttermilk and Y-O.* G. E. Conkey Co., Cleveland, Ohio	*Middletown:* Meech & Stoddard, Inc.	10.88	6.08	14.94	14.00	3.84	5.00	58.53	5.73	5.50

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein Found	Protein Guaranteed	Fiber Found	Fiber Guaranteed	Nitrogen-free extract	Fat Found	Fat Guaranteed
2667	*C. A. Blue Seal Mash.* C. A. Cowles, Plantsville	*Plantsville:* C. A. Cowles	10.10	10.85	18.19	18.00	6.23	6.00	49.73	4.90	4.00
1098	*Cowles' Scratch.* C. A. Cowles, Plantsville	*Plantsville:* C. A. Cowles	12.68	1.53	9.63	10.00	3.05	5.00	69.88	3.23	1.50
1206	*Crosby's Egg Mash.* Crosby Milling Co., Brattleboro, Vt.	*Manchester:* O. E. Bailey	10.10	10.70	19.00	20.00	6.02	7.00	49.23	4.95	4.00
1204	*Crosby's Gritless Chick Feed.* Crosby Milling Co., Brattleboro, Vt.	*Shelton:* Wolf Savitsky	12.78	1.60	11.06	11.00	2.04	3.50	70.19	2.33	2.50
1205	*Crosby's Growing Feed.* Crosby Milling Co., Brattleboro, Vt.	*Manchester:* O. E. Bailey	11.00	10.76	18.00	15.00	5.03	4.50	50.21	5.00	4.50
2799	*Crosby's Intermediate Chick Feed.* Crosby Milling Co., Brattleboro, Vt.	*Manchester:* O. E. Bailey	11.68	1.53	11.25	10.00	1.80	3.50	70.26	3.48	2.50
1071	*Crosby's Scratch Feed.* Crosby Milling Co., Brattleboro, Vt.	*Shelton:* Wolf Savitsky	12.50	1.58	10.25	11.00	3.03	5.00	69.61	3.03	3.00
1120	*Davis Buttermilk Mash Feed.* R. G. Davis & Sons, New Haven	*Ansonia:* Ansonia Flour & Feed Co.	10.05	8.18	19.06	18.00	5.64	8.00	51.39	5.68	3.50
1121	*Davis Scratch Feed.* R. G. Davis & Sons, New Haven	*Ansonia:* Ansonia Flour & Feed Co.	13.40	1.74	10.50	10.00	2.99	5.00	68.69	2.68	2.00
1100	*Delaware Chick Grains.* Delaware Mills, Inc., Deposit, N. Y.	*Southington:* Southington Lumber Co.	12.53	1.18	10.13	10.00	1.58	3.00	72.73	1.85	3.00
961	*Delaware Chick Starting Mash.* Delaware Mills, Inc., Deposit, N. Y.	*Southington:* Southington Lumber Co.	10.28	9.00	17.63	15.00	5.40	5.00	51.86	5.83	4.00
1099	*Double Circle Scratch Grains.* Delaware Mills, Inc., Deposit, N. Y.	*Southington:* Southington Lumber Co.	13.78	1.74	10.88	10.00	3.20	5.00	68.05	2.35	2.50
2672	*Delaware Growing Mash (with Dried Buttermilk).* Delaware Mills, Inc., Deposit, N. Y.	*Southington:* Southington Lumber Co.	9.65	10.88	18.75	17.00	5.40	6.00	49.44	5.88	6.00
1016	*Delaware Scratch Grains.* Delaware Mills, Inc., Deposit, N. Y.	*Thompsonville:* Geo. S. Phelps & Co.	11.50	1.65	10.75	10.00	3.13	5.00	70.39	2.58	2.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Poultry Feeds—Continued		%	%	%	%	%	%	%	%	%
2898	*Indian Laying Mash, with Dried Buttermilk.* Delaware Mills, Inc., Deposit, N. Y.	*Norwalk:* Frank Libner & Sons	10.03	8.25	17.88	18.00	5.83	7.00	51.98	6.03	4.00
1088	*Indian Scratch Grains.* Delaware Mills, Inc., Deposit, N. Y. ...	*Norwalk:* Frank Libner & Sons	13.68	1.45	10.31	10.00	2.69	5.00	69.37	2.50	2.50
2767	*Eastern States Egg Mash, Open Formula.* Eastern States Farmers' Exchange, Springfield, Mass.	*Abington:* Joseph Stoddard	9.50	11.32	18.19	16.50	5.98	6.50	60.28	4.73	4.00
2484	*Eastern States Milk Egg Mash, Open Formula.* Eastern States Farmers' Exchange, Springfield, Mass.	*Clinton:* A. L. Lockwood	10.13	9.62	18.88	16.50	5.10	6.50	51.39	4.88	4.00
2482	*Eastern States Scratch Grains (with Coarse Cracked Corn, Open Formula).* Eastern States Farmers' Exchange, Springfield, Mass.	*Clinton:* A. L. Lockwood	12.15	1.73	10.69	9.50	2.88	4.00	69.55	3.00	2.50
2757	*Eastern States Starting & Growing Mash, Open Formula.* Eastern States Farmers' Exchange, Springfield, Mass.	*North Haven:* Ridgewood Farm	9.88	9.10	17.25	16.00	4.05	6.00	54.89	4.83	4.00
1094	*Chixsaver.* Elmore Milling Co., Oneonta, N. Y.	*Newtown:* R. H. Holcomb & Co.	10.78	9.13	19.13	18.00	3.93	8.00	52.65	4.38	4.00
1065	*Elmore Egg Mash.* Elmore Milling Co., Oneonta, N. Y.	*Shelton:* Wolf Savitsky	10.10	7.80	16.75	18.00	4.10	8.00	56.30	4.95	4.00
1064	*Elmore Scratch Feed.* Elmore Milling Co., Oneonta, N. Y. ..	*Shelton:* Wolf Savitsky	12.00	1.61	11.00	10.00	2.65	7.00	70.54	2.20	3.50
2515	*Elmore Scratch Feed.* Elmore Milling Co., Oneonta, N. Y. ..	*Norwich:* A. E. Shedd	12.35	1.72	10.63	10.00	2.95	7.00	69.30	3.05	3.50
1093	*Elmore Storrs Formula Laying Mash.* Elmore Milling Co., Oneonta, N. Y.	*Newtown:* R. H. Holcomb & Co.	10.13	7.04	17.38	18.00	6.28	7.00	53.27	5.90	4.00
1102	*Emco Scratch Feed.* Elmore Milling Co., Oneonta, N. Y. ..	*Hazardville:* A. D. Bridge's Sons	11.83	1.67	10.69	10.00	2.73	7.00	70.70	2.38	3.50
964	*Eshelman's Baby Chick Starter.* John W. Eshelman & Sons, Lancaster, Pa.	*Wallingford:* A. E. Hall	9.10	4.54	15.63	14.00	4.90	6.00	61.78	4.05	4.00
2992	*Eshelman's Fattening Mash.* John W. Eshelman & Sons, Lancaster, Pa.	*New Britain:* Wm. Cohen	9.58	7.40	16.56	14.00	3.88	5.00	56.23	6.35	4.00
2661	*Eshelman's Growing Mash.* John W. Eshelman & Sons, Lancaster, Pa.	*Simsbury:* Woods-Chandler Co..	10.45	6.78	18.56	16.00	5.80	7.00	52.36	6.05	4.00
1084	*Eshelman's Laying Mash.* John W. Eshelman & Sons, Lancaster, Pa.	*Devon:* Devon Coal & Ice Co. ..	9.50	8.18	21.56	20.00	5.83	7.00	48.83	6.10	5.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Poultry Feeds—Continued		%	%	%	%	%	%	%	%	%
956	*Eshelman's Scratch Feed.* John W. Eshelman & Sons, Lancaster, Pa.	*Hamden:* Ira W. Beers	13.15	1.58	10.13	10.00	2.38	4.00	70.26	2.50	2.50
1087	*Imperial Scratch Feed.* John W. Eshelman & Sons, Lancaster, Pa.	*Southport:* C. Buckingham & Co.	11.95	1.59	10.31	9.00	3.15	4.00	70.47	2.53	2.50
2601	*Pennsy Laying Mash.* John W. Eshelman & Sons, Lancaster, Pa.	*Devon:* Devon Coal & Ice Co.	9.85	8.35	20.56	18.00	7.80	8.00	46.99	6.45	5.00
2562	*Pennsy Scratch Feed.* John W. Eshelman & Sons, Lancaster, Pa.	*Devon:* Devon Coal & Ice Co.	12.40	1.70	9.69	9.00	2.73	4.00	70.88	2.60	2.50
1012	*Flory's Egg Mash.* Flory Milling Co., Bangor, Pa.	*Bloomfield:* Bloomfield Farmers' Exchange	8.95	10.88	19.69	20.00	5.80	8.00	49.50	5.18	4.50
2790	*Flory's Scratch Feed.* Flory Milling Co., Bangor, Pa.	*Bloomfield:* Bloomfield Farmers' Exchange	12.30	1.47	10.13	9.00	2.75	4.00	70.52	2.83	2.50
1013	*Sunray Scratch Feed.* Flory Milling Co., Bangor, Pa.	*Bloomfield:* Bloomfield Farmers' Exchange	12.13	1.49	9.81	9.00	2.73	5.00	71.34	2.50	2.50
2441	*R Own Laying Mash.* F. A. Forbes, East Haven	*East Haven:* F. A. Forbes	11.03	6.51	17.81	18.00	5.77	8.00	53.80	5.08	4.00
2446	*R Own Scratch Feed.* F. A. Forbes, East Haven	*East Haven:* F. A. Forbes	13.15	1.82	10.31	10.00	2.69	5.00	68.53	3.50	3.00
2857	*Washburn's Gold Medal Developing Feed—No Grit.* General Mills, Inc., Minneapolis, Minn.	*Riverton:* L. A. Coe	12.50	1.26	10.19	10.00	2.20	5.00	71.52	2.33	2.50
2931	*Grandin's Growing Feed.* D. H. Grandin Milling Co., Jamestown, N. Y.	*Falls Village:* H. E. Dean	9.45	13.79	15.75	14.00	6.48	8.00	50.08	4.45	4.00
2925	*Grandin's Laying Mash with Buttermilk.* D. H. Grandin Milling Co., Jamestown, N. Y.	*Falls Village:* H. E. Dean	9.68	13.50	21.75	20.00	5.53	8.00	45.41	4.13	4.00
2924	*Grandin's Screened Scratch Feed.* D. H. Grandin Milling Co., Jamestown, N. Y.	*Falls Village:* H. E. Dean	12.25	1.63	10.00	10.00	3.15	5.00	70.17	2.80	2.50
2500	*Red Comb Chick Starter, with Dried Buttermilk.* Hales & Hunter Co., Chicago, Ill.	*New London:* B. J. McCarthy	9.05	10.14	16.56	14.00	5.18	5.00	54.74	4.33	4.00
2703	*Red Comb Duck Fattener.* Hales & Hunter Co., Chicago, Ill.	*Hamden:* Ira W. Beers	10.35	6.60	14.94	15.00	4.18	5.00	59.80	4.13	3.50
2702	*Red Comb Duck Grower.* Hales & Hunter Co., Chicago, Ill.	*Hamden:* Ira W. Beers	10.23	8.18	18.31	18.00	6.43	7.00	52.12	4.73	3.50
2501	*Red Comb Egg Mash, with Dried Buttermilk.* Hales & Hunter Co., Chicago, Ill.	*New London:* B. J. McCarthy	9.15	10.60	17.19	15.00	6.20	6.00	52.31	4.55	4.00
2502	*Red Comb Growing Mash, with Buttermilk.* Hales & Hunter Co., Chicago, Ill.	*New London:* B. J. McCarthy	9.38	10.11	16.75	14.00	5.93	6.00	53.23	4.60	4.00
2499	*Red Comb Scratch Feed.* Hales & Hunter Co., Chicago, Ill.	*New London:* B. J. McCarthy	11.68	1.78	10.88	10.00	2.93	5.00	69.65	3.08	2.50

Table I. Analyses of Commercial Feeds, Inspection of 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	Proprietary Mixed Feeds—*Continued*										
	Poultry Feeds—Continued		%	%	%	%	%	%	%	%	%
2794	*"Hudson's" Developing Mash.* L. W. Hudson, Windsor	*Windsor:* L. W. Hudson	10.08	9.00	16.25	17.00	7.05	5.25	52.87	4.75	5.85
1014	*Hudson's Laying Mash.* L. W. Hudson, Windsor	*Windsor:* L. W. Hudson	9.93	9.45	17.69	18.00	6.85	5.50	50.73	5.35	5.50
2759	*Just Right Egg Mash.* Jersee Co., Minneapolis, Minn.	*Guilford:* Fred C. Morse & Son	9.28	7.38	22.75	20.00	9.48	8.00	44.68	6.43	4.00
2927	*Blue Top Egg Mash.* Chas A. Krause Milling Co., Milwaukee, Wis.	*Thomaston:* I. Levy	9.30	5.63	18.63	20.00	7.23	7.50	53.93	5.28	5.00
965	*Dry Mash.* S. F. Labieniec, Kensington	*Kensington:* S. F. Labieniec	9.20	10.14	19.75	19.00	7.35	8.00	48.43	5.13	5.00
1063	*Larro Chick Grains.* Larrowe Milling Co., Detroit, Mich.	*Shelton:* Wolf Savitsky	10.68	1.29	11.25	10.00	1.50	3.50	72.70	2.58	2.50
1042	*Larro Chick Starter.* Larrowe Milling Co., Detroit, Mich.	*Collinsville:* Lawton-Miner Co.	8.85	6.24	15.13	14.00	5.53	6.50	57.70	6.55	4.50
1070	*Larro Growing Grains.* Larrowe Milling Co., Detroit, Mich.	*Shelton:* Wolf Savitsky	12.43	1.33	10.69	10.00	1.98	4.00	70.72	2.85	3.00
1044	*Larro Egg Mash.* Larrowe Milling Co., Detroit, Mich.	*Collinsville:* Lawton-Miner Co.	7.75	12.14	20.38	19.00	7.15	8.00	46.43	6.15	5.00
1043	*Larro Growing Mash.* Larrowe Milling Co., Detroit, Mich.	*Collinsville:* Lawton-Miner Co.	9.15	8.83	17.13	16.00	5.63	6.50	53.81	5.45	5.00
2689	*Homestead Dry Mash.* C. W. Lines Co., New Britain	*New Britain:* C. W. Lines Co.	9.53	11.40	19.63	18.00	6.78	7.00	47.58	5.08	4.00
967	*Homestead Scratch Feed.* C. W. Lines Co., New Britain	*New Britain:* C. W. Lines Co.	11.78	1.60	10.38	9.00	2.78	5.00	71.01	2.45	2.50
966	*Mill Pride Fancy Scratch Feed.* C. W. Lines Co., New Britain	*New Britain:* C. W. Lines Co.	12.18	1.89	10.63	10.00	2.78	5.00	69.67	2.85	3.00
2687	*Mill Pride Milk Mash.* C. W. Lines Co., New Britain	*New Britain:* C. W. Lines Co.	8.98	12.75	18.88	18.00	7.33	7.50	47.51	4.55	5.00
2934	*Common Sense Growing Mash.* Litchfield County Coöperative Association, Torrington	*Torrington:* Litchfield Co-op. Assoc.	9.73	8.31	16.63	15.00	5.43	7.00	55.22	4.68	4.00
2933	*Common Sense Laying Mash.* Litchfield County Coöperative Association, Torrington	*Torrington:* Litchfield Co-op. Assoc.	10.13	7.71	16.00	15.00	5.65	7.00	56.06	4.45	4.00
2887	*Square Deal Buttermilk Laying Mash.* Long Hill Feed Store, Long Hill	*Long Hill:* Long Hill Feed Store	7.50	14.67	20.38	20.00	6.80	7.00	45.55	5.10	5.00
1140	*Huntington Red Star Egg Mash.* E. Manchester & Sons, Winsted	*Winsted:* E. Manchester & Sons	9.93	11.93	16.25	15.00	6.44	6.00	50.96	4.49	4.00
1137	*Red Star Egg Mash.* E. Manchester & Sons, Winsted	*Winsted:* E. Manchester & Sons	11.58	10.31	18.38	16.00	6.28	8.00	47.82	5.63	4.00
1141	*Red Star Scratch Feed.* E. Manchester & Sons, Winsted	*Winsted:* E. Manchester & Sons	13.30	1.76	10.44	10.00	3.53	6.00	68.34	2.63	3.00
1138	*Red Star Starting and Growing Mash.* E. Manchester & Sons, Winsted	*Winsted:* E. Manchester & Sons	10.23	11.14	17.94	15.00	6.73	6.00	49.28	4.68	4.00
2867	*Bull Brand Laying Mash, with Dried Buttermilk.* Maritime Milling Co., Buffalo, N. Y.	*Brookfield:* S. A. Smith & Son	9.35	10.47	21.38	20.00	6.45	8.00	46.92	5.43	5.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Poultry Feeds—Continued		%	%	%	%	%	%	%	%	%
1096	*Bull Brand Red-E-Mixt Egg Mash.* Maritime Milling Co., Buffalo, N. Y.	*New Milford:* Geo. E. Ackley Co.	9.83	9.75	18.31	18.00	6.45	9.00	50.68	4.98	5.00
1097	*Bull Brand Scratch Feed.* Maritime Milling Co., Buffalo, N. Y.	*New Milford:* Geo. E. Ackley Co.	10.83	1.65	10.94	10.00	3.55	4.00	70.38	2.65	2.50
1142	*Jersey Dry Mash.* Maritime Milling Co., Buffalo, N. Y.	*Riverton:* L. A. Coe	10.63	7.73	18.38	18.00	6.14	9.00	51.57	5.55	5.00
2440	*Red Wing Special Buttermilk Chick Starter.* Meech & Stoddard, Inc., Middletown	*Middletown:* Meech & Stoddard, Inc.	9.80	14.98	14.25	13.00	5.35	5.00	50.87	4.75	4.00
1197	*Red Wing Special Buttermilk Growing Feed.* Meech & Stoddard, Inc., Middletown	*Middletown:* Meech & Stoddard, Inc.	9.88	14.05	18.63	17.00	5.42	8.00	47.32	4.70	5.50
2772	*Red Wing Special Buttermilk Growing Feed.* Meech & Stoddard, Inc., Middletown	*Middletown:* Meech & Stoddard Inc.	8.93	12.62	18.56	17.00	6.60	8.00	48.04	5.25	5.50
1196	*Red Wing Special Buttermilk Laying Mash.* Meech & Stoddard, Inc., Middletown	*Middletown:* Meech & Stoddard, Inc.	10.63	11.13	17.00	17.00	6.13	8.00	50.23	4.88	5.50
1254	*Red Wing Special Chick Feed.* Meech & Stoddard, Inc., Middletown	*Middletown:* Meech & Stoddard, Inc.	15.23	1.52	9.63	10.00	4.00	5.00	67.24	2.38	3.00
2494	*Red Wing Special Intermediate Chick Feed.* Meech & Stoddard, Inc., Middletown	*Essex:* Meech & Stoddard, Inc.	12.45	1.85	11.38	10.00	2.88	5.00	68.14	3.30	3.00
2674	*Memo All Mash Ration.* Mennel Milling Co., Toledo, Ohio	*Plainville:* W. S. Eaton	10.10	8.75	16.88	16.00	4.40	5.00	54.04	5.83	4.50
2954	*Mennel's Mixed Grains.* Mennel Milling Co., Toledo, Ohio	*Plainville:* W. S. Eaton	11.80	1.35	9.94	10.00	2.75	5.00	71.33	2.83	3.00
2430	*Moon's Baby Chick Grains.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Manchester:* I. W. Campbell	12.95	1.47	9.81	10.00	1.00	2.50	73.59	1.18	3.00
1127	*Moon's Laying Mash, with Dried Buttermilk.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Waterville:* Wooster Feed Store	9.83	9.65	19.31	20.00	6.16	9.00	50.05	5.00	4.00
1163	*Moon's Scratch Feed.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Manchester:* I. W. Campbell	13.30	1.46	9.94	10.00	3.18	5.00	69.67	2.45	2.00
3015	*Moon's Special A Laying Mash, with Buttermilk.* Geo. Q. Moon & Co., Binghamton, N. Y.	*Plainville:* F. B. Newton	7.85	12.86	19.88	18.00	6.50	9.00	46.91	6.00	5.00
2833	*C. B. Mash.* Moran-Paton Co., New Haven	*New Haven:* Moran & Patton Co.	9.58	8.35	18.44	18.00	7.52	7.00	50.41	5.70	4.00
2764	*Old Mill Growing Mash.* Fred C. Morse & Son, Guilford	*Guilford:* Fred C. Morse & Son	9.78	6.85	16.81	15.00	6.18	6.00	55.20	5.18	5.00
2761	*Old Mill Laying Mash.* Fred C. Morse & Son, Guilford	*Guilford:* Fred C. Morse & Son	9.33	11.95	21.13	19.00	6.18	8.00	45.93	5.48	4.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued* *Poultry Feeds—Continued*		%	%	%	%	%	%	%	%	%
1034	*Old Mill Laying Mash, with Milk.* Fred C. Morse & Son, Guilford	*Guilford:* Fred C. Morse & Son	9.95	8.05	20.31	20.00	7.00	8.00	49.54	5.15	5.00
1036	*Old Mill Scratch Feed.* Fred C. Morse & Son, Guilford	*Guilford:* Fred C. Morse & Son	12.13	1.78	10.75	10.00	3.08	4.00	69.63	2.63	3.00
1219	*Genesee Scratch Grains.* Newman Bros. Grain Co., Rochester, N. Y.	*Hazardville:* Amos D. Bridge's Sons.	13.70	1.48	9.69	10.00	2.75	3.00	70.25	2.13	2.50
1049	*Mystic Laying Mash.* Newman Bros. Grain Co., Rochester, N. Y.	*Hazardville:* Amos D. Bridge's Sons.	8.83	14.56	19.19	17.00	5.90	10.00	46.49	5.03	4.00
2776	*Aunt Mary's Egg Mash, with Dried Buttermilk.* Ontario Milling Co., Oswego, N. Y.	*Middletown:* P. Levson & Son	9.25	11.72	20.19	19.00	5.78	8.50	47.43	5.63	4.00
1940	*Aunt Mary's Scratch Feed.* Ontario Milling Co., Oswego, N. Y.	*Collinsville:* Rourke - Robotham Co.	11.80	1.55	10.63	10.00	3.18	5.00	70.21	2.63	2.50
1041	*Oswego Egg Mash, with Meat and Fish.* Ontario Milling Co., Oswego, N. Y.	*Collinsville:* Rourke - Robotham Co.	8.45	12.88	18.00	18.00	6.35	8.50	49.02	5.30	4.00
1054	*Osborn Mash.* S. V. Osborn Est., Branford	*Branford:* S. V. Osborn Est.	9.78	6.17	14.38	12.00	6.40	8.00	59.69	3.58	3.00
1038	*Osborn Scratch.* S. V. Osborn Est., Branford	*Branford:* S. V. Osborn Est.	11.50	1.70	10.38	10.00	2.58	5.00	71.26	2.58	2.00
2884	*Bidwell Dry Mash.* Park & Pollard Co., Buffalo, N. Y.	*Bridgeport:* Samp Morter Mills	8.78	10.75	18.38	18.00	5.70	10.00	52.29	4.10	1.50
1057	*Bidwell Scratch Feed.* Park & Pollard Co., Buffalo, N. Y.	*Plainville:* F. B. Newton	11.95	1.79	10.63	10.00	2.85	5.00	69.60	3.18	1.50
1056	*Growing Feed.* Park & Pollard Co., Buffalo, N. Y.	*Plainville:* F. B. Newton	11.05	8.08	15.25	14.00	5.00	8.00	56.74	3.88	3.00
2789	*Intermediate Chick Feed.* Park & Pollard Co., Buffalo, N. Y.	*Bloomfield:* Bloomfield Farmers' Exchange	12.40	1.37	10.25	10.00	2.50	5.00	70.53	2.95	3.00
1055	*Lay or Bust Dry Mash.* Park & Pollard Co., Buffalo, N. Y.	*Plainville:* F. B. Newton	10.40	10.90	19.38	18.00	5.55	8.00	50.32	3.45	3.00
1066	*Park & Pollard Chick Starter.* Park & Pollard Co., Buffalo, N. Y.	*Shelton:* Shelton Feed Co.	12.20	5.71	14.94	14.00	4.10	5.00	59.85	3.20	3.00
928	*Red Ribbon Chick Feed.* Park & Pollard Co., Buffalo, N. Y.	*West Cheshire:* Cheshire Grain & Coal Co.	11.88	1.65	10.00	10.00	1.80	5.00	72.03	2.64	3.00
927	*Red Ribbon Scratch Feed.* Park & Pollard Co., Buffalo, N. Y.	*West Cheshire:* Cheshire Grain & Coal Co.	12.30	1.78	10.19	10.00	2.63	5.00	69.90	3.20	3.00
1200	*Platco Laying Mash.* Frank S. Platt Co., New Haven	*New Haven:* Frank S. Platt Co.	9.05	11.19	21.88	20.00	5.04	7.00	46.51	6.33	5.50
1201	*Platco Perfection Grain Mixture.* Frank S. Platt Co., New Haven	*New Haven:* Frank S. Platt Co.	12.13	1.70	10.31	10.00	3.49	3.50	69.27	3.10	3.00
1058	*Puritan Scratch Feed.* W. W. Potter & Sons, Greenfield, Mass.	*Bloomfield:* Bloomfield Farmers' Exchange	11.83	1.79	10.63	10.00	3.60	2.50	69.35	2.80	3.00
1089	*Pratt's Baby Chick Food, with Buttermilk.* Pratt Food Co., Buffalo, N. Y.	*Norwalk:* Frank Libner & Sons	9.68	7.98	13.06	13.00	3.05	3.80	61.85	4.38	3.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Poultry Feeds—Continued		%	%	%	%	%	%	%	%	%
1060	*Pratt's Circle A Chick Scratch Feed.* Pratt Food Co., Buffalo, N. Y.	*Thompsonville:* Geo. S. Phelps & Co.	10.93	1.16	10.00	10.00	1.50	5.00	74.23	2.18	2.00
929	*Pratt's Circle A Large Scratch Feed.* Pratt Food Co., Buffalo, N. Y.	*Bristol:* Bristol Grain & Supply Co.	12.63	1.47	9.69	10.00	2.73	5.00	71.02	2.46	2.50
1059	*Pratt's Supreme Growing Mash, with Buttermilk.* Pratt Food Co., Buffalo, N. Y.	*Thompsonville:* Geo. S. Phelps & Co.	7.53	12.53	19.13	17.50	5.35	7.00	50.23	5.23	4.50
1147	*Pratt's Victory Chick Scratch Feed.* Pratt Food Co., Buffalo, N. Y.	*New Britain:* S. P. Strople	11.48	6.40	10.63	10.00	1.45	5.00	67.51	2.53	2.00
1162	*Pratt's Victory Intermediate Scratch Feed.* Pratt Food Co., Buffalo, N. Y.	*New Britain:* S. P. Strople	12.68	1.31	10.13	10.00	1.65	5.00	72.10	2.13	2.00
2899	*Pratt's Victory Large Scratch Feed.* Pratt Food Co., Buffalo, N. Y.	*Norwalk:* Frank Libner & Sons	11.80	1.68	10.75	10.00	2.53	5.00	70.59	2.65	2.50
930	*Pratt's Victory Laying Mash, with Buttermilk.* Pratt Food Co., Buffalo, N. Y.	*Bristol:* Bristol Grain & Supply Co.	8.65	10.88	20.19	20.00	5.90	8.00	48.08	6.30	4.00
1082	*Quaker Ful-O-Pep Chick Starter.* Quaker Oats Co., Chicago, Ill.	*Devon:* Devon Coal & Ice Co.	8.30	7.98	15.75	15.00	5.58	6.00	56.19	6.20	5.00
1108	*Quaker Ful-O-Pep Egg Mash.* Quaker Oats Co., Chicago, Ill.	*Norwalk:* Frank Libner & Sons	8.30	10.07	20.06	20.00	6.52	8.00	49.45	5.60	4.00
1111	*Quaker Ful-O-Pep Fine Chick Feed.* Quaker Oats Co., Chicago, Ill.	*Seymour:* Seymour Grain & Coal Co.	10.45	1.63	11.81	11.00	1.80	2.00	71.03	3.28	2.50
1107	*Quaker Ful-O-Pep Growing Mash.* Quaker Oats Co., Chicago, Ill.	*Norwalk:* Frank Libner & Sons	7.78	9.19	18.88	19.00	5.35	6.00	52.92	5.88	5.00
955	*Quaker Ful-O-Pep Scratch Grains.* Quaker Oats Co., Chicago, Ill.	*Hamden:* Ira W. Beers	12.30	1.68	10.50	9.00	3.00	3.50	69.22	3.30	2.00
1083	*Schumacher's Little Chick Feed, No Grit.* Quaker Oats Co., Chicago, Ill.	*Devon:* Devon Coal & Ice Co.	11.38	1.62	10.19	10.00	2.28	2.00	71.59	2.94	2.00
1095	*Schumacher's Scratch Grains, No Grit.* Quaker Oats Co., Chicago, Ill.	*Danbury:* C. S. Barnum & Son	11.55	1.59	10.25	10.00	2.45	3.50	71.41	2.75	2.00
934	*Purina Baby Chick Chow Feed.* Ralston Purina Co., St. Louis, Mo.	*Meriden:* H. Grulich	11.50	1.61	10.63	10.00	2.13	4.00	71.28	2.85	2.00
2653	*Purina Chicken Chowder Feed containing Mineral.* Ralston Purina Co., St. Louis, Mo.	*Meriden:* H. Grulich	9.80	11.25	21.00	19.00	6.68	8.00	46.59	4.68	3.50
2907	*Purina Chicken Fat Chow Feed containing Mineral.* Ralston Purina Co., St. Louis, Mo.	*Stamford:* Clapboard Hill Feed Co.	10.25	4.40	16.19	15.50	3.95	5.00	61.36	3.85	3.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Water	Ash	Protein (N x 6.25) Found	Protein Guaranteed, not less than	Fiber Found	Fiber Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat Found	Fat Guaranteed, not less than
			Pounds per Hundred								
	PROPRIETARY MIXED FEEDS—*Continued* *Poultry Feeds—Continued*										
			%	%	%	%	%	%	%	%	%
2566	*Purina Chicken Fatena Feed containing Mineral.* Ralston Purina Co., St. Louis, Mo.	*Stratford:* Farmers' Flour & Grain Co.	10.38	4.58	12.44	12.00	6.25	6.60	62.20	4.15	3.00
932	*Purina Chick Growena Feed containing Mineral.* Ralston Purina Co., St. Louis, Mo.	*Meriden:* H. Grulich	8.78	8.33	17.19	16.30	6.15	7.00	54.55	5.00	4.00
931	*Purina Chick Startena Feed containing Mineral.* Ralston Purina Co., St. Louis, Mo.	*Meriden:* H. Grulich	8.35	9.56	19.94	19.00	5.53	7.00	50.79	5.83	4.00
2806	*Purina Hen Chow Feed.* Ralston Purina Co., St. Louis, Mo.	*Manchester:* Manchester Grain Co.	12.05	1.71	10.13	10.00	2.88	4.00	69.88	3.35	2.50
933	*Purina Intermediate Hen Chow Feed.* Ralston Purina Co., St. Louis, Mo.	*Meriden:* H. Grulich	11.78	1.35	10.00	10.00	1.90	4.00	72.17	2.80	2.50
2496	*Purina Lay Chow Feed containing Mineral.* Ralston Purina Co., St. Louis, Mo.	*New London:* New London Grain Co.	10.43	10.85	17.19	17.00	7.73	8.00	49.85	3.95	2.50
2869	*Winner Scratch Feed.* Ralston Purina Co., St. Louis, Mo.	*Danbury:* H. E. Meeker	11.53	1.53	10.38	9.50	2.58	4.00	70.73	3.25	2.00
2431	*Diamond Intermediate Chick Feed.* Rockville Grain & Coal Co., Rockville	*Manchester:* Manchester Grain Co.	13.13	1.70	10.75	10.00	1.75	3.00	68.99	3.68	3.00
2432	*Diamond Scratch Feed.* Rockville Grain & Coal Co., Rockville	*Manchester:* Manchester Grain Co.	13.93	1.56	9.63	10.00	2.58	4.00	70.40	1.90	2.50
1117	*Hubbard's Egg Producer.* F. H. Rolf, Inc., Guilford	*Guilford:* F. H. Rolf, Inc.	8.73	13.38	24.69	22.00	5.49	5.00	42.61	5.10	4.00
1327	*Rolf's Chic Grains.* F. H. Rolf, Inc., Guilford	*Guilford:* F. H. Rolf, Inc.	13.80	1.42	9.81	10.00	1.80	4.00	69.92	3.25	4.00
1116	*Rolf's Chic Mash.* F. H. Rolf, Inc., Guilford	*Guilford:* F. H. Rolf, Inc.	7.93	13.96	19.31	17.00	4.85	6.00	49.30	4.65	3.00
1328	*Rolf's Scratch Grains.* F. H. Rolf, Inc., Guilford	*Guilford:* F. H. Rolf, Inc.	13.40	1.76	10.63	9.00	3.24	4.00	67.12	3.85	3.00
1101	*Atlas Poultry Greens.* A. W. Scott & Co., San Francisco, Cal.	*Wallingford:* A. E. Hall	7.75	10.03	17.88	20.00	23.33	18.00	38.93	2.08	2.00
1159	*See-More Egg Mash Buttermilk.* Seymour Grain & Coal Co., Seymour	*Seymour:* Seymour Grain & Coal Co.	9.43	11.81	18.88	18.00	5.18	7.00	50.17	4.53	4.50
1160	*See-More Egg Scratch Feed.* Seymour Grain & Coal Co., Seymour	*Seymour:* Seymour Grain & Coal Co.	12.48	1.58	10.31	10.00	3.08	6.00	69.42	3.13	3.00
1068	*Nelson's Laying Mash.* Shelton Feed Co., Shelton	*Shelton:* Shelton Feed Co.	10.63	7.38	17.19	16.00	7.40	8.00	52.47	4.93	4.00
1067	*Nelson's Mixed Chicken Feed.* Shelton Feed Co., Shelton	*Shelton:* Shelton Feed Co.	13.23	1.62	10.00	10.00	2.58	5.00	69.47	3.10	1.50
1144	*Mill Streams "Fortune Hunter" Scratch Grains.* Winchell Smith Grist Mill, Farmington	*Farmington:* Winchell Smith Grist Mill	12.85	1.91	10.38	10.00	3.15	3.00	67.83	3.88	2.50
1143	*Mill Streams "Lightnin" Laying Mash.* Winchell Smith Grist Mill, Farmington	*Farmington:* Winchell Smith Grist Mill	10.35	10.10	20.50	16.00	5.33	8.00	49.38	4.29	3.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred								
			Water	Ash	Protein (N x 6.25)		Fiber		Nitrogen-free extract (starch, gum, etc.)	Fat	
					Found	Guaranteed, not less than	Found	Guaranteed, not more than		Found	Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Poultry Feeds—Continued		%	%	%	%	%	%	%	%	%
2582	*Ansonia Egg Mash, with Buttermilk.* I. Sovitsky Grain & Coal Co., Ansonia	*Ansonia:* I. Sovitsky Grain & Coal Co.	10.28	10.20	20.00	18.69	5.53	5.70	48.29	5.70	6.61
2993	*Ansonia Egg Mash, with Buttermilk.* I. Sovitsky Grain & Coal Co., Ansonia	*Ansonia:* I. Sovitsky Grain & Coal Co.	9.30	8.83	19.38	18.69	6.20	5.70	49.99	6.30	6.61
2742	*Ansonia Scratch Feed.* I. Sovitsky Grain & Coal Co., Ansonia	*Ansonia:* I. Sovitsky Grain & Coal Co.	11.48	1.63	10.75	10.63	2.85	2.72	70.56	2.73	2.29
1165	*King Baby Chick Food (containing Cod Liver Meal, Buttermilk).* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	10.85	6.29	17.81	16.50	3.58	5.00	57.47	4.00	4.00
1164	*King Chick Feed.* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	12.80	1.51	10.38	10.00	1.40	4.00	71.43	2.48	2.50
1169	*King Growing Feed (containing Buttermilk).* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	10.75	7.77	17.06	15.00	5.88	5.00	51.99	6.55	4.00
1166	*King Intermediate Chick Feed.* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	12.50	1.40	10.19	10.00	1.79	3.50	71.12	3.00	2.50
1170	*King Mash Feed (containing Buttermilk).* St. Albans Grain Co., St. Albans, Vt.	*Willimantic:* Willimantic Grain Co.	10.85	9.57	19.06	19.50	5.54	7.50	50.78	4.20	4.00
1190	*King Scratch Feed.* St. Albans Grain Co., St. Albans, Vt.	*Norwich:* Norwich Grain Co.	13.60	1.62	10.56	10.00	2.74	5.50	68.88	2.60	2.50
2640	*Paragon Scratch Feed.* St. Albans Grain Co., St. Albans, Vt.	*Meriden:* H. Grulich	12.20	1.83	10.50	10.00	2.83	5.00	69.89	2.75	2.50
926	*Wirthmore All-Grain Chick Feed (Fine Chick Scratch).* St. Albans Grain Co., St. Albans, Vt.	*Plantsville:* C. A. Cowles	12.18	1.39	10.44	10.00	1.68	3.50	71.81	2.50	2.50
925	*Wirthmore Baby Chick Starter (containing Cod Liver Meal-Buttermilk).* St. Albans Grain Co., St. Albans, Vt.	*Plantsville:* C. A. Cowles	10.88	6.23	16.75	17.00	3.63	5.00	58.36	4.15	4.00
1053	*Wirthmore Growing Feed (containing Buttermilk).* St. Albans Grain Co., St. Albans, Vt.	*Branford:* S. V. Osborn Est.	9.25	10.69	17.50	15.00	5.90	5.00	51.68	4.98	4.50
2449	*Wirthmore Growing Feed (containing Buttermilk).* St. Albans Grain Co., St. Albans, Vt.	*East Haven:* F. A. Forbes	11.68	8.37	16.25	15.00	5.30	5.00	53.67	4.73	4.50
924	*Wirthmore Intermediate Chick (Coarse Chick Scratch).* St. Albans Grain Co., St. Albans, Vt.	*Hamden:* Ira W. Beers	12.33	1.68	11.00	10.00	2.03	3.50	69.69	3.27	2.50
1051	*Wirthmore Laying Mash (containing Buttermilk).* St. Albans Grain Co., St. Albans, Vt.	*Guilford:* Fred C. Morse & Son	8.53	10.22	20.31	20.00	5.53	7.00	49.93	5.48	4.00
923	*Wirthmore Scratch Feed.* St. Albans Grain Co., St. Albans, Vt.	*Hamden:* Ira W. Beers	13.38	1.71	11.25	10.00	2.43	4.00	68.68	2.55	2.50

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein (N x 6.25): Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Poultry Feeds—Continued										
			%	%	%	%	%	%	%	%	%
2637	*Wirthmore Turkey Starter (containing Cod Liver Oil-Buttermilk).* St. Albans Grain Co., St. Albans, Vt.	*Naugatuck:* Naugatuck Fruit & Produce Co.	10.53	8.35	18.19	17.00	3.43	5.00	55.10	4.40	4.00
2890	*Symco Scratch Grains.* Syracuse Milling Co., Syracuse, N. Y.	*East Bridgeport:* J. Simon	11.50	1.68	10.25	9.00	3.18	10.00	70.26	3.13	2.50
1217	*Syragold Chick Feed.* Syracuse Milling Co., Syracuse, N. Y.	*Colchester:* P. Cutler, Inc.	12.83	1.82	11.69	10.00	2.19	5.00	68.44	3.03	2.50
1104	*Syragold Chick Starter.* Syracuse Milling Co., Syracuse, N. Y.	*East Bridgeport:* J. Simon	10.65	8.68	18.50	18.00	2.53	4.00	55.01	4.63	3.50
2897	*Syragold Egg Mash.* Syracuse Milling Co., Syracuse, N. Y.	*Southport:* C. Buckingham & Co.	9.90	7.94	18.63	18.00	6.68	8.00	51.70	5.15	3.00
1105	*Syragold Growing Mash.* Syracuse Milling Co., Syracuse, N. Y.	*Southport:* C. Buckingham & Co.	9.95	10.15	17.13	16.00	3.40	7.00	54.67	4.70	4.00
1103	*Syragold Laying Mash, with Buttermilk.* Syracuse Milling Co., Syracuse, N. Y.	*East Bridgeport:* J. Simon	9.65	11.23	18.31	18.00	8.63	9.00	46.98	5.20	3.00
1106	*Syragold Scratch Grains.* Syracuse Milling Co., Syracuse, N. Y.	*Southport:* C. Buckingham & Co.	12.50	1.59	9.75	10.00	2.55	5.00	70.89	2.72	2.50
1128	*Thomaston Egg Mash.* Thomaston Supply Co., Thomaston	*Thomaston:* Thomaston Supply Co.	9.23	14.23	17.94	20.00	6.68	7.00	47.39	4.53	4.50
1129	*Thomaston Scratch Feed.* Thomaston Supply Co., Thomaston	*Thomaston:* Thomaston Supply Co.	12.73	1.68	10.13	10.00	3.40	5.00	69.11	2.95	3.00
2852	*Chicatine.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Hawleyville:* W. A. Honan, Inc.	10.10	7.58	22.88	18.00	3.85	6.00	50.26	5.33	3.00
2853	*Egatine.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Hawleyville:* W. A. Honan, Inc.	9.90	8.15	24.75	23.00	4.95	6.00	46.95	5.30	2.50
2679	*Derby E Gee 'Scratch Feed.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Collinsville:* Lawton-Miner Co.	12.48	1.65	10.19	9.00	2.88	4.50	70.27	2.53	2.04
2855	*Tioga Chick and Growing Mash.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Hawleyville:* W. A. Honan, Inc.	10.95	5.76	16.56	12.00	4.75	6.00	57.00	4.98	2.00
2854	*Tioga Laying Food.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Hawleyville:* W. A. Honan, Inc.	9.50	7.15	20.25	17.00	5.75	6.00	51.65	5.70	2.50
2844	*Tioga Neverfail Chick Grains.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Torrington:* Litchfield Co-op. Assoc.	11.43	1.18	10.25	10.00	1.05	3.50	72.81	3.28	3.00
2856	*Tioga Neverfail Growing Grains.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Hawleyville:* W. A. Honan, Inc.	11.78	1.38	10.31	10.00	1.60	4.00	71.78	3.15	2.50
2838	*Tioga Neverfail Poultry Grain.* Tioga-Empire Feed Mills, Waverly, N. Y.	*Torrington:* Litchfield Co-op. Assoc.	11.88	1.55	10.00	9.00	3.05	4.79	70.99	2.53	2.08

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Poultry Feeds—Concluded		%	%	%	%	%	%	%	%	%
2531	*Ubiko All Mash Complete Laying Ration.* Ubiko Milling Co., Cincinnati, Ohio	*Lebanon:* Berkman Grain Co. ..	9.13	7.85	17.69	16.00	5.03	6.00	55.07	5.23	3.50
2600	*Ubiko All Mash Developer.* Ubiko Milling Co., Cincinnati, Ohio	*Lebanon:* Berkman Grain Co. ..	10.18	6.45	16.31	14.00	4.43	5.00	58.18	4.45	4.00
1005	*Vitality Egg Mash.* Vitality Mills, Inc., Chicago, Ill.	*Meriden:* Raymond Ives	9.38	13.36	19.19	20.00	5.65	8.00	46.49	5.93	4.00
1007	*Vitality Scratch Feed (No Grit).* Vitality Mills, Inc., Chicago, Ill.	*Meriden:* Raymond Ives	12.30	1.89	11.06	10.00	2.78	5.00	68.84	3.13	2.50
938	*Wayne All Mash Chick Starter.* Wayne Feed Mills, Fort Wayne, Ind.	*New Britain:* New Britain Bird Store	10.03	6.72	17.50	16.00	5.05	6.00	55.65	5.05	4.00
852	*Wayne Egg Mash.* Wayne Feed Mills, Fort Wayne, Ind.	*New Britain:* New Britain Bird Store	7.25	8.80	18.00	18.00	5.68	7.00	55.24	5.03	3.50
1008	*Wayne Scratch Feed.* Wayne Feed Mills, Fort Wayne, Ind.	*New Britain:* New Britain Bird Store	11.25	1.66	9.81	10.00	2.88	5.00	70.50	3.90	3.00
2824	*Big (Y) Growing Feed.* Yantic Grain & Products Co., Norwich	*Mystic:* Mystic Grain Co.	9.15	10.21	17.50	16.00	6.28	6.00	52.13	4.73	4.00
1171	*Big (Y) Laying Mash.* Yantic Grain & Products Co., Norwich	*Willimantic:* Boston Grain Co..	10.68	8.64	17.00	16.00	5.84	7.00	53.26	4.58	4.00
1191	*Big (Y) Laying Mash, with Buttermilk.* Yantic Grain & Products Co., Norwich	*Norwich:* Yantic Grain & Products Co.	11.88	8.57	19.25	16.00	5.47	7.00	50.08	4.75	4.00
2826	*Big (Y) Scratch Feed.* Yantic Grain & Products Co., Norwich	*Mystic:* Mystic Grain Co.	11.98	1.64	10.56	10.00	3.32	5.00	69.85	2.65	3.00
1275	*Gingh'm Gal Scratch Feed.* Yantic Grain & Products Co., Norwich	*New London:* New London Grain Co.	13.93	1.65	10.63	10.00	3.25	5.00	68.36	2.18	3.00
	Beef Scraps, etc.										
2908	*"Capitol Meat & Bone Scrap."* American Agricultural Chemical Co., N. Y.	*Springdale:* Springdale Coal & Ice Co.	7.50	28.03	48.13	45.00	2.15	3.00	4.69	9.50	3.00
1167	*Atco Brand Fish Meal.* Atlantic Coast Fisheries Co., N. Y. ...	*Willimantic:* Willimantic Grain Co.	8.36	22.22	67.19	65.00	0.43	0.50	....	1.80	0.50
1081	*Buell-Boston Dried Skim Milk.* C. E. Buell, Inc., Boston, Mass.	*Danbury:* C. S. Barnum & Son ..	4.85	8.01	34.63	31.00	....	....	51.61	0.90	0.20
962	*Burck Brand Powdered Skim Milk.* C. W. Burckhalter, New York City	*Wallingford:* A. E. Hall	6.90	8.44	34.00	32.00	....	....	49.78	0.88	0.75
1168	*Collis Process Pure Dried Skim Milk.* Collis Products Co., Clinton, Iowa	*Willimantic:* Willimantic Grain Co.	7.35	8.04	34.38	30.00	....	....	49.23	1.00	1.00
2508	*Collis Dried Buttermilk.* Collis Products Co., Clinton, Iowa ..	*Mystic:* Mystic Grain Co.	10.38	10.33	30.13	30.00	....	....	42.11	7.05	5.00

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Continued*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred: Water	Ash	Protein (N x 6.25): Found	Protein: Guaranteed, not less than	Fiber: Found	Fiber: Guaranteed, not more than	Nitrogen-free extract (starch, gum, etc.)	Fat: Found	Fat: Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Continued*										
	Beef Scraps, etc.—Continued										
			%	%	%	%	%	%	%	%	%
1002	*Meat Scrap for Poultry.* Conn. Fat Rendering & Fertilizer Corp., New Haven	*Hamden:* Ira W. Beers	7.68	28.61	49.88	45.00	....	....	2.85	10.98	10.00
1326	*Consolidated Bone Meal.* Consolidated By-Products Co., Philadelphia, Pa.	*Norwich:* A. E. Shedd	3.88	72.05	14.50	10.00	0.95	2.00	3.17	5.45	5.00
2557	*Corenco Bone Meal, An All Animal Feed for Cattle, Hogs & Poultry.* Consolidated Rendering Co., Boston, Mass.	*West Cheshire:* Cheshire Grain & Coal Co.	7.68	65.20	23.94	20.00	....	....	2.83	0.35	3.00
2984	*Corenco Bone Meal, An All Animal Feed for Cattle, Hogs & Poultry.* Consolidated Rendering Co., Boston, Mass.	*West Cheshire:* Cheshire Grain & Coal Co.	7.53	66.70	24.13	20.00	....	....	1.39	0.25	3.00
2763	*Chikora.* Dry Milk Co., N. Y.	*Guilford:* Fred C. Morse & Son	5.35	8.10	36.06	35.14	....	....	49.39	1.10	1.00
2690	*Pure Dried Skim Milk Powder.* Eastern Grain Co., Bridgewater, Mass.	*New Britain:* C. W. Lines Co.	5.90	7.85	34.38	32.00	....	....	51.04	0.83	0.75
2858	*Butterfly Brand Dried Skimmilk.* S. T. Edwards & Co., Chicago, Ill.	*Winsted:* E. Manchester & Sons	6.53	7.50	35.19	32.00	....	....	49.83	0.95	0.25
2479	*Yankee Dried Buttermilk.* S. T. Edwards & Co., Chicago, Ill.	*Guilford:* Fred C. Morse & Son	6.75	7.85	33.75	32.00	....	....	50.02	1.63	4.00[1]
2929	*Yankee Dried Buttermilk.* S. T. Edwards & Co., Chicago, Ill.	*Guilford:* Fred C. Morse & Son	6.43	7.72	33.63	32.00	....	....	50.57	1.65[1]	4.00[1]
1015	*Fairmont's Better Pure Flake Buttermilk.* Fairmont Creamery Co., Omaha, Neb.	*Thompsonville:* Geo. S. Phelps & Co.	7.85	13.95	27.88	32.00	....	....	40.89	9.43	6.00
2628	*Frisbie's Poultry Feed.* L. T. Frisbie Co., New Haven	*Westville:* R. G. Davis & Sons	6.13	36.18	44.50	45.00	....	....	3.31	9.88	8.00
1130	*Frisbie's Poultry Feed.* L. T. Frisbie Co., New Haven	*Thomaston:* Thomaston Supply Co.	5.45	29.80	52.00	50.00	....	....	4.63	8.12	8.00
2791	*Frisbie's Poultry Feed.* L. T. Frisbie Co., New Haven	*Bloomfield:* Bloomfield Farmers' Exchange	6.25	28.21	53.63	55.00	....	....	2.13	9.78	8.00
960	*Gorton's Codfish Meal.* Gorton-Pew Fisheries Co., Gloucester, Mass.	*Plantsville:* C. A. Cowles	6.28	38.63	52.06	55.00	....	....	2.08	0.95	0.10
2753	*Gorton's Codfish Meal.* Gorton-Pew Fisheries Co., Gloucester, Mass.	*Thomaston:* Thomaston Supply Co.	4.80	36.10	56.13	55.00	1.53	1.00	0.31	1.13	0.10
2146	*Edible Bone.* Hafleigh & Company, Philadelphia, Pa.	*Norwich:* Norwich Grain Co.	6.92	67.39	23.06	....	....	....	0.22	2.41	....
2964	*Land O'Lakes Dried Skim Milk.* Land O'Lakes Creameries, Inc., Minneapolis, Minn.	*West Cheshire:* Cheshire Grain & Coal Co.	6.53	8.20	34.00	30.00	....	....	49.64	1.63	0.50

[1] Roese-Gottlieb Method.

TABLE I. ANALYSES OF COMMERCIAL FEEDS, INSPECTION OF 1929—*Concluded*

Station No.	Manufacturer and Brand	Retail Dealer	Pounds per Hundred								
			Water	Ash	Protein (N x 6.25)		Fiber		Nitrogen-free extract (starch, gum, etc.)	Fat	
					Found	Guaranteed, not less than	Found	Guaranteed, not more than		Found	Guaranteed, not less than
	PROPRIETARY MIXED FEEDS—*Concluded*										
	Beef Scraps, etc.—Concluded										
			%	%	%	%	%	%	%	%	%
2808	*Cooked Meat & Bone Scrap.* A. G. Markham & Co., Springfield, Mass.	*Stafford Springs:* Dennis Grain Mill	7.33	25.74	55.88	50.00	....	....	2.22	8.83	8.00
2882	*Marsh's Pure Ground Scraps for Poultry.* Geo. E. Marsh Co., Lynn, Mass.	*Hawleyville:* W. A. Honan, Inc.	5.43	34.25	41.25	40.00	....	....	6.62	12.45	8.00
2632	*Morse's Meat Scraps.* Jas. F. Morse & Co., Somerville, Mass.	*Seymour:* Seymour Grain & Coal Co.	6.25	36.75	41.00	40.00	....	....	7.60	8.40	8.00
2670	*Blue Seal Meat Scraps.* N. E. By-Products Corp., Lawrence, Mass.	*Plantsville:* C. A. Cowles	6.70	32.03	46.75	50.00	1.58	3.00	2.21	10.73	5.00
2987	*Blue Seal Meat Scraps.* N. E. By-Products Corp., Lawrence, Mass.	*Plantsville:* C. A. Cowles	6.28	30.28	48.00	50.00	1.48	3.00	1.66	12.30	5.00
2748	*White Seal Meat Scraps.* N. E. By-Products Corp., Lawrence, Mass.	*Watertown:* Watertown Co-operative Assoc.	5.73	43.49	39.63	40.00	1.28	4.00	1.59	8.28	5.00
2510	*Register Brand Meat Scrap.* John Reardon & Sons Co., Cambridge, Mass.	*Westerly:* C. W. Campbell Co.	5.20	35.40	44.63	45.00	1.70	3.00	2.07	11.00	6.00
2509	*Register Brand Meat Scrap.* John Reardon & Sons Co., Cambridge, Mass.	*Westerly:* C. W. Campbell Co.	5.50	28.90	54.25	55.00	1.60	3.00	1.45	8.30	6.00
2813	*Edible Bone Flour for Cattle & Poultry.* The Rogers & Hubbard Co., Portland	*Willimantic:* Willimantic Grain Co.	8.55	67.03	24.00	23.85	....	....	0.12	0.30	0.25
2527	*Edible Steamed Bone.* The Rogers & Hubbard Co., Portland	*Norwich:* Norwich Grain Co.	3.75	85.70	5.81	5.00	....	....	4.41	0.33	....
1110	*Chic-Chuck "The Ideal Concentrated Poultry Food."* Russia Cement Co., Gloucester, Mass.	*Seymour:* Seymour Grain & Coal Co.	4.83	35.51	53.31	45.00	1.69	1.00	3.53	1.13	0.10
2237	*Shoemaker's "Swift-Sure" 50% Meat & Bone Scrap.* M. L. Shoemaker & Co., Philadelphia, Pa.	*New Milford:* Geo. T. Soule	6.13	28.46	48.38	50.00	1.74	3.00	1.76	13.53	6.00
2597	*Slugg's Dried Skim Milk.* W. G. Slugg, Milwaukee, Wis.	*Guilford:* F. H. Rolf, Inc.	6.98	8.78	34.56	30.00	....	....	48.90	0.78	0.50
2707	*Springfield Poultry Feed.* Springfield Rendering Co., Springfield, Mass.	*Hazardville:* A. D. Bridge's Sons	6.63	36.35	45.63	45.00	....	....	3.26	8.13	8.00
1112	*Stanley's Meat & Bone Scrap.* John T. Stanley Co., New York City	*Danbury:* C. S. Barnum & Son	7.28	29.58	46.31	45.00	1.77	3.00	5.01	10.05	10.00
935	*Struven's Fish Meal.* Chas. M. Struven & Co., Baltimore, Md.	*Wallingford:* A. E. Hall	9.78	21.26	57.19	55.00	0.68	2.00	4.26	6.83	4.00
2812	*P. W. Meat Scraps.* Worcester Rendering Co., Auburn, Mass.	*Willimantic:* Willimantic Grain Co.	6.10	30.21	48.50	45.00	1.45	6.00	2.81	10.93	8.00
2526	*P. W. Special Meat Scrap.* Worcester Rendering Co., Auburn, Mass.	*Norwich:* Norwich Grain Co.	7.80	24.73	56.25	55.00	1.90	5.00	0.59	8.73	8.00

TABLE II. ANALYSES OF FEEDS SUBMITTED BY INDIVIDUALS

Station No.	Material	Submitted by	Pounds per Hundred: Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free extract (starch, gum, etc.)	Ether extract (Crude fat)
			%	%	%	%	%	%
	Dairy Feeds							
1858	Dairy Ration	*New Haven:* Ambrose Allen	8.55	7.38	19.50	10.48	49.12	4.97
1020	Eastern States Full Pail 20%	*Wallingford:* Barnes & Co.	7.93	7.01	20.50	7.73	52.25	4.58
1021	20% Open Formula Feed A	*Wallingford:* Barnes & Co.	7.83	5.18	20.63	8.10	52.83	5.43
1022	20% Open Formula Feed B	*Wallingford:* Barnes & Co.	8.83	7.25	20.06	7.70	51.68	4.48
2937	Dairy Feed	*Litchfield:* Harry Borgeson	8.50	5.68	21.75	8.93	51.01	4.13
1683	Basic Dairy Ration No. 2	*Clintonville:* John Carlson	11.80	7.74	19.56	7.48	48.78	4.64
3127	Syragold 24% Dairy Ration	*New Canaan:* Clapboard Hill Co., Inc.	....	....	23.13	10.80	....	5.23
9919	Dairy Ration	*Middletown:* The Coles Co.	8.77	6.20	19.50	7.40	53.26	4.87
9871	Dairy Feed	*Meriden:* Grulich & Son	10.16	....	25.75	9.30	....	3.74
2960	Dairy Feed	*Wallingford:* Laden Bros.	9.35	6.44	21.31	9.15	48.92	4.83
872	Dairy Ration	*Middlefield:* The Lyman Farm	9.63	8.18	17.63	11.03	49.00	4.53
2180	Dairy Ration	*Hartford:* New York Feed & Grain Co.	8.81	7.08	21.88	9.40	47.95	4.88
2918	Paragon Dairy Feed	*Stepney Depot:* Nusbaum's Feed Store	7.83	8.15	23.06	10.10	46.21	4.65
2822	Dairy Mixture, Sample No. 1	*Southbury:* H. R. Stone	9.85	7.15	23.75	7.73	46.97	4.55
2823	Special Sample No. 2	*Southbury:* H. R. Stone	9.55	7.60	20.00	11.73	46.47	4.65
1731	20% Dairy Feed	*Ansonia:* I. Sovitsky Grain & Coal Co.	8.33	8.15	19.13	10.14	49.45	4.80
2025	Dairy Feed 20%	*Ansonia:* I. Sovitsky Grain & Coal Co.	8.47	8.15	19.88	9.70	47.90	5.90
2110	Ansonia Dairy Feed 20%	*Ansonia:* I. Sovitsky Grain & Coal Co.	9.42	7.40	19.88	9.99	48.78	4.53
2026	Ansonia Stock Feed	*Ansonia:* I. Sovitsky Grain & Coal Co.	9.19	4.95	9.56	10.39	61.24	4.67
662	Big (Y) Dairy Ration	*Norwich:* Yantic Grain & Products Co.	7.58	8.13	24.63	7.50	47.11	5.05
819	Big (Y) Dairy Ration	*Norwich:* Yantic Grain & Products Co.	8.13	9.43	23.00	7.63	47.63	4.18
3158	Abington Dairy Feed	*Norwich:* Yantic Grain & Products Co.	7.13	....	22.00	12.15	....	3.95
	Horse Feeds							
515	Alfalfa Leaf Meal	*Glastonbury:* B. O. Bailey	7.23	15.31	17.38	13.03	44.35	2.70
9920	California Leaf Meal	*Norwich:* Yantic Grain & Products Co.	6.71	18.31	19.75	17.08	36.16	1.99
3139	Pulverized Oats	*Norwich:* Yantic Grain & Products Co.	7.48	....	13.50	14.25	....	5.20
	Poultry Feeds							
8179	Mash No. 1	*West Cheshire:* Cheshire Grain & Coal Co.	7.05	8.89	17.75	5.68	55.93	4.70
8180	Mash No 2	*West Cheshire:* Cheshire Grain & Coal Co.	6.80	7.02	17.38	6.08	57.39	5.33
8472	Dry Mash A	*Middletown:* The Coles Co.	6.33	9.49	16.75	6.53	56.32	4.58
8473	Dry Mash B	*Middletown:* The Coles Co.	6.25	8.84	18.25	6.13	55.75	4.78
2891	Edible Steamed Bone	*New Haven:* R. G. Davis & Sons	....	87.03	5.56	....	....	0.23
2732	Mash No. 1	*Windsor:* L. W. Hudson	9.28	9.78	22.44	5.73	49.17	3.60
2733	Mash No. 12	*Windsor:* L. W. Hudson	9.93	10.83	22.06	3.93	49.50	3.75
2961	Growing Feed	*Wallingford:* Laden Bros.	9.68	6.65	17.06	4.33	56.88	5.40
2962	Laying Mash	*Wallingford:* Laden Bros.	9.40	5.86	17.13	4.80	56.78	6.03
1594	Mash No. 1	*South Coventry:* E. W. Latimer	7.88	9.75	16.50	7.15	56.02	2.70
1595	Mash No. 2	*South Coventry:* E. W. Latimer	8.06	9.75	17.25	5.57	55.66	3.71
8901	Mash A	*Guilford:* Fred C. Morse & Son	11.05	....	17.38	5.80	....	4.70

TABLE II. ANALYSES OF FEEDS SUBMITTED BY INDIVIDUALS—*Concluded*

Station No.	Material	Submitted by	Pounds per Hundred: Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free extract (starch, gum, etc.)	Ether extract (Crude fat)
			%	%	%	%	%	%
	Poultry Feeds—Concluded							
8902	Mash B	*Guilford:* Fred C. Morse & Son	11.05	....	16.50	5.55	....	3.25
1532	Starting Mash	*Thomaston:* Mary Pfundt	9.13	11.14	16.69	6.30	51.61	5.13
9005	Laying Mash	*Meriden:* Reliable Grain & Feed Co.	8.06	....	19.19	6.74	....	2.70
1730	Scratch Grains	*Ansonia:* I. Sovitsky Grain & Coal Co.	11.10	2.36	10.63	2.72	70.90	2.29
1732	Mash	*Ansonia:* I. Sovitsky Grain & Coal Co.	9.93	10.15	15.19	5.55	55.77	3.41
2027	Buttermilk Egg Mash	*Ansonia:* I. Sovitsky Grain & Coal Co.	10.10	7.79	18.69	5.70	51.11	6.61
	Maize Products							
305	Gluten Feed A	*Middletown:* The Coles Co.	7.55	7.23	26.50	7.95	48.22	2.55
306	Gluten Feed B	*Middletown:* The Coles Co.	7.58	8.36	27.06	8.08	45.69	3.23
2309	Corn Meal No. 1	*Kensington:* S. F. Labieniec	13.45	....	....	....	....	....
2310	Corn Meal No. 2	*Kensington:* S. F. Labieniec	14.04	....	....	....	....	....
8842	Whole Corn	*Norwalk:* Frank Libner & Sons	10.20	....	....	....	....	....
8843	Cracked Corn	*Norwalk:* Frank Libner & Sons	9.85	....	....	....	....	....
1911	Corn Flakes	*Meriden:* William S. O'Brien	9.69	0.53	9.00	0.46	79.67	0.65
	Miscellaneous							
2343	Bread Meal	*Storrs:* A. R. Merrill	11.48	2.43	12.19	0.57	69.42	3.91
3128	Calf Meal No. 1	*Chester:* Leet Bros.	....	....	24.50	2.53	....	5.90

Station No.	Material	Submitted by	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free extract (starch, gum, etc.)	Ether extract (Crude fat)
	Miscellaneous—Concluded							
3129	Calf Meal No. 2	*Chester:* Leet Bros.	....	....	20.19	3.40	....	7.45
2730	Cod Liver Meal	*Stafford Springs:* Dennis Grist Mills	8.08	10.68	56.25	3.53	3.28	18.18
2461	Corn Distillers' Grains	*Guilford:* Fred C. Morse & Son	6.65	2.26	25.25	12.38	43.81	9.65
9007	Corn Distillers' Grains	*Norwich:* Yantic Grain & Products Co.	5.15	....	25.50	13.80	....	8.93
1487	Feed	*Middletown:* Henry F. Brock	6.78	10.63	20.44	5.48	51.04	5.63
3168	Feed A	*Westport:* Samuel S. Daskam	7.68	....	25.25	9.00	....	4.53
3169	Feed B	*Westport:* Samuel S. Daskam	8.30	....	18.50	8.25	....	4.85
8264	Feed	*South Norwalk:* Roodner Feed Co., Inc.	4.13	4.84	9.06	12.00	65.59	4.38
9270	Feed No. 2	*Middletown:* John Robb	8.63	....	24.19	7.98	....	4.65
9269	Feed No. 1	*Middletown:* John Robb	8.75	....	24.56	8.43	....	4.45
341	Feed	*Southbury:* H. R. Stone	8.15	7.12	23.19	7.98	48.71	4.85
568	Feed No. C	*Wesleyan University:* Prof. Hoover	6.95	....	23.81	....	....	....
567	Feed No. B	*Wesleyan University:* Prof. Hoover	8.53	....	19.75	....	....	....
566	Feed No. A	*Wesleyan University:* Prof. Hoover	7.05	....	15.81	....	....	....
663	Dealer's Mixing Feed with Molasses	*Watertown:* Watertown Co-op. Assoc., Inc.	7.93	5.61	11.38	8.65	60.38	6.05
664	Hi-Test Mixing Feed	*Watertown:* Watertown Co-op. Assoc., Inc.	9.38	5.04	10.75	10.68	61.12	3.03
676	Feed	*Portland:* S. E. Frisbie	9.75	8.45	20.25	6.65	51.05	3.85
1172	Feed	*Stepney Depot:* Nusbaum's Feed Store	6.43	7.34	22.00	10.88	48.65	4.70
1218	Buckwheat Feed	*Guilford:* Fred C. Morse & Son	9.33	2.58	13.13	17.71	54.52	2.73
1365	Feed	*Norwich:* Walter T. Clark	....	....	20.88	....	....	....
1434	Grain	*Storrs:* A. D. Pratt	8.65	6.50	21.13	7.71	51.55	4.46
2271	Feed No 2	*Wallingford:* Laden Bros.	10.13	....	16.56	5.83	....	6.25
2270	Feed No. 1	*Wallingford:* Laden Bros.	9.93	....	17.56	5.50	....	6.48
3144	Peanut Waste	*Wallingford:* Laden Bros	5.13	2.31	21.38	6.93	32.60	31.65
2462	Jersey Milk Food Compound	*Guilford:* Fred C. Morse & Son	10.65	6.11	17.25	1.88	60.06	4.05
2914	Pig Feed	*Salisbury:* D. J. Decker	....	....	20.13	....	....	....
2913	Cooked Wheat Middlings	*Bridgeport:* Wm. Snow	10.88	2.35	12.25	5.13	65.41	3.98
2912	Cooked Wheat Hulls—Bran	*Bridgeport:* Wm. Snow	9.35	2.86	11.00	10.43	62.61	3.75
9125	Rye Middlings Feed	*Colchester:* Red Wing Feed & Lumber Co.	8.00	....	16.94	4.45	....	2.55

MISCELLANEOUS MATERIALS

In addition to feed samples listed in Table II, which were submitted for the regular fodder analysis, 42 other samples were examined which for the most part require no particular comment.

Many of these were feeds suspected of having caused sickness or death of poultry. In such cases, unless conspicuous poisons can be detected, the probable cause of the trouble experienced cannot be determined. Although it is conceivable that some ingredient in the feed may be responsible, it is altogether more probable that the results were due to other causes. Thus, an instance came to our notice where a large portion of a flock of chicks died, the deaths beginning to occur at about the time a change of feed was made. This particular feed was replaced by another brand of similar type and at the time the suspected feed was submitted mortality in the flock had practically ceased. Under the circumstances suspicion attached rather strongly to the feed, but careful examination revealed nothing to justify or confirm that suspicion. Bacteriological examination (made elsewhere) of the dead chicks showed that the flock was infected with white diarrhea. This story is typical of many complaints that accompany samples of feed submitted, and while the explanation may not always be the same as in the instance cited, some other disease of an epidemic nature may be the cause.

Several samples of Fos-for-us poultry grits were submitted for determinations of fluorine. The manufacturers of this product point out that this is not ordinary rock phosphate, which may contain from 3 to 4 per cent of fluorine and from which unfavorable results due to fluorine have been noted in feeding experience. Fos-for-us is said to contain 70 per cent of calcium carbonate, 25 per cent of calcium phosphate, the balance being chiefly iron, sulfur and silica. Our examination of the samples submitted showed total calcium (CaO), ranging from 48.90 to 49.98 per cent; total phosphorus (P_2O_5), from 8.78 to 10.60 per cent; and fluorine (Fl.), from 0.1 to 0.25 per cent. So far as we can judge these small amounts of fluorine are not sufficient to give cause for suspicion or alarm.

Bulletin 318 May, 1930

REPORT OF THE DIRECTOR

For The Year Ending October 31, 1929

Connecticut
Agricultural Experiment Station
New Haven

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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THE TUTTLE, MOREHOUSE & TAYLOR COMPANY, NEW HAVEN, CONN.

REPORT OF THE DIRECTOR

For the Year Ending October 31, 1929

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

In discussing the events of the past year there comes to mind at once the death of Dr. Thomas B. Osborne whose outstanding work in biochemistry and nutrition brought fame and honor, not only to himself but to the Station where he spent his entire professional life. A memorial is now being prepared, to be published as a Station bulletin, in which we have tried to record our high regard for our fellow worker and friend. It will include certain unpublished papers of Dr. Osborne, a complete bibliography and a number of biographical and personal papers.

Mr. Charles R. Treat of Orange, for many years a member of the Board of Control and in recent years its vice-president, died in February. To the Station this was a great loss. Mr. Treat's interest in the work of the Station was always active, intelligent and helpful; his judgment was sound and his time freely given.

Each year brings new problems to the farmers of the state and many of these are passed on to the Station. The spread of the European Corn Borer, the Japanese Beetle, the Oriental Peach Moth and other insect pests has placed unusually heavy burdens upon us. The Peach Moth has become a major pest in many orchards and at the request of the growers we have undertaken an attack along the line that is now most promising, namely, the rearing and distribution of parasites. In September a fund was subscribed by the growers and a special allotment of $5,000 made by the State Board of Finance and Control. Work was begun immediately, involving the building and purchase of a large amount of equipment and the employment of two assistants. It is hoped that sufficient numbers of two parasites to bring about substantial control can be reared for release in peach orchards next June.

Other new enterprises are the inauguration of the plan to eradicate the black currant, an alternate host of the White Pine Blister Rust; the establishment of a field station at Windsor for the growing of forest planting stock, vegetable breeding and soil fertility studies. Mention should also be made of the enactment of a "pure seed law" by the General Assembly of 1929, under which the Station has accepted the task of examining the samples collected by the Commissioner of Agriculture.

Thus it will be seen that our duties are constantly increasing. The last addition to our building space was in 1912, when the main laboratory was enlarged. To-day with a staff doubled in size we are very seriously crowded, with the result that it is increasingly difficult to carry on our work. New problems require new equipment and facilities which we are at present unable to house. At the last session of the General Assembly, an item of $45,000 for a new laboratory was included in our estimates, but this was eliminated from the budget. I present this as our greatest need and recommend that it be included in the estimates to be presented next fall.

CONTROL AND INSPECTION WORK

Inspection of Fertilizers, Feeds, Foods, Drugs, etc.

In accordance with the statutes relating thereto, the Analytical Chemistry Laboratory has analyzed 900 samples of *Fertilizers and Fertilizer Materials*. The report on these was published and distributed before the middle of December.

Similar control work on *Feeding Stuffs* has involved chemical analysis of more than 800 commercial and other fodder materials, many of which have had microscopic examination.

A report, Bulletin 307, upon food products and drugs summarizing inspection and analyses of 1320 samples, largely submitted by the Dairy and Food Commissioner, was issued in May of this year, covering the work done in the previous year. An equal volume of analytical work has been required in this branch of the service during the current year.

Statutes requiring the certification of *Glassware* used in the Babcock test for fat in milk and cream, and of thermometers to be used in dairies for checking pasteurization temperatures, have involved the examination of 2746 pieces.

No systematic inspection of *Insecticides* and *Fungicides* has been made but a considerable number of spray materials submitted by purchasers and others interested have been examined. A useful compilation of analyses (160 pages), of insecticides, fungicides, bactericides, rodenticides and weed killers was prepared and published in January of this year as Bulletin 300.

The department has also done a very considerable amount of analytical work in collaboration with the Tobacco Substation at Windsor and the Experiment Station at Storrs. Analyses of special foods have been made from time to time in coöperation with the American Medical Association's Council on Pharmacy and Chemistry. A review of the literature on color reactions for vitamins has been made and submitted to the Association of Official Agricultural Chemists and will be published in the journal of that association. The laboratory has also continued to take part, with other control laboratories and industrial and trade laboratories in the United States, in programs of check analyses on cottonseed meal and on various fertilizer mixtures. And finally, the department is always interested in the examination of new food products and in special and miscellaneous food to the extent that time and facilities permit.

Control of Insect Pests

There has been no particular spread of the *Gipsy Moth* in Connecticut during the season. As in 1928, there was no noticeable defoliation of trees in Connecticut, but larger areas were stripped in Massachusetts, Maine and New Hampshire than ever before. We believe that this relative freedom from injury is due in large measure to the careful and thorough work in scouting and spraying carried on year after year in coöperation with the Federal forces.

The *Satin Moth* has continued to spread westward, and a State quarantine conforming with the Federal quarantine was placed on the eastern half of the State, effective March 15, 1929. The Federal quarantine was later revised, effective November 1, 1929.

The *European Corn Borer* has made an extensive spread, especially from the two-generation area in the eastern portion of the State. The entire State was scouted by Federal men and the pest found in 39 new towns. In revising quarantines, it has seemed best to include 30 of these infested towns together with seven towns not yet found infested but surrounded or nearly surrounded by infested towns, leaving nine towns in which clean-up work will be done.

The last General Assembly enacted a compulsory clean-up law, as a means of corn borer control, the compulsion depending upon orders and regulations issued by the Director of the Station for the quarantined area only. Federal agents patrolled the main highways along the margin of the quarantined area from July 15 to October 15.

There has been no important spread during the season of the *Japanese Beetle*. Federal agents scouted more than 60 of the cities and larger towns along the principal lines of traffic and shipping, and the only new infestation discovered was at Willimantic, where 21 beetles were found. Soil treatment was carried on at Hartford and New London in the infestation centers discovered in 1928, and where grubs were found. Notwithstanding this treatment, more beetles were caught in traps in both cities in 1929 than were found in 1928. Road patrol was maintained between June 15 and October 1 on the main highways leading out of the larger quarantined areas.

The only infestation of the *Asiatic Beetle* discovered outside of the quarantined towns of New Haven and West Haven was in a small private yard in Bridgeport. On an inspection tour for lawn injury, approximately 52 towns were visited, mostly in the central and western portions of the State outside the Japanese beetle quarantined area, but no signs of infestation were found. The insect has been found in New Haven outside of the former infested area.

There has been an increase in the number of nurseries, all of which have been inspected since July 1 by the Station entomologists. We have also inspected the fruit and rose stocks imported from Europe for propagation in Connecticut nurseries.

In the *Mosquito Elimination* work very substantial progress has been made. New ditching in Old Lyme started in 1928 was continued in the spring of 1929, until the appropriation of $5,000 was exhausted. Another $5,000 was appropriated and work is now going on. Ditches are now being cut in Hamden and all of the salt marsh area in that town will soon be completed. Many ditches were recut in the East River section of Madison, and all ditches have been maintained except in certain portions of Madison and Guilford.

Distribution of Forest Planting Stock

During the calendar year 1929, the Station distributed 1,458,000 trees for forest planting, shelter belts and wind breaks; at least 99 per cent was for forest planting purposes. Of the entire amount, 463,000 trees were sent to farmers under the Clarke-McNary Act. The rest went to water companies, manufacturing plants, estate owners and others. This is an increase of 10 per cent more than the number distributed in 1928, showing an ever increasing interest in reforestation.

White Pine Blister Rust

During the season of 1929, 134,407 wild Ribes and 10,922 cultivated Ribes were destroyed on 34,597 acres, in 20 towns. Approximately 18 per cent of the acreage covered was re-eradication work.

Nursery Sanitation Zones have now been established around 11 nurseries, including one area established this year. The ten previously established zones were rechecked. Five thousand nine hundred and sixty acres were inspected on this project this year and 1,182 wild Ribes and 1,814 cultivated Ribes removed.

The European Black Currant law, effective July 1, 1929, gives the Director the authority to conduct a state-wide campaign on the elimination of this plant, which is an alternate host of the Blister Rust. The presence of this species of Ribes constitutes the most serious menace to the white pine.

SUMMARY OF WHITE PINE BLISTER RUST CONTROL, 1928-1929

Year	Initial erad. ac.	Re-erad. acres	Total ac. erad.	Wild Ribes destroyed	Cult. Ribes destroyed
1925	6.688	40	6,728	258,515	684
1926	21,687	570	22,256	182,826	330
1927	12,068	8,836	20,904	159,121	2,235
1928	68,539	1,122	69,661	123,383	1,151
1929	28,394	6,203	34,597	134,407	10,922

Seed Testing

For more than 50 years seed testing for farmers has been one of the Station's activities, it having pioneered in this work. The General Assembly of 1929 passed a statute requiring that all seeds, except of vegetables and flowers, be labeled as to germination and purity. The Commissioner of Agriculture is charged with the administration of the act, and the Station is making the examinations. This will increase the duties of the Botany Department and some provision should be made for financing the work.

Spray Service

The spray service, so popular among fruit growers, is carried on in coöperation with the Extension Service of the Connecticut Agricultural College. The Station botanists and entomologists maintain constant touch with the development of fungous and insect pests and by use of special weather data furnished by the New Haven office of the Weather Bureau, are able to advise orchardists as to the time of the several spray applications. The warnings or "bulletins" are telephoned to the several County Agents, who in turn send them out over a previously arranged telephone chain.

PROGRESS OF INVESTIGATIONS

Here follow brief notes on those projects of special interest or on which definite results have been obtained during the year. No attempt is made to discuss all of the investigations under way, a list of which will be found on page 766.

Biochemistry

Cell Chemistry. The investigation of the tobacco leaf has been continued throughout the year. Existing methods for the determination of nitrate, ammonia and amide nitrogen have been so modified as to become applicable to tobacco which, owing to the presence of the volatile alkaloidal base nicotine, presents unusually difficult analytical problems. Pure specimens of nicotine have been prepared by a method especially developed for the purpose and the dissociation constants of this base have been determined. Curves drawn with the knowledge of these constants form the basis of a new method for the determination of "free nicotine" in tobacco, a matter of some importance in the judgment of tobacco quality. Three papers embodying the results of this work have been published.

Protein Chemistry. Two papers on the basic amino acids of crystallized horse hemoglobin and of the keratins of human hair respectively have been published in the *Journal of Biological Chemistry.* These investigations were undertaken as illustrations of the application of the recent modifications of the methods of base analysis to proteins with unusual distributions of amino acids. An investigation of methods for the preparation of the sulfur-containing amino acid cystine has been carried out as well as an investigation of the compounds that this substance forms with silver and copper. A method for the separation of cystine from histidine has been developed and employed in the analysis of the keratins of human hair.

Nutrition. An elaborate experimental investigation of the effect of certain inorganic constituents of the diet on the growth of bone tissue has been planned and in part completed. Various phases of this investigation are being conducted with the collaboration of scientists of other institutions, notably Yale University, the Johns Hopkins Medical School, and Vanderbilt University. This investigation is founded on a method of varying the proportions of the determining factors in the diet that was developed in this laboratory recently.

An investigation of the vitamin distribution in watercress has been completed. This widely used salad "green" has been shown to provide a rich source of vitamins A and E as well as a moderately rich source of B.

A study of the curious phenomenon known as "refection" in the rat has been completed. The existence of refection in a rat colony renders the investigation of vitamin B-bearing tissues difficult, if not impossible. The failure of our attempts to produce this phenomenon in our animals was therefore gratifying.

The biochemical laboratory has also coöperated with Dr. F. G. Benedict of the Nutrition Laboratory of the Carnegie Institution of Washington at Boston in a study of the fundamental characteristics of the basal metabolism of the rat. The effect upon the basal metabolism of the rate at which the animal has been grown has also been investigated. It is now possible to grow animals at any prescribed rate within the growth capacity of the species and the detailed study of animals that have been grown at widely different rates is expected to lead to valuable conclusions regarding the optimal rate of growth.

The annual grants of the Carnegie Institution of Washington first made in 1904 to the late Dr. Thomas B. Osborne, and since 1912 jointly to Dr. Osborne and Prof. Lafayette B. Mendel, have broadened the scope of the Station's work in the field of biochemical investigation. This generous financial assistance has been continued through the current year by a grant to Professor Mendel and Dr. Vickery.

Botany

The Willow Scab Fungus. Work on this disease has continued. It was found in North America for the first time in 1927 by the Station Botanist, although it had been known for some years in Europe. Bulletin 302, March, 1929, presents the results of the investigation up to that time. During the past year further data have been obtained on the occurrence of this disease in the United States and Canada, on control by spraying and on the life history of the fungus itself.

Chestnut Blight. Some hope exists that the virulence of this fungus may decrease as time passes, and that we may in the future hope to reestablish this very valuable forest tree. Several lots of chestnut seedlings have been planted in various parts of the state to determine the amount of natural infection; also regular observations are being made at two locations on native trees under forest conditions to determine the spread of the fungus.

Damping-off of Vegetable Seedlings. This constitutes a source of considerable loss each year to the vegetable industry on both greenhouse and field crops. Various soil treatments are being compared in an effort to find one that is both effective and practical. Excellent results have been obtained by the use of acetic acid and formalin.

Entomology

Asiatic Beetle. The results of the investigations on the life history, habits and methods of control of the Asiatic beetle have been published as Bulletin 304. Work on the control of this insect by applying lead arsenate in varying amounts to the soil has been continued, as well as tests for the effect of such applications on the germination and growth of the different kinds of grasses used in making lawns. New plots on several lawns in Westville were laid out to check work previously done with lead arsenate and to assure a correct method of application per unit area. Observations will continue for a few years.

Oriental Peach Moth. An investigation on the life history, habits and control of the Oriental peach moth has been under way for several years and the data have been assembled in Bulletin 313. No satisfactory control by means of applications has yet been discovered. Consequently, control or partial control by parasites has been given considerable attention. In the late summer a request was received from the Connecticut Pomological Society that the Station undertake to rear these parasites and distribute them in peach orchards in 1930. A study of possible methods was made and a constant temperature room and a work room were fitted up with the necessary cages and apparatus, and an electric refrigerator was installed. A portion of the greenhouse was assigned to this work and strawberry plants were grown in order to rear the strawberry leaf-roller, which is a host to one of the parasites, the *Macrocentrus ancylivora.*

Mexican Bean Beetle. During the summer, the Mexican bean beetle was found to be present in certain towns in Fairfield, Litchfield, Hartford and New Haven Counties, in the western half of the State. The first discovery was made by Dr. E. P. Felt, of Stamford. It is questionable whether this insect will become a serious pest in Connecticut, as it is thought to be near its northern limit. However, it has seemed best to conduct a brief study of the life history of this insect and methods of controlling it in Connecticut and therefore a new project is added to the list.

Cabbage Root Maggot. Investigations were carried on in the control of the cabbage root maggot, principally to determine whether or not the gains in yield were justifying the expense of the control methods. This project will be continued for another season.

Squash Vine Borer. Insecticides were used directly on the larvae of the squash vine borer to see whether the control of this pest could be made more effective.

Forestry

The Rainbow Forest. Originally planted to both conifers and hardwoods, this experimental forest is now essentially coniferous, the hardwoods having succumbed to disease, insects and unfavorable conditions. The soil is very sandy, too much so for cultivated crops or pasture and was selected as representing one type of our sub-marginal land. The plantings are in blocks of one or two species and constitute not only a trial of the various species of conifers, but of various spacings. As they have grown, experiments in thinning, pruning and other silvicultural practices have been possible. A complete discussion of the results up to 1924 is available in Bulletin 262.

Work during the year has included very little planting but considerable thinning. Several new sample plots have been laid out and the thinnings have been extended to other plantations which were in need of such treatment.

In coöperation with the Soils Department a study of pine leaf litter and its effect on sandy soil was begun. Several plots were laid out, from which the leaf litter was removed or treated in such a way as to alter its character, by burning or otherwise, so that a comparison might be made later with the check area where the litter was left in its natural condition. There is reason to believe that pine needles unmixed with hardwood leaves have a deleterious effect on soil conditions rather than otherwise. It is hoped that some definite data on this point will be secured through this experiment.

Treatment to Prolong the Life of Native Woods for Tobacco Shade Poles. The coöperative demonstration at the Tobacco Substation is being continued although no new posts have been set. It is planned to try out some other species in addition to those already under test.

The Distribution and Rate of Growth of the Forest as Influenced by Soil Conditions. The studies on the rate of growth of red pine in pure plantations have been continued and the result prepared for publication. Normal growth curves have been prepared, thus providing a "yardstick" by which growth on different sites can be computed to a common age and the quality of sites compared.

Plant Breeding

Hereditary Characters in Corn. The inheritance and linkage relations of a sterile tassel condition have been studied further and its possibilities for use in the production of crossed seed corn determined. This character is being introduced into the seed-parental stock of Canada-Leaming to be used in growing hybridized seed without detasseling. Other characters including sugary with abnormally high and low segregation, are being studied further.

Effects of Inbreeding and Crossing Upon Corn. The investigation bearing upon conflicting theories as to the interpretation of hybrid vigor is being continued but has not reached a stage where progress is to be reported.

Improvement of Naturally Cross-Fertilized Plants. Canada-Leaming, a cross of inbred strains of Canada Yellow Flint and

Leaming, has been tested the second year in Massachusetts, Vermont, New Hampshire and Maine and in spite of the unfavorably dry season has been outstanding in many places in its early maturity, large stalk growth and heavy production of grain. This companion of Burr-Leaming combines many of the qualities of earliness and hardiness of the flint type with the large stalk growth and grain yield of the dent type.

About 400 first generation crosses of inbred strains of Whipple's Early Yellow sweet corn were grown in a preliminary trial for a market garden type of sweet corn having the uniform size and shape of ear and even maturity characteristic of crossed corn. Some 30 of these have been selected for further trial.

A new hybrid type of canning Evergreen sweet corn has been tested three years. This has been named Green Cross and will be distributed to canners and seed growers in 1930.

A new variety of Early Yellow sweet corn called Spanish Gold has been developed by crossing an amber-colored flint corn from Spain with Alpha white sweet and Gaspe flint and other varieties of extreme earliness. The new variety in the trials at Mount Carmel has ripened earlier and produced somewhat larger ears than any other extra early variety grown in comparison with it. Seed will be distributed for general trial in 1930.

New varieties of straightnecked squash, early pepper, and spinach are ready for distribution for trial by market gardeners under various soil conditions and different methods of handling.

Preliminary results of inbreeding and crossing strawberries show that this plant behaves much the same as corn. With the added advantage of vegetative propagation it is to be hoped that valuable varieties can be originated in this way. Inbred strains of Harvard 17, Chesapeake and Glen Mary are being grown in the greenhouse for the purpose of making many crosses in a further test of this method.

Black raspberries show no reduction in growth or fruitfulness after two generations of self-fertilization. Strains differ in size, form and number of fruit as well as in cane and foliage color and other details of vegetation. Some strains are uniform and come true to type from seed. A comparison of seed propagation with tip-layering will be made to see if there is any advantage in the former method. Black raspberry plants are easily grown from seed and since these seedlings start free from mosaic there is a definite advantage in this method of propagation.

Improvement of Naturally Self-Fertilized Plants. The root-rot resistant strains of shade tobacco have continued to show a noticeable superiority in this respect over the variety generally grown. The origin and inheritance of this character are being studied. A combination of some of the growth characters of Round Tip tobacco with the quality and leaf characters of Cuban Shade is being attempted. Several selections in this material are being tested for uniformity, growth habit and leaf quality.

A new variety of tomato combining the earliness of Alacrity with the shape and color of Bonny Best is being tested on various soils under market garden conditions.

Soils

Nutrient Requirements of Connecticut Soil Types. During the past four years 70 different soils representing practically all the important soil types of the State, under various conditions of former treatment, have been carefully studied as to plant food constituents and acidity as shown by chemical analysis, and as to the response of crops to various combinations of nitrogen, phosphorus and potassium, both with and without lime, under greenhouse conditions. The crops used include tobacco, alfalfa, lettuce, beets, carrots, cabbage, turnips, oats, buckwheat and sweet corn. These respond to lime in the following order from highest to lowest lime requirement of the crop: Lettuce, alfalfa, beets, carrots, cabbage, turnips, sweet corn, oats, tobacco and buckwheat.

Of the 70 soils, 67 need lime for lettuce, 64 for alfalfa, 60 for beets, 58 for carrots, 50 for cabbage, 43 for turnips, 40 for sweet corn, 34 for oats, 9 for tobacco and 4 for buckwheat.

Nitrogen response under greenhouse conditions is so abnormally low, due to the favorable conditions for liberation of nitrogen from the soil, that no definite conclusions can be drawn. Of all the crops grown, oats appear to show the most marked response to nitrogen. Tobacco is the only other crop that has shown definite symptoms of nitrogen deficiency on any appreciable number of soils.

Phosphorus is a serious limiting factor for nearly all crops grown in the case of 63 of the 70 soils. Three old tobacco soils included in the list failed to show response to phosphorus. Alfalfa, tobacco and turnips were almost complete failures on soils that are particularly low in this element. Data is somewhat irregular for other crops, but the approximate order of response to phosphorus was alfalfa, tobacco, turnips, sweet corn, cabbage, lettuce, carrots, oats, buckwheat.

Potassium is of such low availability that only six of the 70 soils fail to show measurable response. However, the majority of the soils produce somewhat higher yields without potash than without phosphorus. Differences in the potash requirement of the various crops are not sufficiently great to justify any statement as to order of response for the crops grown. Alfalfa and tobacco are the only ones that suffer markedly when the soil fails to supply sufficient potash.

Two other malnutritional abnormalities of tobacco have appeared on some of these soils. On three very acid soils tobacco has shown symptoms of an excess assimilation of manganese (manganese toxicity). On several heavily limed soils where the fertilization has been deficient in nitrogen or potassium or both, a physiological trouble known as "frenching" has appeared. Factors affecting the occurrence of these troubles are being studied more fully.

Two year old maple transplants failed to show any consistent differences in growth on nine soils on which tobacco had previously shown marked response to the various nutrients. The experiment with young maple transplants will be continued for several years under outdoor conditions on a soil of marked nutrient deficiency.

In general, it may be stated that the soil type is less important than the past history of the field in determining the present nutrient requirements of the soil for the various crops. However, under field conditions, differences in the physical character of the soil, topography and stoniness will be of paramount importance in determining economic response to fertilizer and lime treatment.

Farm Soil Surveys. During 1928 and 1929 nearly two hundred farms in the towns of Woodstock, Griswold, Coventry, Brooklyn, Columbia, Stonington, North Stonington and Canterbury have been carefully surveyed as to soil types on the various fields of the farm. This is part of a project, the "Economic Significance of Soil Type," conducted in coöperation with the Agricultural Economics Department of the Storrs Agricultural Experiment Station. Soil acidity tests of practically every field on the above farms, a total of nearly 1500 tests, gives the following results:

0.5% of fields—neutral or above (7.0 + pH)
12.9% of fields—slightly acid (6.2-7.0 pH)
28.1% of fields—moderately acid (5.4-6.2 pH)
56.0% of fields—strongly acid (4.6-5.4 pH)
2.5% of fields—very strongly acid (3.8-4.6 pH)

Available phosphorus tests of all soils collected from three of the above towns show the following indications:

1.3% of fields—very high test (40 lbs. + per A)
4.7% of fields—high test (20 lbs.-40 lbs. per A)
6.6% of fields—medium test (10 lbs.-20 lbs. per A)
31.1% of fields—low test (5 lbs.-10 lbs. per A)
56.3% of fields—very low test (less than 5 lbs. per A)

A serious deficiency of available phosphorus undoubtedly exists on dairy farms in the highland regions of the State.

Leaching Experiments. During the spring of 1929 a battery of lysimeters was constructed at the Tobacco Substation in Windsor. This includes a long concrete-walled chamber built underground except for windows and roof, with raised earth platforms on each side and at one end, in which the drainage cylinders are imbedded. The bottoms of these cylinders drain into brass, tin-lined tubes which lead through the walls and drain into collecting tanks on shelves along the walls of the chamber. The drainage cylinders, or lysimeters, are 20 inches in diameter. Thirty-four are 10 inches in depth while 34 are 20 inches in depth, the former filled with a seven-inch depth of surface soil, while the latter have also a ten-inch layer of subsoil. The capacity of the equipment provides for 34 additional lysimeters 30 inches in depth which have not yet been installed. This equipment, built at a cost of $3,000, compares favorably with any other of its kind elsewhere and is the only apparatus in operation in New England that provides for collection and analysis of the soil and fertilizer constituents that are lost through leaching.

The first problem to be undertaken is a study of the losses occurring under heavy applications of various types of nitrogenous fertilizers. Sixteen different sources of nitrogen and four different types of soils are under investigation. The current season was exceptionally dry and practically no drainage water was collected until the entire crop was destroyed by hail on July 31. Much valuable data has since been collected which will be published later.

Forest Soil Studies. In coöperation with the Forestry Department of this Station, an intensive study of the soil factors affecting the site quality for red pine in plantations is being continued. Typical soils under various conditions of forest cover are being investigated in the laboratory as to biological, chemical and physical characteristics of the various soil horizons. Results to date indicate that the micro-organisms of the soil are most active in the fresh litter. In this layer organic nitrogen is being rapidly transformed into ammonia. Only a small part of this is transformed into nitrates in a three months' incubation period, except on soils of slight acidity. Ammonification occurs to a lesser degree in the older humus layer, which lies beneath the litter in forest soils where "mull" formation is not active. Nitrate formation rarely occurs in this type of material. The more favorable "mull" types, under hardwood cover, usually show nitrate production in the surface layer of mineral soil.

Three main groups of forest soils are represented in Connecticut. The first of these, the "podsol type," has a definite layer of light gray mineral soil occurring just beneath a thick humus covering. Below this gray layer are layers of dark coffee brown or rust brown color. This type is most general under hemlock-white pine-hardwoods associations in the northern part of the State, although it occurs locally in oak and beech forests in southern Connecticut. The second, or "mull type," has no older humus layer under the leaf litter, and the upper mineral soil is dark brown in color and of a mellow, crumb-like structure. Earthworms are active. This type is characteristic of the best hardwood forests, where ash, elm, basswood, black and yellow birch and hard maple predominate.

A third or intermediate type has no definite gray layer beneath the forest humus, but there is an accumulation of leaf mold, and the upper mineral soil is firm and compact, with no earthworm activity to mix and mellow the soil. This is the most common type on the second growth and sprout hardwoods forests with a predominance of red and scarlet oak.

An important object in further research is to determine the factors that produce these forest soil types and to predict the effect of various silvicultural practices in modifying them.

Tobacco Substation

Despite the fact that the entire crop of tobacco on the station farm was ruined by hail August 1, satisfactory progress has been made on most of the active projects.

Shade Tobacco Resistant to Black Rootrot. The 4R strain that was found two years ago has proved this year to be very highly resistant to rootrot. This is particularly gratifying since the ordinary strain of Cuban shade tobacco is very susceptible to this disease and the losses have been very large. This should make it possible to grow shade on many fields that have been abandoned because of black rootrot.

Depressing Effect of Stable Manure. Tobacco was stunted and unusually poor on plots that received annual applications of stable or "adco" manure for four successive years. On these plots, the manure was used *in addition* to the regular commercial fertilizer application. The unusually dry season probably accounts for this behavior of the crop, which is quite different from the results of the wet seasons of 1927 and 1928.

Cause of Poor Combustion of a Dry Year Crop. Chemical comparison of tobacco of a dry season (1924) and a wet season (1927) shows the poor burning tobacco of the dry season contained more calcium, magnesium, phosphorus, sulfur, chlorine and nitrogen, all of which may be injurious to burn as measured on the leaf, while the good burning crop was distinguished by the increased potash, which aids combustion. Also the alkalinity of the water soluble ash of the wet year crop was higher. This is considered a good index of combustability.

Seasonal Fluctuation in Soil Reaction. In trying to find the optimum soil reaction for tobacco production it will be necessary to take into consideration the period of the year when the test is made. On plots where monthly tests have been made for the past two years the reaction was found to be highest in December and lowest in June, the extreme variation being from .5 to 1.0 pH unit.

FIELD DAY

The Station field day at the Mount Carmel Farm, August 29, was one of the most successful we have ever had. Five hundred visitors gathered at the farm to inspect the experimental plots and to take part in the program. President George A. Works of the Agricultural College and Dr. E. W. Sinnott of Columbia University gave the principal addresses.

The Tobacco Substation Field Day was also well attended. Fifty of the visitors were members of a party of tobacco growers from Canada, who made this one of the important features of their tour.

The abandonment of the State Fair at Hartford relieved the staff of the very considerable task of preparing an exhibit. Several smaller exhibits were sent to town fairs.

LIBRARY

About 900 accessions of permanent value were added during the year to the Station library. Journals purchased now number 85, in addition to which some 30 farm journals and about 24 foreign agricultural journals are received regularly in exchange. The total number of bound volumes is now about 17,000.

PHYSICAL EQUIPMENT

The most extensive addition to the Station's equipment is the lysimeter installation at Windsor, mentioned elsewhere. Also the rat room of the biochemical laboratory has been completely renovated, new steel shelves and tables being installed. Other items are: a Pfaudler vacuum still, two electric refrigerators, a hydrogen sulfide apparatus, a Hobart chopping device for preparing forest litter samples, and a Parr combustion equipment for determining soil organic matter.

CHANGES IN STAFF

Appointments:

Henry Bull, M.F., Assistant Forester, August 1, 1929.
Miss Dorothy Amrine, B.Litt., Editor, July 1, 1929.
O. E. Street, M.S., Plant Physiologist, Tobacco Substation, July 1, 1929.
Mrs. Catherine R. Miller, M.A., Secretary Plant Breeding and Soils Departments, September 1, 1929.

Resignations:

Mrs. Mary B. Hunter, Secretary Plant Breeding and Soils Departments, August 31, 1929.

ACTIVE PROJECTS, 1929-1930

Analytical Chemistry

Dr. E. M. Bailey in charge

1. Inspection of Fertilizers.
2. Inspection of Feeding Stuffs.
3. Inspection of Foods and Drugs.
4. Calibration of Babcock Glassware and Thermometers.
5. Inspection of Insecticides and Fungicides.
7. Analysis of Special and Miscellaneous Foods.

Biochemistry

Dr. H. B. Vickery in charge
In Collaboration with Dr. L. B. Mendel, Yale University

1. Cell Chemistry.
   a. A detailed examination of the nitrogenous constituents of plant cells, in particular those of leaf tissues, and the further development of methods for the determination of the different forms of nitrogen in extracts of such tissues.
   b. An investigation of the nitrogenous constituents of the tobacco plant.
2. Protein Chemistry.
   a. The methods for the determination of the basic amino acids of proteins with the object of effecting improvements.
   b. Methods for the preparation of pure proteins on a large scale with the object of obtaining material for chemical and nutritional study.

Entomology

Dr. W. E. Britton in charge

3. Spraying and Dusting Experiments on Apples and Peaches. (With Botany.)
6. Control of Foul Brood of Bees. (Inactive.)
9. Insect Survey of Connecticut.
16. Experiments with the Cabbage Maggot.
17. Life History and Methods of Controlling the Oriental Peach Moth, *Laspeyresia molesta.*
18. Life History of Imported Currant Worm.
20. Life History, Habits and Control of the Imported Birch Leaf-Miner, *Fenusa pumila.*
21. Life History and Control of the Spinach Leaf-Miner.
26. Experiments on the Control of Squash Vine Borer.
27. (New) Rearing and Distributing Parasites of the Oriental Peach Moth.
28. (New) Investigations on Oil Sprays.
29. (New) Life History of the Mexican Bean Beetle.

Control Projects

10. Inspection of Orchards and Nurseries.
11. Control of Gipsy Moth. (With U. S. Dept. Agric.)
12. Elimination of the Mosquito Nuisance in Salt Marshes.
13. Inspection of Apiaries.
19. Control of the European Corn Borer. (With U. S. Dept. Agric.)
24. Control of the Asiatic Beetle. (With U. S. Dept. Agric.)
25. Control of the Japanese Beetle. (With U. S. Dept. Agric.)

Forestry

Mr. W. O. Filley in charge

1. Experimental Plantations on a Sandy Tract at Rainbow.
   a. Comparison of a wide variety of conifers and hardwoods.
   b. Methods of management for those species that have survived.
   c. Studies on growth and habits of the several species.
2. Effect of Thinning in White Pine. (At Shaker Station.)—Three

Botany

Dr. G. P. Clinton in charge.

2. The Nature and Cause of Mosaic Disease of Plants.
5. Plant Disease Survey of Connecticut.
6. *Thielavia basicola,* a Study of the Perfect Stage.
8. Spraying and Dusting Experiments on Apples and Peaches. (With Department of Entomology.)
15. Chestnut Blight, Virulence Studies.
16. Tobacco Diseases, Especially Black and Brown Root Rot. (At Tobacco Substation.)
20. Tree Diseases.
23. Rogueing as a Control for Raspberry Mosaic. (With U. S. Dept. Agric.)
24. Willow Scab, Studies of Morphology of Fungus (perfect stage, inoculations and control).
26. Tests of Various Materials for Soil Treatment in Control of Dampening-off of Vegetable Seedlings.
27. A Study of an Elm Disease in Connecticut.
28. Studies on the Identification of Apple Varieties by Seed Characters.

Control and Service

12. Seed Testing.
25. Apple Scab, Determination of Discharge of Ascospores in Connection with Telephone Spray Service.

4. Method for the Improvement of Naturally Self-Fertilized Plants, with particular attention to Tobacco and Vegetable Crops, such as lettuce, lima beans and tomatoes.

Soils

Mr. M. F. Morgan in charge

1. The general project "What Soil Characters are Factors in Determining the Agronomic Value of Utilization of Land" has developed into five distinct phases as follows:
   a. A descriptive inventory of Connecticut soil types, in relation to their adaptation for crops, pasture and forest.
   b. The physical and chemical characteristics of important soil types, including the nutritive response of tobacco and other plants when these soils are variously treated in the greenhouse.

ACTIVE PROJECTS, 1929-1930

Analytical Chemistry

Dr. E. M. Bailey in charge

1. Inspection of Fertilizers.
2. Inspection of Feeding Stuffs.
3. Inspection of Foods and Drugs.

26. Experiments on the Control of Squash Vine Borer.
27. (New) Rearing and Distributing Parasites of the Oriental Peach Moth.
28. (New) Investigations on Oil Sprays.
29. (New) Life History of the Mexican Bean Beetle.

Control Projects

10. Inspection of Orchards and Nurseries.
11. Control of Gipsy Moth. (With U. S. Dept. Agric.)
12. Elimination of the Mosquito Nuisance in Salt Marshes.
13. Inspection of Apiaries.
19. Control of the European Corn Borer. (With U. S. Dept. Agric.)
24. Control of the Asiatic Beetle. (With U. S. Dept. Agric.)
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Forestry

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1. Experimental Plantations on a Sandy Tract at Rainbow.
   a. Comparison of a wide variety of conifers and hardwoods.
   b. Methods of management for those species that have survived.
   c. Studies on growth and habits of the several species.
2. Effect of Thinning in White Pine. (At Shaker Station.)—Three Grades of Thinning.
3. Effect of Thinning in Hardwoods. (At Quassipaug Lake.)
5. Distribution of Forest Planting Stock. (Under Clark-McNary Act.)
6. Studies of Forest Plantations. (State-wide.)
   a. Comparative growth of various species.
   b. Reasons for success or failure.
   c. Soil and other site factors necessary for success of each species.
10. An Investigation of the Distribution and Growth of Forest Trees as Influenced by Soil Conditions and Other Site Factors.
11. Coniferous Seed Bed Study to Determine:
   a. The value of fertilizers in seed beds.
   b. The value of different amounts of seed.
   c. The value of dusts and sprays in preventing damping off.
12. A Study of Preservative Treatments of Native Woods.

Control Project

7. Control of White Pine Blister Rust. (With U. S. Dept. Agric.)

Genetics (Plant Breeding)

Dr. D. F. Jones in charge

1. A Genetic Study of Hereditary Characters in Corn Involving Their Linkage Relations and Variability, with particular attention to characters directly influencing yield.
2. The Effect of Inbreeding and Crossing upon Corn in Relation to Vigor, Rate of Growth, Productiveness and Variability.
3. Methods for the Improvement of Naturally Cross-Fertilized Plants by Selection in Self-Fertilized Lines, with particular attention to field corn for grain and ensilage, alfalfa, and to some of the more important Vegetable Crops, such as sweet corn for market gardening and canning, beets, cabbage, carrots, cucumbers, melons, onions, radish, rutabagas, squash and some Fruits such as bush fruits and strawberries.
4. Method for the Improvement of Naturally Self-Fertilized Plants, with particular attention to Tobacco and Vegetable Crops, such as lettuce, lima beans and tomatoes.

Soils

Mr. M. F. Morgan in charge

1. The general project "What Soil Characters are Factors in Determining the Agronomic Value of Utilization of Land" has developed into five distinct phases as follows:
   a. A descriptive inventory of Connecticut soil types, in relation to their adaptation for crops, pasture and forest.
   b. The physical and chemical characteristics of important soil types, including the nutritive response of tobacco and other plants when these soils are variously treated in the greenhouse.

c. Fertilizer experiments with vegetable crops on several typical soils in concrete frames.
d. A study of the physical, chemical and biological conditions of the soil in natural mixed and planted coniferous forests. (With Forestry Department.)
e. A study of the drainage losses and other changes that occur in several soils under heavy fertilization, as practiced for tobacco and vegetables. (Lysimeter experiments at Windsor.)

2. Experiments in Lawn Fertilization, Seeding and Management.

Tobacco Substation

Dr. P. J. Anderson in charge

1. Fertilizer Experiments: Various Sources and Rates of Nitrogen, Phosphoric Acid and Potash.
2. Field Tests with Farm Manure.
3. Field Tests with Manure Substitutes.
4. Tobacco Nutrition Studies: the Rôle of Nitrogen, Sulfur, Chlorine, Potassium, Calcium, Manganese, Boron and Magnesium.
5. Improvement of Havana Seed Tobacco.
6. Improvement of Broadleaf Tobacco.
7. Improvement of Cuban Shade Tobacco.
8. The Effect of Various Winter Cover Crops used on Tobacco Land.
9. Brown Root Rot of Tobacco. (With U. S. Dept. Agric.)
10. Studies on Black Root Rot of Tobacco.
11. Soil Reaction in Relation to Tobacco.
13. Preservative Treatment of Shade Tent Poles.
17. The Rôle of Humidity and Temperature in Curing Tobacco.

PUBLICATIONS

Bulletins

No. 296. Report on Commercial Fertilizers for 1928.
No. 297. The Effect of Topping and Suckering on Havana Seed Tobacco.
No. 298. Report of the Director for the Year Ending October 31, 1928.
No. 299. Report of the Tobacco Substation at Windsor for 1928.
No. 300. The Composition of some Commercial Insecticides, Fungicides, Bactericides, Rodenticides and Weed Killers.
No. 301. Control Studies on the Plum Curculio in Connecticut Apple Orchards.
No. 302. The Willow Scab Fungus.
No. 303. Report on Commercial Feeding Stuffs for 1928.
No. 304. The Asiatic Beetle in Connecticut.
No. 305. Report of State Entomologist for 1928.
No. 306. Soil Reaction and Liming as Factors in Tobacco Production in Connecticut.
No. 307. Report on Food Products and Drugs for 1928.

Bulletins of Immediate Information

No. 62. The Control of the Asiatic Beetle in Lawns.
No. 63. The European Corn Borer, a Menace to Corn, Vegetable and Garden Plants.
No. 64. The Japanese Beetle Quarantine.
No. 65. The Asiatic Beetle Quarantine.
No. 66. The Satin Moth Quarantine.
No. 67. Control of Ant Invasions. (Revised edition of Bulletin of Immediate Information No. 17, July, 1922.)

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MASON, KARL E. The effect of purified diets, and their modifications, on growth and testicular degeneration in male rats. Jour. Nut., **1**: 311-334. 1929.

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BRITTON, W. E. Report of committee on injurious insects. Proc. 38th Annual Meeting Conn. Pom. Soc., 28. 1929.

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FRIEND, R. B. Control of insects affecting truck crops. Report Conn. Veg. Growers Assoc., 28. 1928.

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MORGAN, M. F. Tobacco as an indicator plant in studying nutritional deficiencies of soils under greenhouse conditions. Jour. Am. Soc. Agron., **21**: 130-136. 1928.

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WHAT THE STATION CAN DO

Each mail brings to the Station requests for information and service, the range of subjects being almost without limit. Every effort is made to comply with these requests, even though they are outside the fields under investigation. This is one of the purposes for which the library is maintained. However, some of the letters request help that requires an intimate knowledge of live stock management and the like and others ask us to make laboratory determinations for which we do not have the equipment or staff. Therefore it is helpful to publish from time to time a list of the subjects on which we can furnish information and the kinds of samples we can accept.

The Station can furnish information on:

Fertilizers and fertilization.
Soils and management.
The chemical composition of foods, drugs, insecticides and fungicides.
The composition of diabetic foods.
Insect pests of plants and their control.
Fungous and other diseases of plants and their control.
Sprays and spraying.
Fruits and fruit management.
Weeds and their control.
Forestry—all phases.
Care of shade trees.
Plant breeding—especially field and sweet corn.
Lawns, establishment and care.
Bees.
Mosquito elimination.
Tobacco culture.

Samples and specimens that can be analyzed, tested or identified:

Fertilizers.
Feeding stuffs.
Foods and drugs.
Milk—except for bacterial count.
Seeds.
Weeds and other plants.
Insects.
Diseased and injured plants.
Soils.

The Station cannot furnish information on:

Live stock feeding and management including poultry.
Animal diseases.
Household management.
Clothing.
Farm management.
Marketing and coöperation.

Requests for information on these subjects should be sent to the Connecticut Agricultural College at Storrs.

The Station cannot make analyses and examinations of:

Drinking water—apply to the State Board of Health, Hartford.

Milk for bacterial content—apply to the Dairy and Food Commissioner, Hartford.

Sick or dead poultry should be sent to the Poultry Department, Storrs Agricultural Experiment Station, Storrs, Conn.

All of which is respectfully submitted.

William L. Slate,
Director.

Bulletin 319 June 1930

THE THIRTY-FOURTH REPORT ON
FOOD PRODUCTS

AND THE TWENTY-SECOND REPORT ON
DRUG PRODUCTS

1929

Connecticut
Agricultural Experiment Station
New Haven

The bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY, NEW HAVEN, CONN.

THOMAS HOLT

The Station, and particularly this department, was grieved to learn of the sudden death on April 29, 1930, of Thomas Holt, Dairy and Food Commissioner. The operation of the food and drug law and of other regulations brought us into continual contact with him and his office, first as Deputy Commissioner and later as Commissioner, for a total period of 16 years. Good sense, sound judgment, hard work and kindly disposition characterized the man and his administration. There can be no better testimonial to his worth than that he grew constantly in the esteem and confidence of his fellow officials and others with whom he came in contact in his public service, and that in the more private relationships of his home and his home community he was held in respect and affection.

CONTENTS AND SUMMARY

Material	Page	Sampled by, or Submitted to		Total	Adulterated, below standard, or otherwise illegal
		The Station	The Dairy and Food Commissioner		
FOODS					
Beverages, soda water type	780	0	149	149	3
Malt, near beer type	780	0	23	23	2
Cereal products, etc.:					
Breakfast food, etc.	780	6	80	86	...
Flour, bread, etc.	787	5	0	5	...
Coffee	787	1	1	2	...
Eggs	788	2	2	4	...
Fats and oils:					
Butter	788	0	199	199	1
Oleomargarine	788	0	5	5	0
Olive oil	789	2	24	26	8
Foods, special and miscellaneous	789	54	0	54	...
Fruit products:					
Cider	794	0	5	5	...
Grape-fruit juice	794	0	2	2	...
Grape juice, etc.	794	3	1	4	...
Honey	794	3	0	3	...
Ice cream, etc.	794	5	301	306	4
Meat products:					
Hamburg steak	804	0	19	19	4
Frankfurts	805	15	9	24	8
Pork sausage	805	0	20	20	1
Meat loaf seasoning	805	0	1	1	0
Milk and milk products:					
Market milk	805	53	112	165	36[1]
Chocolate skimmed milk	806	0	4	4	0
Buttermilk, semi-solid	806	1	0	1	0
Evaporated milk	806	1	0	1	0
Powdered whole milk	806	1	0	1	0
Cream	806	2	0	2	0
Vinegar	808	11	340	351	64
Total for foods		165	1297	1462	131

[1] Not including samples below standard only.

Material	Page	Sampled by, or Submitted to: The Station	Sampled by, or Submitted to: The Dairy and Food Commissioner	Total	Adulterated, below standard, or otherwise illegal
DRUGS, ETC.					
Ammonia, aromatic spirits of	810	0	7	7	3
Calcium hydroxide, solution of	811	0	5	5	0
Camphor, spirit of	812	0	9	9	0
Ethyl nitrate, spirit of	813	0	13	13	7
Iodine, tincture of	814	0	10	10	1
Magnesium citrate, solution of	814	0	8	8	5
Peppermint, essence of	816	0	4	4	1
Rhubarb, comp.	816	0	1	1	...
Total for drugs		0	57	57	17
MISCELLANEOUS					
Drugs and other materials	817	19	2	21	2
Materials examined chiefly for poisons	818	50	5	55	...
Tobacco	818	170	0	170	...
Potatoes	820	22	0	22	...
Beets	820	17	0	17	...
Water (State Water Commission)	821	6	0	6	...
Total for miscellaneous		284	7	291	2
Total for all, exclusive of glassware		449	1361	1810	150
Babcock glassware and thermometers	821	2538	0	2538	21

FOOD PRODUCTS, THIRTY-FOURTH REPORT

DRUG PRODUCTS, TWENTY-SECOND REPORT

E. M. Bailey

The Department of Analytical Chemistry is primarily concerned with analytical and other work incidental to inspection and control of commercial fertilizers, feeding stuffs, foods, drugs and insecticides, and to the certification of glassware used in carrying out the Babcock test upon milk and cream, and of thermometers used in the control of the pasteurization of milk. The Statutes also provide for collaboration with the State Water Commission, if required, and as our facilities permit. A considerable amount of work is required each year due to an arrangement with the Storrs Agricultural Experiment Station, whereby analyses needed in connection with field experiments and feeding trials are made in this laboratory. Collaboration in tobacco investigations being carried on by this Station has involved the examination of more than 160 samples during the past year, requiring approximately 1,000 separate determinations. In addition to the preparation of annual reports upon inspection of fertilizers, feeding stuffs, and foods and drugs, the department has within the year assumed most of the office work connected with the annual registration of fertilizers and feeding stuffs.

This report summarizes work done for the year 1929 for purposes of food and drug inspection, samples for the most part being submitted by the Dairy and Food Commissioner. The report includes a large number of analyses of cereal breakfast foods and similar products taken from a previous bulletin[1] and supplemented by 86 new analyses, most of them representing new products. Various members of the staff have collaborated with referees of the Association of Official Agricultural Chemists in studies of methods of analysis for foods and drugs. The chemist in charge has continued to serve on two committees of that Association and in October, 1929, was elected its president. With this appointment the presidency of the Association comes to the Station for the fifth time. Service on the Food Standards Committee of the United States Department of Agriculture and as a consultant to the Council on Pharmacy and Chemistry of the American Medical Association has been continued.

The interested coöperation of the staff of this department in carrying on the work herein reported, and in all matters pertaining to the general conduct of the department's work, is gratefully acknowledged.

[1] Conn. Agric. Exp. Sta., Bull. 197. 1917.

FOODS

BEVERAGES

SODA WATER TYPE

The statutes relating to carbonated beverages of the soda water type are very generally observed. Only occasional samples are found to contain saccharin and the minimum limit for sugar, five per cent, is always exceeded. Artificial colors and flavors are indicated by suitable declarations.

One hundred and forty-nine samples were submitted by the Dairy and Food Commissioner. One, sample 41947, lemon and lime soda, purchased of J. Richmond and Son, Moosup, contained saccharin. Sample 42487, Pale Moon, purchased of C. Manwaring and Son, Niantic, contained artificial color, which was not declared. Sample 41932, strawberry soda, purchased of the Newgate Ginger Ale Company, Thompsonville, bore misleading statements of equivalent food value.

NEAR-BEER

Twenty-three samples of malt beverages of the "near-beer" type were submitted by the Dairy and Food Commissioner. Two of these were found to contain caffeine in amounts ranging from 0.8 to 0.9 of a grain per bottle of 12 fluid ounces. Objection was taken to these products for the reason that caffeine is an added substance foreign to the article generally known as beer, which these beverages purport to be. The products bore labels of the Munch Brewery and the Edelbrau Brewing Co., both of Brooklyn, New York.

CEREAL PRODUCTS, ETC.

CEREAL BREAKFAST FOODS, ETC.

Analyses of breakfast foods and of similar preparations have been given in previous bulletins[1] of this Station. During the past year a considerable number of analyses has been added, which represent many products not included in previous summaries. Table I includes the older analyses together with those of products examined recently. Eighty-six new analyses have been added to the list. All of the samples were submitted by the Dairy and Food Commissioner, with three exceptions.

The classification of products is suggested largely by the name of the article or by information at hand concerning its origin. In the case of mixtures or of products the names of which do not suggest the proper grouping, some errors of classification may occur. Besides the ordinary breakfast foods the list includes so-called "health" and laxative preparations.

[1] Conn. Agric. Exp. Sta., Bull. 197, 1917; Ibid., Bull. 286. 1927.

Table I. Analyses of Cereal Breakfast Foods, etc.

Description of Food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
	%	%	%	%	%	%	
Barley preparations:							
Cream of Barley	9.2	1.4	11.1	0.6	76.1	1.6	363
*Cris Cross Brand Barley Crystals Breakfast Cereal	9.2	1.1	9.7	0.8	78.3	0.9	360
Farwell & Rhines' Barley Crystals	9.9	1.2	11.5	0.9	75.2	1.3	359
*Lust's Old Fashioned Barley Health Food	5.3	2.4	12.2	11.9	66.2	2.0	332
Quaker Scotch Brand Pearled Barley	12.1	1.0	9.5	0.3	76.2	0.9	351
Corn (maize) preparations:							
Cerealine	11.2	1.5	6.9	0.1	79.9	0.4	351
E-C Corn Flakes Toasted	12.1	2.2	6.6	0.2	78.6	0.3	344
F. S. Granulated Hominy	13.3	0.4	8.0	0.2	77.1	1.0	349
Hecker's Cream Hominy	11.7	0.3	9.8	0.5	77.3	0.4	352
H. O. New Process Hominy	11.3	0.4	8.0	0.2	79.8	0.3	354
Jackson's Roman Meal	8.5	3.7	13.3	5.0	66.1	3 4	348
Jersey Corn Flakes	7.7	0.9	8.5	0.3	82.3	0.3	366
*Kellogg's Corn Flakes	4.4	2.5	7.2	0.6	85.1	0.2	371
Kellogg's Toasted Corn Flakes	11.7	2.7	6.4	0.2	78.8	0.2	343
Korn Kinks	12.0	2.2	7.4	0.1	77.9	0.4	345
Nichols' Snow White Samp	13.4	0.3	7.8	0.5	77.7	0.3	345
*Pillsbury's Hominy Grits	8.5	0.3	7.8	0.6	82.2	0.6	365
*Post's Corn Flakes	7.6	2.3	7.1	0.5	82.1	0.4	360
Post Toasties	11.7	1.8	6.6	0.2	79.4	0.3	347
Quaker Best Yellow Corn Meal	12.3	0.5	7.5	0.2	78.7	0.8	352
Quaker Corn Puffs	12.0	0.4	8.7	0.1	78.5	0.3	352
Quaker Toasted Corn Flakes	11.6	1.3	6.8	0.0	79.9	0.4	350
Ralston Hominy Grits	11.3	1.0	9.0	0.4	75.4	2.9	364
*Royal Scarlet Toasted Corn Flakes	7.6	2.1	7.5	0.7	81.6	0.5	361
Street's Perfection Hominy	12.4	0.4	7.9	0.1	77.9	1.3	355
Sunbeam Pearl Hominy	14.3	0.4	9.4	0.3	75.0	0.6	343
*Sunbeam Toasted Corn Flakes	7.4	2.2	7.5	0.7	81.6	0.6	362
*Sunny Corn	8.5	0.4	8.4	0.6	81.5	0.6	365
Sunseal Sunny Corn	12.3	0.4	8.3	0.4	78.2	0.4	350
Sunseal Cream Corn Meal	12.0	0.5	8.9	0.4	77.2	1.0	353
Sunseal Hominy Grits	11.6	0.5	8.5	0.4	77.8	1.2	356
*Three Minute Hominy Grits	8.6	0.3	8.4	0.5	81.8	0.4	365
Washington Corn Crisps	12 1	2.9	7.8	0.2	76.8	0.2	340
Quaker Hominy Grits	13.2	0.5	7.9	0.2	77.7	0 5	347

* Analyzed in 1929.

TABLE I. ANALYSES OF CEREAL BREAKFAST FOODS, ETC.—*Continued*

Description of Food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
	%	%	%	%	%	%	
Oat preparations:							
Bestovotes	11.0	2.1	16.2	1.0	63.1	6.6	377
Bufceco Rolled Oats	11.1	2.0	15.1	1.0	64.0	6.8	378
Fruited Oats	9.7	3.3	13.1	1.3	68.2	4.9	369
Grandmother's Crushed Oats	10.7	1.9	14.9	0.6	65.4	6.5	380
Health Brand White Oats	10.9	2.0	13.8	1.0	64.5	7.8	383
Hecker's Cream Oat Meal	11.5	1.8	15.6	0.9	64.6	5.6	371
*H–O	7.2	2.0	14.8	1.4	67.8	6.8	392
Hornby's Steam Cooked Oat Meal	10.6	1.7	16.1	0.8	64.1	6.7	381
Keen & Robinson's Granulated Scotch Oatmeal	10.4	1.9	13.7	0.8	64.1	9.1	393
*Lee's Quick Cooking Rolled Oats	7.6	2.1	14.1	1.5	67.6	7.1	391
Leggett's Premier 15 Minute Oat Flakes	11.3	1.8	17.2	0.6	63.7	5.4	372
*Mascot Brand Rolled Oats	7.0	1.8	13.6	1.5	68.9	7.2	395
McCann's Irish Oat Meal	9.2	1.8	15.1	0.3	64.9	8.7	398
Mother's Crushed Oats	10.9	1.6	15.6	0.9	64.9	6.1	377
*Mother's Quick Cooking Oats	7.4	1.9	14.2	1.3	67.9	7.3	395
*New Oata	7.7	1.9	15.8	2.1	67.8	4.7	376
Paw-Nee Rolled Oats	10.8	1.9	15.8	0.8	64.0	6.7	380
Purity Rolled Oats	13.5	2.0	16.3	1.0	61.1	6.1	365
Quaker Oats	10.8	1.9	15.9	0.9	64.5	6.0	376
*Quaker Oats	7.5	1.8	15.8	1.3	67.3	6.3	389
Robinson's Patent Groats	8.4	1.8	12.8	0.7	67.7	8.6	399
*Scotch Brand Oats	7.1	1.9	14.4	1.3	68.5	6.8	392
*Scotch Oat Meal	5.2	1.9	12.6	1.3	70.6	8.4	409
Scotch Porage Oats	10.1	1.7	13.3	0.4	64.9	9.6	399
Sovereign 15 Minute Oat Flakes	10.8	2.0	16.5	0.9	64.0	5.8	374
*Three Minute Oat Flakes	7.6	1.7	15.9	1.1	67.6	6.1	390
White Rose Rolled Oats	10.3	1.9	14.3	0.7	64.8	8.0	388
Rice preparations:							
*Comet Brown Rice Flakes	6.8	3.9	7.5	1.0	79.4	1.4	361
Comet Cereal	11.3	0.3	7.2	0.2	80.7	0.3	354
Cook's Flaked Rice	12.6	0.4	7.8	0.2	78.9	0.1	348
Cook's Malto Rice	11.3	0.6	7.6	0.1	80.2	0.2	353
*Cream of Rice	9.3	0.7	7.6	0.6	81.3	0.5	361
*Heinz Rice Flakes	4.2	3.1	7.6	4.2	80.4	0.5	357
*Kellogg's Rice Krispies	5.0	2.4	6.9	0.5	84.8	0.4	371
Kellogg's Toasted Rice Biscuit	5.0	3.7	10.1	0.2	80.7	0.3	366
Kellogg's Toasted Rice Flakes	4.7	3.4	10.0	0.2	81.3	0.4	369
Milk Rice	12.3	3.2	6.9	0.2	77.2	0.2	338
Quaker Puffed Rice	12.2	0.4	7.6	0.1	79.5	0.2	350

* Analyzed in 1929.

TABLE I. ANALYSES OF CEREAL BREAKFAST FOODS, ETC.—*Continued*

Description of Food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
	%	%	%	%	%	%	
Rice preparations—Concluded:							
*Quaker Puffed Rice	6.5	0.4	6.4	0.5	86.0	0.2	371
*Toasted Rice Flakes	7.3	3.4	7.3	0.5	81.2	0.3	357
*White House Rice Flakes	8.9	4.8	7.4	1.4	75.2	2.3	352
Rye preparations:							
Cream of Rye	11.5	1.7	12.0	1.4	71.8	1.6	350
*Cream of Rye	8.3	1.7	9.9	1.3	77.8	1.0	359
Kellogg's Toasted Rice Flakes	8.1	2.2	11.4	0.6	76.2	1.5	364
Ry-Krisp	5.8	2.8	14.0	1.3	74.4	1.7	369
*Ry-Krisp	6.5	3.6	13.0	2.1	73.3	1.5	359
Wheat preparations:							
Alber's Wheat Flakes Mush	11.5	1.6	11.1	0.3	73.4	2.1	357
Cero-Vita	4.6	3.5	8.9	0.3	82.0	0.7	370
Cinnamon Rusks	9.9	0.7	10.3	0.2	71.7	7.2	393
*Cream Farina	9.3	0.5	11.4	0.6	77.5	0.7	362
*Cream of Wheat	8.5	0.6	12.3	0.6	77.2	0.8	366
Cream of Wheat	13.1	0.6	11.5	0.2	73.7	0.9	349
Cresco Grits	11.1	0.6	17.8	0.5	68.6	1.4	358
*Cris Cross Brand Whole Wheat Breakfast Cereal	9.6	1.7	12.3	2.2	72.4	1.8	355
Crystal Wheat	9.5	1.9	11.3	1.7	73.6	2.0	358
Dieto Rusks	6.4	1.5	15.9	1.0	66.1	9.1	410
*"Force" Toasted Wheat Flakes	6.4	3.0	10.3	1.3	77.2	1.8	366
Force	10.7	2.8	10.6	1.1	73.7	1.1	347
F. S. Farina (Quaker Farina)	13.7	0.4	10.2	0.2	74.6	0.9	347
Fruited Wheat	9.9	3.6	15.6	2.4	66.2	2.3	348
Grandmother's A. & P. Farina	12.9	0.6	10.8	0.1	75.0	0.6	349
Granola	6.1	2.3	13.9	0.6	76.3	0.8	368
Granose Biscuit	11.3	3.9	10.3	1.8	71.1	1.6	340
Granose Flakes	6.0	3.9	10.3	0.5	75.4	3.9	378
Hecker's Farina	12.7	0.6	10.0	0.1	75.9	0.7	350
Holland Rusk	11.0	1.3	12.1	0.1	70.4	5.1	376
Jireh Frumenty	6.2	1.4	12.3	1.1	77.3	1.7	374
Jireh Whole Wheat Farina	6.2	1.8	12.9	2.2	74.6	2.3	371
Kellogg's Breakfast Toast	7.7	1.6	13.6	0.3	74.9	1.9	371
Kellogg's Krumbles	10.0	2.6	12.0	1.9	72.3	1.2	348
*Kellogg's Krumbles	6.3	3.3	11.5	1.9	75.3	1.7	362
*Kellogg's Shredded Whole Wheat Biscuit	7.7	2.2	12.3	2.2	73.8	1.8	361
Kellogg's Toasted Wheat Biscuit	5.8	2.4	14.2	1.5	74.7	1.4	368

* Analyzed in 1929.

TABLE I. ANALYSES OF CEREAL BREAKFAST FOODS, ETC.—*Continued*

Description of Food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
	%	%	%	%	%	%	
Wheat preparations—Concluded:							
Kellogg's Toasted Wheat Flakes	5.2	2.7	9.3	1.2	80.5	1.1	369
Kellogg's Zwieback	6.2	1.6	14.3	0.2	76.1	1.6	376
Leggett's Premier Farina	14.1	0.5	11.1	0.1	73.3	0.9	346
*Mack's Wheat Toast	5.9	2.4	12.9	1.3	66.9	10.6	415
*Malt Breakfast Food	6.2	1.8	13.6	1.5	75.4	1.5	370
Malt Breakfast Food	9.6	1.4	13.8	1.0	72.7	1.5	360
Manana Gluten Breakfast Food	7.6	2.5	42.6	1.7	43.6	2.0	363
*Mapl-Flake	6.9	3.8	8.5	2.0	77.3	1.5	357
Mapl-Flake	10.8	2.8	9.3	1.2	74.7	1.2	347
*Mello Wheat	9.7	0.4	11.3	0.6	77.3	0.7	361
*Monarch Food of Wheat	9.3	0.5	11.3	0.5	77.4	1.0	364
*Monarch Leenie Weenie Wheat Hearts	8.2	0.4	11.9	0.5	78.5	0.5	367
Mother's Wheat Hearts	13.5	0.4	10.7	0.2	74.1	1.1	349
Pettijohn's Breakfast Food	10.3	1.7	9.1	2.0	74.9	2.0	354
*Pettijohn's Rolled Wheat	7.7	1.5	14.4	2.5	71.9	2.0	364
Pillsbury's Best Cereal	11.3	0.5	11.5	0.1	75.9	0.7	356
*Pillsbury's Farina	8.0	0.5	12.1	0.5	78.1	0.8	368
*Pillsbury's Vitas Wheat	8.4	0.5	10.9	0.4	79.0	0.8	367
Quaker Cracked Wheat	11.7	1.7	9.3	1.7	73.3	2.3	351
*Quaker Farina	8.9	0.3	11.4	0.5	78.1	0.8	365
*Quaker Puffed Wheat	6.3	1.6	14.3	2.1	74.2	1.5	368
Quaker Puffed Wheat	11.5	1.8	13.1	1.6	70.2	1.8	349
Quaker Wheat Berries	9.8	1.4	14.0	1.2	71.6	2.0	360
Ralston Health Food	12.4	1.4	11.9	1.1	71.5	1.7	349
*Ralston Wheat Flakes	5.8	4.0	9.6	1.7	77.4	1.5	362
Ralston Wheat Food	11.9	1.1	11.3	0.8	73.1	1.8	354
Sanitas Granuto	4.9	1.3	10.1	0.4	81.6	1.7	382
Saxon Wheat Food	9.8	0.8	12.8	0.5	74.4	1.7	364
Shredded Wheat Biscuit	8.5	1.5	11.0	2.6	75.0	1.4	357
*Shredded Whole Wheat	6.5	1.6	12.9	2.4	74.6	2.0	368
Street's Perfection Farina	13.1	0.5	10.3	0.1	74.9	1.1	351
Triscuit	10.3	1.7	11.0	1.7	73.9	1.4	352
Vitos	11.6	0.5	11.1	0.2	75.6	1.0	356
*Vita-O-Wheat	7.8	1.3	12.6	1.1	75.0	2.2	370
*Wheatena	6.8	1.6	11.9	1.6	75.6	2.5	372
Wheatena	10.4	0.7	11.3	0.6	74.2	2.8	367
Wheatlet	12.2	0.8	12.8	0.3	72.3	1.6	355
*Wheatsworth Whole Wheat	8.4	6.6	11.4	1.9	70.2	1.5	340
Whole Grain Wheat (prepared)	66.2	1.5	6.6	1.2	23.7	0.8	128
*Whole Wheat Flake Wheaties	7.4	4.6	13.5	1.7	71.3	1.5	353
Zest	10.7	2.6	9.0	1.2	75.3	1.2	348

* Analyzed in 1929.

TABLE I. ANALYSES OF CEREAL BREAKFAST FOODS, ETC.—*Continued*

Description of Food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
	%	%	%	%	%	%	
Wheat bran:							
Ballard's Obelisk Sanitary Edible Bran	11.5	4.5	17.3	5.6	55.7	5.4	301
Cuip's Capitol Health Bran	11.2	5.3	13.4	8.2	57.6	4.3	323
*Dina-Mite Wheat Bran Flax	8.7	2.8	14.4	4.0	66.1	4.0	358
Health Food Co.'s Wheat Bran	11.6	5.6	14.3	8.2	56.2	4.1	319
Jireh Wheat Bran	11.1	4.3	16.8	6.3	56.7	4.8	337
*Johnson's Educator Bran	7.8	5.9	15.6	8.8	57.0	4.9	335
Johnson's Educator Wheat Bran	11.6	6.1	15.4	7.8	54.4	4.7	322
*Kellogg's Bran Flakes	6.7	3.6	10.9	2.8	74.2	1.8	357
Kellogg's Sterilized Wheat Bran	9.6	6.0	16.3	8.5	54.4	5.2	330
*Monarch Wheat Bran	7.3	6.3	14.0	10.8	56.7	4.9	327
*Pillsbury Wheat Bran	6.0	6.9	16.0	9.3	57.6	4.2	332
Wheat Bran Biscuit and other laxative preparations:							
Bran Bisque	8.5	3.1	12.1	2.2	61.0	13.1	410
Bran-eata Biscuit	9.8	4.4	9.1	3.6	72.2	0.9	333
Bran-Zos	11.9	3.0	13.2	3.8	65.6	2.5	338
*Brose	7.3	3.1	14.2	4.1	67.1	4.2	363
Brose Good Health Breakfast Food	10.1	2.6	14.4	3.1	65.5	4.3	358
*Cellu Bran	3.9	4.6	3.6	20.8	37.1	30.0†	433
Cerag	9.2	3.6	11.3	2.0	73.0	0.9	345
Cerena	7.2	4.9	27.8	2.4	46.3	11.4	399
Christian's Laxative Bread	9.9	2.8	10.0	1.3	74.6	1.4	354
Christian's Laxative Cereal Flakes	13.0	1.7	10.4	1.0	72.5	1.4	344
Colax	13.1	2.1	1.1	0.1	82.8	0.8	343
Dietetic Bran Biscuit	9.3	5.0	9.9	1.7	69.1	5.0	361
Educator Bran Cookies	7.1	3.3	8.9	1.5	64.7	14.5	425
Educator Bran Meal	11.8	2.9	12.3	3.8	66.4	2.8	340
F. B. A. Laxative Health Biscuit	11.1	3.1	6.1	0.7	77.3	1.7	349
*Fig and Bran	6.3	7.1	13.3	7.8	62.6	2.9	330
Fruit Nut Cereal	7.3	3.2	13.5	2.4	72.4	1.2	354
Good Health Biscuit (Kellogg)	10.9	4.2	7.7	1.5	74.5	1.2	340
Health Food Wafers	9.7	5.3	10.0	1.4	65.7	7.9	374
India (Digestive) Biscuit	8.7	5.0	12.8	5.2	66.1	2.2	335
*Kellogg's All Bran	6.0	7.4	14.4	6.3	63.5	2.4	333
Laxa	6.6	5.0	12.4	6.6	66.6	2.8	341

* Analyzed in 1929.
† Largely mineral oil.

TABLE I. ANALYSES OF CEREAL BREAKFAST FOODS, ETC.—*Concluded*

Description of Food	Water	Ash	Protein	Fiber	Carbohydrate (other than fiber)	Fat	Calories per 100 gms.
	%	%	%	%	%	%	
Wheat Bran Biscuit and other laxative preparations—Con.							
Laxative Biscuit (Kellogg)..	9.4	3.0	16.7	2.4	57.7	10.8	395
*Lust's Original Fig Bran ..	5.9	5.7	11.3	5.9	69.4	1.8	339
Mansfield's Agar Agar Wafers	7.9	2.3	7.1	0.8	69.9	12.0	416
Oval Digestive Biscuit (H. & P.)	8.8	2.1	7.8	0.5	64.5	16.3	436
*Post Bran Flakes	6.3	4.7	14.4	3.5	68.9	2.2	353
*Prepared Bran	5.4	6.1	18.3	14.2	51.9	4.1	319
*Raisin Bran	6.0	2.4	13.7	1.9	74.0	2.0	369
*Sanitarium Cooked Bran ..	4.8	6.8	16.9	9.5	57.7	4.3	338
*Sanitarium Fig and Bran Flakes	4.8	5.9	11.5	4.4	71.0	2.4	352
Uncle Sam Health Food	6.3	3.1	21.3	4.0	40.9	24.4	468
*Uncle Sam's Laxative Food	6.2	3.3	18.8	3.5	52.9	15.3	425
Zim	13.2	2.0	7.4	1.5	74.2	1.7	342
Miscellaneous preparations:							
*Alvita Breakfast Cereal ...	8.7	1.8	15.1	2.3	68.8	3.3	365
*Branola	7.7	2.7	13.5	3.8	69.8	2.5	356
Dieto Nut Cereal	5.0	2.0	21.6	1.2	51.8	18.4	459
Dieto Wheat and Barley Cereal	6.8	1.7	11.6	2.0	75.7	2.2	369
*Enright's Old Fashioned Cereal	8.7	1.5	15.4	2.3	69.9	2.2	361
Grape Nuts...............	10.3	1.9	11.5	1.5	74.2	0.6	348
*Grape Nuts	3.7	2.5	11.6	1.5	78.5	2.2	380
*Hoyt's Gluten Bran Flakes	6.2	2.9	52.9	4.1	28.2	5.7	377
Jireh Wheat Nuts	7.6	2.3	19.0	1.0	54.5	15.6	434
*Kellogg's Pep	5.3	3.2	10.2	2.4	77.1	1.8	366
*Lima Bean Flakes	5.9	2.5	13.8	2.4	74.2	1.2	363
Malabar Manoca	13.3	1.3	0.6	0.6	84.1	0.1	340
*Melba Vegetized Toast	9.4	2.4	13.4	1.5	62.7	10.6	400
*Melba Vegetized Toast	6.6	2.2	14.3	1.7	65.9	9.3	405
*Muffets	6.7	1.7	12.1	2.3	76.0	1.2	363
Post Tavern Porridge	12.7	1.5	10.3	0.2	74.5	0.8	346
Post Tavern Special	9.9	0.9	10.9	0.3	76.9	1.1	361
*Post Toasties	6.6	2.9	7.2	0.6	82.3	0.4	361
*Ralston's	8.3	1.2	13.7	1.4	74.0	1.4	363
*Roman Meal	7.7	4.8	15.3	5.4	63.6	3.2	345
*Roman Meal	7.7	2.8	12.2	3.8	70.8	2.7	357
Sea Moss Farina	15.6	13.6	9.1	1.5	59.9	0.3	279
Sunbeam Tapioca	13.5	0.2	0.6	0.1	85.5	0.1	345
*Sunera	10.2	1.5	12.0	1.7	74.0	0.6	349
*Toasted Bran-Gluten Flakes	6.2	3.6	51.9	6.7	24.9	6.7	368
*Trix	6.7	2.3	14.6	0.7	72.8	2.9	376
Trix	6.2	1.5	14.5	0.3	77.3	0.2	369
Trufood (Trufood Co.)	5.7	1.4	11.5	1.8	77.1	2.5	377
*Vita-Bits	5.4	3.9	13.8	3.1	71.9	1.9	360
Zep (Battle Creek Food Co.)	5.0	2.9	14.0	1.3	74.6	2.2	374
*Zo	5.0	3.3	13.4	1.8	74.9	1.6	368

* Analyzed in 1929.

WHOLE WHEAT FLOUR

Through the courtesy of a local flour mill the laboratory had an opportunity to examine a sample of whole wheat flour and one of Graham flour as made at that mill, and also a sample of the wheat grain from which these products were made. It was pointed out to us that the only difference between the two flours was in degree of fineness, the Graham product being coarser than the whole wheat product. Within the limits of reasonable analytical error these three samples show the same composition, as we would expect them to do.

The analyses are as follows:

	No. 2950 Whole wheat flour %	No. 2951 "Graham flour" %	No. 2952 Wheat grain %
Moisture	10.63	10.53	10.23
Ash	1.64	1.75	1.67
Protein (N x 5.7)	13.22	13.45	13.17
Fiber	2.43	2.63	2.40
Carbohydrate, other than fiber, by difference	69.73	69.09	70.18
Fat (ether extract)	2.35	2.55	2.35
Protein-ash ratio	8.00	7.70	7.90

BREADS, WHOLE WHEAT AND OATMEAL

Two samples of bread, one featured as a whole wheat loaf and the other as an oatmeal loaf, were analyzed. The whole wheat loaf was made from whole wheat and first clear flours and the oatmeal loaf was made from stone ground oatmeal, whole wheat flour and rye flour.

In the absence of official definitions for products of these types there is no objection to the names "whole wheat" and "oatmeal" as applied to these respective products.

The analyses are as follows:

	No. 2916 Whole wheat bread %	No. 2917 Oatmeal bread %
Moisture	35.54	32.52
Ash	2.06	2.08
Protein (N x 6.25)	10.08	10.74
Fiber	1.10	0.62
Carbohydrate, other than fiber, by difference	46.22	48.92
Fat	5.00	5.12

COFFEE, ETC.

A sample of Dacosta liquid coffee, 40926, submitted by the Dairy and Food Commissioner, was analyzed as follows:

Total solids	8.78%
Nitrogen, total	0.29
Ash	1.54
Water-insol. ash	0.22
Acid-insol. ash	0.009
Alkalinity of water-soluble ash	18.38[1]
Alkalinity of water-insol. ash	4.88[1]
Caffeine	0.42

[1] N/1 HCl, cc. per 100 gms. sample.

A sample of Al-Mo-Co, a mixture of cereal, coffee, molasses and chicory according to declaration, was examined. It contained 0.18 per cent of caffeine.

This product is claimed to be 99.74 per cent caffeineless. Probably this means that it contains 0.26 per cent of caffeine and that the remainder, 99.74 per cent, is non-caffeine material. Construed in this way our result substantiates the claim. However, it may not be clear to everyone that ordinary coffee is 98.8 per cent non-caffeine material, assuming 1.2 per cent as a fair average for the caffeine content of coffee. Al-Mo-Co contains about one-seventh as much caffeine as does ordinary coffee.

EGGS

Two samples of eggs were examined for the Dairy and Food Commissioner and both passed as fresh eggs.

Two unofficial samples were examined, one of which was not fresh and the other was classed as inedible.

FATS AND OILS

BUTTER

One hundred and ninety-nine samples of butter from retail stores were submitted by the Dairy and Food Commissioner during the year.

Standard butter should contain not less than 80 per cent of fat and not more than 15.99 per cent of water. Only one sample was found to be substantially outside these limits. All of the others fully satisfied the legal requirements or varied so slightly from them that they were passed without question. The deficient sample, purchased of Ferrera and Co., New Canaan, contained 20.7 per cent of moisture and 77.3 per cent fat.

OLEOMARGARINE

Five samples of oleomargarine were submitted by the Dairy and Food Commissioner to be examined for color. These were tinted products, which fact led to the suspicion that they were in violation of our statute. No objection is raised to the sale of oleomargarine somewhat colored by reason of the natural color of ingredient fats or oils which may impart some degree of yellow color to the finished product. The law prohibits the sale of oleomargarine to which artificial color has been added for the sole purpose of producing color. An act of Congress permits artificial color to be added to butter without declaration or other restriction.

Examination of these products disclosed no artificial color present. This was later substantiated by information as to the process of manufacture, and further confirmed in two instances by information that the government imposed a tax of only one-quarter of a cent per pound, which is the rate provided for uncolored oleomargarine.

OLIVE OIL, ETC.

Twenty-three samples of olive oil and one of salad oil were examined, 16 of which were not found adulterated. Eight were adulterated, misbranded or short weight.

Gallo's Brand Salad Oil, No. 43741, packed by I. A. Gallo, Hartford, was cottonseed oil colored with a coal-tar dye. The sample was also short weight, weighing 7.4 pounds to the gallon, whereas the weight per gallon calculated from the specific gravity of the oil should have been 7.64 pounds. In terms of volume the sample represented .97 of a gallon instead of a full gallon as labelled.

Olive oil in bulk, bought of the Roma Importing Co. of Waterbury, consisted in part of cottonseed oil.

Olive oil, Italia brand, bought of Gelgrego, New Haven, was also adulterated with cottonseed oil.

El Toro brand olive oil, International Importing Co., Hartford, contained cottonseed oil, as did also the same brand sold by S. Garofalo of Hartford.

Azrite brand olive oil purchased of J. Romas, Ansonia, said to have been supplied by Almeida and Co., of New Bedford, Mass., was adulterated with peanut oil.

Two unofficial samples for investigational purposes were found to contain cottonseed oil.

SPECIAL AND MISCELLANEOUS FOODS

In Table II are analyses of 54 special and miscellaneous foods. Some of these are for diets in which a minimum of carbohydrate is desired, as in certain cases of diabetes. In diabetes it is possible to provide suitable diets from natural foods of known composition but special foods are admissible and sometimes desirable to provide variety or attractiveness in the diet. Insulin treatment is resorted to when the minimal amount of carbohydrate cannot be given without the appearance of glycosuria. In any case a considerable excess of carbohydrate should be avoided and in this connection it must be kept in mind that 50 per cent of the protein may be converted into sugar. Some restriction in protein intake is therefore essential. Those so-called diabetic foods that do not differ from ordinary foods in digestibility offer no specific advantage in diabetic diets and must be eaten with the same precautions as are ordinary foods of like composition.

Flour of cooked chestnuts is a product of French manufacture. It does not appear to be made from the whole, cooked, dry chestnut (excluding shell). Comparison of this analysis with that of fresh chestnuts on the same water basis indicates that in the process of manufacture of the flour some of the nitrogenous and fatty portions of the nut are removed and that the starch is proportionately increased.

The *S.M.A.* preparations are specially designed for the feeding of infants. The significance of the symbol S.M.A. is "synthetic milk adapted." All of the preparations are directed to be fed on the advice and under the supervision of a physician.

Similac is another modified milk preparation intended for infant feeding also under the direction of a physician.

Nouron is not a milk substitute but is rather intended for children at the period when they are passing from wholly liquid to partially solid diet. It is made from soy beans, whole wheat flour and egg yolk.

The three algae samples, 3141, 3142 and 3143, were analyzed for a student of Iowa State College who is interested in them from a nutritional standpoint. Only one of them, 3141, is a commercial product.

"Fiddle heads," so-called, are a species of native ferns said to have been used by the Indians as food.

The soybean products, 2347, 2683 and 2682, were submitted by the Madison Rural Sanitarium in connection with its experimental studies in dietetics.

TABLE II. SPECIAL AND MISCELLANEOUS FOODS.

No.	Kind	Water	Ash	Protein (Factor 6.25)	Fiber	Carbohydrate: Starch + Water-soluble calculated as dextrose	Carbohydrate: Undetermined	Fat
	Groult, Jor, Paris	%	%	%	%	%	%	%
3010	Flour of Cooked Chestnuts	6.30	2.00	6.63	2.05	65.28	14.76	2.98
	Kings County Packing Co., Armona, Cal.							
837	Sac-A-Rin Brand, California Muscat Grapes	92.80	0.38	0.63	0.41	13.73[1]	....	....
838	Sac-A-Rin Brand, California Seedless Grapes	82.80	0.38	0.63	0.20	15.23[1]	....	....
841	Sac-A-Rin Brand, California Spinach	93.19	0.99	2.31	0.68	0.49[2]	....	....
840	Sac-A-Rin Brand, California Kadota Figs	83.79	0.49	0.50	0.51	13.02[1]	....	....
339	Sac-A-Rin Brand, California Yellow Cling Peaches	92.11	0.32	0.56	0.34	5.18[1]	....	....
	The Laboratory Products Co., Cleveland, Ohio							
3206	S. M. A.	2.28	2.51	10.44	none	57.67		27.10[3]
3207	S. M. A. Protein (Acidulated)	3.95	5.98	32.44	none	39.35		18.28[3]
3208	S. M. A. (Concentrated)	71.50	0.66	3.06	0.85	16.33		7.60[3]
	Loeb Dietetic Food Co., New York City							
2083	Loeb's Gluten Cracker Meal	8.57	1.64	41.78[4]	0.39	34.19	3.72	9.71
2084	Loeb's Gluten Zwieback	7.83	3.29	43.09[4]	0.46	34.44	4.26	6.63
2085	Loeb's Gluten Zwieback-Almond	7.76	2.97	42.52[4]	0.53	34.13	2.93	9.16
2086	Loeb's Gluten Bread Sticks	9.55	3.50	42.58[4]	0.76	35.88	1.30	6.43
2087	Loeb's Gluten Almond Bread Sticks	9.15	3.40	37.73[4]	0.96	29.00	5.49	14.27
2088	Loeb's Genuine Gluten Bread—Sliced and Toasted	7.61	5.71	43.78[4]	0.38	35.25	0.88	6.39
2089	Loeb's Gluten Breakfast Cereal	6.18	3.12	37.28[4]	0.98	27.44	8.07	16.93
2090	Loeb's Aerated Gluten Rolls	7.74	1.16	44.29[4]	0.25	35.81	2.11	8.64
2091	Loeb's Genuine Gluten Bread	24.93	2.45	35.81[4]	0.36	28.20	3.15	5.10
2092	Loeb's Self-Rising Gluten Flour	8.74	6.85	38.13[4]	0.25	40.44	4.04	1.55

[1] Calculated as invert sugar. Contains saccharin.
[2] Contains no saccharin.
[3] Roese-Gottlieb Method.
[4] Factor 5.7.

TABLE II. SPECIAL AND MISCELLANEOUS FOODS—*Continued.*

No.	Kind	Water	Ash	Protein (Factor 6.25)	Fiber	Carbohydrate		Fat
						Starch + Water-soluble calculated as dextrose	Undetermined	
	Loeb Dietetic Food Co., New York City—Con.	%	%	%	%	%	%	%
2093	Loeb's Lady Fingers	8.25	4.61	49.65	0.38	6.31	3.69	27.11
2094	Loeb's Dietetic Bran Wafers	6.71	4.73	26.00	10.65	2.06	30.81	19.04
2095	Loeb's Plain Gluten Noodles—Fine	9.43	1.61	39.56[4]	0.44	41.75	1.15	6.06
2096	Loeb's Plain Gluten Noodles—Broad	6.42	1.18	40.01[4]	0.32	44.19	0.00	7.88
2097	Loeb's Pure Gluten Flour	9.67	1.08	41.50[4]	0.29	42.88	2.99	1.59
2098	Loeb's Gluten Butter Cookies	7.18	2.63	37.56[4]	0.49	29.65	4.31	18.18
2099	Loeb's Gluten Crackers	7.05	2.71	35.34[4]	0.46	30.50	4.06	19.88
2100	Loeb's Sponge Cookies	8.90	4.14	53.81	0.40	4.81	3.77	24.17
2101	Loeb's Almond Macaroons	5.29	5.15	29.88	5.98	4.75	8.62	40.33
2102	Loeb's Starch Free Bran	8.38	4.89	17.75	16.57	2.81	41.24	8.36
2103	Loeb's Gluten Egg Barley	9.60	1.26	42.41[4]	0.67	36.31	1.26	8.49
2104	Loeb's Dietetic India Gum	15.88	5.42	0.63	....	....	77.82	0.25
2105	Loeb's Cocoa and Casein	6.21	4.46	35.63	3.75	12.63	20.24	17.08
2107	Loeb's Aerated Gluten Bread	8.28	1.06	44.86[4]	0.45	35.13	1.49	8.73
2108	Loeb's Dietetic Chocolate Bars	6.28	3.10	14.25	3.27	9.25	14.19	49.43
2109	Loeb's Chocolate Almond Bars	5.08	3.06	15.13	4.68	8.75	12.78	50.52
	Madison Health Foods, Madison, Tenn.							
1153	Malta	25.81	0.41	....	....	72.40		....
1150	Nut Meat	53.68	2.04[5]	14.38	0.44	7.77		21.69
1151	Nut Roast with Tomato	58.33	1.76[6]	11.19	0.84	12.71		15.17
1152	Vegetarian Meat	58.70	2.38[7]	14.13	1.22	7.67		15.90
	Mellin's Food Co. of North America, Boston, Mass.							
3210	Mellin's Food	2.20	3.90	10.63	none	81.54		1.73[3]

[3] Roese-Gottlieb Method.
[4] Factor 5.7.
[5] NaCl 0.94%.
[6] NaCl 0.81%.
[7] NaCl 1.30%.

TABLE II. SPECIAL AND MISCELLANEOUS FOODS—*Concluded.*

No.	Kind	Water	Ash	Protein (Factor 6.25)	Fiber	Carbohydrate		Fat
						Starch + Water-soluble calculated as dextrose	Undetermined	
	M & R Dietetic Laboratories, Inc., Columbus, Ohio	%	%	%	%	%	%	%
3204	Similac	2.45	4.04	12.50	none	55.46		25.55[3]
	Nestle's Food Co., Inc., New York City							
3205	"Lactogen"—"Milk for Babies"	3.10	3.48	16.38	none	52.34		24.70[3]
3209	Nestle's Milk Food	3.25	2.57	14.38	0.60	69.85		9.35[3]
	Nouron Products Corp., New York City							
3280	Nouron	8.30	2.48	24.38	3.05	52.46		9.33
	Vitae Health Food Co., Seattle, Wash.							
2272	Blended Dietetic Bran (Starch Free)	8.33	4.50	14.75	22.05	9.63[8]	35.57	5.17
2273	"Soya Manna"	8.05	4.68	42.13	2.00	10.25[9]	12.42	20.47
	Miscellaneous							
3141	"Flour of Algae," Thyodine Chemical Co., Washington, D. C.	7.48	35.62[10]	5.38	7.43	43.46		0.63
3142	Laminaria Sp., from Osaka, Japan	5.95	23.83[11]	6.56	5.15	57.78		0.73
3143	Algae, Undaria Pinnatifida, from Kobe, Japan	6.95	34.50[12]	12.38	3.40	42.02		0.75
1893	Fiddle Heads, *Osmunda cinnamomea*	87.03	1.24	4.72	1.04	5.56		0.41
3539	Jeru Artichoke Soup, Pabst Dietary Products, Inc., Milwaukee, Wis.	73.92	6.50	2.25	0.75	16.55		0.03
2437	Soy Cheese, Madison Rural Sanitarium, Madison, Tenn.	77.20	0.55[13]	14.44	....	trace	4.31	3.50
2683	Soy Milk, raw, Madison Rural Sanitarium, Madison, Tenn.	91.29	0.48	4.94	....	0.92[14]	0.88	1.49
2682	Soy Milk, boiled, Madison Rural Sanitarium, Madison, Tenn.	94.54	0.42	2.25	....	0.96[14]	0.91	0.92

[3] Roese-Gottlieb Method.
[8] Starch, qualitative, present.
[9] Starch, qualitative, trace
[10] Total P_2O_5 0.60%; Fe_2O_3 0.24%; CaO 1.75%; Iodine 0.15%.
[11] Total P_2O_5 0.67%; Fe_2O_3 0.04%; CaO 1.48%; Iodine 0.36%.
[12] Total P_2O_5 0.97%; Fe_2O_3 0.07%; CaO 1.34%; Iodine 0.03%.
[13] NaCl, trace.
[14] Starch, qualitative, none.

FRUIT PRODUCTS

CIDER

Five samples were examined. Three contained benzoate of soda. Two were products not offered for sale but represented stock for the manufacture of vinegar.

GRAPE FRUIT JUICE

Two samples of grape fruit juice, Florida Gold Brand and Taylor's, were submitted by the Dairy and Food Commissioner. They contained respectively 17.80 and 18.67 per cent of solids, 15.12 and 15.25 per cent of sugar (as invert sugar), and 0.37 and 0.35 per cent of ash. No preservative was found.

GRAPE JUICE, ETC.

A sample of grape juice, white, 42496, submitted by the Dairy and Food Commissioner, was examined. It was Giltedge brand, sold by The Walter Stewart Co., Ridgefield. Treatment with sulfur dioxide and the addition of cane sugar in the form of a water solution were declared. Sulfur dioxide was found in the amount of 120 milligrams per liter. There was 18.6 per cent of invert sugar present, 0.5 per cent of sucrose and a total sugar content of 19.1 per cent. It was estimated that about 16 per cent of water and 4 per cent of sugar had been added.

Two other samples of grape juice, red, were examined for experimental purposes. Unsweetened juice contained 13.41 per cent of invert sugar and the same juice sweetened contained 17.8 per cent.

A sample of grape-flavored syrup contained 65.15 per cent of invert sugar and a sample of grape soda made from this syrup contained 14 per cent of invert sugar.

JAMS AND JELLIES

Eleven samples were tested for preservatives and for saccharin but no evidence of either substance was obtained.

HONEY

Three unofficial samples of honey were examined and all found to be within the limits of composition of pure honey.

ICE CREAM, ETC.

Three hundred and one samples of ice cream and 17 samples of so-called frozen custard were submitted by the Commissioner. One unofficial sample of ice cream, two of ice cream mix and two of frozen custard were also examined for producers.

The State standard for fat content in plain ice cream is 8 per cent and for fruit and nut ice cream 6 per cent. Ice cream may be manufactured and sold, however, containing less than the above percentages of fat, provided proper declaration of the actual fat content is made. Experience has shown that there is very little inclination to market the substandard article under any circumstances. Only four samples below eight percent were found this year.

A Federal standard proposed several years ago fixing the fat content for plain ice cream at 12 per cent has never become official. The multiplicity of standards obtaining in the several states makes the adoption of a satisfactory Federal standard difficult, and perhaps it is unnecessary. The manufacturer who ships ice cream into several States may be embarrassed at times by conflicting State standards, but he will encounter the same difficulty under a Federal standard unless the States choose to revise their present laws and regulations to conform therewith.

A summary of the inspection of official samples is here given, and the results in detail appear in Table III.

Per cent of fat	No. of samples	Per cent of total
8.0 to 9.9	31	10.3
10.0 to 11.9	82	27.2
12.0 and above	184	61.1
7.9 and below	4	1.4
Total	301	100.0

TABLE III. ANALYSES OF ICE CREAM

No.	Flavor	Dealer	Manufacturer	Fat
		Ansonia		%
40647	Vanilla	J. Casagrande	Own make	8.4
40648	Vanilla	C. M. Georges	Own make	12.0
42594	Vanilla	Purity Tea Room	Own make	10.8
42593	Vanilla	Stever's North End Drug Store	Own make	14.4
40649	Vanilla	Venetas Bros.	Own make	11.8
42700	Strawberry	Venetas Bros.	Own make	11.2
		Branford		
40617	Vanilla	Branford Candy Shoppe	Tait Bros., New London	11.2
40618	Strawberry	Branford Candy Shoppe	Tait Bros., New London	9.0
41180	Vanilla	L. G. Shmouny	Harris-Hart, New Haven	10.6
		Bridgeport		
42821	Vanilla	Athens Confectionery Co.	Own make	14.8
42730	Vanilla	Atlantic Confectionery Co.	Own make	17.6
42824	Vanilla	Boston Candy Co.	Own make	14.2
42825	Vanilla	Bridgeport Lemon Ice Co.	Own make	10.4
42747	Vanilla	Candyland	Own make	13.0
42828	Vanilla	George Casteines	Own make	8.4
42733	Vanilla	Downy Flake Doughnut Shop	Mitchell Dairy Co., Bgpt.	17.0
42734	Orange-pineapple	Downy Flake Doughnut Shop	Mitchell Dairy Co., Bgpt.	13.2
42827	Vanilla	S. Gerstl	Own make	10.4
42732	Vanilla	Goodie Chocolate Shop	Own make	16.8
42736	Vanilla	Kozy Corner Store	Huber's, Bgpt.	13.2
42737	Strawberry	Kozy Corner Store	Huber's, Bgpt.	11.4
42731	Vanilla	Lane's	Own make	13.0
42830	Vanilla	Newfield Candy Co.	Own make	12.0
42748	Vanilla	Paradise Confectionery Co.	Own make	13.2
42735	Vanilla	Park City Spa	Own make	14.8
42829	Vanilla	Vincent Rossi	Own make	8.2
42826	Vanilla	Royal Candy Co.	Own make	11.0
42746	Vanilla	Strand Confectionery Co.	New Haven Dairy	12.0
42729	Vanilla	Venus Confectionery Co.	Own make	12.8
42822	Vanilla	Villari's Pharmacy	Park City I. C. Co., Bgpt.	13.6
42823	Strawberry	Villari's Pharmacy	Park City I. C. Co., Bgpt.	10.8
42728	Chocolate	J. Wakins	Huber's, Bgpt.	12.0
		Bristol		
41199	Vanilla	Central Lunch	Palace of Sweets, Plainville	14.4
42554	Vanilla	The Liberty Confectionery Co.	Own make	14.4
42550	Maple-nut	The Main Pharmacy	Eastern Dairies, New Britain	11.0
42551	Strawberry	The Main Pharmacy	Eastern Dairies, New Britain	9.6
41197	Vanilla	The Palace of Sweets	Own make	14.2
42553	Vanilla	The Soda Shoppe	Own make	14.0
41198	Vanilla	Sweetland Confectionery	Own make	14.0
		Brooklyn		
42846	Vanilla	J. W. Albro	Own make	13.2
		Canton		
42755	Vanilla	Margaret Dyer	....	23.6

TABLE III. ANALYSES OF ICE CREAM—*Continued*

No.	Flavor	Dealer	Manufacturer	Fat
		Collinsville		%
42596	Vanilla	Collinsville Candy Kitchen	Own make	15.8
		Columbia		
42796	Vanilla	Myrtle Collins	Own make	4.3
		Cos Cob		
42814	Vanilla	Mead's Pharmacy	J. M. Horton I. C. Co., N. Y.	15.6
42815	Strawberry	Mead's Pharmacy	J. M. Horton I. C. Co., N. Y.	12.6
42718	Vanilla	Taylor's Store	Breyer's I. C. Co., Phila.	12.8
		Danbury		
42974	Orange-pineapple	Crownland Soda Shop	General I. C. Corp.	8.8
42973	Vanilla	Danbury Candy Co.	Own make	11.6
42972	Vanilla	The Eagle Confectonery	Own make	13.2
42968	Vanilla	Nader and Libbos	Rider's I. C. Co.	13.0
42969	Strawberry	Nader and Libbos	Rider's I. C. Co.	11.2
42970	Vanilla	Palace Confectionery	Chester Hatch's I. C. Co.	12.6
42971	Strawberry	Palace Confectionery	Chester Hatch's I. C. Co.	12.0
		Danielson		
42839	Vanilla	Rexall Pharmacy	Dolbey's Fro-Joy	10.6
42840	Strawberry	Rexall Pharmacy	Dolbey's Fro-Joy	10.6
42841	Vanilla	Woodward Pharmacy	Hood's I. C. Co.	12.6
42842	Strawberry	Woodward Pharmacy	Hood's I. C. Co.	11.2
		Deep River		
40616	Vanilla	Hartford Candy Kitchen	New Haven Dairy	11.6
		Forestville		
42555	Vanilla	The Forestville Soda Shop	Crown I. C. Co., New Britain	14.6
42556	Strawberry	The Forestville Soda Shop	Crown I. C. Co., New Britain	10.2
		Greenwich		
42717	Vanilla	Greenwich Candy Shop	Neilsen's, N. Y.	16.4
42715	Vanilla	A. B. Libano Co.	Own make	15.8
42716	Strawberry	A. B. Libano Co.	Own make	12.8
42812	Vanilla	Palm Tea Room	Own make	15.2
42813	Vanilla	Rose Ely Goodie Shop	Own make	16.4
		Groton		
42955	Vanilla	Scuris Bros.	Own make	17.4
42956	Peach	Scuris Bros.	Own make	16.8
		Hartford		
42779	Vanilla	Besse's	Own make	14.8
42780	Peach	Besse's	Own make	15.2
42788	Vanilla	Capitol-Lyric Confectionery	Own make	14.6
41165	Vanilla	Ce Brook Ice Cream Co.	Own make	11.2
41166	Strawberry	Ce Brook Ice Cream Co.	Own make	9.6
41167	Chocolate	Ce Brook Ice Cream Co.	Own make	10.0
42787	Vanilla	Rosario Cippola	Own make	8.8

TABLE III. ANALYSES OF ICE CREAM—*Continued*

No.	Flavor	Dealer	Manufacturer	Fat
		Hartford—Concluded		%
42774	Vanilla	Crown Confectionery	Own make	13.4
42781	Vanilla	Empire Delicatessen	General I. C. Co.	9.8
43525	Vanilla	The Federal Baking Co.	Reid's I. C. Co., N. Y.	11.4
43526	Strawberry	The Federal Baking Co.	Reid's I. C. Co., N. Y.	11.4
42773	Vanilla	G. Fox & Co.	Own make	18.6
42775	Vanilla	Henri's Wooster Shoppe	General I. C. Co.	11.2
42769	Vanilla	Highland Dairy Co.	Own make	12.6
42770	Strawberry	Highland Dairy Co.	Own make	12.6
42771	Vanilla	Jensen's	Own make	17.6
42772	Peach	Jensen's	Own make	14.8
42979	Strawberry	L & B Delicatessen	Ce Brook I. C. Co.	9.0
42980	Chocolate	L & B Delicatessen	Ce Brook I. C. Co.	9.8
43527	Vanilla	Loft, Inc.	Own make	14.2
43528	Strawberry	Loft, Inc.	Own make	11.8
41168	Chocolate	New Haven Dairy	Own make	10.8
41169	Vanilla	New Haven Dairy	Own make	11.4
41170	Strawberry	New Haven Dairy	Own make	9.6
42777	Vanilla	The New Paris	Own make	16.2
42778	Peach	The New Paris	Own make	17.8
42782	Vanilla	Patterson's Candyland	Own make	12.6
42785	Vanilla	Peter's' Soda Shop	Own make	14.6
42786	Strawberry	Peter's' Soda Shop	Own make	15.6
42776	Vanilla	Robbin's, Inc.	Own make	18.2
42789	Vanilla	Royal Candy Kitchen	Own make	10.8
42783	Vanilla	Shelton Lemon Ice Co.	Own make	9.8
42784	Vanilla	South Green Confectionery Co.	Own make	16.2
42754	Coffee	John Stiguel	Semon's	10.6
42790	Country Club Special	Thrall Pharmacy	Ce Brook I. C. Co.	11.0
		Hazardville		
42587	Vanilla	Geo. F. Conley	Hood's I. C. Co.	12.8
		Jewett City		
42849	Vanilla	Fred Maynard	Own make	14.0
		Lakeville		
42960	Vanilla	Leverty's Pharmacy	General I. C. Co.	10.8
42961	Strawberry	Leverty's Pharmacy	General I. C. Co.	10.4
		Lyme		
41179	Vanilla	Hall-Mark Chocolate Co.	....	13.6
		Manchester		
42578	Vanilla	Manchester Candy Kitchen	Manchester Dairy I. C. Co.	15.2
42579	Strawberry	Manchester Candy Kitchen	Manchester Dairy I. C. Co.	12.6

TABLE III. ANALYSES OF ICE CREAM—*Continued*

No.	Flavor	Dealer	Manufacturer	Fat
		Meriden		%
42761	Chocolate	Broderick Pharmacy	....	9.4
42757	Vanilla	Billie Burns Candy Shoppe	Own make	13.8
42759	Vanilla	The Candy Box	Own make	13.8
42760	Vanilla	The Chocolate Shoppe	Own make	15.2
42756	Vanilla	Geo. Hartmann	O. D. Foote's I. C. Co.	14.4
42758	Vanilla	Katt Bros.	Own make	13.2
		Middletown		
40611	Orange-pineapple	Cubeta Bros.	Millbrook Dairy	12.4
40612	Strawberry	Cubeta Bros.	Millbrook Dairy	11.6
41176	Vanilla	Kresge's Dept. Store	Fro-Joy Brand	11.4
41177	Strawberry	Kresge's Dept. Store	Fro-Joy Brand	9.6
40613	Vanilla	Linbrook I. C. Co.	Own make	15.0
40614	Strawberry	Linbrook I. C. Co.	Own make	12.4
41178	Vanilla	Neville's Candy Shop	....	16.2
41174	Vanilla	Olympia Candy Shop	....	14.8
40615	Vanilla	Park St. Pharmacy	Millbrook Dairy	12.6
41175	Vanilla	Stueck & Son	....	15.2
		Montville		
42950	Vanilla	Uncasville Candy Co.	Own make	16.4
		Moosup		
42845	Vanilla	Daggett's Ice Cream Store	Own make	21.8
		Mystic		
42951	Vanilla	Riverside Ice Cream Parlor	Own make	22.2
		Naugatuck		
40645	Vanilla	Naugatuck Dairy Ice Cream Co.	Own make	17.0
40646	Strawberry	Naugatuck Dairy Ice Cream Co.	Own make	9.8
		New Britain		
42981	Vanilla	Blew's Soda Spa	Millbrook I. C. Co.	12.0
42740	Vanilla	Burritt Hotel Soda Shoppe	New Haven Dairy	10.6
42982	Vanilla	Coutaras Bros.	Ce Brook I. C. Co.	11.2
42983	Lemon	Coutaras Bros.	Ce Brook I. C. Co.	11.4
42738	Vanilla	Elmain Garden	New Haven Dairy	11.0
42739	Strawberry	Elmain Garden	New Haven Dairy	9.4
42809	Maple-nut	Kaufman's Store	Nelson's Purity, Inc.	13.8
42804	Vanilla	Star Confectionery	Own make	15.8
42805	Vanilla	St. Clair Confectionery	Own make	15.2
42806	Vanilla	West End Drug Store	Coon's Fro-Joy	11.2
42807	Strawberry	West End Drug Store	Coon's Fro-Joy	8.6
		New Canaan		
42975	Vanilla	Olympia Candy Co.	Own make	16.4
		New Haven		
41183	Vanilla	Basil's Confectionery	....	10.8
42572	Vanilla	Beaver Confectionery	Own make	11.4

TABLE III. ANALYSES OF ICE CREAM—*Continued*

No.	Flavor	Dealer	Manufacturer	Fat
		New Haven—Concluded		%
42573	Vanilla	Boulevard Candy Shop	Own make	12.2
42562	Vanilla	Bouzoucos Bros.	Own make	12.6
42568	Vanilla	De Lupe Bros.	Own make	12.6
40623	Vanilla	Crescent Drug Co.	Semon's	10.8
40624	Strawberry	Crescent Drug Co.	Semon's	9.8
42564	Vanilla	Cummings Bros.	Own make	12.4
40632	Vanilla	Peter Daniels	Own make	9.8
40622	Vanilla	Liberato Dellamura	Own make	9.2
42569	Vanilla	I. Dickstein	Own make	10.0
42571	Vanilla	Edgewood Soda Shoppe	Own make	9.6
41185	Vanilla	D. Felice	....	8.8
41186	Vanilla	Gabriel's Ice Cream Parlor	....	11.0
42575	Vanilla	Garden Drug Store	Sagal-Lou I. C. Co.	11.4
42576	Strawberry	Garden Drug Store	Sagal-Lou I. C. Co.	9.6
41187	Vanilla	Grand Confectionery Co.	....	10.0
42565	Vanilla	John Gilbert & Son	Own make	11.4
42566	Vanilla	House of Hasselbach	Own make	13.4
41196	Vanilla	Howard Ice Cream Parlor	....	13.6
42577	Vanilla	Huntington Confectionery	Own make	10.8
42563	Vanilla	Kum-On-Inn Shop	Own make	9.8
42741	Brick	Liggett's' Drug Store	Consolidated Dairy Products Co., Long Island City, N. Y.	10.2
41188	Strawberry	L. Liscio	Harris-Hart	12.4
40621	Vanilla	Olympia Candy Kitchen	Own make	10.6
41184	Vanilla	Original Olympia Candy Co.	....	10.0
40625	Vanilla	Palace of Sweets	....	12.4
40626	Strawberry	Palace of Sweets	New Haven Dairy	9.6
40619	Vanilla	Polos Confectionery Co.	Own make	10.4
40620	Orange-pineapple	Polos Confectionery Co.	Own make	9.4
41189	Chocolate	Polos Confectionery Co.	Own make	7.4
42567	Vanilla	Mrs. Root's Food Shop	Own make	11.6
42976	Vanilla	The Smoke Shop	Brock-Hall Co.	14.0
42977	Strawberry	The Smoke Shop	Brock-Hall Co.	12.8
42570	Vanilla	Sweetland Confectionery Co.	Own make	10.8
41181	Vanilla	Peter Villani	....	10.6
41182	Peach	Peter Villani	....	9.0
42574	Vanilla	Westville Confectionery Co.	Own make	10.6
		New London		
41172	Vanilla	Boston Candy Kitchen	Own make	16.8
40608	Vanilla	Conti Bros.	Own make	19.6
40601	Vanilla	Capitol Candy Kitchen	Own make	15.2
40602	Vanilla	Garde Catering Co.	Own make	18.8
40610	Vanilla	Liberty Candy Kitchen	Own make	16.6
40605	Vanilla	A. J. Maloof	Own make	12.4
40606	Orange-pineapple	A. J. Maloof	Own make	10.8
40607	Vanilla	A. J. Maloof	Own make	11.8
40603	Vanilla	Mohican Hotel Candy & Soda Shoppe	Own make	22.0

TABLE III. ANALYSES OF ICE CREAM—*Continued*

No.	Flavor	Dealer	Manufacturer	Fat
		New London—Concluded		%
40600	Vanilla	John Nichols	Own make	19.8
41171	Vanilla	Petersen's Tea Room	Own make	20.0
40609	Vanilla	G. P. Photos	Own make	13.2
40604	Strawberry	Victory Candy Shop	Own make	16.2
41173	Vanilla	M. Y. Vong's Sweet Shoppe	Own make	14.4
		New Milford		
42962	Vanilla	Arthur Bona	Own make	13.6
42963	Vanilla	Hipp's Ice Cream Store	Own make	12.8
42964	Orange-pineapple	Hipp's Ice Cream Store	Own make	12.8
42965	Vanilla	George Nichols	Own make	11.2
42966	Orange-pineapple	Park Pharmacy	Fro-Joy Brand	10.2
42967	Vanilla	Park Pharmacy	Fro-Joy Brand	11.0
		Niantic		
42959	Vanilla	Arthur Lockwood	Own make	10.4
		Norwalk		
42725	Vanilla	Golden's	Own make	14.8
42727	Vanilla	Main Confectionery Co.	New Haven Dairy, Bgpt.	11.2
42726	Vanilla	Peter's Sweet Shop	Own make	14.4
42820	Vanilla	Thomas Soda Shop	Own make	19.2
		Norwich		
42711	Vanilla	The Arcadia	Own make	17.6
42803	Strawberry	G. Lacahera	A. J. Maloof, New London	10.6
42709	Vanilla	Norwich Dairy Ice Cream Co.	Own make	15.4
42710	Strawberry	Norwich Dairy Ice Cream Co.	Own make	14.6
42708	Vanilla	Olympia Candy Kitchen	Own make	12.6
42714	Vanilla	Pitcher & Service	Dairymaid Ice Cream Co., Worcester, Mass.	13.8
42801	Vanilla	Sellas Spa	Own make	17.2
42802	Strawberry	Sellas Spa	Own make	15.4
42800	Vanilla	The Terminal Restaurant	Own make	17.8
42712	Vanilla	C. C. Treat	Own make	17.4
42713	Orange-pineapple	C. C. Treat	Own make	18.6
		Pawcatuck		
42953	Vanilla	Greek-American Co.	Own make	26.0
		Plainfield		
42847	Vanilla	The Maples	Kelly's	13.4
42848	Peach	The Maples	Kelly's	11.0
		Plainville		
42808	Vanilla	Kaufmann's Store	Nelson's Purity Ice Cream Co.	14.0
42558	Strawberry	The Palace of Sweets	Own make	14.4
42557	Strawberry	Rialto Soda Shop	Ce Brook Ice Cream Co.	8.8

Table III. Analyses of Ice Cream—*Continued*

No.	Flavor	Dealer	Manufacturer	Fat,
		Plainville—Concluded		%
42559	Vanilla	The Thrall Pharmacy	R. H. Worden & Sons Co., Waterbury	13.4
42560	Strawberry	The Thrall Pharmacy	R. H. Worden & Sons Co., Waterbury	12.0
		Pomfret		
42831	Vanilla	Allard's	Own make	30.0
		Putnam		
42838	Coffee	D. Allard	Fro-Joy Brand	11.0
42836	Strawberry	W. B. Carroll, Rexall Drug Store	Turner Center I. C. Co.	11.6
42837	Vanilla	Olympia Candy Co.	Own make	20.2
42835	Vanilla	Progress Confectionery Co.	Own make	14.8
42832	Vanilla	United Cigar Stores	Crown Quality I. C. Co.	14.6
42833	Strawberry	United Cigar Stores	Crown Quality I. C. Co.	13.8
		Rockville		
40634	Vanilla	S. H. Conners	Tait Bros., Spfld.	10.8
40633	Vanilla	John E. Gawtrey	Own make	13.0
42582	Vanilla	Peter's Chocolate Shop	Own make	14.4
		Seymour		
42592	Vanilla	Kalardis Bros.	Own make	10.4
		Shelton		
42595	Vanilla	E. J. Barton	Own make	15.4
		Somers		
40638	Chocolate	Mrs. Herbert N. Kibbe	Hood's I. C. Co.	14.4
42585	Vanilla	Somers Tea Room	Turnbull's I. C. Co.	15.0
42586	Strawberry	Somers Tea Room	Turnbull's I. C. Co.	13.8
		Southington		
42561	Vanilla	The Candy Shoppe	Own make	12.0
		South Manchester		
42580	Vanilla	The Coffee Shoppe	C. C. Treat I. C. Co.	17.2
42581	Strawberry	The Coffee Shoppe	C. C. Treat I. C. Co.	16.4
		South Norwalk		
42724	Vanilla	The Mahackamo	Own make	15.0
42819	Vanilla	Palace Confectionery	Own make	12.6
		Stafford Springs		
40635	Vanilla	Louis Campo	Own make	14.4
40636	Strawberry	Louis Campo	Own make	13.6
42583	Vanilla	P. J. Murray	Own make	14.4
40637	Vanilla	E. J. Parizean	Own make	17.2
42584	Chocolate	Stafford Candy Kitchen	Fro-Joy Brand	11.0

Table III. Analyses of Ice Cream—*Continued*

No.	Flavor	Dealer	Manufacturer	Fat,
		Stamford		%
42810	Vanilla	Maplehurst Dairy Co.	Own make	16.0
42811	Strawberry	Maplehurst Dairy Co.	Own make	15.2
42719	Vanilla	Massoletti's	Own make	14.6
42720	Peach	Massoletti's	Own make	9.8
42721	Vanilla	Olympia Candy Shop	Own make	12.6
42818	Vanilla	Stamford Health Food Store	Rider's I. C. Co.	13.0
42723	Vanilla	Star Confectionery Co.	Own make	16.0
42722	Vanilla	Strand Confectionery Co.	Own make	15.6
42817	Vanilla	Whelan's Drug Store	Cons. I. C. Co., N. Y.	14.8
		Thompson		
42834	Coffee	Vernon Stiles Inn	Own make	12.8
		Thompsonville		
42588	Vanilla	A. Tatoian	Own make	15.2
		Torrington		
42597	Vanilla	Allen Candy Co.	Own make	11.6
42751	Vanilla	Jacob's Bros.	Own make	14.4
42752	Strawberry	Jacob's Bros.	Own make	13.6
42598	Vanilla	Olympia Candy Kitchen	Own make	14.6
42599	Vanilla	Rexall Drug Store	Torrington Creamery Co.	11.2
42750	Strawberry	Rexall Drug Store	Torrington Creamery Co.	11.2
		Wallingford		
42763	Chocolate	O. D. Foote	Own make	13.4
42764	Peach	O. D. Foote	Own make	13.2
42762	Vanilla	J. H. Griffin	Own make	15.0
42766	Vanilla	A. Pappas	Own make	12.0
42767	Chocolate	A. Pappas	Own make	12.6
42765	Vanilla	The Sugar Bowl	Own make	15.2
		Wauregan		
42844	Vanilla	H. J. Fournier	Own make	13.4
42843	Vanilla	Mrs. A. J. Hope	Fro-Joy Brand	14.4
		West Haven		
40631	Vanilla	Big Y Drink Stand, Savin Rock	....	3.8
41191	Vanilla	Cameo Confectionery Co.	....	11.4
42791	Vanilla	A. Goldman, Savin Rock	Clark's Dairy	10.2
42792	Strawberry	A. Goldman, Savin Rock	Clark's Dairy	8.8
40628	Vanilla	Goraieb Co., Savin Rock	Sagal-Lou Co.	10.6
41195	Vanilla	R. R. Grove Midway, Savin Rock	Clark Dairy	11.0
41190	Vanilla	Thompson's Spa	....	13.4

TABLE III. ANALYSES OF ICE CREAM—*Concluded*

No.	Flavor	Dealer	Manufacturer	Fat
		Waterbury		%
40642	Vanilla	The Allen Candy Shop	Own make	14.2
40641	Vanilla	The Candy Shoppe	New Haven Dairy	10.6
40643	Vanilla	A. Magi	Whelan's I. C. Co.	11.2
40644	Pineapple	A. Magi	Whelan's I. C. Co.	10.0
42591	Strawberry	Martin's Pharmacy	R. F. Worden & Sons Co.	11.6
42590	Vanilla	Martin's Pharmacy	R. F. Worden & Sons Co.	13.2
42589	Vanilla	Puritan Tea Room	Own make	16.4
		Westerly		
42954	Vanilla	George Bailey	Maine I. C. Co.	16.2
		Willimantic		
42797	Vanilla	C. J. Albro	Own make	19.0
42799	Vanilla	Bay State Pharmacy	Hood's I. C. Co.	13.2
42706	Vanilla	Hallock's, Inc.	B. C. Hallock	14.6
42707	Strawberry	Hallock's, Inc.	B. C. Hallock	13.6
42705	Vanilla	Michael Longo	Bushway I. C. Co.	12.4
42798	Vanilla	Thread City Candy Kitchen	Own make	13.8
		Windsor Locks		
40639	Vanilla	DeFocie Bros.	Somers Creamery Co., Spfld.	12.8
40640	Strawberry	DeFocie Bros.	Somers Creamery Co., Spfld.	11.2
		Winsted		
42753	Maple-walnut	Highland Sweet Shop	Torrington Creamery Co.	12.2
		Address Unknown		
42552	Vanilla	Central Drug Co.	Ce Brook I. C. Co.	10.4

MEAT PRODUCTS, ETC.

HAMBURG STEAK

Nineteen samples of hamburg steak were tested for sulfites and four were found to contain amounts ranging from 540 to 2,209 milligrams per kilo.

Salts of sulfurous acid are not permissible admixtures in meat products. Sulfites cause a reddening of the meat tissue, which makes it appear fresh longer than it would without such treatment. Moreover, they conceal the odor of decomposition without materially checking the decomposition process, wherein lies the chief objection to their use.

Meat thus preserved was obtained at the American Market, Bristol, and at the Boston Market and Economy Markets, Meriden.

FRANKFURTS

Nine samples of frankfurts were examined and all but one were misbranded by reason of failure to declare the presence of cereal or other starchy material. Cereal up to 3.5 per cent is allowable provided declaration of its presence is made but more than 3.5 per cent is not permitted even if declared.

Misbranded products were obtained at the Dwan Co., Torrington; the Fairfield Provision Co., Stamford; Eastern Provision Co., Public Market, International Market, and Frank Luzzi, all of Hartford; Stevens and Roth, Bristol; and William Stange, Meriden.

The prevalence of misbranded frankfurts is not to be judged by the large proportion shown by the data here recorded. The inspector makes qualitative tests and brings only suspicious samples to the laboratory.

Fifteen unofficial samples were also examined.

PORK SAUSAGE

Twenty samples of pork sausage were submitted by the Commissioner. One was misbranded because of an excessive amount (4.5 per cent) of starchy material.

Moisture and nitrogen were determined in order to get indications of excessive water. It has been found by comprehensive study that water in the meats commonly used in sausage making does not exceed 25 times the nitrogen (or four times the protein, using the factor 6.25) content. In three instances the application of this formula indicated excessive moisture in amounts ranging from 6.5 to 11 per cent.

MEAT LOAF SEASONING

Mumsie-Mix, 40927, submitted by the Commissioner, appeared upon examination to consist essentially of corn starch, salt and various spices such as sage, red pepper, mustard, etc. It is a seasoning mixture.

MILK, AND MILK PRODUCTS

MARKET MILK

One hundred and twelve official samples of milk were submitted by the Dairy and Food Commissioner.

The summary of the inspection shows a considerable proportion of samples adulterated by skimming. This is because a survey was made of places where milk was found being dispensed by the glass rather than in bottles. Adulterated samples are listed in Table IV.

Summary of Inspection

	No. of samples	Per cent
Not found adulterated	50	44.6
Adulterated by watering	5	4.5
Adulterated by skimming	31	27.7
Below standard:		
in solids and solids-not-fat	10	8.9
in solids and fat	7	6.3
in solids, fat and solids-not-fat	9	8.0
Totals	112	100.0

In addition to official samples submitted by the Commissioner, 53 samples were tested for consumers and producers.

CHOCOLATED SKIMMED MILK

Four samples of chocolate-skimmed milk products were examined and found to contain from 0.6 to 1.8 per cent of fat.

BUTTERMILK

One sample of semi-solid buttermilk was examined for a purchaser. It contained 27.4 per cent of solids.

EVAPORATED MILK

One sample was examined. It contained 25.7 per cent of solids and 8 per cent of fat, the sum of solids and fat being 33.7. This meets the State standard for products of this type.

POWDERED WHOLE MILK

A sample of Klim Powdered Whole Milk, made by the Borden Co., was analyzed as follows:

Moisture	1.98%
Ash	5.99
Protein (N x 6.38)	25.64
Sugar (by difference)	38.41
Fat	27.98

CREAM

Two samples of cream were tested. One of them was suspected of containing preservative, but no evidence of such substances was found.

Table IV. Adulterated Milk

No.	Dealer	Solids	Fat
	Containing Added Water	%	%
	Bantam		
40656	Perry Howland	7.11	2.3
40657	Perry Howland	6.91	2.3
	Bridgeport		
43117	Geo. Pappas	11.00	3.6
43144	H. Kiekel	10.58	2.9
	Falls Village		
43365	Mrs. Francis Malnati	9.92	2.7
	Skimmed Milk		
	Ansonia		
43069	P. Haggis	10.70	1.9
43066	Angeio Musante	10.98	2.2
43065	J. K. Wislocki	10.35	1.6
	Branford		
42889	Branford Pharmacy	10.08	1.4
42888	Michael Torello	11.63	2.7
	Bridgeport		
43140	Joseph Cuneo	10.54	1.8
43125	Abraham Frger	9.68	1.5
43139	P. Fancuilli	10.22	1.7
43136	D. Fialk	9.75	1.6
43123	James Forskrotes	9.62	1.2
43118	H. Freudenbein	8.99	0.7
43133	Louis Garabaldi	9.70	1.1
43135	Andrew Genci	10.81	2.3
42857	R. Gerstl	9.48	0.9
42852	Anthony Gerth	9.24	0.8
43124	Boghoz Laglagian	10.57	2.1
43134	Louis Levy	10.47	2.5
43127	F. Maglione	9.79	1.8
42851	Veronica Miller	10.80	2.5
42850	John Trifon	11.44	2.5
	Danbury		
42886	Danbury Confectionery	10.68	1.9
	Derby		
43072	Debarbieri & Masante	10.96	1.9
	East Haven		
42890	M. Levine	10.10	1.6

TABLE IV. ADULTERATED MILK—*Concluded*

No.	Dealer	Solids	Fat
	Skimmed Milk—*Concluded*	%	%
	New Canaan		
42866	Olympia Candy Co.	10.93	2.5
	New Haven		
42868	A. Gabriela	11.10	2.6
42867	A. Wolfson	10.74	2.0
	Ridgefield		
42876	G. A. Mignerey	12.05	2.2
	Waterbury		
43059	Frank Carissimi	11.04	2.4
43055	Kenyon's Hillside Pharmacy	9.55	0.9
43053	W. L. Costen	11.13	2.5
43050	A. Rizk & Son	10.20	1.6

CIDER VINEGAR

The law requires that vinegar (cider vinegar) shall contain not less than 1.6 per cent of solids and not less than four per cent of acidity. The Federal standard has been revised so that the only numerical standard is that for acid strength, viz., four per cent. Since it is now known that genuine vinegar may sometimes contain less than 1.6 per cent of solids it may be unfair to adhere strictly to that limit.

In the inspection carried on by the Commissioner during the past year cider vinegar was called for in all cases.

Three hundred and forty samples were submitted for examination. In most cases products of the substance and quality asked for were obtained as judged by acid strength, solids and other characters.

Forty-five samples were clearly not cider vinegar as shown by negative or faint Hortvet tests and by low solids, generally of a magnitude between 0.2 and 0.6 per cent, which characterize molasses or syrup vinegars. These were purchases of vinegar in bulk.

Nineteen were considerably deficient in acid strength.

Twenty were of legal acid strength but did not meet the required 1.6 per cent of total solids. With some tolerance many of these could probably be passed without serious objection. There were a number, however, showing solids of about one per cent which were regarded with suspicion. One of these was examined in more detail, the analysis being compared with recorded analyses of genuine vinegar and with vinegar diluted with water. The composition of the suspected sample corresponded to that of a reduced vinegar but the manufacturer gave assurance that it had not been diluted. It was explained that the vinegar in question represented a mixture of genuine vinegars from vinegar stocks of several different years. Analyses of these component vinegars showed substantially the same composition as that of the finished product as regards potential acidity and other characters. The only sample of vinegar stock available for examination had no direct connection with the suspected vinegar, as it represented the product of another season. However, its potential acidity was very different (higher) from that of the vinegar in question, and other values were within the limits of recorded analyses for vinegar stock.

The examination of further samples from this source with more exact histories seemed desirable before reaching final conclusions about this particular product.

In addition to samples examined for the Commissioner, five were analyzed for producers or purchasers.

The total, including samples for investigational purposes, is 351.

DRUGS

Contrary to the usual practice, the drugs examined this year have been taken chiefly from general stores in smaller towns where drugs may be dispensed, if they are sold in original containers and bear the label of a licensed pharmacist, as provided by the regulations of the State Board of Pharmacy. It was thought that the quality of such drugs might be inferior by reason of deterioration due to less rapid turnover of stock. Whether or not this is a reasonable hypothesis, such stocks are, of course, subject to inspection on the same basis as drugs sold in larger establishments in cities.

The results of this inspection show that the proportion of drugs found to be below standard is not greater than that observed when inspection is confined to larger dispensing centers. The proportion is almost exactly the same as was found in the inspections of the two immediately previous years when inspections were confined to larger towns and cities of the State.

It is true, of course, that drugs found on sale in general stores are in all cases products of the same manufacture as are found on the shelves of wholesale and retail druggists, and the results, so far as can be learned from these data, do not indicate that drugs purchased in general stores in country towns are any more likely to be substandard than are the same articles purchased in the city drug store.

AROMATIC SPIRITS OF AMMONIA

According to the formula for the preparation of this article the finished product should contain 1.84 gms. of ammonia (NH_3), in each 100 cc. of solution. The alcoholic strength should be from 62 to 68 per cent by volume.

Seven samples were examined, four of which were of the quality and strength required, and three were somewhat deficient in ammonia.

TABLE V. ASSAY OF AROMATIC SPIRITS OF AMMONIA

No.	Dealer	Manufacturer	Ammonia, gms/100 cc.	Alcohol by vol. %
	Columbia			
42934	H. W. Porter	Charles Osgood Co., Norwich	1.88	63.20
	Cornwall Bridge			
42947	H. W. O'Dell	C. W. Whittlesey Co., New Haven	1.85	64.40
	East Berlin			
42911	Robert Cole	Sisson Drug Co., Hartford	1.42	69.85
	Granby			
42907	H. L. Cowles	Williams & Carlton Co., Hartford	1.99	68.00
	Moodus			
43709	W. J. Thomas & Son	Sisson Drug Co., Hartford	1.54	70.05
	Southington			
43736	E. W. Ferguson	United Chemists, Jersey City	1.48	62.35
	Thompsonville			
43717	David Dixon	Superba Products Co., Boston	1.84	64.55

LIME WATER

Solution of calcium hydroxide (lime water) should contain not less than 0.14 gm. of calcium hydroxide at 25° C. It will contain about 0.17 gm. at 15° C., the amount diminishing as the temperature rises.

The five samples examined were all of standard quality.

TABLE VI. ASSAY OF LIME WATER

No.	Dealer	Manufacturer	Calcium hydroxide, gms/100 cc.
	Cobalt		
43706	Ed. Elkin	Williams & Carlton Co., Hartford	0.17
	Moodus		
43710	W. J. Thomas & Son	Sisson Drug Co., Hartford	0.16
	Northford		
43728	Johnson Bros.	Williams & Carlton Co., Hartford	0.15
	North Stonington		
42939	Brown & Stone	Charles Osgood Co., Norwich	0.15
	Thompsonville		
43718	David Dixon	Cabot Drug Store, Chicopee, Mass.	0.15

SPIRIT OF CAMPHOR

This preparation should contain not less than 9.5 gm. nor more than 10.5 gm. of camphor in each 100 cc. of solution.

Nine samples were analyzed and all were within the limits of the standard or reasonably close to those limits.

TABLE VII. ASSAY OF SPIRIT OF CAMPHOR

No.	Dealer	Manufacturer	Camphor, gms/100 cc.
	Cornwall Bridge		
42949	H. W. O'Dell	C. W. Whittlesey Co., New Haven	10.6
	East Berlin		
42910	Robert Cole	Sisson Drug Co., Hartford	11.0
	Moodus		
43708	Purple & Silliman	Sisson Drug Co., Hartford	10.5
	Old Mystic		
42941	W. S. Walbridge	Charles Osgood Co., Norwich	11.2
	Quinnebaug		
43713	Fred E. Willette	Charles Osgood Co., Norwich	10.3
	Rock Fall		
43725	Collins & Lindemark	Williams & Carlton Co., Hartford	8.9
	Southington		
43737	E. W. Ferguson	Apothecaries Hall Co., Waterbury	9.5
	Tariffville		
42905	B. F. Farrell	Foley & Co., Chicago	10.6
	West Goshen		
42946	H. H. Ives	Williams & Carlton Co., Hartford	10.4

SPIRIT OF ETHYL NITRITE

This preparation, also called sweet spirit of nitre, should contain not less than 3.5 nor more than 4.5 per cent of ethyl nitrite ($C_2H_5NO_2$).

An important consideration in keeping this product, and one that is emphasized in the United States Pharmacopoeia, is that it shall be kept in small, well stoppered, amber bottles in a cool, dark place, remote from fire.

The large proportion of substandard samples found in this and other inspections is no doubt due largely to failure to observe these precautions.

Thirteen samples were examined, of which six were passed.

TABLE VIII. ASSAY OF SPIRIT OF ETHYL NITRITE

No.	Dealer		Ethyl Nitrite, %
	Addison		
42931	Addison Cash Grocery	Hartford Drug Co., Hartford	3.0
	Cobalt		
43704	Ed. Elkin	Sisson Drug Co., Hartford	3.3
	Columbia		
42932	H. W. Porter	Charles Osgood Co., Norwich	2.3
	Cornwall Bridge		
42948	H. W. O'Dell	C. W. Whittlesey Co., New Haven	3.2
	Granby		
42906	H. L. Cowles	Williams & Carlton Co., Hartford	4.7
	Hartford		
43729	Sunlight Grocery	Sisson Drug Co., Hartford	4.2
	Quinnebaug		
43712	Fred E. Willette	Charles Osgood Co., Norwich	2.3
	Rock Fall		
43726	Collins & Lindemark	Williams & Carlton Co., Hartford	2.5
	South Coventry		
42937	L. M. Phillips	Fraser Tablet Co., Inc., Brooklyn N. Y.	3.9
	Southington		
43735	E. W. Ferguson	United Chemists, Jersey City, N. J.	0.4
	South Woodstock		
42921	R. K. Safford	S. Kidder & Co., Boston	3.0
	Thompsonville		
43715	David Dixon	Cabot Drug Co., Chicopee, Mass.	2.6
	West Goshen		
42944	H. H. Ives	Williams & Carlton Co., Hartford	3.4

TINCTURE OF IODINE

Tincture of iodine should contain not less than 6.5 gms. nor more than 7.5 gms. of iodine, and not less than 4.5 gms. nor more than 7.5 gms. of potassium iodide in each 100 cc. of solution.

Ten samples were examined, only one of which was notably deficient.

TABLE IX. ASSAY OF TINCTURE OF IODINE

No.	Dealer	Manufacturer	Iodine, gms/100 cc.	Potass. iodide, gms/100 cc
	Bloomfield			
42902	L. R. Ladd	American Lab., Inc., Richmond, Va.	5.8	4.9
	Collinsville			
42913	Philip Reichert	Dill Co., Morristown, Pa.,	6.4	4.6
	Columbia			
42933	H. W. Porter	Charles Osgood Co., Norwich	6.7	4.9
	Cornwall Bridge			
43700	H. W. O'Dell	C. W. Whittlesey Co., New Haven	6.7	4.7
	East Berlin			
42909	Robert Cole	Sisson Drug Co., Hartford	7.0	5.1
	Granby			
42908	Loomis Bros. Co.	Williams & Carlton Co., Hartford	7.0	5.0
	North Woodstock			
42920	O. Milligan	Lee & Osgood Co., Norwich	7.1	5.2
	Old Mystic			
42942	W. S. Walbridge	....	6.6	4.8
	Quinnebaug			
43714	Fred E. Willette	Charles Osgood Co., Norwich	6.7	4.9
	South Coventry			
42938	L. M. Phillips	United Drug Co.	6.8	5.0

SOLUTION OF MAGNESIUM CITRATE

This product should contain not less than 1.5 gms. of magnesium oxide (MgO), in each 100 cc. of solution. The specifications further require not less than 3.3 gms. of free citric acid and not less than 9.8 gms. of total citric acid in 100 cc.

Eight samples were submitted. Three were passed and five were below standard in one or more particulars. All were sold

upon request for solution of magnesium citrate or "citrate of magnesia." One, however, was labelled "Citro" with the further information that the article was a substitute for the U. S. P. product, and the formula was given. Another was labelled "Aperient" magnesia and two were labelled to show that they were made according to the specifications of the ninth revision of the Pharmacopoeia instead of the text now official.

"Citro" was deficient in total citric acid even on the basis of the declared formula, but in other respects conformed to the declaration.

Aperient magnesia was low in magnesia and in total citric acid for the U. S. P. article. The term "aperient" is as correctly applied to the standard U. S. P. product as to a substandard product so that such designation is not sufficiently descriptive to indicate to the consumer the substandard character of the article.

Sample 42925 was labelled U. S. P.: IX but it was low in total

TABLE X. ASSAY OF SOLUTION OF CITRATE OF MAGNESIA

No.	Dealer	Manufacturer Manufacturer	MgO, gms/100 cc.	Free citric acid, gms/100 cc.	Total citric acid, gms/100 cc.
	Beacon Falls				
42925	Peoples Grocery (U. S. P. IX)	Apothecaries Hall Co., Waterbury	1.6	2.5	8.3
	Berlin				
42912	J. Cole (Aperient)	Sisson Drug Co., Hartford	1.2	4.0	8.5
	Cornwall Bridge				
43701	H. W. Breen (Citro)	Williams & Carlton Co., Hartford	1.1	2.0	6.4
	Hamden				
43738	Robert Reinwald	Charles S. Leete Co., Inc., New Haven	1.6	2.4	8.4
43739	M. Tomassi	Superior Drug Co., Stamford	1.6	2.3	8.1
	North Stonington				
42940	Brown & Stone	Sterling Magnesia Co., New York	1.6	3.8	9.6
	South Woodstock				
42922	R. K. Safford	McCambridge Co., Washington, D. C.	1.5	3.9	9.3
	Tariffville				
42903	B. F. Farrell	National Magnesia Co., Brooklyn, N. Y.	1.6	3.8	9.5

citric acid on the basis of that standard. Sample 43739 was similarly labelled but it was deficient in free citric acid and in total citric acid.

There is apparently some difficulty in preparing this official solution to fully meet the standard for total citric acid although it can be made closely to approximate the standard. An experimental mixture made in the laboratory showed 9.65 grams total citric acid instead of the calculated value of 9.81 and a sample of freshly prepared stock, submitted at our request by a local druggist, was also slightly under the required value. However, with ingredients of U. S. P. purity there should be no difficulty in preparing a product that will pass inspection with a reasonable tolerance.

ESSENCE OF PEPPERMINT

According to the formula given in the U. S. P. this article should contain 10 per cent of peppermint oil per 100 cc.

Four samples were examined. Two were satisfactory, one was somewhat over strength and one was labelled "extract" but was below standard for that product. Extract should contain 3.0 per cent of oil.

TABLE XI. ASSAY OF ESSENCE OF PEPPERMINT, ETC.

No.	Dealer	Manufacturer	Oil of Peppermint %
43707	*Moodus* Purple & Silliman	Sisson Drug Co., Hartford	11.9
42936	*South Coventry* L. M. Phillips	Continental Drug Corp., St. Louis, Mo.	10.7
43716	*Thompsonville* David Dixon	Eastern Drug Co., Boston	10.8
42945	*West Goshen* H. H. Ives (Extract)	Williams & Carlton Co., Hartford	2.5

COMPOUND MIXTURE OF RHUBARB

From the formula for this preparation it is calculated that 100 cc. should contain from .004 to .005 gm. of ipecac alkaloids and 3.5 gms. of bicarbonate of soda.

The one sample examined contained 3.8 gms. of sodium bicarbonate and .014 gm. of mixed alkaloids. The alkaloidal residue was evidently contaminated and the value is no doubt too high. Tests for rhubarb were positive.

MISCELLANEOUS

DRUGS AND OTHER MATERIALS

The following materials, 21 in number, have been examined for the Dairy Food Commissioner, local health officers or other officials interested:

42985. *Alcohol.* Contained 3.8 per cent of methyl alcohol by volume. Total alcohols 43.25 per cent.

1148, 1149. *Apples.* These were examined for spray residue and 0.0016 and 0.0015 grains of arsenic (As_2O_3) per pound of fruit were found. These amounts are well within the limit at present allowed, viz., 0.01 grain per pound.

2718. *Coal* (Station sample). Water 1.10 per cent; ash 6.47 per cent; volatile combustible matter 20.2 per cent; fixed carbon 72.23 per cent; sulfur 0.94 per cent.

768. *Cod liver oil.* Free fatty acids as, oleic acid, 0.53 per cent; saponification No. 183.0; iodine No. 166.7; unsaponifiable 0.26 per cent; vitamin test, color value 26. Constants meet U. S. P. specifications. Color value indicated a probably satisfactory vitamin A content.

1359, 1360. *Cod liver oil.* For poultry feeding. There is no reliable way of comparing the two oils as to vitamin potency except by feeding trials. Color values for vitamin A indicated relatively large amounts of this factor, the respective values being 75 and 60.

2050. *Dr. De Pew's Prescription 10,010.* Sample submitted by a patient. Advertising literature emphasizes the benefits to be derived from the administration of gland tissue or extracts and it is implied that this "treatment" contains such substances. The tablets were found to consist of, or to contain, starch, calcium phosphate, strychnine in medicinal quantity, a trace of iodine and some nitrogenous material. Thyroid or a similar gland tissue may be present.

2428. *Doz-it.* A medicated stock salt, Farmers Medicated Stock Salt Co., Mifflinburg, Pa. It was found to consist of, or to contain, chiefly common salt with some charcoal, Epsom salt and iron sulfate. Advertising literature is objectionable because there is no known medicine that will prevent abortion; nor is it at all likely that this salt will prevent cholera as the circular implies.

3102. *F. L. P.* A pickling and curing compound for meats said to consist of salt and saltpetre. It was found to contain about 75 per cent of salt and 25 per cent of nitrate of soda. Both of these substances are permissible preservatives for meats. The term "saltpetre," however, applies to potassium nitrate rather than to sodium nitrate. The latter is known as Chili saltpetre.

748. *Hall's Muneac.* Hall Remedy Co., Tampa, Fla. The medicine was described as a wonderful remedy for rheumatism and diseases arising from uric acid in the system. It was a mixture of hydrochloric and nitric acids and contained some free chlorine. Acidity 2.51 normal. Dilute nitrohydrochloric acid (N.F. 5) would have a total acidity of about 2.8 normal.

2177. *Liquid soap.* Analysis: water 83.5 per cent; ash 2.88 per cent; free potassium hydroxide none; free potassium carbonate 0.24 per cent; fatty acids 8.95 per cent; soap (fatty acids + combined K_2O), 10.68 per cent; non-soap ash 0.10 per cent; undetermined 5.5 per cent. Evidently a potassium oleate soap.

975. *Normacol.* A laxative preparation. Sample consisted of, or contained, agar-agar and a vegetable cathartic, probably senna extract, coated with chocolate.

43524. B. Paul's Henna. Nature's Hair Restorer. Said to be a mixture of henna, herbs and other harmless ingredients. There were two separate powders. One was a brownish-green substance, which was apparently the dye proper. The other was marked "developer."' The brownish powder contained copper and iron in quantity, was acid to litmus, and contained tannic acid. Crystals of copper sulfate could be seen under the microscope. Paraphenylenediamine test negative. Coal tar color may be present. Wool was dyed brown and the color could be partially removed with ammonia and a redye made. The "developer" was alkaline to litmus and to phenolphthalein. No organic matter was present. Tests for sodium, peroxide and borate were positive. The preparation evidently owes its coloring properties to the reaction between the metals and tannic acid by which cupric and ferric tannate is formed. Some other dye (e. g. coal tar), may be present and possibly some henna, as there was organic material present other than tannic acid. Conjunctivitis was thought to have followed the use of this preparation. The high alkalinity of the developer might have caused such a condition.

3160-3166 incl. *Silver polishes.* Tested for cyanide. No evidence of cyanide was found in any of the samples. The test used was that of Schonbein-Pagenstecher (Anteureith and Warren, p. 21). The brands tested were Gelbard's "Just Rite," Green's, Whiting's, Wright's, Noxon, Priscilla, and Removit.

MATERIALS EXAMINED CHIEFLY FOR POISONS

Fifty-five other samples, chiefly instances of suspected poisoning of domestic animals, have been examined at the request of the Commissioner on Domestic Animals and of other officers having similar interests. Some examinations have been made for individuals. Detailed discussion of each of these is not required.

Examinations of this kind require very careful work and consume a considerable amount of time. However, this coöperation appears to serve a useful purpose and it is appreciated by the authorities concerned.

TOBACCO

In addition to partial analyses of 167 samples of tobacco, chiefly determinations of various ash constituents made in connection with tobacco investigations of the Station which are to be reported elsewhere, proximate analyses of tobacco seed and of fresh and cured leaves were made. The carbohydrate separations were made by Mr. Shepard.

PROXIMATE ANALYSIS OF TOBACCO SEED

Water	3.34%
Ash	3.71
Protein (N x 5.34)	20.76
Fiber	14.44
Carbohydrate (other than fiber):	
Starch	none
Water-sol. after hydrolysis, calc. as dextrose	3.08
Water-insol. after hydrolysis, calc. as dextrose	0.55
Undetermined	11.89
Fat, ether extract	42.23

The factor 5.34 for the evaluation of nitrogen in terms of protein is based upon the work of Vickery and Pucher.[1] Water-insoluble carbohydrates represent cell wall constituents converted to reducing sugars upon acid hydrolysis and calculated as dextrose.

PROXIMATE ANALYSES OF TOBACCO, CURED LEAF AND FRESH LEAF

(Air-dry-basis)

	2190 Air dry fermented leaf	4057 Air dry fresh leaf
Water	6.38%	4.50%
Ash	20.80	18.09
Nitrogen, total	4.46	4.51
Fiber	7.18	8.11
Carbohydrate other than fiber:		
Sol. in hot 95% alcohol calc. as dextrose	1.07	2.39
Sol. in water, calc. as dextrose	0.97	0.84
Starch	1.88	1.51
Hemicelluloses, calc. as dextrose	1.47	1.85
Fat (ether extract)	3.20	6.43

Nitrogen is not evaluated as protein because in the cured leaf of tobacco as much as 25 per cent of the total nitrogen may be present in the form of nitrate, about 10 per cent in alkaloidal combination and a smaller amount may be present in ammonium salts.

For the separation of the carbohydrates the fine-ground air-dry tobacco was extracted with petroleum ether and the ether-extracted material then boiled for eight hours with 95 per cent alcohol, enough sodium carbonate being added to neutralize the predetermined acidity of the tobacco. The extract was evaporated to remove alcohol and the residue dissolved as far as possible by repeated additions and decantations of hot water. There was some gum-like material, which did not dissolve. The soluble portion of the alcohol extract was made up to definite volume and aliquots were taken for the determination of reducing power. Sugars were calculated both from the weights of cuprous oxide and from copper determined therein volumetrically. Direct reduction sugar, calculated as dextrose, was found to be 1.02 per cent in the cured leaf and 2.40 per cent in the fresh leaf, both results being on the basis of the original air-dry tobacco. After a 10-minute inversion with hydrochloric acid the reducing power indicated little or no change in sugar, 1.07 per cent being found in the cured leaf and 2.39 per cent in the fresh leaf. A long hydrolysis (two and one-half hours), with dilute acid resulted in a decrease in sugar in both

[1] Dept. of Biochemistry, unpublished data.

cases, probably due to destruction of some carbohydrate. The identity of the sugars present was not established. Mosca[1] however, has reported the presence of levulose in tobacco examined by him, and Smirnow and his co-workers[2] have reported sucrose, maltose and monosaccharides. Our failure to obtain any considerable increase in reducing power after a short hydrolysis indicates no appreciable amount of sucrose in these samples. The behavior on longer hydrolysis is consistent with that which would be expected if levulose or invert sugar were present.

The ether and alcohol extracted material was next extracted with water to remove dextrins and any water-soluble hemicelluloses which might be present. The water extract was then hydrolyzed with 1.25 per cent hydrochloric acid for two and one-half hours and the copper reducing power of the hydrolyzed solution determined. Carbohydrate, expressed as dextrose, was found to be 0.97 and 0.84 per cent in the cured and the fresh leaves respectively, both results being on the basis of the original air-dry tobacco.

Another portion of the ether and alcohol extracted material was extracted with water and then digested with malt extract for the determination of starch. Starch was found to comprise 1.88 per cent of the air-dry cured leaf and 1.51 per cent of the air-dry fresh leaf.

The residue from the malt digestion was washed free from soluble carbohydrates and then hydrolyzed for two and one-half hours with dilute acid to convert hemicelluloses (cell wall constituents) into reducing sugars. Reducing sugars from this source accounted for 1.47 and 1.85 per cent of the air-dry cured leaf and the air-dry fresh leaf respectively.

Crude fat as reported in the analysis is the extract obtained by the use of ethyl ether after extraction for 16 hours.

POTATOES

In collaboration with the Storrs station, 22 samples of potatoes were analyzed. Eleven of these represented tubers after digging in the fall of 1928 and eleven represented the same varieties just before planting in the spring of 1929. Determinations of proximate constituent groups and certain of the ash constituents were made.

Discussion of this work is for publication elsewhere.

BEETS

Seventeen samples of beets were examined for sugar content for the Department of Soils of this Station.

[1] Zeitschr. f. Untersuchung Nahr. Genussm., **33:** 93. 1917.
[2] Planta Archiv fur wissenschaftliche Botanik, **6:** 687. 1928.

WATER

Under the provisions of a statute this laboratory collaborates with the State Water Commission in the investigation of waters polluted by trade wastes. Six samples have been examined during the year and the results reported to Mr. Copeland, sanitary engineer to the Commission.

BABCOCK AND OTHER GLASSWARE

During the year, 2,427 pieces of Babcock test bottles and pipettes and 111 dairy thermometers have been checked, making a total of 2,538 pieces.

	Accurate	Rejected	Total
Test bottles and pipettes	2415	12	2427
Thermometers	102	9	111

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Bulletin 320 September, 1930

THE SOILS OF CONNECTICUT

Progress Report of Investigations 1924-1930

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Connecticut
Agricultural Experiment Station
New Haven

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY, NEW HAVEN, CONN.

CONTENTS

FOREWORD

The Soils Department of this Station was organized in July, 1923. During the first two years the work was confined largely to detailed soil surveys of selected areas of the state in coöperation with the Economics Department of the Storrs Agricultural Experiment Station in order to ascertain the distribution of the various soil types and their importance in determining the distribution of land cover and the type of agriculture. The work was expanded in 1925 under funds made available by the Purnell Act. Outstanding results of our studies have been reported from time to time in journal papers, press reports, talks at conferences and farmers' meetings, and in the annual reports of this Station. It now appears desirable to present the information which has been accumulating as a bulletin of comprehensive nature.

The results of a considerable amount of soil studies with special reference to forestry problems are not included, since this material is part of a separate bulletin which is being prepared for publication.

The first soil survey by the United States Bureau of Soils was made in the Connecticut Valley in 1899. This was enlarged to include a considerable adjacent area in 1902. A decade later, in 1911 and 1912, the counties of Windham and New London were also covered. However, all of this early work was of a rather general character, many very important soil differences were not recognized, and the location of soil areas on the map was frequently inaccurate. In spite of these limitations, these older surveys have served a useful purpose, especially in the Hartford County area, where the physical characteristics of the soils most desirable for cigar-wrapper tobacco were clearly shown.

Since the discontinuance of their soil survey work in this state, the United States Bureau of Soils (now the Bureau of Chemistry and Soils) has greatly improved its system of classification and the accuracy of the maps, which now cover nearly one-half of the farm land of the United States.

The work is usually done in close coöperation with the soils departments of the state experiment stations and the published reports present detailed soil maps and descriptions of each soil with respect to their natural character and relationships to crops, fertilizer practices and farm values. These reports furnish invaluable information, not only to the individual farmer, but to the extension worker who offers him advice, the research man who studies his problems, the organizations that direct his collective efforts and the banker who loans him money on the value of his land. They are necessary in activities involving policies of land utilization such as forestry, recreation and wild life. They furnish a physical basis for estimates of road construction problems. In fact, a knowledge of the natural soil factors as pictured by the soil survey is of prime importance in any program relating to an intelligent direction of the future development of all non-industrial activities of the state.

Connecticut, while extremely varied in the minor details of the character of its soils, presents a very simple problem to the trained soil surveyor, on account of its small size and excellent transportation facilities. However, the present topographic map, prepared over forty years ago and relatively inaccurate in detail, is not a satisfactory basis for the accurate location of the various small areas of soil types that occur on nearly every farm. A new topographic map of the state, prepared with the assistance of data obtained from aerial photographs, and printed on a scale of at least one inch to a half mile, would be necessary, but since such a map is seriously needed to meet many other demands of the state, it will doubtless be prepared within the near future.

The material presented in this bulletin, supplemented by other information which will be accumulated in the course of our future investigations, should furnish an excellent basis for the intelligent interpretation of the soil survey when it is prepared. The ground work has been done, which includes the development of an adequate basis of classification and maps already prepared for the equivalent of 20 different towns. It is earnestly hoped that as quickly as a new aeroplane photograph or topographic survey of the state is available, the detailed application of our knowledge of the soil factors in agriculture, forestry and related fields may be made possible through a state-wide soil survey.

The author is indebted to the following persons for their contributions and coöperation in connection with various phases of the subject matter presented in this bulletin:

G. D. Scarseth, former Assistant in Soils Research, and H. G. M. Jacobson, Assistant Agronomist, for soil and land cover maps, laboratory analyses and greenhouse studies.

D. B. Downs, General Assistant, for land cover maps and greenhouse studies.

Mark Baldwin, Inspector, Soil Survey Division, United States Bureau of Chemistry and Soils; G. W. Conrey, Chief of Soil Survey, Ohio Agricultural Experiment Station, and W. H. Latimer, Soil Surveyor, United States Bureau of Chemistry and Soils for soil type identifications and correlations.

I. G. Davis and C. I. Hendrickson, Economics Department, Storrs Agricultural Experiment Station, for economic studies on various soil types.

M. F. M.

PART I

A DESCRIPTIVE INVENTORY OF CONNECTICUT SOILS

Connecticut is a state of diversified agriculture, and the economic trend is in the direction of increased diversification and more intensive use of land wherever possible. The soils of the region are extremely varied in their characteristics, and it is believed that a better understanding of these soil differences and their significance will be of material assistance in improving the adjustment of land utilization to soil.

The specific purpose of this portion of the bulletin is to furnish a "guide-book," whereby the various types of soil can be systematically studied, and to present certain data that indicate the agronomic significance of some of the more important soil differences to be observed.

A detailed soil map of the state cannot be available for a number of years. It is our hope that the material herein presented will enable the reader to recognize the more important soil types and to understand something of their relationships to agricultural use.

Terms Used in Soil Descriptions

It is not possible to describe adequately soil conditions without using a number of terms somewhat unfamiliar to many readers. The following paragraphs are necessary to make the meanings of such expressions more understandable.

Surface soil. The upper portion of a soil in which the mineral soil is mixed with a certain amount of organic matter, and is thus darker in color than the lower layers of soil.

Subsoil. The soil layer underlying the surface soil, and extending to a depth where there is a noticeable difference in character of the material.

Substratum. The material underlying the subsoil, and usually extending practically unchanged to bedrock formations.

Soil horizon. In a scientific study of soils as they occur in the field, the various layers of the soil are designated as "horizons." These horizons are more or less distinct, and are of great significance in showing the conditions under which the soil is developed.

In the regions of the world where the downward movement of water in the soil is practically continuous, such as is the case in all the eastern half of the United States, the soils tend to form two important horizons. The "A" horizon, the one nearest the surface and immediately below the leaf mold, if such exists, is a zone from which soluble material and the very finest soil particles designated as "colloids" tend to move downward. In all cultivated soils and in some virgin soils, at least the upper portion and sometimes all of this horizon contains enough organic matter to be darker than the lower layers of the soil. Thus there may be both "A_1" and "A_2" horizons, the former containing more organic matter, but both being "A" horizons in the sense described above.

The "B" horizon, occupying a position just beneath the "A" horizon, shows evidence that at least some of the material that has moved down from the "A" horizon has tended to accumulate in this zone. There may be differences in this general horizon, such as in color and clay content, to justify separation into B_1, B_2, etc., horizons.

Below the "B" horizon lies the rock material from which the soil is formed. In Connecticut, except where solid bedrock lies within two or three feet of the surface, this material is usually a mixture of loose stones or gravel, sand, silt and clay in varying proportions, laid down as glacial deposits or as sediments from running water. Such material is designated as the "C" horizon, although not soil in the strictest sense.

Soil color. Soils show many variations in color, and these are frequently valuable aids in distinguishing between different soils. Thirty-one standard soil color names have been selected for use in describing different color variations to be recognized in this state. In order that scientific workers in other states may properly interpret these names, these colors have been analyzed by means of the Munsell color disc method. The results are as follows:

TABLE I. ANALYSIS OF CONNECTICUT SOIL COLORS.

	White (Neutral 9)	Yellow (Yellow 8/8)	Red (Red 4/9)	Black (Neutral 1)
Light gray	45	4	0	51
Gray	36	13	0	51
Cream	34	36	0	28
Yellowish-gray	16	35	0	49
Yellow	4	30	8	58
Grayish yellow-brown	14	23	0	63
Yellowish-brown	6	26	8	60
Yellowish-brown with slight reddish cast	6	21	11	62
Medium brown	11	16	2	71
Medium brown with slight yellowish cast	7	23	4	66
Medium brown with slight reddish cast	9	15	10	66
Dark brown	6	15	2	77
Light grayish-brown	19	20	0	61
Grayish-brown	12	13	0	75
Dark grayish-brown	10	10	0	80
Very dark grayish-brown	9	6	0	85
Black	9	1	0	90
Reddish-gray	32	21	15	32
Reddish-yellow	11	21	19	49
Light reddish-brown	14	17	15	54
Reddish-brown	14	15	13	58
Dark reddish-brown	10	11	9	70
Brownish-red	13	13	21	53
Olive-gray	28	11	0	61
Dark olive-gray	20	9	0	71
Bluish-olive	20	7	0	73
Yellowish-olive	22	18	0	70
Olive-drab	20	15	0	65
Drab	26	17	0	57
Dark olive-drab	16	11	0	72

Soil texture. The texture is determined by the sizes of the soil grains which compose the soil. From this standpoint, the coarse material, larger in diameter than two millimeters (about 0.08 inch), is not included in the calculation. The names applied to the various sizes of soil particles as used by the United States Bureau of Soils are as follows:

TABLE II. THE NAMES AND RANGES IN SIZE OF SOIL PARTICLES.

Separate	Diameter in mms.
Very coarse sand	2.0 — 1.0
Coarse sand	1.0 — 0.5
Medium sand	0.5 — 0.25
Fine sand	0.25 — 0.10
Very fine sand	0.10 — 0.05
Total sands	2.0 — 0.05
Silt	0.05 — 0.005
Clay	0.005 and smaller size

Soils contain varying proportions of particles of all the different sizes. Few soils contain more than 90 per cent of total sands, while even the heaviest clays seldom exceed 60 per cent clay.

For convenience in designating soils with different relative proportions of sand silt and clay, textural class names are used. The following classes occur in this state in areas of appreciable size:

Coarse sand—
Less than 15 per cent silt and clay.
35 per cent or more coarse and very coarse sand.

Sand—
Less than 15 per cent silt and clay.
35 per cent or more very coarse and coarse sand.

Loamy sand—
15 to 20 per cent silt and clay.
35 per cent or more very coarse, coarse and medium sand.

Loamy fine sand—
15 to 20 per cent silt and clay.
35 per cent or more very fine and fine sand.

Sandy loam—
20 to 50 per cent silt and clay.
25 per cent or more very coarse, coarse and medium sand.

Fine sandy loam—
20 to 50 per cent silt and clay.
25 per cent or more very coarse, coarse and medium sand.

Very fine sandy loam—
20 to 50 per cent silt and clay.
35 per cent or more very fine sand.

Loam—
Less than 20 per cent clay.
30 to 50 per cent silt.
30 to 50 per cent sand.

Silt loam—
Less than 20 per cent clay.
More than 50 per cent silt.
Less than 50 per cent sand.

Clay loam—
20 to 30 per cent clay.

Clay—
30 per cent or more clay.

Soil colloids. The extremely fine particles in the soil are called colloids. Due to their large surface in proportion to their weight, they exhibit many important properties not possessed by larger soil grains. They are able to absorb not only moisture but also many important chemical components, such as potassium, calcium, ammonium and phosphate, although apparently able to liberate them to the plant under many conditions. The colloids also act as a cement between the larger particles, and may form a complete coating over the sand and silt grains. They thus cause them to cluster or granulate, and when large in amount may cause the soil to be very sticky when wet, thus making the soils difficult to work. The poor condition produced by an excessive amount of colloids may be partially corrected by organic matter and lime. Soils low in colloids are not retentive of moisture and plant food material, and are lacking in "body." A moderate amount of colloids in proportion to the amount of sand and silt is most desirable.

Organic matter and humus. Plant and animal material enter the soil from the following sources: leaves, bark, twigs and other forest debris; dead grass, roots, stems and other crop residues; the bodies of earth worms and insects; the dead cells of bacteria, fungi and other micro-organisms; applications of animal manures, straw, tobacco stems and stalks, and fertilizers of organic substances such as cottonseed meal, castor pomace or fish scraps. This material in the soil is attacked by bacteria and fungi, thus

gradually decomposing into more or less stable organic compounds of complex nature. All organic substances, in any stage of decomposition, are included in the general term "organic matter," as applied to soils. The well decomposed material, which has lost its original physical and chemical form, is usually called "humus." In a cultivated soil the greater portion of the organic matter is in a humus condition, and is mixed with more or less mineral soil. Well-drained soils contain from 1 to 10 per cent of organic matter in the surface layer, while swamp accumulations, known as peat, may be almost pure organic matter.

Organic matter in soils performs many important functions. It makes a heavy clay soil more easy to till, and increases the retentiveness of a very sandy soil for moisture. It increases the ability of a soil to absorb heat. Aside from these physical effects, organic matter is the food and energy supply for bacteria and fungi and through their activities plant food contained in the organic matter is made available for crop growth. The carbon dioxide set free in the decay of the organic matter greatly increases the solvent action of the soil water on the mineral matter in the soil, thus increasing its availability.

Nitrogen. Closely related to organic matter is the nitrogen supply in the soil. In fact the total amount of nitrogen in the soil is usually about five per cent of the amount of organic matter. Only a small portion of this nitrogen is available for plant growth at any one time. It is released from the decomposing organic matter by the action of bacteria and fungi, and a small amount of nitrogen is taken directly from the air and added to the soil through the action of two important groups of bacteria, one of which produces the nodules on the roots of leguminous plants, while the other is able to fix nitrogen from the air without the assistance of a host plant, when soil conditions are favorable.

Chemical elements essential to plant growth. Carbon and oxygen are obtained by the plant from the atmosphere. Hydrogen and oxygen are furnished by the water entering the plant roots through the soil. The soil also furnishes the plant with the following essential elements: Nitrogen, Potassium, Phosphorus, Sulfur, Magnesium, Calcium, Iron, Manganese, and perhaps others such as Boron, Copper and Zinc, minute quantities of which may play some important part in the life processes of the plant. Silicon and aluminum are absorbed by the plant from the soil in considerable amounts, but it has not been definitely proven that they are required by the plant.

All soils contain these elements. An average soil in Connecticut shows a total amount of all the more important elements sufficient for hundreds of years of cropping. But most of the supply is combined in the soil minerals and slowly decomposing organic matter in such a way as to permit only small fractions to be available to the plant in the season of its growth.

Three of these elements, Nitrogen, Phosphorus and Potassium, are so often available in insufficient quantities for many crops that they are added in the form of animal manures or fertilizers. The soil may under certain conditions be deficient in calcium, magnesium, sulfur or manganese. The other "essential" elements are almost always furnished to the plant by the soil in adequate amounts.

Soil reaction. Water that is in contact with the soil particles is affected by them, and is either made acid or alkaline or may remain neutral. This property of the soil is called soil reaction. It is one of the most important of soil characteristics, since the degree of acidity or alkalinity is related to a great many other soil processes, such as the liberation of injurious inorganic compounds in the soil, the decomposition of organic matter, the formation of nitrates, fixation of nitrogen from the air, and solubility of nutrient elements such as phosphorus and calcium.

The strength or intensity of soil reaction is now almost universally measured in terms of a scale of figures, known as "pH," in which 7 pH expresses approximate neutrality (neither acid nor alkaline). Six, 5 or 4 pH indicate increasing degrees of acidity, while 8, 9 or 10 pH represent increasing degrees of alkalinity.

Lime requirement. The intensity of soil acidity does not show the total amount of acidity, or vice versa, the amount of lime which must be applied to neutralize completely this acidity. The total acidity depends not only upon its strength, but upon other factors, chief of which are the amounts of organic matter and clay in the soil.

The "lime requirement" of the soil is not usually the same as the lime requirement of the crop, since plants vary greatly in their ability to withstand acid conditions, and many crops are most satisfactory on soils with moderate lime requirement and a slight intensity of acidity. Hence laboratory measurements of lime requirement must be interpreted in the light of the preferences of the crop to be grown.

Common rocks that contribute material for soil formations in Connecticut:

Granite. A grayish-colored, hard, massive rock containing recognizable crystals of quartz, feldspar and mica, as well as other accessory minerals.

Syenite. Light gray or pinkish-gray, hard, massive, composed chiefly of feldspar with smaller amounts of mica and little or no quartz.

Diorite. Dark gray or very dark gray, hard, massive, heavy for its bulk, composed of feldspar, black mica (biotite), and hornblende with little or no quartz.

Gneiss. A grayish-colored, hard, massive crystalline rock, showing evidences of having been changed through former intense heat and pressure

(metamorphism). Shows distinct banded arrangement of the crystals, the bands frequently being highly distorted. Gneiss may be a granite-gneiss, syenite-gneiss or diorite-gneiss, similar in mineral composition to these respective rocks.

Schist. Differs from gneiss in having closely paralleled layers, along which the rock tends to split. Flakes of some of the minerals, such as mica, chlorite or hornblende, are arranged in thin layers or "folia." Schists are designated by the mineral responsible for their foliation as mica-schist, chlorite-schist or hornblende-schist.

Trap. A dark gray, dark brown or nearly black, very hard and flinty rock occurring in characteristic columnar cliffs in many parts of the central region of Connecticut, such as West Peak in Meriden and East Rock, New Haven.

Phyllite. A dark-colored, slaty type of rock, with no noticeable mineral formation, but possessed of a glossy lustre due to minute flakes of mica. It breaks readily into thin plates.

Sandstone. A rock formed from the cementation and solidification of strata of sand and fine gravel, deposited at some remote geologic age. The most common examples in Connecticut are the reddish-colored sandstones of the Connecticut Valley formed in the Triassic Age.

Shale. Also a sedimentary rock, formed in the same fashion as sandstone but of very fine silt and clay material. The rock is thus fine-grained, splitting into thin plates, and has a dull lustre.

Limestone. A sedimentary rock, formed from the deposition of limy substance on the bottom of prehistoric lakes, bays or ocean floor, and later cemented by the carbonate of lime into a rock. The distinctive feature of limestone is the fact that it effervesces freely when hydrochloric acid comes into contact with it. Limestone that becomes crystalline due to metamorphic action is called *marble.*

Causes Contributing to Differences in Soil Occurring in Connecticut

The Character of the Rocks

The geologic past of southern New England has been such as to give us a wide variety of rocks, and the difference in their character has in many cases brought about a marked effect on the soil from which these rocks have been derived.

The greater portion of Connecticut, with the exception of the central portion and included in Areas I and II in Figure 59, represents a complex assortment of crystalline rocks varying from massive gray and pinkish granites and granite gneisses through a wide variation of composition, color and structure to fissile schists which sometimes approach the character of sandstones and which they may have been ages ago, before some titanic disturbance of the earth's crust destroyed the fossil evidences of the true origin of the rocks.

Near the northwestern corner of the state, in a narrow strip along the Upper Housatonic Valley and in the vicinity of Danbury (Area III in Figure 59), marble or limestone rock (the Stockbridge limestone) is found, a relic of submarine calcareous deposits laid down in a far distant past when the highest form of life was the trilobite, a very strange cousin of the crabs and lobsters that now frequent our shores. With the exception of a very few small and scattered localities in Area IV where thin seams of limestone are found, particularly near Northford, no other calcareous rocks are found in the state. The absence of limestone rock over most of the state has contributed largely to the acidity that is characteristic of most of our soils.

Central Connecticut, and a small area in the Pomperaug Valley (Area IV), have had an entirely different history. At a period millions of years later than when the Stockbridge limestone was formed, and when evolution had proceeded as high as the gigantic reptile forms of the Triassic Age, certain changes in the earth's surface brought this region under water and deposition of sandstone material on the bottom of this body of water began to take place. Climatic conditions and the chemical nature of the water was such as to give a reddish color to the cementing material that developed about these sand grains. The latter were usually composed of small and but slightly weathered fragments of the crystalline rocks of the rugged uplands of eastern and western Connecticut, from which they were washed by torrential streams.

During the same period great sheets of molten rock welled up from far below the surface and either spread out over the surface, with additional deposits of sandstone laid down above it later, or forced itself horizontally from a central fissure between the strata of rock already formed. This lava cooled to form a dark-colored, firm-textured, minutely crystalline rock commonly known as "trap." Great "faults" occurred in the earth's surface, so that the truncated edges of these formations are now exposed as nearly perpendicular cliffs, almost invariably facing in a westerly direction in this state. The chief areas of rock of this type are shown in black in Figure 59.

The Effect of Glaciation

At a period estimated as between 15,000 and 30,000 years ago, the great ice age was in progress. The effects brought about by the advance and retreat of that great sheet of ice must be realized if we are to understand many important differences to be found in the soils described in this bulletin.

That great mass, thick enough to drown the summit of Mount Washington in its icy depths, flowed like so much molasses, yet infinitely slower, down across the northern part of our continent until a climate was reached sufficiently warm to melt it back as fast or faster than it oozed gradually southward. The farthest extent of the glacier in our section of the country was just south of Long Island. Thus the entire area of Connecticut was covered with ice.

In its advance, the glacier scraped over and scooped out the original soil that had probably covered the surface previously, and mixed it with rocks and rock fragments which it dug or snatched from the jagged edges of the irregular slopes. Much of this material was deposited as a thin mantle of "till" from several inches to a few feet in depth, overlying the fresh and unweathered surface of the resistant rock masses beneath. Occasionally the loose material being dragged along under the ice accumulated to considerable thickness, and piled up to such an extent that the ice

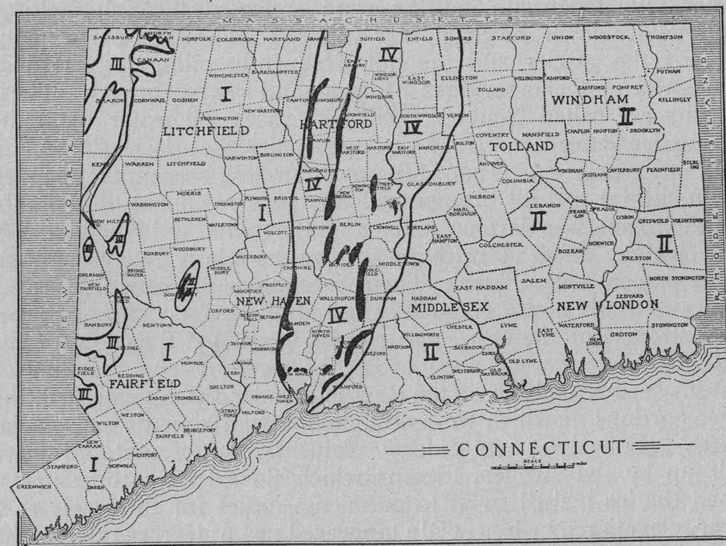


FIGURE 59. Chief physiographic and geologic regions of Connecticut. I. Western Highland of schists and gneiss rocks; II. Eastern Highland of gneiss and schist rocks; III. Western Valleys of limestone rock; IV. Central Lowland of triassic sandstone and shale rocks; black areas—"trap rock" ridges within Central Lowland.

rode over and around it, leaving long, narrow and smoothly convex ridges of material, usually a mile or so in length and about a quarter of a mile wide, rising to a height of from 75 to 200 feet above the surrounding surface. These ridges are called "drumlins." Many occur in the state, particularly in the western portion, as in the towns of Goshen, Litchfield and Bethlehem, and in northeastern Connecticut with best development in Woodstock and Pomfret.

In most cases the greater portion of the material thus spread upon the surface has been derived from rock formations either directly underlying or occurring within a mile or so to the northward. Frequently the influence of a single small outcrop of a peculiarly colored rock can be clearly traced.

The ice sheet at its southermost limit deposited ridges of loose, coarse material highly mixed with boulders, called "terminal moraines." These are not found in Connecticut but at intervals in the melting of the glacier the ice front may have remained nearly stationary for certain periods of time. Thus there were deposited locally, deep and irregular deposits of coarse and comparatively loose morainic material.

As the ice melted, its surface was gradually lowered until the higher hills emerged, and the water released through melting, raced wildly down the temporary valleys thus formed between the edge of the glacier and the hill, frequently piling up irregular hummocks and short ridges of sand and coarse gravel. These deposits are called "kames." In such cases the water from the melting ice flowed for some distance under the glacier, dropping sand and coarse gravel along its more or less serpentine channel. When the ice had all disappeared, the former course of the sub-glacial-stream was left as a long and narrow and winding low ridge, usually rising 20 or 30 feet above the relatively level ground of the present valley floor. These formations are called "eskers." Kames and eskers are frequently found along the valleys of most small streams of the state, particularly those that flow toward the south.

With further melting of the ice, the broader valleys emerged, the lower portions of which were occupied by ice remnants and glacial debris. Extensive, nearly level plains of sandy material were built up by the swollen streams which flowed over these areas. When the ice melted so as to permit an outlet for the water at a lesser elevation, such a plain appeared as a terrace above the general level of the new stream flow. In many cases a series of successively lower terraces were thus formed until the entire valley was cleared of ice. This is the most logical explanation for the extensive areas of sandy soils, containing no boulders or large stones, which occur in the Connecticut Valley north of Middletown, and in smaller belts elsewhere along most of the larger streams of the state.

In some cases, the valley was dammed by the ice-deposited material after the glacier had melted from most of the low-lying lands in the immediate vicinity. In the quiet waters of the lake thus formed the fine silt and clay being washed into it from the melting glacier to the north was gradually deposited. In the summer coarser silt and very fine sand settled out on the bottom of the lake. In the winter, little additional coarser material was supplied because of decreased melting of glacial ice. The fine clay particles which require a long time to settle were then deposited. Thus the clay formations of these glacial lake bottoms show a

"laminated" effect of alternate layers of clay and silt, which record the procession of years during that period. Such clay deposits occur in the Connecticut Valley north of Rocky Hill and in the Mattabesset and Quinnipiac valleys.

When all the ice had melted from the headwaters of our streams, they subsided to their present size. Since then, their occasional floods have deposited some alluvial material on the areas commonly known as "bottomland," especially along the Connecticut River, where the width of such deposits sometimes exceeds half a mile. This recent alluvial material forms soils which are still being periodically changed by new flood deposits. Much fresh sand and silt was added to the Connecticut bottomlands in the great flood of 1927.

Climate

Given sufficient time, the effects of climate on soil formation are such as to completely blot out the differences in kind of rock from which the soils were originally formed. Thus in regions where the soil has been undisturbed for vast periods of time, and where very little erosion and consequent exposure of fresh material from below has taken place, as in many areas in the southern and western parts of the United States, the soil is practically the same, whether originally derived from granite, sandstone or limestone.

Different combinations of rainfall and temperature have thus produced major differences in soils in various parts of the world. In southern New England, regardless of the type of rock or the mode of deposition of the material, all the soils possess certain points of similarity which are distinct from the soils of northern New England, the South, the Middle West, the Great Plains and the arid regions of the Southwest. The soils of Connecticut lie at the border of a Climatic Soil Region and show gradations from the general soil characteristics of the soils of the Middle Atlantic States and the soils of northern New England and Southeastern Canada.

Since the soils of Connecticut are derived from material deposited on the surface by glacial action in geologically very recent time, and the rock material is for the most part rather resistant to the soil-forming processes brought about by our particular type of climate, the climatic effects are not as pronounced as might be otherwise expected.

Drainage

Differences in the rapidity with which percolating waters pass down through the soil, due to the presence or absence of heavier or more clayey substratum, have caused the soils to show corresponding variations in their weathered horizons. A periodical or permanent waterlogging of the soil reveals evidences of this condition in the soil itself, such as mottled coloration of the subsoil (streaked with rusty, reddish yellow and gray), and the accumulation of more organic matter in the surface soil.

Erosion

Soils on exposed or very steep slopes have been modified by the washing away of the accumulations of organic matter on the surface and the removal of clay, silt and fine sand, leaving the soil depleted in organic matter or excessively stony, gravelly or sandy. While the region was forested, erosion had little effect except on very steep slopes, but since the land was cleared, the soil is frequently much affected.

Clearing and Cultivation

Immediately after the soil is cleared, rapid decomposition of the organic accumulations of the original forest floor begins to take place. This process is often hastened by burning, and goes on more rapidly when the soil is put under the plow, exposing a greater surface to the air and quickening the activities of the micro-organisms of the soil. Erosion is often permitted to take place. Crops are removed. Manure, fertilizer, or lime is added to the soil. The different soil horizons that occur within a few inches of the surface are mixed together. A soil that has once been cultivated or even only cleared and pastured for a few years, is a recognizably different soil for at least a century after it has reverted to woodland, from adjacent areas which have always been in forest.

Connecticut Soils as Compared with other Soils of the United States

As has already been mentioned, climate is the most important determining factor in the broad differences in soil which occur in different regions.

To the north of us, beginning to be fully developed in the higher areas of Litchfield County, lies a region of soils developed under conditions of long cold winters, heavy snowfall, and short, mild summers with abundant rainfall. The soils in their virgin state show a strikingly characteristic profile. (See Figure 60.) Beneath about three or four inches of dark brown, slowly decomposing forest humus there are about two or three inches of a peculiar light gray sandy material (A horizon). Directly under this lie about two inches of dark coffee-brown, firm and compact mineral soil, becoming reddish-yellow-brown and more sandy in the several inches immediately below it (B horizon). The soils of this region possessing the gray layer directly under the leaf

mold, are called "podzol" soils by soil scientists and are classed by the United States Bureau of Soils as the "Canadian Family" of soils.

Southern New England and the region south to Washington, D. C., and westward to the prairies, have soils developed under the action of more moderate winters and warmer summers, with abundant rainfall well distributed through the year. The typical virgin soil (see Figure 60) has a thin, well decomposed layer of

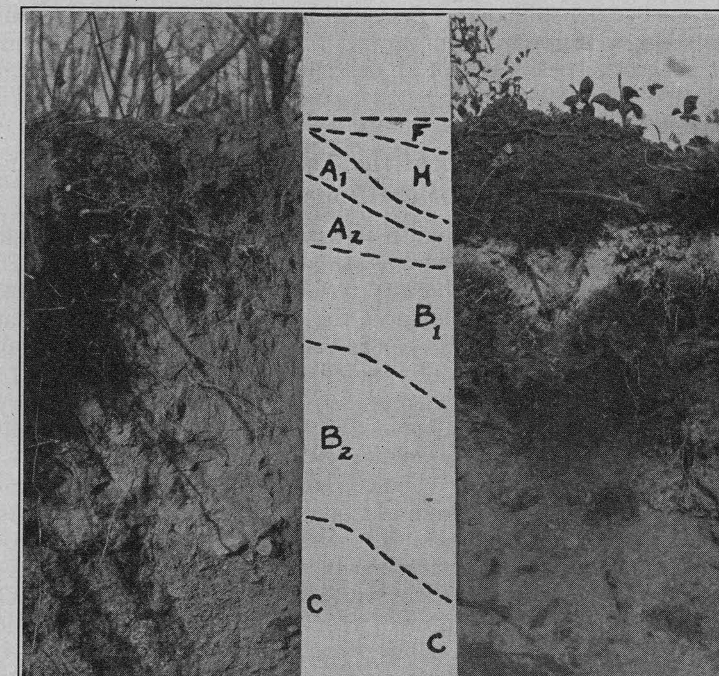


FIGURE 60. Typical non-podsolized or brown forest soil profile of Connecticut (left) and well podsolized forest soil profile of White Mountain region in New Hampshire.

leaf mold resting upon five or six inches of brown mellow loam. Under this the subsoil (B horizon) is somewhat heavier in texture, yellow brown to reddish-yellow brown in color and extending to the depth of 24 to 36 inches from the surface. Below this the substratum (C horizon) is usually of a grayish or grayish-brown color and coarser in texture than the subsoil.

Most Connecticut soils belong in this general group, which is termed the region of "brown forest soils" and classed under the "Jerseyan Family" by the United States Bureau of Soils.

However, there is an evident gradation toward the "Podzol Soil" character in many areas, particularly in northern Litchfield County. Besides this, the resistant character of the rock material and the relatively short time since glaciation have given the soils of Connecticut a somewhat different character than is typical of the climatic soil group.

In the South we have red and yellow soils, in the eastern prairies black soils without lime hardpan, in the western prairies black soils with lime hardpan, in the great plains "chestnut-colored" soils, and in the arid regions the desert gray and brown soils. All these soils are strikingly different from any of the soils of Connecticut, but their characteristics need not be described here.

General Description of the Topographic Features of the State

Connecticut is usually divided into three distinct physiographic regions. A central belt, extending north and south, about 20 miles wide at the Massachusetts border, and narrowing to five miles at New Haven, is known as the "Central Lowland." That part of the state west of this belt is called the Western Highland, while the area east of it is designated the Eastern Highland. In northwestern Litchfield County and in the vicinities of Danbury and New Milford an area should also be recognized which might be called the "Limestone Valleys."

The Central Lowland is characterized by a general low elevation, ranging from an average of about 50 feet at New Haven to about 200 feet at the Massachusetts border. Narrow belts of pronounced trap-rock ridges, extending in a general north-south direction, with sharp cliffs on their western faces and gentler slopes toward the east, rise to heights of from two to 400 feet above the adjacent lowland.

There are three general areas in the Central Lowland where extensive stretches of level or nearly level plains are to be found. The largest of these is in the Connecticut River Valley north and east of Hartford, in the Farmington Valley between Plainville and Southwick, Mass., and in the Quinnipiac Valley between New Haven and Meriden. Elsewhere the country is rolling to moderately hilly.

The Western Highland rises abruptly from the western edge of the Central Lowland to about 200 feet just west of New Haven and about 800 feet at the Massachusetts line. Toward the northwest there is a general rise to more than 2,000 feet at the northwestern corner of the state.

There is a considerable local range in elevation, and the greater portion of the region is hilly to mountainous in relief. Exceptions to this are extensive areas where the uplands flatten out into long ridges with smooth outline and more gentle slopes. These ridges are of a uniform character, with their longer axes about three-quarters to one and one-half miles long and from one-quarter to three quarters of a mile wide. These have been previously described as drumlins. The most extensive development of this type of topography is in central Litchfield County.

The Limestone Valleys, lying within the Western Highland region, are from 200 to 1,000 feet lower in elevation. This is due to the more easily weathered type of rock. The topography is rolling to moderately hilly, in sharp contrast to the adjacent mountainous slopes.

The Eastern Highland rises abruptly from the eastern edge of the Central Lowland. The elevations are in general somewhat lower than in the Western Highland, ranging up to about 1,200 feet. Mountainous topography is only local in occurrence, and for the most part the surface is hilly, with a marked irregularity of relief. Since the hills are smaller than in northwestern Connecticut, there are many more of them in a given area than in northwestern Connecticut.

The drumlin type of topography occurs to a more limited extent in the Eastern Highland. Hills of this sort are numerous only in the vicinity of Woodstock, Pomfret and Lebanon. Isolated drumlins may be found elsewhere, but they make up a small proportion of the total area.

In the Eastern Highland region many of the valleys are partially or completely occupied by gravelly mound-like knolls of the "kame" type, with occasional narrow serpentine elevations called "eskers." The best development of such topography is in the Natchaug and Quinnebaug valleys. It occurs in the Western Highland in local areas only.

In both the Eastern and Western Highlands the larger streams may have level, sandy terraces at intervals along their courses. Flood plains are narrow and of small importance along the smaller streams of the highlands, and the only flood plains of any considerable size are those along the Connecticut River, in the portion of its course that lies in the Central Lowland.

Small inland swamps and bogs of from 10 to 500 acres in size occur in almost every town. Their total area amounts to about three per cent of the state.

Along the shore of Long Island Sound many tidal marshes are developed. As fingers these may extend two or more miles inland, and they are sometimes 1,000 or more acres in size. Frequently the tidal swamp is separated from the sea by narrow belts of sand thrown up by the waves and blown inland by the wind. The area of such formations is insignificant, being occupied almost entirely by shore cottages.

Chief Characteristics and Geographical Distribution of the Important Soils of Connecticut

In order to obtain accurate information as to nature of local soil differences, and to study the distribution of crops, pastures and forest on the various soils, careful field surveys have been conducted on areas in the state represented in Figure 61. Maps were prepared on the scale that one inch equals one-half mile, which permitted the correct representation of all areas of soil larger than about two acres. However, since many fields contain "spots" of noticeably different soil that are only a few square rods in extent, absolute accuracy in soil mapping in a region of such great local diversity could never be attained without exorbitant cost in the preparation and publication of maps of a scale of such size.

Until financial provisions have been made for the complete survey of the state in reasonably accurate detail, the maps of the areas already covered will be kept on file for the reference of interested persons, but their publication will not be attempted.

However, from the information obtained in the course of these surveys, supplemented by extensive reconnaissance over the entire state and by thorough study of existing maps showing the topography, geology and forests, we have prepared an Outline Soil Map, which accompanies this bulletin.

This map is in no sense an attempt to show the exact local variation in soils. It is designed to represent the major areas of the main soil types of the state. The state is divided into areas designated as soil groups which are named from the characteristic soil that may be found within the area represented on the map. Many other soil types besides those thus named are known to occur, but these are ones that are naturally associated or closely related in their more important properties to the types named as the soil group.

In the key to the soil types of the state presented in another section of this bulletin, the soil group on which these various types may be expected to occur is indicated by the appropriate letter symbol.

Gloucester fine sandy loam group. (Map symbol G.) These soils are developed on more or less hilly topography. Boulders and angular rock fragments are always present, but not sufficiently numerous to prevent the improvement of 30 per cent or more of the total area. They are light-textured, medium brown surface soils, with light yellow-brown subsoils developed from moderately deep, stony, coarse and uncompacted glacial till of predominantly grayish color.

As the map indicates, they include the soils of most of the Eastern Highland, and of the southern and western portion of the Western Highland. Rock outcrop frequently occurs. Boulders

are frequent, although the more stony areas are assigned to the Stony Soil Group. Cultivated fields were formerly much more stony, but have been partially cleared of stone to be utilized as fences or road material. The rock material is predominantly gray in color, due to the high percentage of quartz and light-colored feldspars.

Underdrainage is rapid because of the open, porous character of the underlying material. Surface drainage is excellent, due to the irregularly hilly topography. The surface and subsoil are of fine sandy loam, or more rarely, a light loam texture, giving good mechanical condition.

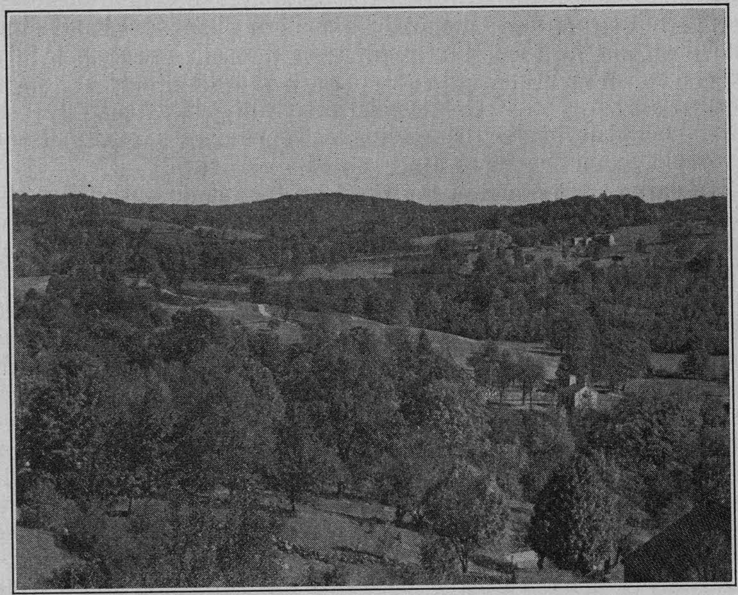


FIGURE 61. Typical landscape of the Western Highland, with Charlton soils on the hills in the background, Hinckley soils on the low gravelly knolls in the middle distance, and irregular slopes with Gloucester soils in the foreground.

When not too stony for easy cultivation, good yields of corn, potatoes and vegetable crops are obtained. Grass hay is the chief crop, although yields are light and of poor quality because of the leachy character of the soil. Fields are of small size, and difficult to operate on account of frequent large boulders and the irregular surface. The wooded portion and much of the pastured area of the farms are usually quite stony.

Charlton loam group. (Map symbol C.) Such soils occur on the more smoothly rolling hills of the Eastern and Western

Highlands. Large boulders and rock fragments of various size may be found, but are usually less abundant than in the Gloucester fine sandy loam group. The surface soils are grayish-brown loams and fine sandy loams, with yellowish-brown, yellowish-olive or light brown subsoils of slightly heavier texture, developed over deep, very compact glacial till ("boulder clay" or "hard-pan") of yellowish-olive, grayish-olive, or light brown color, containing from five to fifteen per cent of actual clay in most cases. The presence of this sort of substratum within about two feet of the surface has a marked effect in decreasing the rapidity of under-drainage and the retentiveness of the soil for moisture and soluble plant nutrients. Reasonably favorable topography and degree of stoniness permit larger fields upon which modern tillage and harvesting machinery can be used. In many cases the soils are slow to dry out and warm up in the spring and are regarded as "late" for some market garden crops. Commercial orcharding is extensively followed, but dairying is the leading enterprise, as a result of the favorable conditions for grass hay and silage corn.

The largest areas are in the Western Highland, although commonly occurring in the vicinity of Woodstock, Pomfret and Lebanon, as well as locally in several other eastern Connecticut towns.

Wethersfield loam group. (Map symbol W.) Over the hilly portion of the central lowland of Connecticut, the soils are closely related to the reddish-colored sandstones and shales which here form the bedrock material. Slabs and chips of this rock are common in the soil, but large boulders are of infrequent occurrence. A reddish cast is commonly observed in the brown color of the surface soil. The subsoil is reddish yellow-brown or red-brown, over a thick and usually compact substratum of sandy loam or sandy clay, which contains much decomposing red sandstone and shale material.

The topography is usually favorable for cultivation and a wide range of crops is commercially grown. Market gardening, dairying and orcharding are equally successful, while there is some use of these soils for tobacco in the Hartford County tobacco district.

Dover fine sandy loam group. (Map symbol D.) In the limestone areas of northwestern and western Litchfield County and in northwestern Fairfield County on the rolling hills overlying such formation, a sufficient amount of lime exists in the parent material to form soils that are noticeably less acid than is natural for other soils of the state.

The surface soils are of a medium brown color, with yellow-brown subsoils over a rather sandy substratum containing noticeable amounts of disintegrating white marble fragments. There are usually some boulders of gneiss and schist rocks, and the areas also include many soils of the general type described as Charlton fine sandy loam. Exposed limestone ledges occasionally prove an obstacle to cultivation, but on the whole the soil is of excellent character for hay and corn, vegetable crops, potatoes and grazing.

Hollis loam group. (Map symbol I.) These soils occur only in the towns of Woodbridge, Orange and Milford, where they are closely associated with the underlying bedrock of phyllite and chlorite-schist. The topography is gently to strongly rolling. Boulders are infrequent, although the soils contain many "chips" of shale and slate fragments of a dark bluish or greenish-gray color. The surface soils are dark grayish-brown, with yellowish-olive subsoils over glacial till and weathered bedrock composed chiefly of a mass of dark gray shale and slate fragments. The soils are heavier in texture than most other upland soils of the state, heavy loams and silt loams being the rule. They are well adapted to grazing, hay and corn, although usually heavy lime and fertilizer applications are required.

Enfield very fine sandy loam group. (Map symbol E.) In certain towns of Hartford County, especially in Enfield, East Windsor, South Windsor and East Hartford, there are low, rolling hills of a soil of exceptionally fine sandy texture. The material forming this soil is believed to have been deposited by wind action during a period at the close of the ice age, laid down as a layer from two to five feet thick of very fine sand and silt over the older surface, which was either compact glacial till or water-deposited sand and gravel. From such deposits a soil has been formed that is entirely free from coarse sand, gravel, or stone, and that contains an unusual proportion of very fine sand. The surface soil is light brown in color, while the subsoil is grayish-yellow-brown. There is a complete absence of stone, gravel and coarse sand in both surface and subsoil, although the underlying substratum may be quite stony or gravelly. Such a soil has an almost ideal physical condition, being quite absorbent of moisture, easy to cultivate, and with adequate fertilization high yields of crops of excellent quality are obtained in years of normal rainfall. A very high percentage of the soils is in cultivation. Tobacco is especially favored. Good results are obtained with both vegetable crops and general field crops. Exceptionally good potato fields are found on these soils. The humus content is somewhat lower than for most other soils of the region.

Manchester sandy loam group. (Map symbol N.) These soils occur in the Central Lowland division of the state with considerable areas in many towns. They are most often associated with the smaller valleys, but commonly occur on belts of strongly rolling to irregularly hilly relief, which follow the same general topographic level for many miles as fringes around the main drainage basins of the Connecticut, Farmington and Quinnipiac rivers.

The typical condition is a moderately gravelly sandy loam surface of dark brown color, with reddish yellow-brown subsoil, over coarsely stratified sand and gravel of light reddish-brown color, composed chiefly of red sandstone and shale material. When not too steep or gravelly, the Manchester soils are well suited to tobacco, early vegetable crops and potatoes. Corn does fairly well when heavily fertilized. Grass hay and pasture sods are commonly thin as compared to the less leachy "Wethersfield" soils of the region.

Hinckley gravelly sandy loam group. (Map symbol H.) These soils are very common in both the Eastern and Western Highlands, but find their most extensive development in the Quinnebaug and Natchaug valleys. They occur in narrow belts or isolated patches at varying heights above drainage levels in practically every sizable valley in the highlands. The topography is frequently quite irregular but as a rule they occur along the same general level in any particular valley. No large boulders occur, but rounded "cobbles" of considerable size are common.

The surface soil is brown in color, with a yellow-brown sandy and gravelly subsoil, over a coarsely stratified sand and gravel substratum composed chiefly of igneous and metamorphic rocks.

The texture of the soil is quite variable and a single small field may include a half dozen different soil classes. Normally the more gravelly and sandy soils occur on the knolls, while more loamy soils of darker color are to be found on the lower slopes and depressions.

Where the land surface is not too steep and the fields include only small patches of the excessively gravelly or sandy types, these soils are well suited to early crops. Field corn and grass hay are severely injured by drouths and alfalfa is the most promising hay crop. Pasture herbage is thin, and the soil is too leachy in character to give hope of satisfactory top-dressing results.

Merrimac coarse sand group. (Map symbol Z.) Such soils occur chiefly on the broad flat terrace lands in Windsor Locks, East Granby, Granby, Windsor, Suffield, Enfield, Wallingford, North Haven, North Canaan and Canaan, with a few smaller areas in other parts of the state. A medium to dark brown surface soil, of coarse sandy texture, with a yellow-brown coarse textured subsoil is formed over a substratum of stratified sand and fine gravel of light grayish-brown color.

The excessively sandy character of such soils makes moisture a serious limiting factor in dry seasons. In wet seasons soluble nutrients are leached out so rapidly that it is difficult to furnish the crop with adequate amounts of fertilizer. Tobacco under

shade is a successful crop in the Hartford County areas on the more favorable soils, while much of the land is overgrown with scrub oak, gray birch and pitch pine.

Merrimac sandy loam group. (Map symbol M.) These types occur on the level terrace lands of the Farmington and Connecticut valleys in Hartford County. They have medium brown surface soils of moderately sandy texture, with yellow-brown, slightly heavier subsoils developed over a well stratified sand and gravel substratum of grayish brown color composed chiefly of granitic material. The texture is highly favorable for the production of cigar leaf tobacco of excellent quality with the heavy fertilization usually practiced in this state. Early vegetables do well. Potatoes may suffer severely from dry seasons. Corn makes large yields, particularly on land with an accumulation of fertility from previous tobacco fertilization. Grass hay crops are short-lived, due to the sandiness of the soil. Alfalfa is a promising forage crop. The topography and character of the soil are less favorable for orchard fruits than on the upland soils of the state.

A high percentage of these soils is in cultivation.

Merrimac fine sandy loam. (Map symbol L.) These soils occur as terraces in the valleys of most of the important streams of the Eastern and Western Highlands, and as broader level areas along the borders of Long Island Sound in many of the shore towns. The surface soil is medium brown in color, of fine sandy loam and loam texture, with yellow-brown gravelly loam subsoil over a stratified gravel and coarse sand substratum of grayish brown color. They are favored for market gardening, trucking and potato growing, while the soil is sufficiently loamy to permit the growing of most general farm crops. Tobacco is the common crop in Hartford and Litchfield counties. Grass hay is less successful than on the upland soils. A considerable portion of these areas is occupied by cities, villages and shore resorts.

Hartford sandy loam group. (Map symbol R.) These soils occur as terraces along the smaller streams of the central lowland, adjacent to upland soils of the Wethersfield loam group. They are most extensively developed in New Haven County.

The surface soils are usually slightly gravelly, of dark reddish-brown color, with reddish-brown or reddish-yellow subsoils formed over well-stratified coarse sand and gravel composed chiefly of red sandstone and shale material. Under average conditions the Hartford soils are excellent for market-gardening, since they combine the qualities of "earliness," good drainage, and favorable topography, while a reasonably good moisture-holding capacity is favored by a somewhat higher humus and clay content than is usually found in sandy loam soils. Tobacco is grown over most of the areas of these soils that occur in the tobacco district.

Suffield clay loam group. (Map symbol F.) These soils are formed from deposits of clay laid down at the close of the ice age in certain areas in Hartford, Middlesex and New London Counties, chiefly in Suffield, Enfield, East Windsor, Windsor, Hartford, Berlin, Middletown, and North Haven. (The clays in the last three towns are of a reddish-chocolate, while the more northern deposits are of a drab color, with a corresponding difference in the soils derived from them.) They are light grayish-brown or light reddish-brown surface soils of silt loam or clay loam texture, with light grayish-brown, light olive-drab, or reddish-brown subsoils, developed over laminated clay of drab or reddish-chocolate color. The soils are entirely free from stony gravel or coarse sand.

The topography is level except along ravines where the streams have eroded through the clay beds. Drainage is often poor, except on the eroded slopes. They are difficult to till as compared to other soils of the state, and are most extensively used for hay and pasture. Certain areas where the texture of the surface soil is a very fine sandy loam are occasionally used for tobacco in the Hartford County section, but the heavier Suffield soils produce crops of poorer quality than the sandier soils of the same region.

Podunk silt loam group. (Map symbol A.) The most extensive area of these alluvial soils is on the flood plain of the Connecticut River, popularly known as the "meadows." A few other streams, notably the Farmington River, have flood plains of important extent, while many brooks and small rivers have narrow strips of "bottom-land" at intervals along their course. The surface soils are of a dark grayish-brown, gray-black or dark reddish-brown color, and of texture ranging from fine sand to silt loam. The subsoil is almost identical to the surface soil, usually becoming of a lighter gray somewhat mottled color with increasing depth. A deep substratum of light gray sand is frequently encountered.

The chief value of these soils is in the production of hay crops for long periods with little or no fertilizer treatment. More than 75 per cent of the Connecticut River meadows is in hay, chiefly of native grasses. The narrower bottom-lands of the smaller streams are generally used as pasture, with small areas in hay or corn. The higher-lying, least frequently flooded areas of the Connecticut and Farmington river bottoms are occasionally used for tobacco, corn and vegetable crops.

Whitman loam group. (Not represented on the Outline Map.) In practically all parts of the state there are many small areas of poorly drained upland soils, which occur in land depressions or on slopes that are kept water-logged through seepage. These scattered "spots" of soil, rarely more than a few rods wide, in the aggregate represent nearly one per cent of the total area of the state. Since they never group themselves in large blocks, no attempt has been made to represent the Whitman soils on the Outline Map. The surface soils are very dark grayish-brown or gray-black in color, with subsoils showing noticeable mottlings of grayish-olive and reddish yellow-brown, as a result of poor drainage conditions. The substratum is usually an olive-gray colored coarse sandy clay in heavy sandy loam containing many rock fragments.

The Whitman soils always contain numerous boulders, unless they have been removed in the clearing of fields that are composed chiefly of better-drained soils. Patches of Whitman soils in such fields can be made quite productive for grass hay and corn if they are artificially drained. Larger Whitman areas have usually been relegated to pasture and woodland, the latter being composed of a strikingly large percentage of red maple.

Muck group. (Map symbol S.) Many land depressions, which were shallow ponds and small lakes for a considerable time after the close of the glacial period, have now become filled. Light gray fine sand and silt accumulated at the bottom of the water, which is now replaced by considerable depths of organic residues of sphagnum moss, sedges and forest debris in varying stages of decomposition.

If the material is thoroughly humified, partially mineralized, and of a nearly black color, it is called "muck." If less completely decomposed, and of a brown color, it is usually called "peat." Since most of such deposits in Connecticut are of the former character, such peat deposits as are known to exist in the state are mapped with the muck.

Both are strongly acid in character, and when drained for cultivation must be heavily limed and manured. Only a few small areas have been thus utilized for agriculture. A couple of generations ago much of the material was used as a soil amendment to add humus to soils that were excessively sandy or that "baked" badly in dry weather. Excessive labor costs have restricted this practice, and it seems probable that most of the muck and peat soils of the state will remain in woodland for some time to come, although they constitute a valuable potential resource for muck crop production, soil amendment and possible use as fuel.

Tidal marsh. (Map symbol K.) All the shore towns have tracts of these tidal marshes. They are never wooded, and are usually covered with sedge and wild grass vegetation. This growth is cut for "salt hay" and is largely used as bedding and packing material. The soil is composed of an admixture of fine silt with the humus remains of the above vegetation. It is impregnated with salt, and contains much lime from shell remains.

The agricultural reclamation of such areas is frequently practicable. It involves the construction of dikes (usually short in proportion to the area reclaimed, since most of the marshes are fringed with natural sea walls in the form of coastal sand dunes), tide-gates, and a few large drainage ditches. The salt is leached out rapidly after permanent drainage of the marsh and most crops could safely be grown within three years. When economic conditions demand their utilization, many of these tidal marshes may prove a valuable agricultural asset, rather than continue to furnish a constant mosquito-control problem, as is now the case. In the meantime areas near population centers are being developed for factory and airport sites.

Holyoke stony loam group. (Map symbol T.) The trap rock ridges which are a conspicuous feature of the landscape in central Connecticut, while showing abrupt cliffs along their western face in most cases, are elsewhere covered to a rather shallow depth by these stony soils. The surface soil is a dark reddish-brown loam containing many angular fragments of trap rock. The subsoil is a reddish yellow-brown, very fine sandy loam, over either bedrock or a substratum of loose trap fragments usually more or less mixed with red sandstone and shale material.

Practically all such soils are in woodland, although a few of the smoother and less stony areas have been cleared for pasture.

Miscellaneous stony soils. (Map symbol X.) For the purposes of the Outline Map, all areas besides the Holyoke with a predominance of soils that are too stony for economic cultivation have been grouped together under this head. However, it is desirable that these be briefly described under several distinct headings, or sub-groups.

Sub-Group X-1. Stony Soils of Light Texture, with Perfect Surface Drainage and Rapid Underdrainage

Soils of this character form the highest percentage of both the Eastern and Western Highlands. They are developed on hilly or mountainous topography. In northern and eastern Litchfield County, northern Tolland County, eastern and southwestern New London County, southern Middlesex County, western New Haven County and northwestern Fairfield County the area is chiefly of this type, while considerable tracts of such land occur in almost every one of the highland towns.

The typical soil is the one described in detail later as the Gloucester Series, of which the Gloucester stony fine sandy loam is the most common type. The surface soil, in its virgin condition in the forest, consists of a thin layer of slowly decomposing leaf mold, resting upon a four or five inch layer of grayish yellow-brown fine sandy loam. When disturbed by the plow, this forms a six or seven inch horizon of medium brown fine sandy loam. The subsoil, to the depth of about thirty inches, is a light yellow-brown fine sandy loam of friable consistency. Below this is to be found a coarse, rather loose and open mass of boulders, smaller rock fragments, sand and a relatively small percentage of silt and clay. The color of this material is predominantly gray. There are many boulders, from 20 to 50 per cent of the surface being occupied by stones more than eight inches in diameter. Small isolated fields have been partially cleared of stone by the herculean labors of the early settlers, who failed to realize that better land was to be found which could be brought under the plow with infinitely less exertion.

Other soils of similar characteristics are the stonier types of the Brookfield, Hinsdale, Maltby, Wilton, Coloma and Plymouth series. There is less than 10 per cent of improved land on such soils. These are located in small uneconomic units. Even when partially cleared of stone, the crop production is low, due to high acidity, general deficiency in available plant food material, excessive leachiness and poor drouth resistance.

From ten to 15 per cent of these soil areas are used for permanent pasture, practically all of which is of low grade. The edible native grasses, chiefly Rhode Island bent and redtop, make slow and irregular growth on account of adverse soil reaction, low fertility and severe dry weather damage, thus rapidly losing ground in competition with moss, cinquefoil, poverty grass, and dewberry vines. Bushy clumps of bayberry, sweetfern, juniper and sumac rapidly encroach on the open spaces. Gray birch or red cedar find excellent conditions for propagation, and unless heavily overgrazed or kept clear at great expense, the land rapidly reverts to these old field conditions, from which it is but a step to complete reversion to forest.

Eighty per cent or more of these soil areas is now occupied with some sort of woodland, much of which is of low grade. The chief reasons for the poor productivity of this land are as follows:

1. Being once cleared for tillage and pasture for considerable periods, the natural conditions of the forest soil have been destroyed. The fibrous organic matter of the original leaf mold has been broken up, and the soil reverting to woodland is in poor physical condition. The readily available food materials in this organic matter were dissipated, and the organic matter remaining in the soil is the residue that decomposes with difficulty.

2. The species predominating in unmanaged recently reverted stands are of undesirable type.

3. Areas have been repeatedly clear cut for firewood. The soil has been compacted through the beating action of rains and the breaking down of the normal crumb structure as a result of the reduced buffering effect of the leaf mold. Rapid decomposition

of organic matter and loss through excessive leaching occurs during the frequently recurring periods when the forest soil lies exposed.

4. Frequent and severe fires have consumed the natural humus conditions of the forest soil, and have destroyed the seeds furnishing reproduction for the best species.

Large areas of valuable forest also occur, when the removal of the virgin stand has been followed by wisely managed tree production, carefully guarded against fire and not subject to clear cutting for firewood as often as trees of from four to six inches in diameter are available. With adequate fire protection, the systematic weeding for firewood of the undesirable forest species, and a state taxation policy that encourages the landowner to permit the better species to grow to maturity, soils of this type will eventually be restored to their true conditions of productivity.

Sub-Group X-2. Stony Soils of Medium Texture, with Good Surface Drainage and Moderately Slow Underdrainage

Such soils constitute a considerable area of the highland regions of the state. They are most extensively developed in the northwestern part.

The typical soil is the Charlton stony loam. The surface soil in its virgin condition in the forest consists of a thin layer of well decomposed leaf mold resting upon a mellow, dark grayish-brown loam from three to four inches thick. Below this is a light grayish-brown fine sandy loam three or four inches in depth. The subsoil, to a depth of about 20 inches from the surface, is a grayish yellow-brown fine sandy loam of rather firm consistency. The substratum is a very compact grayish to yellowish olive-colored mass of sand and irregular rock fragments, with a considerable amount of silt and clay.

Other soils of similar characteristics except for minor color differences and of varied types of parent rock material are the stony types of the Dutchess, Hollis, Taugwank, Bernardston, Paxton, Woodbridge, Haddam and Litchfield series.

The percentage of cultivated land on such soils is also very small (less than 10 per cent), but their superior character for permanent pasture has resulted in an extensive use for this purpose estimated at from 20 to 30 per cent of the total area. Long periods of grazing without any attention to fertility maintenance has usually left such pastures in a low productive condition, except where used as night pasture with heavy barn feeding. There is a sparse growth of red top or Rhode Island Bent, some blue grass and white clover. Moss, cinquefoil, sumac and steeplebush are very prevalent. In northern Litchfield County the shrubby cinquefoil, *potentilla fructosa,* is a common pasture pest.

Pastures on these soils may be greatly improved by topdressing with superphosphate and lime and on more intensively grazed areas should also receive potash and nitrogen in the fertilizer treatment.

From 60 to 70 per cent of the soils of this group are in brush or woodland. More than 20 per cent of this is accounted for as areas previously kept clear for pasture. Recent changes in economic conditions have caused many former pasture fields to be permitted to grow up to brush.

In general, 50 per cent or more of the above soil group is in hardwood forest, usually in small form woodlot tracts. The productive conditions are somewhat better than those previously described for sub-group X-1. The soil has not been as sensitive to poor forest management, and perhaps in general there has not been the repeated clear cutting on the farm woodlot type of holdings as has been practiced on forest areas not in farms.

Sub-Group X-3. Rough Stony Land

This simple designation applies to a considerable area well distributed over the highland regions of the state, where the surface is so rough and broken in topography, or so completely strewn with large boulders that the topography and stoniness mask the effects of variations in the soil itself.

Practically all such land is in forest, and must remain so, except where the recreational and scenic possibilities warrant the clearing of small blocks for parks or country estates. Except where bedrock outcrops or lies within two feet of the surface, the fine earth among the loose stone is sufficiently deep and otherwise suitable for the maintenance of good natural stands of mixed hardwoods in the southern part of the state, and mixed hardwoods, hemlock and white pine in the northern part of the state. Where the areas have been severely burned, or clear cut repeatedly, the humus conditions of the soil have become unfavorable, resulting in poor growth and a predominance of practically worthless "weed" trees, such as gray birch, scrub oak and pitch pine.

A Key to the Soil Types of Connecticut

(The letter following the name of the soil type indicates the soil group to which it is assigned on the Outline Soil Map.)

a 1. Upland soils, derived from glacial till (unstratified rock debris).
b 1. Well drained.
c 1. With loose, coarse and very porous substratum (containing little or no clay) at from 28 to 36-inch depth.
d 1. Derived from morainal deposits; usually with irregular topography.
e 1. Rock material: mixed granite gneiss and schist. Light brown surface soil; brownish-yellow subsoil; grayish-yellow and very stony substratum, with many large, irregularly rounded boulders; distribution—in small, isolated areas, chiefly in extreme southeast portion of state.
f 1. Moderately stony—**Plymouth loamy fine sand** (G).
Plymouth fine sandy loam (G).
f 2. Very stony—**Plymouth stony fine sand** (X).
Plymouth stony fine sandy loam (X).
d 2. Derived from glacial till overlying practically unweathered bedrock, usually at 10 to 25 feet depth; hilly to mountainous topography.
e 1. Rock material: grayish-colored granite-gneiss. Medium brown surface soil; yellow brown subsoil; brownish-gray to gray, coarse and stony substratum; distribution—very extensive over both Eastern and Western Highlands.
f 1. Moderately stony—**Gloucester fine sandy loam** (G).
Gloucester loam (G).
f 2. Very stony—**Gloucester stony fine sandy loam** (X).
Gloucester stony loam (X).
f 3. Very stony; similar to Gloucester, but showing noticeable grayness in the mineral soil underlying the forest humus when observed under woodland conditions (podsolized).
—**Hermon stony fine sandy loam.**
d 3. Derived from glacial till overlying partially weathered bedrock at variable depth, usually less than 10 feet, topography hilly to mountainous.
e 1. Rock material: light gray quartzite or quartz-schist. Light brown surface soil; light brownish-yellow subsoil; light gray substratum with much fine sand mixed with broken quartzite or quartz-schist rock fragments; distribution—chiefly in extreme eastern portion of state, in Putnam, Killingly and Plainfield.
f 1. Moderately stony—**Coloma loamy fine sand** (G).
Coloma fine sandy loam (G).
f 2. Very stony—**Coloma stony loamy fine sand** (X).
Coloma stony fine sandy loam (X).
e 2. Rock material; mica schist. Brown surface soil, with slight reddish coat; reddish yellow-brown subsoil; light yellowish brown substratum consisting chiefly of disintegrating mica-schist; distribution—extensive in many parts of Eastern and Western Highlands especially on stony, non-agricultural areas.

f 1. Moderately stony—**Brookfield fine sandy loam** (G).
Brookfield loam (G).
f 2. Very stony—**Brookfield stony fine sandy loam** (X).
Brookfield stony loam (X).
e 3. Rock material: dark gray granite gneiss, usually with large crystals; medium brown surface soils; yellow-brown subsoil with slight reddish cast; light yellowish-brown to grayish-brown substratum with many slightly discolored, sharply angular rock fragments; not micaceous; distribution — extensive in Eastern Highland, especially west of Connecticut River.
f 1. Moderately stony—**Hinsdale fine sandy loam** (G).
Hinsdale loam (G).
f 2. Very stony—**Hinsdale stony fine sandy loam** (X).
Hinsdale stony loam (X).
e 4. Rock material: dioritic schist with high percentage of hornblende. Dark brown surface soil with slight reddish cast; reddish yellow-brown subsoil; grayish-brown substratum with many nearly black rock fragments; only slightly micaceous; distribution—a few important areas in southern Fairfield County, chiefly in Wilton, Weston and Westport, local in Brookfield and New Milford.
f 1. Slightly to moderately stony—
Wilton fine sandy loam (G).
Wilton loam (G).
f 2. Very stony—**Wilton fine sandy loam** (X).
Wilton stony loam (X).
e 5. Rock material: greenish-gray chlorite schist. Medium to dark brown surface soil; reddish-yellow subsoil, noticeably more sticky when wet than surface soil; light gray to pinkish-gray substratum with much fine sand mixed with disintegrating chlorite rock; distribution—Woodbridge, West Haven and Orange, chiefly on stony, non-agricultural areas.
f 1. Moderately stony—**Maltby fine sandy loam** (I).
Maltby very fine sandy loam (I).
f 2. Very stony—**Maltby stony fine sandy loam** (X).
Maltby stony loam (X).
e 6. Rock material: bluish-gray phyllite or slate, dark grayish-brown surface soil; yellow-brown to olive-drab subsoil; bluish-gray substratum consisting chiefly of a soft mass of disintegrating phyllite or slate; distribution—Bethany, Woodbridge, Orange, Milford, and Stratford.
f 1. Slightly to moderately stony—**Hollis loam** (I).
Hollis silt loam (I).
Hollis shaly loam (I).
f 2. Very stony—**Hollis stony loam** (X).
e 7. Rock material: shaly schists. Medium gray-brown surface soil; greenish-yellow to yellowish-olive subsoil; yellowish olive substratum, firm and composed of disintegrating shale fragments; distribution—extreme northwestern part of state in Salisbury and Sharon.
f 1. Slightly to moderately stony—
Dutchess loam (D).
Dutchess silt loam (D).
Dutchess shaly loam (D).

f 2. Very stony—**Dutchess stony loam** (X).

e 8. Rock material: impure limestones and shaly dark olive-brown surface soil. Greenish-yellow subsoil; olive-drab substratum with disintegrating schist and limestone fragments; often somewhat micaceous; distribution—Sharon and New Milford.

f 1. Slightly to moderately stony—
Pittsfield fine sandy loam (D).

f 2. Very stony—**Pittsfield stony fine sandy loam** (X).

e 9. Rock material: principally limestone or marble. Light to medium brown surface soil; yellow to reddish-yellow brown subsoil; light gray to nearly white substratum with disintegrated limestone or marble fragments; distribution—Shawn, upper Housatonic Valley and in vicinity of Danbury.

f 1. Slightly to moderately stony—
Dover fine sandy loam (D).

f 2. Very stony—**Dover stony fine sandy loam** (X).

d 4. Derived from glacial till of variable depth, usually very shallow, overlying practically unweathered bedrock; very rugged topography as a rule; commonly adjacent to steep cliffs without soil covering.

e 1. Rock material; chiefly basaltic or dioritic "trap." Dark chestnut-brown to reddish-brown surface soil; reddish yellow-brown subsoil; grayish to yellowish-brown substratum usually composed chiefly of slightly weathered angular fragments of "trap" rock. Distribution—coincident with the "trap" ridges which rise from the central lowland of Connecticut. The areas are usually of the very stony type.

f 1. Moderately stony—
Holyoke very fine sandy loam (T).
Holyoke loam (T).

f 2. Very stony—**Holyoke stony loam** (T).

e 2. Rock material—massive, coarse, conglomerate sandstone of pinkish-gray color; medium brown surface soil; reddish yellow-brown subsoil; brownish gray coarse gravelly substratum (gravel formed from disintegration of the conglomerate rock); distribution—local occurrence in southern Middletown and northern Durham.

f 1. Moderately stony—**Middletown loam** (W).

f 2. Very stony—**Middletown stony loam** (X).

c 2. With dense, compact glacial till substratum containing a moderate amount of clay (so-called "hardpan").

d 1. Derived from deep glacial till of drumlin or drumloid character; topography well rounded hills of uniform slope; soil and subsoil extend to compact substratum more than 24 inches below surface.

e 1. Rock material: grayish-colored granite gneiss. Grayish-brown surface soil; grayish yellow-brown subsoil; olive-drab substratum, becoming very compact at 28 to 30 inches below surface; distribution—very common occurrence in both Eastern and Western Highlands of the state, particularly in southern portion of Western Highland on the smoother ridge tops.

f 1. Slightly stony—**Woodbridge fine sandy loam** (C).
Woodbridge loam (C).

f 2. Moderately to very stony—
Woodbridge stony fine sandy loam (X).
Woodbridge stony loam (X).

f 3. Moderately to very stony. Similar to Gloucester but showing definite grayness in the mineral soil underlying the forest humus when observed under woodland conditions (podsolized)—
Becket stony loam (X).

e 2. Rock material: mixed granite gneiss and schist. Grayish-brown to dark grayish-brown surface soil; grayish yellow-brown subsoils; yellowish-olive to olive-drab substratum, becoming very compact at 24 to 28 inches below surface; distribution—very common occurrence in Western Highland and particularly in the northern portion of the Eastern Highland, on the more distinctly drumlin type of topography.

f 1. Slightly stony—**Charlton fine sandy loam** (C).
Charlton loam (C).

f 2. Moderately to very stony—
Charlton stony fine sandy loam (X).
Charlton loam (X).

e 3. Rock material: quartz-schist, quartzite or granite gneiss containing much quartz. Dark grayish-brown surface soil; grayish yellow-brown subsoil becoming slightly mottled at 18 to 24 inches; gray to olive-gray substratum of very compact character at 28 to 30 inches below surface; distribution—chiefly in southern Windham County, on the flatter ridge tops.

f 1. Slightly to moderately stony—
Taugwank fine sandy loam (C).
Taugwank loam (C).

f 2. Very stony—**Taugwank stony loam** (X).

e 4. Rock material: dark gray granite gneiss, containing many crystals of biotite and hornblende. Medium brown surface soil; light brown subsoils; light brown to grayish-brown substratum, occasionally with a slight "pinkish" cast, becoming very compact at 28 to 30 inches below surface; distribution—principally confined to that portion of Eastern Highland that lies in Middlesex and New Haven Counties, on smoothly rolling ridges adjacent to rougher areas of soils of *Hinsdale* types.

f 1. Slightly to moderately stony—
Haddam fine sandy loam (C).
Haddam loam (C).

f 2. Very stony—**Haddam stony fine sandy loam** (X).
Haddam stony loam (X).

e 5. Rock material: bluish gray phyllite or slate. Dark olive-brown surface soil; dark olive-drab subsoil; "bluish" olive substratum consisting of a compact mesa of disintegrated chips of phyllite or slate at 24 to 28 inches below surface; distribution—confined to Bethany, Woodbridge, Orange and Milford on drumlin hills adjacent to areas of *Hollis* soils.

f 1. Slightly to moderately stony—
Bernardston loam (I).
Bernardston silt loam (I).

e 6. Rock material: impure limestones and shale. Grayish brown surface soil; yellow-brown to greenish-yellow subsoil; olive-drab substratum, compact at 24 to 30 inches from surface, and containing some limestone fragments; distribution—Sharon and New Milford.

f 1. Slightly to moderately stony—
Lenox fine sandy loam (D).
Lenox loam (D).

f 2. Very stony—**Lenox stony fine sandy loam** (X).
Lenox stony loam (X).

e 7. Rock material: reddish-brown to reddish-gray coarse textured sandstone. Medium-brown surface soil; slightly reddish yellow-brown subsoil; light reddish-brown to reddish-gray substratum consisting of a compact, sandy mass of disintegrating sandstone fragments; distribution—very common on the hilly portion of the central lowland.

f 1. Slightly to moderately stony—
Cheshire sandy loam (W).
Cheshire fine sandy loam (W).
Cheshire loam (W).

f 2. Very stony—**Cheshire stony fine sandy loam** (X).
Cheshire stony loam (X).

e 8. Rock material: brownish-red fine textured sandstone or shale. Reddish-brown surface soil; light reddish-brown subsoil; brownish-red substratum consisting of a very compact mass of disintegrating sandstone and shale fragments; distribution—very common on the hilly portion of the Central Lowland.

f 1. Slightly to moderately stony—
Wethersfield fine sandy loam (W).
Wethersfield loam (W).
Wethersfield clay loam (W).

f 2. Very stony—**Wethersfield stony loam** (X).

d 2. Derived from very deep glacial till of drumlin character; topography—elongated hills of distinctly rounded surface; soil and subsoil extend downward to very compact substratum at less than 24 inches below surface.

e 1. Rock material: schists, gneiss and slates. Olive-brown surface soil; yellowish-olive to olive-drab subsoil; olive-drab substratum of very compact glacial till at from 16 to 20 inches below surface. Good drainage as a result of sloping land surface in spite of slowness of underdrainage; distribution—in many parts of the Eastern and Western Highlands, on the crests of the more perfectly shaped drumlin hills.

f 1. Slightly to moderately stony—
Paxton fine sandy loam (C).
Paxton loam (C).

e 2. Rock material: chiefly of schistose character. Dark grayish-brown surface soil; yellowish-olive subsoils, usually heavier in texture than surface soil; olive-drab to grayish-olive substratum of very compact glacial till at from 18 to 24 inches below surface; drainage slow in early spring, due to moderately level topography and compact substratum at shallow depth; distribution—on the broad, flatter-crested drumlin ridges in central Litchfield County.

f 1. Slightly to moderately stony—
Litchfield fine sandy loam (C).
Litchfield loam (C).

f 2. Very stony—**Litchfield stony loam** (X).

b 2. Imperfectly drained upland soils.

c 1. With temporarily high water table in spring due to excessive seepage from adjacent higher areas; drainage usually good in late summer and early fall.

d 1. Derived from glacial till of relatively shallow depth (less than 15 feet); topography—lower slopes and bench lands; usually at the head or along margins of hillside ravines.

e 1. Rock material: mixed gneiss and schist. Dark grayish-brown surface soil; yellow-brown subsoil, substratum-mottled gray and rusty yellow grading to light gray at lower depths, and of coarse and stony character; distribution—very general in Eastern and Western Highland.

f 1. Moderately stony—**Peru fine sandy loam** (G).
Peru loam (G).

f 2. Very stony—**Peru stony fine sandy loam** (X).
Peru stony loam (X).

d 2. Derived from deep glacial till of compact character containing a considerable amount of clay; topography—level or nearly level portions of broad-crested drumlins.

e 1. Rock material: schist and gneiss, with schist predominant. Very dark brown to gray-black surface soil; olive-drab and moderately compact subsoil; substratum mottled gray and rusty yellow becoming grayish-olive in color at greater depths, very compact; with few stones or boulders, except on surface; distribution—occasional in areas where Charlton and Litchfield soils occupy most of the adjacent area, as in towns of Lebanon, Pomfret, Woodstock and in central Litchfield County.

f 1. Slightly to moderately stony—**Sutton loam** (C).

f 2. Very stony—**Sutton stony loam** (X).

c 2. With high water table during most of the year.

d 1. Derived from glacial till of relatively shallow depth (less than 15 feet); topography—lower slopes, at heads and along hillside ravines, in wider areas along small brooks that do not overflow their banks to form alluvial deposits, and other poorly drained depressions not occupied by deep organic accumulations.

e 1. Rock material: mixed granite gneiss, schist, and other non-calcareous, igneous, or metamorphic rocks. Gray-black surface soil; mottled gray and rusty yellow subsoil; light gray to bluish-gray coarse, stony substratum, occasionally with sandy clay, usually water-logged at all times; distribution—general in all parts of the Eastern and Western Highland.

f 1. Moderately stony—**Whitman fine sandy loam** (G, C).
Whitman loam (G, C).
Whitman sandy clay loam (G, C).

f 2. Very stony—**Whitman stony loam** (X).

e 2. Rock material: mixed schist and limestone. Gray-black to black mucky surface soil; gray or grayish-olive-yellow mottled subsoils; light gray to bluish-gray calcareous substratum of compact character with few stone or boulders; distribution—a few small areas in Sharon; the upper Housatonic Valley, New Milford and Danbury.

f 1. Slightly to moderately stony—**Lyons loam** (D).

e 3. Rock material: reddish-brown sandstones and shales. Very dark brown surface soil, with a slight reddish cast; mottled light-reddish brown and rusty yellow subsoil; grayish red-brown to pinkish-gray substratum, with sandstone or shale fragments; distribution—in central Connecticut adjacent to *Wethersfield* and *Cheshire* types.

f 1. Slightly to moderately stony—
Whitfield loam (W).
Whitfield clay loam (W).

a 2. Valley soils, developed over stratified glacial rock debris (sand, gravel and clay).

b 1. Well drained.

c 1. With loose, coarse, gravelly and sandy substratum at from 24 to 36 inches depth.

d 1. Derived from kames, eskers and similar deltal deposits of irregular topography.

e 1. Rock material: mixed non-calcareous metamorphic rocks (schists and gneiss). Medium brown surface soil; yellow brown subsoil; brownish gray substratum of coarse sand and gravel; distribution—very general in both the Eastern and Western Highlands, where they form irregular, frequently interrupted belts along the lower slopes of the hills that have a mantle of unstratified glacial debris (till)—most extensively developed in the Quinnebaug Valley.

f 1. Not excessively sandy or gravelly—
Hinckley fine sandy loam (H).
Hinckley sandy loam (H).
Hinckley gravelly fine sandy loam (H).

f 2. Excessively sandy or gravelly—
Hinckley gravelly sandy loam (H).
Hinckley loamy sand (H).
Hinckley gravel loam (H).

e 2. Rock material: schists and phyllite slates. Medium brown surface soil; reddish yellow-brown subsoil; light yellowish-brown to olive-drab substratum chiefly composed of rounded chips of slate and schist; distribution—in Woodbridge, Orange and Milford, adjacent to areas of *Hollis* soils.

f 1. Not excessively sandy or gravelly—
Hancock fine sandy loam (H).
Hancock very fine sandy loam (H).
Hancock loam (H).

f 2. Excessively gravelly—**Hancock gravel loam.**

e 3. Rock material: mixed gneiss, schist and limestone or marble. Brown surface soil; yellow-brown or reddish yellow-brown subsoil; gray sand and gravel substratum, frequently partially cemented together with calcareous material below a depth of four or five feet; distribution—in upper Housatonic Valley and in Danbury, adjacent to areas of *Dover* soils.

f 1. Not excessively sandy or gravelly—
Rodman fine sandy loam (H).
Rodman sandy loam (H).

f 2. Excessively sandy or gravelly—
Rodman loamy sand (H).
Rodman gravel loam (H).

e 4. Rock material—brownish-red sandstones and shales. Medium brown surface soil with slight reddish cast; reddish yellow-brown subsoil; brownish-red substratum of sand and gravel; distribution—common occurrence on areas of irregular hummocky topography in central lowland of Connecticut, adjacent to areas of Cheshire and Wethersfield soils.

f 1. Not excessively sandy or gravelly—
Manchester sandy loam (N).
Manchester fine sandy loam (N).
Manchester gravelly fine sandy loam (N).
Manchester loam (N).

f 2. Excessively sandy or gravelly—
Manchester gravel loam (N).
Manchester loamy sand (N).

d 2. Derived from level or nearly level terraces of sand and gravel deposited at the close of the glacial epoch.

e 1. Rock material: mixed schists and gneiss. Medium to dark brown surface soil; yellow-brown or brownish-yellow subsoil; gray to brownish-gray substratum of well-stratified sand or gravel; distribution—most extensive on the wider terrace lands in Hartford County, and as narrower terraces in many valleys in all parts of the state.

f 1. Not excessively sandy—
Merrimac sandy loam (M).
Merrimac fine sandy loam (L).
Merrimac loam (L).
Merrimac gravelly fine sandy loam (L).

f 2. Excessively sandy—
Merrimac loamy fine sand (M).
Merrimac loamy sand (M).
Merrimac coarse sand (Z).

e 2. Rock material: slates and phyllite. Medium brown surface soil; reddish yellow-brown subsoil; olive-drab or bluish-olive substratum with many rounded chips of phyllite or slate; distribution—in Orange and Milford, adjacent to areas of Hollis soils.

f 1. **Fairlea fine sandy loam** (L).
Fairlea very fine sandy loam (L).
Fairlea gravelly very fine sandy loam (L).

e 3. Rock material: shales and shaly schists. Olive-brown surface soil; yellowish-olive subsoil; grayish-olive substratum of sand and gravel, containing many rounded fragments of shale and schist; distribution—upper Housatonic Valley.

f 1. **Sheffield fine sandy loam** (L).
Sheffield loam (L).

e 4. Rock material: mixed schist, gneiss and limestone. Medium brown surface soil; yellow-brown subsoil; grayish sand and gravel substratum containing sufficient limestone material to show effervescence with hydrochloric acid; distribution—a few small areas on terraces of the Housatonic Valley, adjacent to areas of *Dover* soils.

f 1. Not excessively sandy or gravelly—
Palmyra fine sandy loam (L).
Palmyra gravelly fine sandy loam (L).

f 2. Excessively gravelly—**Palmyra gravel loam.**

e 5. Rock material: brownish red sandstones and shales. Dark brown surface soil, with slight reddish cast; reddish yellow-brown subsoil; grayish-red substratum of sand and gravel, chiefly of sandstone and shale material; distribution—narrow terraces along most streams of the central lowland, excepting the Connecticut River terraces, which are chiefly *Merrimac* soils.

f 1. Not excessively sandy or gravelly—
Hartford sandy loam (R).
Hartford fine sandy loam (R).
Hartford loam (R).
Hartford gravelly fine sandy loam (R).

f 2. Excessively gravelly—**Hartford gravel loam** (R).

c 1. With fine or very fine sand substratum at 24 to 36 inches depth.

d 1. Occurring on level terraces, forming the lowest terrace of the Connecticut River, which lies about 60 feet above sea level.

e 1. Rock material: gneiss and schists. Medium grayish-brown surface soil; brownish-yellow subsoil; gray to olive-gray substratum of fine sand, with little or no gravel; distribution—just above the Connecticut River flood plain in the towns of Suffield and Enfield.

f 1. Not excessively sandy or gravelly—
Agawam fine sandy loam (M).
Agawam very fine sandy loam (M).

d 2. Occurring on rolling topography; fine or very fine sand substratum underlain with reddish-colored sand, gravel or stony till at from three and one-half to five feet depth.

e 1. Rock material: finely divided crystalline fragments deposited by ancient wind action as a thin mantle (three to five feet deep) overlying previously deposited stratified and unstratified glacial debris that is chiefly of red sandstone and shale material. Light brown surface soil with no gravel or coarse sand; grayish yellow-brown subsoil; olive gray fine sand or very fine sand substratum, which changes abruptly at three and one-half to five feet depth to coarser sand and gravel or stony glacial till of red brown color; distribution—in Hartford County, chiefly in towns of Enfield, East Windsor, South Windsor, East Hartford and Suffield.

f 1. Not excessively sandy or gravelly—
Enfield fine sandy loam (E).
Enfield very fine sandy loam (E).

d 3. Occurring on level topography; fine or very fine sand substratum underlain with stratified clay and silt at three and one-half to five feet depth.

e 1. Rock material: finely crystalline fragments deposited by ancient wind action as a thin mantle three and one-half to five feet deep overlying previously deposited stratified clay and silt. Light grayish-brown surface soil, free from gravel or coarse sand; grayish yellow-brown to yellowish-olive subsoil; olive-gray and rusty yellow mottled very fine sand substratum which changes abruptly to clay at from three and one-half to five feet depth; distribution—Hartford County, principally in East Windsor and Enfield.

f 1. Not excessively sandy or gravelly—
Melrose fine sandy loam (E).
Melrose very fine sandy loam (E).

d 4. Occurring on level topography or as eroded terrace slopes; heavy silty clay at 20 to 24 inches depth.

e 1. Parent material: stratified clay and silt of olive-drab color, originally deposited on the bed of extinct lakes existing at the close of the glacial epoch. Grayish-drab surface soil; olive-drab subsoil; olive-drab substratum of clay and silt; distribution—Hartford County, chiefly in Hartford, Windsor, Windsor Locks, Suffield, Enfield, East Windsor and South Windsor.

f 1. Not excessively sandy or gravelly—
Suffield very fine sandy loam (F).
Suffield silt loam (F).
Suffield clay loam (F).

e 2. Parent material: red brown stratified clay and silt. Grayish-brown surface soil; yellowish red-brown subsoil; red-brown substratum of clay and silt; distribution—chiefly in Berlin, Middletown and North Haven.

f 1. **Berlin silt loam** (F).
Berlin clay loam (F).

b 2. Imperfectly drained.

c 1. With coarse gravelly and sandy substratum at 24 to 36 inches depth.

d 1. Occurring on level terrace lands.

e 1. Parent material: sand and gravel of granite gneiss and schist rock. Very dark grayish-brown to gray-black surface soil; grayish-yellow subsoil, somewhat mottled (gray and rusty yellow) and partially cemented together as "iron-hardpan" at 20 to 24 inches depth; mottled gray—rusty yellow substratum of sand and gravel, water-logged during most of the year; distribution—occasional poorly drained spots on terraces of *Merrimac* soils.

f 1. **Scarbro sandy loam** (M).
Scarbro loam (L).

e. 2. Parent material: sand and gravel of red-brown sandstone and shale rock. Dark grayish-brown surface soil; reddish-yellow brown subsoil, grading at 15 to 18 inches to mottled reddish-gray and rusty-brown; reddish-gray substratum of sand and gravel, chiefly derived from reddish-colored sandstone and shale rock; water-logged during most of the year; distribution—occasional poorly drained terrace lands adjacent to *Wethersfield* and *Cheshire* soils in the central lowland.

f 1. **Ellington loam** (R).

c 2. With heavy clay substratum at 20 to 24 inches depth.

d 1. Occurring in poorly drained low-lying areas underlain with clay.
e 1. Parent material: stratified clay and silt of olive-drab color. Gray black to dark grayish-brown surface soil, heavy, mottled olive-gray and rust-brown subsoil; slightly mottled olive-drab clay substratum; distribution—occasional poorly drained areas adjacent to *Suffield* soils in Hartford County.
f 1. **Scantic loam** (F).
Scantic clay loam (F).

a 3. Alluvial soils—periodically overflowed by flood waters of existing streams.
b 1. Well drained.
c 1. With fine sand substratum at 24 to 30 inches depth.
d 1. Occurring on infrequently flooded portions of the flood plains.
e 1. Parent material: river-deposited fine sand. Medium brown surface soil; yellow-brown subsoil; brownish-gray substratum of fine sand; distribution—on the higher portions of the Connecticut River flood plain, and along a few other large streams of the state.
f 1. Not excessively sandy—
Ondowa sandy loam (A).
Ondowa fine sandy loam (A).
Ondowa silt loam (A).
f 2. Excessively sandy—**Ondowa loamy fine sand** (A).
b 2. Imperfectly drained over most of the area (excessively sandy soils sometimes with very rapid drainage).
c 1. With no well defined color differences between soil, subsoil and substratum; substratum at 36 to 40 inches depth, usually composed of fine sand and silt.
d 1. Occurring on frequently flooded portions of flood plains.
e 1. Parent material: stream deposits washed down from areas of granite gneiss and schist. Dark grayish-brown surface soil; grayish-brown subsoil; brownish-gray to grayish-brown substratum of variable character, ranging from silt loam to loamy sand; distribution—most extensive areas lie on the main portion of the Connecticut River flood plain, smaller areas include most of the "bottomland" along other streams of the state.
f 1. Not excessively sandy—
Podunk silty clay loam (A).
Podunk silt loam (A).
Podunk very fine sandy loam (A).
Podunk fine sandy loam (A).
Podunk sandy loam (A).
f 2. Excessively sandy—**Podunk loamy fine sand** (A).
Podunk loamy sand (A).
Podunk sand (A).
e 2. Parent material: stream deposits washed down from areas of red-brown sandstones and shales. Very dark brown surface soil with slight reddish cast; red-brown subsoil; brownish-red substratum of clay, sand or silt; distribution—as narrow "bottomlands" along a number of small streams in the central lowland of the state.

f 1. Not excessively sandy—
Middlefield clay loam (A).
Middlefield loam (A).
Middlefield fine sandy loam (A).

a 4. Organic soils.
b 1. Poorly drained.
c 1. Inland, fresh-water deposits.
d 1. Occurring in land depressions that receive no alluvial deposits.
e 1. Organic material chiefly composed of forest leaves, shrubby and herbaceous growth. Humus soil black, mellow, well disintegrated, and extending to a mineral substratum of bluish-gray fine sand at depth ranging from less than two feet to 40 feet or more; distribution—in individual areas from less than acre up to about 500 acres distributed over practically every town of the state.
f 1. Mineral substratum less than three feet below surface—**Shallow muck** (S).
f 2. Mineral substratum three feet or more below surface—**Muck** (S).
e 2. Humus soil of brown color, fibrous, composed chiefly of residues from rushes, sedges and sphagnum moss; mineral substratum usually 25 feet or more below surface except at swamp margins; distribution—occasional small areas, chiefly in the Eastern and Western Highlands.
f 1. **Peat** (S).
c 2. Coastal, salt water deposits.
d 1. Occurring as flat areas, periodically flooded by tidal waters.
e 1. Organic material chiefly derived from "salt marsh" vegetation (sedges predominant), surface layer of grayish-brown fibrous residues; lower layers—brownish-gray to bluish-gray, brown-mottled, silty or sandy clay, high in organic matter, containing a high salt concentration, with some shell-fish remains; distribution—along Long Island Sound and its tidal bays and inlets.
f 1. **Tidal marsh** (K).

a 5. Miscellaneous land areas with no definite soil characteristics.
b 1. Surface almost completely paved with large boulders but with a fair depth of soil lying under and between the rocks—
Rough stony land (X).
b 2. Area practically bare, with bedrock exposed—**Rock outcrop** (X).
b 3. Clean, loose sand fringing exposed shores of Long Island Sound, which are swept by waves, tides and wind—**Coastal beach** (K).
b 4. Sand and gravel areas along rapidly flowing streams which are washed clean of all fine earth material by strong channel currents during flood periods—**Riverwash.**
b 5. Areas built up from an original lower level by the dumping of refuse and excavation earth and stone—**Made land.**
b 6. Areas where soil has been removed, exposing the substratum of sand and gravel for use in building and road construction—**Gravel bank.**

PART II

SOIL AND LAND COVER STUDIES

Fifteen areas typical of soil conditions to be found in various parts of the state and indicated on Figure 62, have been intensively surveyed. Maps were prepared showing all soil types and the distribution of crops, pasture, forest and other land use upon these soils.

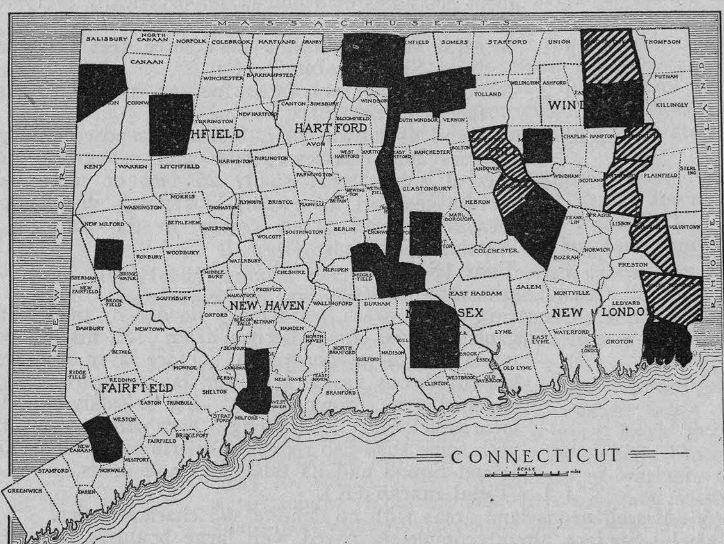


FIGURE 62. Areas over which the soils have been studied in detail. Solid block, soil and land cover surveys for the entire area; shaded, surveys of selected farms within the towns.

In 1928 and 1929, these surveys were supplemented by the results of detailed mapping of the distribution of soils on 190 dairy farms in the towns of Woodstock, Griswold, Coventry, Brooklyn, Columbia, Stonington, North Stonington and Canterbury. These farms are being carefully studied by the Economics Department of the Storrs station, which has also made economic surveys of the Lebanon, Suffield and East Windsor areas, for which soil and land cover maps were prepared.

Complete data as to the details of the distribution of land cover on the soils of these areas is somewhat too voluminous for presen-

tation in this bulletin, but it is hoped that they may be published in their entirety at a later date.

Important soils represented in two or more different areas present a somewhat different picture of land cover, depending upon the relative occurrence of other more or less favorable soils as well as other frequently explicable factors. An example is indicated in comparisons of the results of the land cover tabulation for the less-stony phases of the Gloucester and Charlton soils in the Lebanon, Stonington, Pomfret, Goshen and Wilton areas.

TABLE III. LAND COVER DISTRIBUTION ON GLOUCESTER AND CHARLTON SOILS IN SELECTED AREAS.

Area and soil	Percentages: Tilled land and mowing	Open pasture	Brush and "old field"	Hardwood forest
Lebanon-Gloucester	30.9	19.7	5.5[1]	43.9
Charlton	50.0	26.7	2.8[1]	20.5
Pomfret-Gloucester	30.9	5.0	28.9	35.2
Charlton	54.8	6.76	15.3	23.2
Goshen-Gloucester	48.5	28.9	6.5	16.0
Charlton	56.5	16.5	10.9	16.1
Wilton-Gloucester	43.9	8.7	27.0	20.4
Charlton	56.1	15.9	18.6	9.4
Stonington-Gloucester	57.6	5.0	23.0	14.4
Charlton	62.5	5.8	24.2	7.5

In every area Charlton soils show a higher percentage of tilled land and mowing than Gloucester, yet in towns such as Stonington, with an abnormally large area of extremely stony soils, an unusually high percentage of the small areas of the less-stony phases is in crop production.

The effect of other factors than soil is observed in the land cover distribution in the Goshen area, with respect to open pasture and brush lands. In this town, pastures are quite commonly infested with shrubby cinquefoil (*Potentilla fructosa*) which is much more prevalent on the Charlton pasture areas than on the "drier" Gloucester soil. Summers are cooler and as a consequence Gloucester pastures suffer less severely from dry seasons in Goshen than they might in Stonington. Therefore an unusually high percentage of open pasture is indicated for the Goshen Gloucester soils while the Charlton soils are there so difficult to keep clear of the shrubby cinquefoil that an abnormal portion of the pastures is grown up to brush land or abandoned to gray birches.

In spite of the failure to obtain strictly comparable results in all cases, a tabulation of the data by important soil groups for all of the areas reveals certain important adjustments of land use to the character of the soil.

[1] "Old field," or gray birch areas, were mapped with the woodland in the Lebanon area.

As would be expected, the more adverse stony and poorly drained soils have largely gone out of cultivation. This is shown by the following table:

TABLE IV. LAND COVER ON STONY AND POORLY DRAINED SOILS.

Soil types	Percentages			
	Tilled and mowed	Open pasture	Brush land "old field"	Forest
Holyoke stony soils	1	2	1	96
Brookfield Hinsdale stony soils	3	5	5	87
Gloucester stony soils	7	11	16	66
Charlton stony soils	12	21	23	56
Whitman loam (poorly drained)	18	18	20	56
Muck	11	10	23	56

Other soils, with adverse factors depending upon texture, water-holding capacity and general fertility exhibit marked differences in land cover distribution.

TABLE V. LAND COVER ON IMPORTANT AGRICULTURAL SOILS.

Soil types	Percentages			
	Tilled and mowing	Open pasture	Brush and "old field"	Forest
Enfield v. f. s. l.	70	3	3	24
Merrimac sandy loam	61	8	3	28
Wethersfield f. s. l. and related soils	60	8	5	27
Merrimac fine sandy loam	58	11	8	23
Charlton loam and related soils	56	13	13	28
Suffield silt and clay loam	53	26	3	18
Merrimac coarse sand	44	0.25	8.75	47
Gloucester f. s. l.	36	17	10	37
Podunk loam[1]	34	21	8	37
Hinckley gravelly sandy loam	33	11	25	31

In the tobacco district, two areas have shown that this crop is largely confined to certain soil types. The selection of these soils for tobacco is shown in Table VI.

TABLE VI. TOBACCO ON SOILS OF THE SUFFIELD AND EAST WINDSOR AREAS.

Soil type	Percentage of cultivated area in tobacco
Merrimac sandy loam	52
Merrimac coarse sand	45 (shade)
Enfield v. f. s. l.	40
Manchester gravelly fine s. l.	33
Wethersfield and Cheshire f. s. l. and loam	26
Podunk f. s. l. and loam	20
Suffield silt and clay loam	12

A study of the distribution of commercial apple orchards has shown that these are confined largely to the Charlton and Wethers-

[1] Not including Connecticut River "meadows," which is almost entirely used for native grass hay.

field groups. It is significant that in spite of the large areas of the Gloucester and Merrimac groups of soil, practically no commercial orchards are located upon them.

General Development of Productive Farm Enterprises on Important Soil Types

Dairying. This enterprise, as now being conducted, should prove most successful on lands well suited to the production of silage, hay crops, and pasture. The Charlton, Dover, Wethersfield and Suffield groups of soils most nearly meet these requirements. In spite of the adverse economic conditions that now place Gloucester soils under a serious handicap, dairying still remains the chief enterprise on most of that group. Special local markets have enabled many farms lying chiefly on the adverse sandy Merrimac types to continue to follow dairying as a major pursuit.

Orcharding. As already mentioned, commercial orchards reach their best development on the Wethersfield and Charlton soils. Small home orchards may prove successful on the Gloucester soils, but are generally less satisfactory on the Merrimac, Hartford and Hinckley series.

Small fruits. The chief culture of small fruits is on the Manchester, Hartford and Wethersfield series, and to a slighter extent on the Merrimac and Gloucester series.

Vegetable crops. The sections of most intensive commercial vegetable production are on the Merrimac sandy loam and fine sandy loam, Hartford, Wethersfield and Manchester series. In the vicinity of cities and towns where these soil types are not available, the Gloucester and the less-gravelly phases of Hinckley soils are brought into use. The heavier Charlton and Suffield soils are not able to compete favorably with the lighter soils on a commercial basis.

Potatoes. The most favorable potato soils are probably the Merrimac sandy loam, Merrimac fine sandy loam, Enfield, Manchester and Hartford series, as well as the lighter phases of the Wethersfield and Charlton series. The Gloucester and Hinckley soils, due to their irregular topography and the high percentage of stone and gravel in the soil, are unfavorable for the special planting, spraying, and harvesting machinery that must be used.

Tobacco. The most important tobacco soils, as has been shown by data already given, are the Merrimac sandy loam and fine sandy loam, the Enfield very fine sandy loam, the Manchester fine sandy loam, and to a less extent, the Wethersfield and Cheshire fine sandy loams. The Merrimac coarse sand, when not too excessively sandy, is suited to the production of shade tobacco, but is of little value for the sun-grown crop.

Alfalfa. When properly limed and fertilized, alfalfa may be produced successfully on almost all the well-drained soils. The heavier phases of the Charlton and related series might produce some winter killing. The Gloucester, Hinckley and sandy Merrimac soils, although capable of producing good alfalfa, will probably be less used for this purpose because of the smaller development of the dairy industry upon them.

Grass hay. The heavier upland soils, chiefly of the Charlton group, will stand preeminently as best suited for grass hay. The Wethersfield, Dover and Suffield soils are probably next in order. The Gloucester soils will be kept in grass hay for much of the time, in spite of their lower productivity. Their difficulty of cultivation discourages their use for tilled crops except when the land is not absolutely required in order to furnish sufficient corn silage to support the small-scale dairies that are usually found on these soils. The grass hay crop is thin and shortlived on the sandy or gravelly soils of the Merrimac, Hartford, Manchester and Hinckley series. The alluvial Podunk soils, when not too poorly drained, are well adapted to the production of grass hay.

Corn. The corn crop, except for a few centers of seed production, is closely related to the demands of the dairy industry and the largest utilization of land for the corn crop will be on the Charlton, Wethersfield, Hollis, Dover and Suffield soil groups. The present practice of heavy manuring, if supplemented by adequate commercial fertilizers, should produce good corn crops on a wide range of soils.

Pasture. The Charlton, Suffield, Dover and Wethersfield groups are capable of producing good pasture, especially when improved by top-dressing treatments. The Gloucester areas now in pasture are excessively leachy and otherwise possess lower natural fertility, besides being so stony and irregular in topography that improvement is difficult. They cannot be plowed up for reseeding, and results of top dressing on such soils show little improvement, perhaps due to the excessively leachy character of the soil. The gravelly and sandy soils such as the Hinckley and Merrimac are very low grade pasture producers.

Forest. The larger areas of forest land are obviously to be found on the stony and rough areas. The Gloucester stony soils, the closely related Hinsdale and Brookfield series, and the Holyoke soils of the trap rock ridges are predominant on all the large forests of the state. Smaller areas of woodland cover from 10 to 50 per cent of other soil types. The use of the better agricultural soils for forest is dependent upon local topographic irregularities, inaccessibility of location and economic conditions that do not favor the utilization of all the better areas for crops or pasture. The stony tendency of pasture areas to revert to woodland when not cleared by now expensive labor, is an important factor which frequently operates on even the best soils for pasture production. Some of the better soils may be cleared anew, but at the same time areas of the excessively stony, gravelly and sandy soils should logically revert to forest, through either natural or artificial methods. More than 50 per cent of Connecticut is absolute forest land; probably 15 per cent is of marginal type, the use of which for forest will depend upon fluctuating economic conditions. Problems relating to the proper use of soils for the various forest types are being jointly investigated by the Soils and Forestry Departments, and the present status of these studies will appear in a bulletin now in preparation.

Land utilization for purposes other than agriculture: While such use is not directly related to soil, there are cases where it may become a factor. Most towns and cities occupy land of favorable topography and drainage, and hence compete with agriculture for some of the best land. Recreational land, on the other hand, is rarely good farm land in this region, since rugged wooded hills, rocky shores and forest-circled lakes are the favored sites for park purposes. Country estates, golf courses, polo fields and the usual divertisements of the well-to-do are taking up an increasing proportion of our better agricultural land, particularly in Fairfield County, some parts of Litchfield County, and some of northeast Windham County, as well as the vicinity of our larger cities.

As a result of these surveys supplemented by reconnaissance work over the entire state, we have prepared the following table, which gives a general picture of the relative importance of the various soils for different land uses:

TABLE VII. ESTIMATED AREA AND LAND USE OF CONNECTICUT SOILS, A.

Soil names	Crop A.	Pasture A.	Wooded A.	Urban, etc. A.	Total A.	%
Gloucester, Coloma, etc.						
f. s. l. and l.	65,000	40,000	155,000	10,000	270,000	8.7
stony phases	30,000	105,000	560,000	10,000	705,000	22.6
Brookfield, Hinsdale, etc.						
l. and f. s. l.	7,000	5,500	16,500	1,000	30,000	1.0
stony phases	10,000	40,000	394,000	6,000	450,000	14.4
Dover, Lenox, etc.						
f. s. l. and l.	12,000	8,000	5,000	2,000	27,000	0.9
stony phases	500	3,500	1,500	500	6,000	0.2
Charlton, Hollis, etc.						
l. and f. s. l.	185,000	85,000	85,000	35,000	390,000	12.5
stony phases	20,000	52,500	70,000	7,500	150,000	4.8
Wethersfield, Cheshire, etc.						
l. and f. s. l.	150,000	40,000	50,000	60,000	300,000	9.7
stony phases	500	5,000	28,500	2,000	36,000	1.2
Whitman, Peru, etc.						
l. and f. s. l.	4,000	8,000	8,000	1,000	21,000	0.7
stony phases	2,000	12,000	38,000	2,000	54,000	1.8
Hinckley, Manchester, etc.						
gravel and sand	3,000	6,000	14,000	10,000	33,000	1.1
s. l. and f. s. l.	20,000	6,000	20,000	20,000	66.000	2.2

Soil names	Crop A.	Pasture A.	Wooded A.	Urban, etc. A.	Total A.	%
Enfield						
v. f. s. l.	26,000	3,000	5,000	5,000	39,000	1.3
Merrimac, Hartford, etc.						
s. l. and l. s.	64,000	8,000	24,000	30,000	126,000	4.0
l. and f. s. l.	12,000	5,000	10,000	15,000	42,000	1.4
coarse sand	10,000	1,500	22,500	5,000	39,000	1.3
Suffield, etc.						
si. l. and cl. l.	15,000	12,000	6,000	6,000	39,000	1.3
Podunk, etc.						
l. and si. l.	17,000	19,000	18,000	6,000	60,000	2.0
Muck, etc.	3,000	12,000	82,000	2,000	99,000	3.3
Tidal marsh—18,000 A.	.....	.....	.....	.....	18,000	0.6
Rough stony land	.....	.....	90,000	.....	90,000	3.0
	656,000	477,000	1,703,000	236,000	3,090,000	100.0

A tabulation of the soils on 190 dairy farms in seven towns of the Eastern Highland indicates the relative importance of soils of the 16 series which were there identified, as shown in Table VIII. "Improved land" in this table includes cultivated crops, hay fields, open pasture and farmstead sites.

TABLE VIII. SOIL SERIES AND IMPROVED LAND DISTRIBUTION ON EASTERN CONNECTICUT DAIRY FARMS.

Series	Percentages: Of series in improved land	Of improved land in series	Of all farm land in series
Charlton	44.03	25.40	16.88
Gloucester	18.25	18.21	29.19
Merrimac	80.14	14.25	5.20
Taugwank	41.34	10.17	7.20
Coloma	45.41	9.08	5.85
Hinckley	23.30	8.39	10.54
Brookfield	26.81	7.31	7.98
Whitman	9.23	3.30	10.47
Peru	49.56	1.34	0.79
Plymouth	22.47	1.32	1.72
Podunk	67.19	0.41	0.18
Muck	3.49	0.30	2.52
Hinsdale	7.38	0.26	1.02
Ondowa	100.00	0.12	0.03
Sutton	100.00	0.09	0.03
Scarbro	100.00	0.05	0.02

The last three series are represented in such small areas as to be of no significance. For the other soils, the degree of improvement is nearly what one should expect from their stoniness, topography, and moisture conditions as affected by texture, organic content and the character of the substratum. Apparently a superior natural supply of plant nutrients is either not characteristic of any of these soils, or has little relationship to their selection for agricultural use.

PART III

A CRITICAL STUDY OF THE CHEMICAL COMPOSITION OF REPRESENTATIVE CONNECTICUT SOILS

Soil investigators of two or three decades ago hoped that it would be possible to determine the fertilizer requirements of soil through chemical analyses of soil samples, and many attempts were made to correlate such analytical results with field productivity. The results were disappointing in most instances, and a strong prejudice was built up against the use of chemical soil analyses as a guide in soil diagnosis.

However, the rapid developments in science during recent years have furnished many new tools for attacking the very complex problems of soil chemistry and its relationships with the nutritional requirements of crop plants. While we are yet far from a solution of many important questions, it is now believed that a detailed knowledge of the chemical soil characteristics is a definite aid to the intelligent use of fertilizers, lime and other soil amendments.

During the past five years a large number of representative samples of the important soil types of the state under various cropping systems has been under chemical investigation. The results of these studies are here briefly summarized and will be discussed under headings referring to the particular element or characteristic in question.

Organic Matter and Nitrogen

Organic matter and nitrogen are so closely related in agricultural soils that no permanent change in one can be effected without a corresponding change in the other.

The surface soils of this state, with the exception of forested soils, contain organic matter and total nitrogen in a fairly definite ratio. More than 100 soils for which both the nitrogen and organic matter (computed from total organic carbon) were determined, gave an average value of one part of nitrogen to 20 parts of organic matter, with fluctuations between the limits of 1:16 and 1:25. This is in agreement with the results of Sievers[1] on some typical Massachusetts soils. It thus follows that the total nitrogen content is a good measure of the organic content of the soil, and that a soil with 0.2 per cent of nitrogen contains approximately four per cent of organic matter.

In most cases results of chemical analyses of surface soils are here reported as pounds per acre on the basis of a conventional rule that an acre of soil to plow depth contains approximately 2,000,000 pounds of dry soil. Pounds per acre may be calculated to per cent by dividing by 20,000. Thus 4,000 pounds per acre represent 0.2 per cent of the dry weight of the soil.

[1] Sievers, F. J., Jour. Am. Soc. of Agron., 22: 10-13, 1930.

TABLE IX. NITROGEN CONTENT OF CONNECTICUT SOILS.

	No. of soils	Average: Total percentage	Average: Nitrogen content lbs. per A. of surface soil	Min. and max. range lbs. per A.
General crops and mowing				
Gloucester f. s. l. and loam ...	13	.243	4874	1990-9635
Brookfield f. s. l. and loam	8	.20605	4121	2486-5670
Charlton f. s. l. and loam	25	.23530	4706	2650-9850
Wethersfield f. s. l. and loam ..	8	.12260	2452	1590-3622
Dover f. s. l.	2	.12270	2454	1860-3048
Whitman loam	4	.31160	6232	5850-6950
Taugwank loam	5	.25410	5082	2740-7320
Merrimac f. s. l.	4	.12950	2590	1550-5126
Hinckley gravelly loam	3	.31010	6202	4240-8795
Hartford f. s. l.	3	.16780	3356	2420-3850
Suffield clay loam	2	.18175	3635	3290-3980
Podunk silt loam	25	.11600	2320	1200-3580
Weighted average		.24210	4842	1200-9850
Permanent pasture land				
Gloucester f. s. l. and loam	17	.20235	4047	2930-5362
Brookfield loam	2	.22875	4575	4340-4810
Charlton f. s. l. and loam	21	.26275	5255	3350-7366
Wethersfield f. s. l. and loam ..	6	.19550	3910	2580-6796
Becket f. s. l.	2	.27370	5475	5450-5500
Whitman loam	2	.34605	6921	6220-7622
Suffield clay loam	3	.14780	2956	2346-3516
Merrimac loamy sand	2	.07040	1408	1266-1550
Other soils	5	.21560	4312	2272-6674
Weighted average		.22295	4459	1266-7622
Tobacco land				
Merrimac f. s. l. and sandy loam	29	.14630	2926	2300-4100
Merrimac loamy sand	20	.13210	2642	1560-3100
Wethersfield loam	12	.15420	3084	2166-4170
Enfield v. f. s. l.	10	.13450	2690	2150-3575
Scarbro loam	8	.27650	5530	4966-6366
Weighted average	79	.15560	3112	1560-6366
Barren and other waste land				
Sand barrens of Wallingford and Windsor	4	.05060	1012	386-1545
Old field types	6	.1777	3554	2830-4416

There is a wide range in the nitrogen and consequently in the organic content of Connecticut soils, ranging from 386 to 9,635 pounds per acre of surface soil. (This does not include organic soils, such as muck, peat and tidal marsh.) The average for all soil types of the various cultural groups is approximately 0.2 per cent, equivalent to 4,000 pounds per acre of surface soil.

It is of interest to compare these figures with soils of other regions.

TABLE X. NITROGEN CONTENT OF OTHER SECTIONS OF EASTERN UNITED STATES.

		Percentage of nitrogen in surface soil
165	Coastal plain soils of N. C.	.039
71	Piedmont soils of N. C.	.048
381	Kentucky soils	.120
485	West Virginia soils	.150
125	Ohio soils	.187
105	New York soils	.207
30	Minnesota soils	.338

It is thus seen that the soils of Connecticut as a class compare quite favorably with those of other states and are much higher than those of states further southward.

In a comparison of cultural groups, soils in general crops and mowing, chiefly on dairy farms, contain the highest amounts of nitrogen (4,842 lbs. per acre). The pasture soils are somewhat lower (4,459 lbs.) while the tobacco soils chiefly of sandy texture and lying within the central lowland area of the states, are distinctly below the average (3,112 lbs.).

Of the various soil types within the respective cultural groups, the poorly drained soils, like the Whitman and Scarbro soils, are highest in nitrogen, with Charlton and Gloucester types above the general average, while the Wethersfield and Merrimac soils are definitely lower in nitrogen content. Beyond these generalizations, there is an insufficient number of soils of any one type to justify any definite conclusions.

It does not appear that soils of average texture have suffered any serious decline in nitrogen content in the 200 years or more of agricultural use. The nitrogen content of 21 forest soils to the depth of seven inches, and including any litter which may occur on the forest floor, gives an average of 0.205 per cent nitrogen, which is almost identical with the average of the agricultural soils. Certain excessively sandy soils have undoubtedly suffered some depletion in organic matter and nitrogen content as was found to be the case in a special study of the organic matter of tobacco soils.[1]

The humus and nitrogen requirements of Connecticut soils. The benefits derived from an adequate supply of organic matter are manifold. Excessively sandy soils are improved in moisture-holding and plant food-absorbing capacity. Heavy clay soils are made less difficult to cultivate. Micro-organisms require energy material from decomposing organic matter and plant food constituents, chiefly nitrogen, are liberated by its decomposition.

The present supply of organic matter is adequate to meet these

[1] Morgan, M. F., Conn. Agr. Exp. Sta., Tobacco Substa. Bull. 10:66-71. 1927.

requirements on most soils of the state, but this does not remove the necessity for the continued conservation of a favorable humus supply in every way possible, through green manure crops and animal manures on intensively cultivated lands, the plowing under of sods that have been properly thickened by adequate fertilization, and the return to the soil of plant residues. As manure becomes less abundant, it may become increasingly difficult to maintain a favorable supply of organic matter, but the prospects for serious depletion are not as serious as in many other regions.

The relatively good nitrogen supply which is stored up in most Connecticut soils is a potentially valuable reserve but it should not be depleted by a corresponding decrease in humus content of the soil. Some crops on soils which have been investigated in greenhouse fertilization experiments have shown little or no response to nitrogen under the favorable temperature and the absence of leaching which occur under such conditions. This is due to a liberation of soil nitrogen which is not comparable to field results. Non-leguminous crops demand that nitrogen be added to the soil in commercial fertilizers, manure or the growth of legumes, to offset the rapid loss of liberated soil nitrogen through leaching and crop removal. Available fertilizer of nitrogen during certain periods of crop growth is needed to supplement the supply that naturally becomes available during that time, or to replace losses through leaching.

Soils which contain a relatively low total nitrogen content, such as the Merrimac and Wethersfield types, especially under continuous tobacco culture or intensive vegetable cropping, are in a more serious need of large amounts of fertilizer nitrogen than the upland soils such as the Gloucester and Charlton types under dairy farming or pasture conditions.

The Total and Available Phosphorus Supply in Connecticut Soils

Phosphorus, an element very commonly deficient in soils of eastern United States, exists in the soil in relatively small quantities, and the total amount rarely exceeds 0.15 per cent of the dry weight of surface soils. With figures ranging downward to less than 0.05 per cent, there is a very limited reserve supply and a serious danger of depletion if losses through crop removal and grazing are not replaced by fertilization.

Phosphorus is a relatively insoluble constituent in soils and the water-soluble phosphorus that can be leached or extracted from soils is so small that there is practically no loss through leaching. However, some of the soil phosphorus is in combinations that become available for plant growth, even though it is not dissolved in the soil water. The determination of this available phosphorus

supply is a difficult chemical problem, and no completely satisfactory method for its measurement has been devised. However, our investigations have given a good general agreement between the amount of phosphorus which is dissolved from the soil by N/100 sulfuric acid (obtained by five minute digestion of 10 grams of soil with 100 cubic centimeters of the dilute acid solution) and the response of crops to phosphorus treatments under greenhouse conditions. The values here reported as "available" phosphorus were obtained by this method.

Table XI. The Total and Available Phosphorus in Connecticut Soils.

		Pounds per acre in surface soil			
		Total phosphorus		Available phosphorus	
	No. of soils	Average	Min. and max. range	Average	Min. and max. range
General crops and mowing					
Gloucester f. s. l. and loam ..	13	1817	1508-2404	8.5	2. —24.2
Charlton loam and f. s. l.	25	1996	1080-3638	9.14	2. —24.0
Wethersfield f. s. l.	8	1378	898-2168	16.57	2. —38.0
Brookfield loam	8	1975	970-3400	6.18	2. —23.0
Taugwank loam	5	1538	622-2440	2.70	1.8 — 5.0
Merrimac f. s. l.	4	2094	1660-2670	14.75	6. —23.0
Whitman loam	4	2055	1532-2588	2.43	1.9 — 3.0
Hartford sandy loam	3	1761	1218-2510	22.50	20. —25.
Dover f. s. l.	2	1690	1612-1768	30.5	30. —31.
Suffield clay loam	2	1331	1121-1540	7.5	5. —10.
Podunk silt loam	25	1756	648-2926	16.7	0.5 —36.
Weighted average		1819	622-3638	10.26	0.5 —38.
Pasture					
Gloucester f. s. l. and loam ..	17	1739	612-5150	3.67	2.0 — 8.25
Charlton loam and f. s. l.	21	1677	567-3260	3.91	1.25—12.00
Wethersfield f. s. l.	6	1901	1456-2430	4.62	2.4 — 6.2
Brookfield loam	2	2165	1448-2884	2.4	2.0 — 2.8
Beckel f. s. l.	2	977	844-1110	2.9	1.4 — 4.4
Whitman loam	2	1181	800-1562	3.05	2.9 — 3.2
Suffield clay loam	3	1227	1135-1360	3.55	2.25— 5.7
Merrimac loamy sand	2	1321	932-1710	10.5	6. —15.
Other soils	5	2275	1545-3700	4.55	2. — 8.
Weighted average		1709	612-5150	4.06	1.25—15.
Tobacco land					
Merrimac sandy loam	12	2890	1376-4080	39.72	16.5 —60.
Enfield v. f. s. l.	3	3480	2530-4430	45.0	28. —62.
Other soils, unclassified	48	3260	1750-4960	44.0	25. —63.
Weighted average		3200	1376-4960	42.5	16.5 —63.
Barren and other waste land					
Sand barrens of Wallingford and Windsor	4	842	502-1284	6.25	3. —11.
Old field types	6	1513	980-2220	5.3	1. —13.4

With respect to phosphorus, both total and available, the soils of the state are also extremely variable, the total amount ranging from 502 to 5,150 pounds per acre, while the "available" phosphorus as measured by laboratory tests ranges from 1 to 63 pounds. The average for the state is 1,838 pounds of total phosphorus, equivalent to 0.0919 per cent in the surface soil, and an availability test of 9.84 pounds per acre.

Results of the availability tests used at this station are not directly comparable to those reported from other states, but the following table gives a fair comparison of the conditions of total phosphorus supply.

Table XII. Total Phosphorus Content of Soils in Other States.

	Total phosphorus in surface soil, percent
Kentucky "Bluegrass" soils	0.470
West Virginia, 485 soils	0.052
Illinois, light colored prairie soils	0.060
Illinois, heavy black prairie soils	0.100
Ohio, 126 soils	0.056
New York, average loam	0.074
New Jersey, 14 soils similar to Conn. types	0.073

The total phosphorus content of Connecticut soils is at least as good as, if not above the average of soils in other states, with the exception of the "bluegrass" region of Kentucky and the highly fertile black prairie soils.

In a comparison of cultural groups, soils in tobacco for a period of years are very significantly higher than the other soils of the state. This has been explained in a previous publication[1] on the basis of phosphorus accumulation from heavy fertilization in excess of crop requirements. There is little significant difference between the total phosphorus content of general crop lands and pasture although the average is slightly lower for the latter group.

As between soil types, there appears to be no consistent difference, with the exception of the very infertile barren sand areas in Wallingford and Windsor.

The phosphorus requirements of Connecticut soils. Although the total amounts of phosphorus in most Connecticut soils do not indicate a serious depletion, the availability of the native soil phosphorus is very low in all soils that have not been so heavily fertilized as to produce a surplus of the more available phosphorus in fertilizer residues. This condition has been definitely proven, both by laboratory tests and by fertilizer experiments in both greenhouse and field. The pasture areas, which have rarely received any fertilizer in return for the removal of available phosphorus in animal growth and milk production, are in the most serious condition in this respect. The average of 60 typical pasture soils of the state shows a phosphorus test of only about four pounds per acre,

[1] Anderson, P. J., Morgan, M. F., and Nelson, N. T., Conn. Agr. Exp Sta., Tobacco Substa. Bull. 7. 1927.

as compared to 10 pounds for the general crop and mowing land soils of the state and the very high average of 42.5 pounds for the heavily fertilized tobacco soils. This confirms the results of the Storrs pasture experiment[1] and the numerous pasture fertilizer trials conducted by the Extension Division of the Connecticut Agricultural College.

The general crop and mowing lands, while less seriously depleted in available phosphorus than the pasture lands, are still very seriously in need of fertilizer phosphorus in most cases. The results of the analyses reported in Table XI and of greenhouse results, shown in Tables XXII, XXV, XXIX and XXXII, are supplemented by an extensive survey of phosphorus availability on the fields of a large number of dairy farms in southeastern Connecticut. Of more than 300 fields in the towns of Stonington, North Stonington and Griswold, 87.4 per cent showed tests of 10 pounds or less of phosphorus per acre, and on all such fields we should reasonably expect a marked response to fertilizer phosphorus for almost any crop.

The conditions on all land that has been under heavy tobacco fertilization for a number of years have justified a recommendation of a practical decrease in the rate of application of "phosphoric acid" from the 160 to 200 pounds per acre which has been common in recent years, to as low as 100 pounds per acre. On new tobacco land not previously so heavily fertilized, the higher amounts should be continued for at least the first few years, until a substantial reserve has accumulated. The failure of old tobacco fields, such as the Tobacco Substation field at Windsor, to show significant response to phosphorus fertilization is not due to the low phosphorus requirements of the crop, since tobacco is extremely sensitive to a lack of adequate amounts of available phosphorus in the soil.

A similar condition probably exists on lands that have been very heavily fertilized for potatoes and vegetable crops, and in many such cases the common use of amounts in excess of 100 pounds per acre of "phosphoric acid" in the fertilizer may not be justified.

Total and Replaceable Potassium Supply of Connecticut Soils

Potassium (indicated in fertilizer formulae under the term "potash") exists in most soils in relatively large amounts as compared to nitrogen and phosphorus. On the other hand, most of the total potassium content of the soil is of a very insoluble character, existing in the form of the complex alumino-silicates of rock minerals. In a much more available form, a small part of the total potassium content of the soil occurs in the so-called "replace-

[1] Brown, B. A., and Slate, W. L., Storrs Agr. Exp. Sta. Bull. 155. 1929.

able" or "exchange" condition, being absorbed by the colloidal material of the soil, from which it may be liberated by washing the soil repeatedly by solutions of neutral salts or of dilute acids.

Measurements of available potassium in the soil by chemical means are very difficult. Very little exists in water-soluble form, on account of the absorbing power of the finer particles of the soil for this element. With soils of similar physical character, differences in amounts of "replaceable" potassium are usually associated with differences in "potash" availability.

TABLE XIII. THE TOTAL POTASSIUM CONTENT OF CONNECTICUT SURFACE SOILS.

	No. of soils	Average Percent	Average Lbs. per A.	Min. and max. range—lbs. per A.
General crops and mowing				
Charlton loam and f. s. l.	25	1.4260	28,952	15,791-44,760
Gloucester f. s. l.	13	1.1717	23,435	11,244-31,292
Brookfield loam and f. s. l.	7	1.5557	31,114	16,980-42,483
Wethersfield f. s. l. and l.	6	1.4154	28,108	21,760-31,924
Taugwank loam	3	1.2512	25.024	16,659-35,678
Merrimac f. s. l.	4	1.7090	34,180	20,028-47,032
Suffield clay loam	2	2.5743	51,487	50,877-52,098
Podunk silt loam	25	2.0060	40,120	29,720-57,640
Other soils, unclassified	7	1.2957	25,914	16,723-35,700
Weighted average		1.4273	28,546	11,244-57,640
Permanent pasture land				
Charlton loam and f. s. l.	21	1.5853	31,707	21,700-43,920
Gloucester f. s. l.	16	1.4973	29,946	17,109-43,856
Wethersfield f. s. l. and l.	6	1.4194	28,388	19,425-35,280
Merrimac loamy sand	2	0.8989	17,979	17,660-18,299
Suffield clay loam	2	2.3235	46,471	42,901-50,041
Whitman loam	2	1.1827	23,653	23,509-23,798
Other soils, unclassified	8	1.5862	31,724	21,193-43,770
Weighted average		1.5300	30,600	17,109-50,041
Tobacco land				
Merrimac sandy loam	5	1.2013	24,027	13,720-28,658
Enfield v. f. s. l.	2	1.3218	26,436	....
Average	7	1.2215	24,430	13,720-28,658
Sand barrens and waste land	8	1.3710	27,420	19,104-40,944

Although the total potassium content of Connecticut soils shows considerable variation, the proportionate range is not as great as for the other chemical constituents previously discussed. The state average of approximately 29,000 pounds per 2,000,000 pounds of surface soil, is similar to the potassium content of soils of similar texture in other parts of the country.

There appears to be a general correlation between the texture of the soil and the total potassium content. The lighter textured sandy loam soils of the tobacco district are lower, as a class, while the heavier podunk silt loam and Suffield clay loam are higher in potassium. However, there are individual fields of loam and fine sandy loam texture that are lower than some of the most barren

areas of sand. A large proportion of the sand grains of the sandy soils of this state are composed of minerals that contain potassium (such as fragments of muscovite mica and orthoclase feldspar). This is not so commonly true of the sandy soils of other regions, particularly of the Atlantic coastal plain, where the larger sand grains are chiefly of quartz.

The potassium requirements of Connecticut soils. In spite of their high amounts of total potassium, the soils of this state that have not been liberally fertilized or manured are commonly so deficient in available potassium that most crops grown upon them are apt to suffer from a deficiency in this element. This condition is suggested by the results of "replaceable" potassium determinations reported in Table XIV and confirmed by the results of greenhouse and field trials, Tables XXIII, XXVI, XXX and XXXII.

TABLE XIV. REPLACEABLE POTASSIUM IN SOME CONNECTICUT SOILS.

	Replaceable potassium — Average Percent	Average Lbs. per A.	Min. and max. range lbs. per A.
General crops and mowing, 33 soils from 12 soil types	.00684	136.80	51.46- 474.36
Pasture land, 14 soils from 8 soil types	.00620	124.40	33.72- 239.50
Tobacco, 7 soils	.02356	471.20	133.46-1961.76

The number of soils of any particular soil type was not sufficient to justify any classification on this basis, and there did not appear to be any consistent correlation for any soil type.

However, the effects of previous heavy fertilization are noticeable in case of the soils from tobacco land, which as a class have the lowest total potassium content because of their sandy texture, while their replaceable potassium is much higher than in soils from pasture land and general crops. On the other hand, tobacco fertilization that provides very liberal amounts of potash is justified on the basis of the high potassium requirements of this crop and the considerable leaching losses of potassium from such soils.

Since most vegetables and potatoes are quite sensitive to deficiencies in potash availability in the soil, fertilizers for such crops practically disregard the reserve of this element in the soil. With liberal applications of manure, the use of more than 80 pounds per acre of fertilizer potash for these crops should be adequate, while on sandy soils and with little or no manure as much as 150 pounds per acre may be profitable.

Corn and grass hay on dairy farms may not suffer from lack of potash if the land is well manured, but the results of pot experiments on soils from such fields, reported later, provide strong arguments in favor of the more general use of fertilizer potash. Alfalfa may be expected to respond to "potash" on most soils, and the use of from 100 to 125 pounds of potash per acre on land that is to be seeded to alfalfa is an insurance against a strong possibility of deficiency in this respect.

The potassium situation on permanent pasturelands of the state is still a rather open question. The Storrs pasture experiment has shown little response to potash fertilization, and in general it is believed that until adequate amounts of limestone and superphosphate have been used, the pasture soils will not respond to this element. A high level of productivity of pasture herbage may not be possible on many soils until potash is also used.

Calcium and Magnesium Content of Connecticut Soils

With the exception of a few small areas of the Dover series in western Connecticut, the soils of the state contain calcium and magnesium that is not derived from the decomposition of limestone, but is liberated from the slow weathering of complex silicates such as soda-lime feldspar and ferro-magnesian minerals. Thus, although the soils are predominantly acid, there may be a fair amount of total calcium and magnesium in the soil composition.

TABLE XV. TOTAL CALCIUM AND MAGNESIUM OF CONTENT OF CONNECTICUT SOILS.

	No. of soils	Pounds per acre of surface soil: Calcium, Average	Calcium, Max. and min. range	Magnesium, Average	Magnesium, Max. and min. range
General crops and mowing					
Charlton	16	20,495	11,840-36,800	11,654	5,951-26,100
Gloucester	10	22,759	13,680-26,683	10,182	6,405-13,671
Brookfield	5	23,057	9,902-36,960	16,889	4,886-31,446
Wethersfield	4	11,505	10,720-12,160	8,453	5,450-12,480
Taugwank	3	24,327	18,240-30,262	9,669	6,640-14,195
Other soils	6	24,070	12,160-34,818	17,845	4,824-32,572
Average	44	21,232	9,902-36,960	12,332	4,824-32,572
Pasture land					
Average	11	20,487	10,760-44,740	10,431	4,196-18,760
Tobacco land					
Merrimac sandy loam	5	14,736	11,540-20,160	6,127	4,760- 7,200
Enfield v. f. s. l.	2	17,570	17,440-17,700	8,360	6,859- 9,860
Sandy barrens and other waste land	..	12,947	10,000-15,260	7,177	5,420- 8,340

The average calcium content is 19,827 pounds and the magnesium content 11,140 pounds, per 2,000,000 pounds of surface soil. The variation is considerable, especially in the magnesium content.

The chief difference in cultural groups is the consistently lower figures of both calcium and magnesium for the soils of the tobacco district. (These do not include any samples of soil from the

Housatonic Valley tobacco section, where the opposite conditions may occur.) Many tobacco soils do not naturally contain sufficient available calcium and magnesium for best quality of the cigar ash, and the tobacco plants on some of the sandier soils show actual magnesium deficiency symptoms.

It is doubtful if calcium is ever an actual limiting factor in crop yields on Connecticut soils. Except in the case of tobacco, lack of available magnesium is not known to be a cause of poor yield in this state. However, Jones[1] has found a type of chlorosis in corn which is associated with magnesium-hunger on a soil at the Massachusetts Agricultural Experiment Station.

On the other hand, the "replaceable" calcium in soils is often rather low, especially on highly acid soils. In such cases the absorptive capacity of the soil for bases ("base exchange capacity") is not fully satisfied, and since calcium represents approximately 80 per cent of the exchangeable bases, a base-unsaturated acid soil would show a low value for replaceable calcium.

This is evidenced in the following table.

TABLE XVI. REPLACEABLE CALCIUM AND pH OF CERTAIN CONNECTICUT SOILS.

Replaceable Calcium in Pounds per 2,000,000 of Surface Soil.

Group	Average	pH Average	No. of soils
0— 499	302.68	4.87	13
500— 999	717.03	5.00	20
1000—1999	1408.00	5.12	18
2000+	2792.00	5.84	6

There were no evidences of correlation between replaceable calcium and either soil type or cultural class. There were wide variations in soil acidity, as expressed in pH, for soils of similar replaceable calcium content, but there was a general trend toward high acidity with low replaceable calcium.

The Acidity of Connecticut Soils

Most soils of this state are naturally acid, and except for certain areas of the Dover series where limestone outcrops lie near the surface, soils that have not received lime or limestone applications are almost certainly acid. The conditions of Connecticut soils with respect to acidity and lime requirement have been extensively studied. A previous publication[2] summarizes tests of more than 2,000 tobacco fields in the Connecticut Valley. Nearly 1,500 fields in general farm crops and mowing, distributed over 190

[1] Jones, J. P., Jour. Agr. Res. 39: 873-892. 1929.
[2] Morgan, M. F., Conn. Agr. Exp. Sta. Bul. 306. 1929.

farms in the towns of Griswold, Woodstock, Coventry, Brooklyn, Columbia, Stonington, North Stonington and Canterbury, have been examined for soil acidity. These results are supplemented by the results of tests of the soils that have been analyzed for all important constituents in this laboratory, besides those of more than 500 soils that have been sent in by farmers and gardeners during the past five years.

It is obviously unnecessary to present the individual results of all these tests, and the large number of samples for which we have record justifies the following conclusions:

1. With the exception of soils closely related to limestone outcrops in certain parts of western Connecticut, indicated as the "Dover" soil area on the accompanying soil map, there is no relationship between soil type and soil acidity. In other words, no one soil type is naturally more acid than another.

2. For equal degrees of acidity as measured by the pH test, there is a correlation between lime requirement and the textural and organic characteristics of the soil. Sandier soils at the same pH require less lime to correct the acidity than more loamy or clayey soils, while soils with much organic matter require more lime than those with a lower organic content. This is fully discussed from a technical viewpoint in a journal paper.[1]

3. The previous cultural history is the chief factor in determining the present degree of acidity of the soil. As a group, the pasture soils are slightly more acid, with an average of 4.91 pH. Until the past few years lime was never applied to permanent pasture land, and as yet few such areas have been limed.

Little difference exists between the average figures for tobacco soils (5.37 pH) and for the fields in general crops and mowing (5.39 pH), although the latter group includes 13.4 per cent which have been limed to reaction of above 6.2 pH, and on the tobacco soils only about four per cent of the fields lie above this limit. Tobacco farmers have rightly avoided the use of heavy lime applications, which favor the black root rot organism.

Gardens and fields used for vegetable crops have usually been limed heavily, and are rarely found to be strongly acid.

The lime requirements of Connecticut soils. The amount of lime that should be used on any particular field is determined by four factors:

1. The acidity of the soil, such as measured by pH tests.
2. The textural character of the soil.
3. The organic content of the soil.
4. The optimum reaction for the crop to be grown.

The relationship between the acidity of the soil and its lime requirement as affected by texture and organic content is indicated by the following table:

[1] Morgan, M. F., Soil Sci., 29: 163-180. 1930.

TABLE XVII. LIMESTONE ($CaCO_3$) REQUIRED TO NEUTRALIZE SOIL ACIDITY UNDER AVERAGE CONNECTICUT CONDITIONS (IN TONS PER ACRE).

Soils testing between following pH limits	Very sandy soils Low O.M.[1]	Very sandy soils Medium O.M.	Sandy loams Low O.M.	Sandy loams Medium O.M.	Loams and fine sandy loams Low O.M.	Loams and fine sandy loams Medium O.M.	Loams and fine sandy loams High O.M.
3.80-4.19	1.50	2.25	2.55	3.15	3.50	4.40	5.35
4.20-4.59	1.30	1.95	2.21	2.73	3.00	3.80	4.65
4.60-4.99	1.10	1.65	1.87	2.31	2.50	3.20	3.95
5.00-5.39	0.90	1.35	1.53	1.89	2.25	2.70	3.25
5.40-5.79	0.70	1.05	1.19	1.47	1.75	2.10	2.55
5.80-6.19	0.50	0.75	0.85	1.05	1.25	1.50	1.75
6.20-6.59	0.30	0.45	0.51	0.63	0.75	0.90	1.05
6.60-6.99	0.10	0.15	0.17	0.21	0.25	0.30	0.35

A discussion of the specific reaction preferences and crop lime requirements is not within the scope of this bulletin. However, the following general statements indicate the situation of the state as a whole with respect to the need for lime in growing the economically important crops.

1. About 15 per cent of the improved land of the state is so acid that all crops grown are a practical failure because of the high acidity of the soil.

2. Sixty per cent of the Connecticut fields are so acid that corn and grass hay would probably be benefited by liming.

3. Seventy-five per cent of the land does not grow clover well on account of lime needs.

4. Alfalfa and acid sensitive vegetable crops could not be grown on 90 per cent of Connecticut soils without liberal lime applications.

5. Only one per cent of the total improved area of the state is now limed to the point where no soil acidity exists.

6. Practically all permanent pasture lands must be limed as the first step in pasture improvement before superphosphate and other fertilizers can produce a material benefit.

7. About 70 per cent of fields used for tobacco are at a favorable soil reaction for that crop. About 20 per cent of these soils are so acid that moderate lime applications should be beneficial, while ten per cent have been too heavily limed in the past, with serious black root rot troubles as a consequence. Light applications of magnesian lime might improve the quality on most of the balance of the area.

8. Lime has usually been liberally used on fields devoted chiefly to vegetable crops and the main use of lime in this type of farming will be for maintaining these fields at the present favorable reaction and for new fields not previously limed.

Aluminum and Manganese as Soil Toxins in Acid Soils

Under the strongly acid conditions such as have been shown to exist over much of the state, aluminum and manganese tend to form soluble compounds in the soil. It has been shown clearly at the Rhode Island Agricultural Experiment Station that the high concentration of soluble aluminum which exists in certain strongly

[1] O.M. stands for organic matter in above table, where
—low O.M. is indicated by light brown, yellowish-brown or reddish-brown color.
—medium O.M. is indicated by medium brown or gray brown color.
—high O.M. is indicated by dark brown or very dark grayish brown color.

acid soils of that state is quite poisonous to many crops, while soluble manganese is similarly injurious to some species of plants.

Connecticut soils frequently show considerable amounts of aluminum compounds which are soluble in N/2 acetic acid (so-called "active" aluminum). Twenty-five acid soils when studied under greenhouse conditions showed amounts of "active" aluminum ranging from 571.5 to 69 p.p.m. (parts per million) of Al (equivalent to from 1,080 to 130.4 p.p.m. of Al_2O_3) on soils ranging in acidity from 3.94 to 5.26 pH. Within this group of soils, six soils, testing above 4.8 pH, averaged 120.23 p.p.m. "active" Al, while nine soils testing below 4.2 pH averaged 336.6 p.p.m.

The amounts of water-soluble aluminum present in the soil are small but under strongly acid conditions can be readily detected. Water extracts from soils above 5 pH rarely give a positive test for aluminum, while at lower pH values, tests of leachates from the soil range from about 1 p.p.m., up to about 40 p.p.m., the higher values usually being found on the more acid soils.

Active manganese has also been determined by the half-normal acetic acid method for a number of Connecticut soils. Forty soils ranging from 3.94 to 6.0 pH gave "active" manganese (Mn) of from 0 to 409.0 p.p.m. A correlation between degree of acidity and "active" manganese is suggested in the following table.

Table XVIII. "Active" Manganese and Soil Acidity.

pH group	No. of soils	Average "active" Mn p.p.m.	Range
3.90—4.19	9	113.78	26.6—409.
4.2— 4.79	6	45.40	11.5—116.4
4.8— 5.20	8	21.80	6.0— 46.1
Above 5.20	7	3.16	0.0— 4.2

Manganese is present in the water extracts or leachates from strongly acid soils in appreciable concentrations. This is indicated by some preliminary data from the lysimeter at Windsor, and from analyses of leachates from greenhouse soil pots of different soils and treatments. Thus in a greenhouse experiment with tobacco, two and a half liters leached through 8,000 grams (dry weight) of a soil testing 4.5 pH, with tobacco showing marked symptoms of manganese toxicity, gave a concentration of 47.3 p.p.m. of manganese. The maximum thus far obtained in leachates from acid soils has been 70.5 p.p.m. Details of these studies on water-soluble manganese will be published later.

It is thus seen that Connecticut soils of strong acidity (below 5.0 pH) may contain sufficient amounts of both aluminum and manganese in forms that may be toxic to the growth of plants that are sensitive to soluble concentrations of either of these elements. It has been shown that tobacco is definitely injured by manganese poisoning through the soil, although this particular crop appears not to be affected by the soluble aluminum concentrations that normally exist in acid soils.

PART IV

NUTRIENT REQUIREMENTS OF CONNECTICUT SOILS AS MEASURED BY VARIOUS CROPS IN GREENHOUSE AND SOIL FRAME EXPERIMENTS

Beginning in a small way with limited facilities in 1924 and 1925, and as an important phase of the work since the construction of a new greenhouse in 1926, pot experiments have been conducted to study the fertilizer and lime needs of the important types of Connecticut soils. During this period 79 different soils have been under investigation. The various soil types and the kinds of fields from which the samples were taken are shown in Table XIX.

Table XIX. Check List of Soils Used in Greenhouse Pot Tests.

	Laboratory serial numbers				
Soil type	General crops and mowing, plowed within last five years	Old mowing lots	Permanent pasture	Tobacco	Waste land
Gloucester fine sandy loam	4, 10, 315	7, 22, 320	228, 317, 335	....	1
Gloucester loam	316, 318, 319	......	......	....	....
Coloma very fine sandy loam	......	......	322	....	....
Brookfield fine sandy loam	17	......	......	....	....
Hinsdale fine sandy loam	......	236	......	....	....
Wilton fine sandy loam	229, 234	......	......	....	....
Hollis silt loam	......	234	......	....	....
Dover fine sandy loam	14, 232	......	......	....	....
Holyoke loam	......	......	235	....	....
Middletown loam	......	......	60	....	....
Woodbridge fine sandy loam	2, 15	5	225	....	....
Charlton fine sandy loam	8, 11, 311, 312	241	......	....	....
Charlton loam	3, 9, 12, 310	23, 313, 314	327, 340	....	....
Taugwank loam	234	237	......	....	....
Haddam fine sandy loam	......	238	......	....	....
Lenox fine sandy loam	......	230	......	....	....
Cheshire sandy loam	......	......	......	....	344
Cheshire fine sandy loam	......	......	338	....	243
Wethersfield fine sandy loam	58	......	......	....	....
Wethersfield loam	20, 227	......	......	....	....
Litchfield loam	......	6, 16, 239	......	....	....
Becket fine sandy loam	......	......	1	....	....
Whitman loam	......	240	......	....	....
Hinckley gravelly sandy loam	......	......	242	....	....
Hinckley fine sandy loam	......	......	241	....	....
Hinckley loam	321	......	......	....	....
Manchester fine sandy loam	......	......	336	....	....
Merrimac coarse sand	......	......	......	....	19
Merrimac loamy sand	......	......	224	223	21
Merrimac sandy loam	......	......	......	244	....
Hartford coarse sand	......	......	......	....	343
Enfield very fine sandy loam	......	......	246	....	....
Suffield clay loam	......	18, 245	337	....	....
Podunk silt loam	......	325	......	....	....
Podunk loamy sand	......	......	......	....	326

The geographical distribution of these soils is shown in Figure 63.

The soils are collected in the field during the autumn months. About 500 pounds of the soil at normal field moisture content are thoroughly mixed, passed through a one-quarter inch screen to remove the coarse gravel and stone, bagged and brought into the laboratory, where it is air-dried and potted in two gallon glazed earthenware pots with a hole for drainage and aeration at the

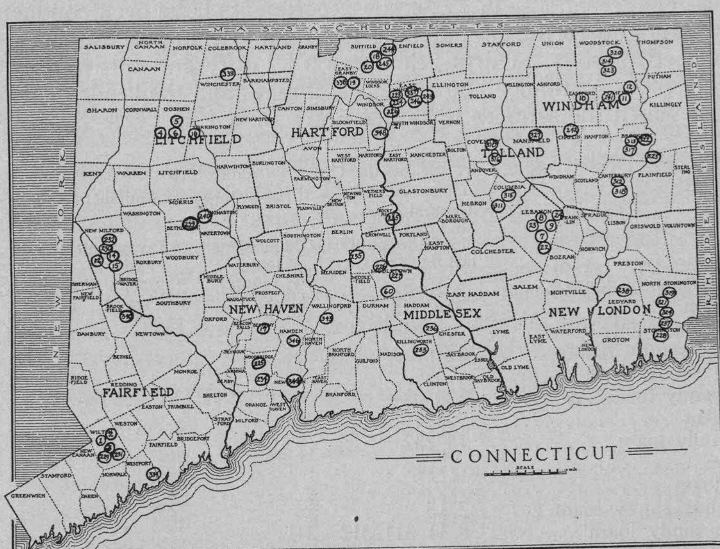


FIGURE 63. Locations of fields from which soils have been taken for fertilizer experiments in greenhouse plots and soil frames. The laboratory record numbers are indicated within the small circles.

bottom of the side. Lime in the form of precipitated chalk ($CaCO_3$) is added in amounts representing one and one-half the lime requirement as determined by the Jones laboratory method. The nutrient elements are applied in solution. The usual treatments per two gallon pot are as follows:

Nitrogen (N): 0.8 gm. urea.
Phosphorus (P): 1 gm. H_3PO_4 (85%).
Potassium (K): 1.5 gms. Potassium acetate.

Thus no other nutrient elements than N, P, and K are added in the fertilizer.

After applying the treatments the soils are made up to about 60 per cent water saturation, and seeded or planted about one week after the nutrient solutions are added.

Distilled water was used in 1924 and 1925, but as insufficient

amounts were available for the expanded greenhouse facilities in 1926, rain water collected from the laboratory roof was used for a time. This proved to be unsatisfactory because of its sulfur content and acid reaction, especially during the winter period when the nearby heating plant, burning soft coal, was in operation. The tap water from the city mains was found to contain only negligible quantities of any of the nutrient elements, and it has been used exclusively for watering the pots during the past three years.

It was originally expected that the unlimed soils would remain at practically the same reaction as when collected from the field. However, subsequent pH tests of the variously treated soils showed an increase in the acidity of unlimed soils when kept under greenhouse conditions without being subject to leaching or the periodic return of low-temperature conditions such as naturally occurs in the field.

This tendency toward increased acidity is most noticeable with the nitrogen treatments (in the form of urea). This is in agreement with results with urea previously reported by Swanback and Morgan.[1]

An illustration of this trend toward increasing acidity in pot experiments is indicated in the data for soils 310 to 325 in 1929.

TABLE XX. SOIL REACTION OF SOILS 310 TO 325 IN GREENHOUSE POTS, NOVEMBER 13, 1929.

Treatments	310 pH	311 pH	312 pH	313 pH	314 pH	315 pH
NK	4.02	4.81	4.07	4.10	4.46	4.54
NP	4.01	4.28	3.94	4.14	4.13	4.11
PK	5.26	5.50	4.78	4.80	4.96	5.12
NPK	4.60	5.03	4.43	4.31	4.66	4.45
Soil from field in autumn, 1928	5.04	5.36	4.79	4.92	5.17	5.27

	316 pH	317 pH	318 pH	319 pH	320 pH
NK	4.66	4.10	3.83	4.06	4.79
NP	4.10	3.91	3.76	4.00	4.32
PK	5.26	5.09	4.27	4.85	5.15
NPK	4.65	4.21	3.93	4.22	4.90
Soil from field in autumn, 1928	5.23	5.18	4.72	4.91	5.36

	321 pH	322 pH	323 pH	324 pH	325 pH
NK	4.20	4.91	4.90	4.23	4.03
NP	3.92	4.08	4.63	4.15	3.93
PK	4.86	5.57	5.50	5.34	4.80
NPK	4.20	4.95	5.23	4.31	4.11
Soil from field in autumn, 1928	4.73	5.24	5.36	4.93	5.06

[1] Swanback, T. R., and Morgan, M. F., Conn. Agr. Exp. Sta. Bull. 311: 264-268. 1930.

The increased acidity under the conditions of our pot experiments is apparently most marked in cases where nitrogen is added and either phosphorus or potassium is omitted from the treatment. The decreased plant growth, with a corresponding diminution of the removal of the soluble salts either added in the fertilizer or produced from the nitrification of the area, may explain this phenomenon.

At any rate, the results from lime treatments in these pot experiments must be interpreted on the basis of the reaction of the potted soil at the time when the crop is grown, rather than the original reaction of the soil when it was collected in the field. This has involved the periodic testing of the pH of the soil from each pot.

Alfalfa

Alfalfa was grown as a test crop on 48 of the soils listed in Table XIX. On only 14 of the soils (Nos. 233-246 inclusive) were the treatments so designed as to show response to nitrogen, since it was believed that this crop, being a legume, would show little or no response to that element. Under greenhouse conditions this proved to be the case, since soils 233 to 246 averaged 98 per cent yield with LPK as compared with 100 per cent on the LNPK and only two soils, Nos. 243 and 246, gave significant responses to nitrogen.

Lime. This was the most serious limiting factor on most of the soils, with an average yield of only 57 per cent without lime, as compared with 100 per cent where lime was applied.

The soils with reference to their response to lime may be grouped as follows, the reaction of the soil in the unlimed, fertilized pots being indicated:

TABLE XXI. GROWTH OF ALFALFA WITHOUT LIME ON COMPLETELY FERTILIZED SOILS AND THEIR REACTION.

Complete failure (less than 5% crop)		Practical failure 5-50% crop		Serious decrease in growth 50-90% crop				Little or no response to lime (90% crop or better)	
Soil No.	pH	Soil No.	pH	Soil No.	pH	Soil No.	pH	Soil No.	pH
234	3.92	2	4.76	1	5.11	19	4.94	3	6.26
237	3.88	224	4.81	5	4.94	20	5.51	3	5.98
239	4.25	225	4.65	6	5.11	21	5.52	10	6.58
243	3.78	228	4.67	7	4.92	22	5.44	14	7.08
		231	4.38	8	5.27	23	5.12	232	6.85
		233	4.76	9	4.96	24	5.14		
		238	4.33	11	5.48	223	5.86		
		241	4.53	12	5.53	226	5.41		
		244	4.59	13	5.07	227	5.35		
		245	4.72	15	5.32	229	5.30		
		246	4.46	16	5.34	230	5.42		
				17	5.51	235	4.74		
				18	4.81	236	4.78		

From the above data, it appears that there is a good general agreement between the lime needs of alfalfa on Connecticut soils and their pH values. At reactions below 4.4 pH, alfalfa is a complete failure, and less than half the yield capacity of the fertilized soils can be attained on soils more acid than 5 pH, with few exceptions. Definite responses to lime are obtained on all soils below 6 pH.

Phosphorus. The omission of this element from the fertilizer produced significant decreases in yield on both limed and unlimed soils in the majority of cases. The average for the 48 soils was an 81 per cent crop of alfalfa on the LK or LNK treatment.

There was no correlation between the total phosphorus content of the soil and its ability to produce a normal crop of alfalfa without phosphorus fertilization. There was a good general agreement between the "available phosphorus" as measured by the previously described laboratory method, and the yield capacity of the soil without the addition of phosphatic fertilizer. This is presented in Table XXII.

TABLE XXII. GROWTH OF ALFALFA WITHOUT PHOSPHORUS FERTILIZATION. (Available Phosphorus, in Pounds per 2,000,000 Pounds, Indicated After Serial Number of Soil.)

Practical failure (less than 50% crop)	Serious reduction in growth (50-90% crop)		Little or no response to phosphorus (90% crop or better)	
1-2	2- 5	224-15	3-33	21-10
6-2	7- 8	226-20	4-14	223-57
225-2	8- 6	227-12	5-10	229- 6
235-2	9- 5	228- 7	12-15	230-10
236-3	10-10	231- 7	13-23	232-42
240-2	11- 7	233- 2	14-31	238-10
	16- 8	234- 3	15-19	239-12
	17- 6	237- 2	18-10	244-40
	19- 7	241- 2	20-24	245-12
	22- 7	242- 2		
	23- 3	243- 5		
	24- 6	246- 7		

Potassium (Potash). The omission of potassium from the fertilizer is almost as serious as is the case with phosphorus, as shown by the results on these 48 soils, which produced on the average an 84 per cent crop on the LP or LNP treatments.

Here, also, there was no similarity between the total content of the element in the soil and the results when that element is omitted from the fertilizer. There is very little agreement between crop results and "exchange potassium" as determined in the laboratory.

TABLE XXIII. GROWTH OF ALFALFA WITHOUT POTASSIUM FERTILIZATION AND THE "EXCHANGE" POTASSIUM IN THE SOIL.

("Exchange" Potassium, in Pounds per 2,000,000 Pounds, Indicated After Serial Number of Soil Whenever Data Is Available.)

Practical failure (less than 50% crop)	Serious reduction in growth (50-90% crop)		Little or no response to potassium (90% crop or more)	
234- 75*	1-	232- 74*	2-	18-
236-148*	3-	233-155*	7-	20-
237-135*	4-	235- 90	9-	21-
243-182*	5-	238- 85	10-	22-
244-132*	6-	239- 72*	11-	24-
	8-	240- 51	12-	223- 64
	19-	241- 92*	13-	226-111*
	23-	242- 56*	14-	227-116
	224- 34*	245-131*	15-	229-214
	225-116*	246- 77*	16-	230-116
	228-166*		17-	231-240

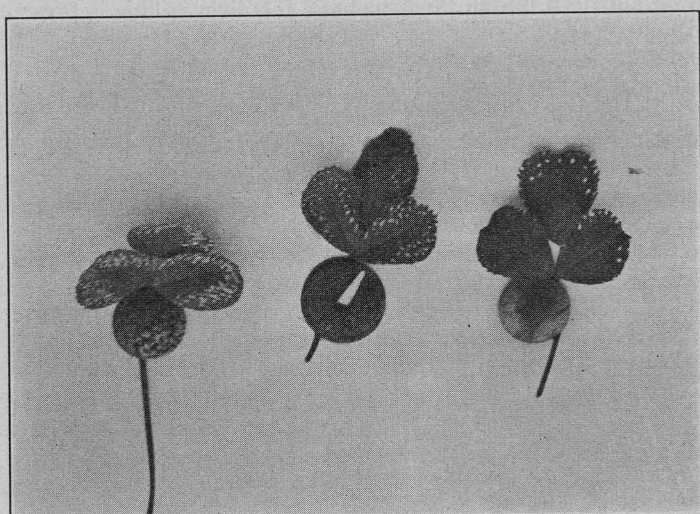


FIGURE 64. Characteristic alfalfa leaves showing spots typical of potash-hunger when grown in the LP pots of many Connecticut soils.

Soils 1 to 24 inclusive were fertilized with di-sodium phosphate as a source of phosphorus. The LP pots of these soils did not show the potash-starvation symptoms indicated by the characteristic spotting of the leaf pictured in Figure 64. This may have been due to a partial replacement of sodium for potassium in the physiological processes of the plant. All the other soils received

* Characteristic leaf spotting symptom when potassium was omitted.

no sodium in the fertilizer, and the leaf spotting was observed on many of the pots that received no potassium in the treatment.

A careful study of the data revealed no consistent correlation between fertilizer and lime requirements and the soil type, except for the lack of lime response on the limestone-derived Dover soils (Nos. 14 and 232).

Buckwheat

Buckwheat was grown in 1924 on soils 13 to 24 inclusive. It was not sufficiently sensitive to lime and nutrient deficiencies to produce significant yield differences on most of these soils, hence its use as an indicator plant to show soil deficiencies was discontinued, and the yield data is not here presented.

Lettuce

Lettuce, of the Cos or Romaine type, was grown as a test crop on 40 different soils. It proved to be a fairly satisfactory crop for indicating the lime and nutrient requirements of Connecticut soils. Yields on duplicate pots were frequently somewhat irregular, due to the failure of one or more plants to survive, but yield differences between various treatments were usually very great.

Lime. Lime was the most serious limiting factor. The crop was a total or practical failure on the majority of the soils when lime was omitted. The 40 soils produced an average of only a 28 per cent crop on NPK treatments. The results are summarized in Table XXIV.

TABLE XXIV. GROWTH OF LETTUCE WITHOUT LIME ON COMPLETELY FERTILIZED SOILS AND THEIR REACTION.

Total failure (less than 5% crop)				Practical failure (5-50% crop)		Serious lime deficiency indicated (50-90% crop)	
Soil No.	pH	Soil No.	pH	Soil No.	pH	Soil No.	pH
223	4.48	314	4.66	1	5.11	3	6.26
224	3.97	315	4.45	2	4.76	4	5.08
227	3.99	316	4.65	6	5.11	5	4.94
228	4.07	317	4.21	9	4.96	8	5.27
229	4.61	318	3.93	60	4.53	9	4.96
230	4.05	319	4.22	225	4.30	10	6.58
231	3.96	321	4.20	226	4.94	11	5.48
310	4.60	322	4.95	311	5.03	12	5.53
312	4.11	324	4.31	320	4.90	58	6.24
313	4.31	325	4.11			232	6.85
						323	5.23

From the above data, lettuce appears to be even more sensitive to soil acidity than alfalfa, being a total failure at most reactions below 4.6 pH, and producing less than 50 per cent yield at reactions below 5 pH. Response to lime is significant, even with soils between 6 and 7 pH.

Nitrogen. Although the results for the average of 28 soils where there was a direct comparison between LNPK and LPK treatments, showed an 83 per cent yield where nitrogen was omitted from the treatment, gains for nitrogen were very erratic, and on ten of the soils there was a significant decrease in growth when nitrogen was applied in the form of urea. The results on soils that might reasonably be expected to show nitrogen response for such a crop as lettuce should not be interpreted as an indication that these soils might not require fertilizer or manurial nitrogen under field conditions. In a greenhouse experiment there is abnormally rapid liberation of nitrogen from the total nitrogen reserve of the soils, which is in most cases relatively high. There was no provision for leaching the soils, such as naturally occurs, hence available nitrogen not taken up by the crop tends to accumulate in the soil. In our recently revised pot experiment technique, field conditions are more closely approximated by periodically leaching the soil.

It has also been shown that the urea treatments have tended to increase the acidity of the soil. This is at least a partial explanation of the depressing effect of urea on the growth of lettuce, which occurred in every case on the unlimed pots, and in several cases even when the soil was limed.

That there is some relationship between total nitrogen content of the soil and the available nitrogen is indicated by the nitrogen response data for lettuce. Thus the following soils showing significant nitrogen response have total nitrogen contents (in pounds per acre of surface soil) as indicated:

58-1746	232-3048
60-2272	317-2840
223-1986	322-2307
225-3782	323-3773
228-3150	

All of these nitrogen contents are below the average for the state (which is 4,000 pounds per acre of surface soil).

Phosphorus. This element is a very serious limiting factor for the growth of lettuce. The average yield on LNK treatments (phosphorus omitted) was but 57 per cent. The data is presented in Table XXV to show relationship with available phosphorus tests of the soil.

TABLE XXV. LETTUCE YIELDS WITHOUT PHOSPHOROUS FERTILIZATION AS RELATED TO PHOSPHORUS AVAILABILITY TESTS.

(Available Phosphorus, in Pounds Per 2,000,000 Pounds, Indicated After Serial Number of Soil.)

Total failure (less than 5% crop)	Practical failure (5-50% crop)		Serious decrease in yield without phosphorus (50-90% crop)		Little or no response to phosphorus (90% crop or more)
310-2	6-2	315-2	1- 2	226-20	5-10
318-2	60-4	316-4	2- 5	227-12	11- 7
	225-2	317-5	3-33	228- 7	12-15
	231-7	321-5	4-14	229- 6	223-57
	311-5	322-9	7- 8	230-10	224-15
	313-4	324-3	8- 6	312- 8	232-42
	314-9	325-3	9- 5	319- 5	323- 5
			10-10	320- 6	
			58-13		

While there are a few unexplained exceptions, there is a good general agreement between the percentage yield without phosphorus and the results of the laboratory tests.

Potassium. Potassium is in general slightly more in demand for lettuce on Connecticut soils than is phosphorus. The average yield on the LNP treatment (without potassium) is 50 per cent of the LNPK yields. Results, with figures following the soil serial number, are shown in Table XXVI.

TABLE XXVI. LETTUCE YIELDS WITHOUT POTASSIUM FERTILIZATION AND THE "EXCHANGE" POTASSIUM OF THE SOIL.

("Exchange" Potassium, in Pounds Per 2,000,000 Pounds, Indicated After Serial Number of Soil Whenever Data is Available.)

Practical failure (Crop 5-50%)		Serious decrease in growth (50-90%)	Little or no response to potassium (Crop 90% or more)
1-	314- 95	3-	5-
2-	315-109	4-	7-
8-	316- 78	6-	9-
58-	317- 98	11-	10-
226-111	318-133	60-	12-
228-166	319-132	223- 64	
232- 74	320- 85	225-116	
310-141	322-166	227-116	
311-176	323-122	229-214	
312-160	324- 72	230-116	
313- 93	325-156	231-240	
		321-344	

Figures as to "exchange" potassium are not available on soils 1 to 12 and it must be recalled that these were the ones that received sodium as part of the phosphorus treatment, which may account for the lack of response to potassium of five of this group. The only correlation to be observed is the appearance of all three soils containing more than 200 pounds per 2,000,000 of "exchange" potassium in the group with 50 to 90 per cent growth without potassium treatment.

New York head lettuce was grown in the spring of 1930 in a series of fertilizer tests in .0001-acre concrete soil frames. The soil, of the Cheshire sandy loam type, is strongly acid and of low natural fertility. It was taken from an abandoned field now overgrown with broomsedge, cinquefoil and dewberry vines. Previous crops showed the following percentage yields with the omission of the various nutrients, as compared with lettuce:

	No lime	No nitrogen	No phosphorus	No potassium	Complete fert. and lime
Beets	0	70	90	56	100
Onions	5	77	76	32	100
Celery	0	79	26	71	100
Sweet Corn	75	59	94	95	100
Spinach	1	32	18	91	100
Tomatoes	88	59	28	96	100
Lettuce	13	43	23	92	100

It appeared that under outdoor conditions on this soil lettuce was less responsive to potassium than are beets, onions or celery.

The growth of lettuce in these soil frames is shown in Figure 65.

Tobacco

Tobacco of the Turkish type (selected because of its medium size, excellent uniformity and suitable habit of growth for greenhouse pots) has been grown on 51 different soils. It is a remarkably good crop to show nutrient deficiencies of the soil, since it shows both decrease in size of the plant and characteristic appearance of the leaves when an element is a limiting growth factor, or if there is some abnormal condition of the soil. This has been previously discussed by the author in a journal paper.[1]

Lime. Tobacco is apparently able to make normal growth on soils that are much too acid for many other crops. On 41 soils where there was a direct comparison between LNPK and NPK, the yield was 110 per cent without lime as compared with 100 per cent with lime. On the other hand there were certain very acid soils that were strikingly benefited by lime treatment. Such soils, notably Nos. 234, 237, 243, 337 and 340, showed an abnormal mottled appearance of the leaves when grown on unlimed pots. Analyses of the plants, chemical studies of the soil, and the similarity of growth with that which has been observed in both soil and solution cultures with the additions of abnormal concentrations of soluble manganese salts, have all confirmed the belief that this condition is due to the high soluble manganese content of these soils. This is corrected by liming, and soils less acid than about 4.6 pH have not shown this trouble. Figure 66 shows a typical plant grown on such a manganese-toxic acid soil.

[1] Morgan, M. F., Jour. Am. Soc. of Agron., 21: 130-136. 1929.

FIGURE 65. Soil frame experiment with New York head lettuce showing marked response to lime (L), phosphorus (P) and nitrogen (N), with slight response to potassium (K).

Nitrogen. While on the average tobacco has shown some response to nitrogen as grown in greenhouse pots without leaching (80 per cent yields on LPK treatments), the data is subject to the same abnormalities as for lettuce.

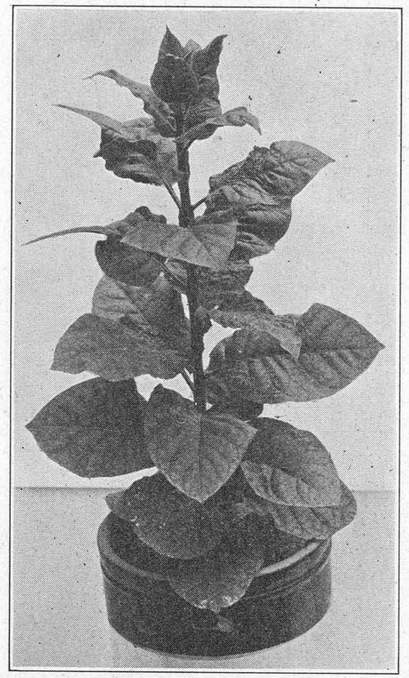


FIGURE 66. Tobacco plant grown on a very acid soil which contains a high concentration of soluble manganese.

Tobacco grown in 1930 on soils 334 to 343 inclusive, which were periodically leached, show much more consistent gains for nitrogen. This is indicated by a comparison of LPK yields on soils 310-325, none of which were leached or previously cropped in the greenhouse, with soils 334-342, leached both before and during the growing period.

TABLE XXVII. YIELDS WITHOUT NITROGEN ON UNLEACHED SOILS 310 TO 325 AND LEACHED SOILS 334 TO 342.

Serial No.	Percentage yield without N	Total N in soil in lbs. per 2,000,000	Serial No.	Percentage yield without N	Total N in soil in lbs. per 2,000,000
310	107	3,759	323	85	3,773
311	137	3,900	324	95	5,420
312	108	3,024	325	132	2,420
313	123	4,035	334	39	4,100
314	92	5,025	335	56	4,292
315	156	8,696	336	57	5,916
316	135	5,470	337	61	3,515
317	132	2,840	338	40	3,070
318	150	9,635	339	67	5,500
319	121	5,525	340	61	4,247
320	140	4,790	341	65	3,820
321	121	8,745	342	30	3,990
322	82	2,307			

In this connection it may be of interest to present the data for the nitrate nitrogen content of the first liter of the liquid leached from soils 310 to 325, subsequent to two crops of tobacco and one crop of lettuce grown in 1929.

TABLE XXVIII. NITRATE NITROGEN CONTENT OF LEACHATE FROM SOILS 310 TO 325, FEBRUARY 1, 1930 IN PARTS PER MILLION.

Soil serial No.	Unlimed		Limed	
	Without N	With N	Without N	With N
310	80	300	48	470
311	70	330	56	280
312	100	260	24	270
313	74	330	36	440
314	58	260	100	315
315	100	480	164	630
316	88	385	108	450
317	84	290	100	490
318	205	410	610	940
319	155	500	470	920
320	104	410	125	610
321	108	450	350	650
322	65	200	16	85
323	60	410	30	350
324	105	450	165	490
325	100	260	120	410

The failure of nitrogen to show increase, in fact, the general decrease in yield with nitrogen treatment on this group of soils is thus explained.

Phosphorus. Tobacco is extremely sensitive to low availability of phosphorus. The average yield without phosphorus on the 51 soils growing tobacco was only 33 per cent. There is a good general agreement between yields on treatments without phosphorus and the laboratory phosphorus availability test, as shown in Table XXIX.

TABLE XXIX. TOBACCO YIELDS WITHOUT PHOSPHORUS FERTILIZATION AS RELATED TO PHOSPHORUS AVAILABILITY TESTS.

(Available Phosphorus, in Pounds Per 2,000,000 Pounds, Indicated After Serial Number of Soil.)

Total failure (less than 5% crop)	Practical failure (5-50% crop)		Serious decrease in yield (50-90% crop)	Little or no response to phosphorus (90% crop or better)
225-2	226-20	242- 2	224-15	223-57
310-2	227-12	243- 5	246- 7	232-42
318-2	228- 7	245-12	312- 8	244-40
327-1	229- 6	311- 5	314- 8	334-46
337-3	230-10	313- 4	316- 4	
339-3	231- 7	315- 2	319- 5	
343-2	233- 2	317- 5	321- 5	
	234- 3	320- 6	322- 9	
	235- 2	324- 3	336-16	
	236- 3	325- 3		
	237- 2	335-16		
	238-10	338- 5		
	239-12	340- 7		
	240- 2	341-13		
	241- 2	342- 6		

Potassium. This element showed very marked gains on practically all soils, and with few exceptions the characteristic leaf-curl of potash-deficiency was in evidence on LNP treatments. It must be noted that tobacco showed more acute potash hunger on limed pots without potassium in the treatment than on corresponding unlimed pots. This will be explained later in connection with the data on the chemical composition of the tobacco from the greenhouse pots. The average yield for 51 soils on LNP treatments was 44 per cent as compared with LNPK pots.

TABLE XXX. TOBACCO YIELDS WITHOUT POTASSIUM FERTILIZATION AND THE "EXCHANGE" POTASSIUM IN THE SOIL.

(Exchange Potassium, in Pounds Per 2,000,000 Pounds, Indicated After Serial Number of the Soil.)

Practical failure (5-50% crop)		Serious decrease in yield (50-90% crop)	Little or no response to potassium (90% crop or more)
223- 64	241- 92	311-176	229-214
224- 34	242- 56	315-109	231-240
225-116	243-182	317- 98	321-344
226-111	244-132	318-133	334-474
227-116	245-131	319-132	
228-166	246- 77	324- 72	
230-116	310-141	327-155	
232- 74	312-160	335-142	
233-155	313- 93	336-110	
234- 73	314- 95	337-166	
235- 90	316- 78	338- 87	
236-148	320- 85	339- 98	
237-135	323-122	340- 97	
238- 85	325-156	341-172	
239- 72	342-151	343-170	
240- 51			

Beyond the fact that all of the four soils that have shown no significant response to potassium are higher than any of the other soils in exchange potassium, there is no evident correlation between the degree of response and the exchange potassium of soils containing less than 200 pounds per 2,000,000 pounds.

Chemical Composition of Turkish Tobacco Grown in Greenhouse Pots Under Various Conditions of Fertilization and Crop Response

In order to show the effect of various combinations of lime and fertilizers upon the composition of greenhouse tobacco grown in 1929, on soils 310 to 325 inclusive, the harvested crop was sorted on the basis of treatment and apparent symptoms of crop deficiency and chemical analyses were made under the direction of Dr. E. M. Bailey, in charge of the Department of Analytical Chemistry. The results are shown in Table XXXI.

TABLE XXXI. CHEMICAL COMPOSITION OF TURKISH TOBACCO GREENHOUSE POT EXPERIMENTS.

1929, Soils 310 to 325 (Moisture Free Percentages).

Leaves and Stems

Treatment and crop condition	CaO	MgO	K_2O	Mn_3O_4	P_2O_5	N	Total crude ash
PK—yellow leaves	5.29	1.16	4.44	0.077	0.75	3.13	19.14
NK—very stunted	6.56	1.65	6.21	0.310	0.65	6.65	27.24
NP—leaves badly distorted	9.36	2.58	1.19	0.445	0.95	5.71	23.96
NK—slightly stunted	7.58	1.94	6.71	0.160	0.73	5.46	27.66
NP—leaves slightly distorted	8.29	2.06	1.58	0.300	0.79	5.75	23.30
PK—normal color	6.61	1.27	4.83	0.116	0.84	4.37	22.15
NP—normal leaves	8.13	2.49	2.05	0.180	0.81	5.27	22.72
NPK—normal plants	6.92	1.51	4.87	0.180	0.69	4.86	22.94
LPK—yellowed leaves	8.60	0.80	4.15	trace	0.71	3.96	23.67
LNK—very stunted	8.19	1.19	6.24	trace	0.58	5.83	29.48
LNP—leaves badly distorted	10.92	1.60	1.03	0.036	1.02	5.55	25.04
LNK—slightly stunted	8.76	1.13	5.04	trace	0.74	5.67	27.20
LNP—leaves slightly distorted	10.76	1.46	1.09	0.011	0.79	5.94	25.16
LPK—normal color	8.56	0.77	3.38	0.000	0.96	3.90	24.73
LNP—normal leaves	10.26	1.31	2.77	trace	0.83	5.09	25.87
LNPK—normal plants	9.44	1.01	4.40	0.014	0.81	4.98	25.62
Stalks							
PK—yellowed leaves	1.12	0.38	3.51	trace	0.43	1.05	8.15
PK—normal color	1.59	0.44	3.78	trace	0.56	1.42	9.51
NK—very stunted	...	...	...	....	0.53	4.12	22.65
NP—leaves badly distorted	3.74	1.36	2.00	0.116	0.51	2.82	11.58
NK—slightly stunted	2.37	0.75	7.73	0.014	0.50	3.04	17.54
NP—leaves slightly distorted	3.38	0.98	1.92	0.088	0.42	2.81	10.46
NP—normal leaves	2.21	0.87	3.27	0.024	0.46	2.46	10.24
NPK—normal plants	1.74	0.53	4.07	0.021	0.40	1.76	10.28
LPK—yellowed leaves	1.83	0.36	3.49	0.000	0.45	1.35	9.38
LNK—very stunted	...	...	...	...	0.43	2.48	18.61
LNP—leaves slightly distorted	3.93	0.64	1.59	0.000	0.53	2.75	9.84
LPK—normal color	1.99	0.28	2.58	0.000	0.49	1.16	8.02
LNP—normal leaves	3.02	0.50	2.50	0.000	0.48	2.20	9.85
LNPK—normal plants	2.32	0.37	3.29	0.000	0.37	1.92	9.91

This data enables one to make the following statements as to the effect of lime and increased availability of nutrient elements in the soil or added in the fertilizer upon the chemical composition of the tobacco plant:

Lime (in the form of pure magnesium-free calcium carbonate). Increases calcium and total crude ash, particularly of the leaf; decreases magnesium, potassium and manganese; has no significant effect upon phosphorus content of either leaves or stalks.

Nitrogen. Noticeably increases nitrogen, calcium and manganese content, and probably slightly increases potassium magnesium and total crude ash; has no consistent effect upon phosphorus.

Phosphorus. Very slightly increases phosphorus content of leaves, but not of stalks, if the soil is markedly deficient in this element; decreases crude ash content.

Potassium. Increases potassium content; decreases calcium and magnesium and phosphorus content; no significant effect upon manganese or total crude ash.

When other nutrients are supplied, plants not provided with:

nitrogen show lower potassium, magnesium, calcium and crude ash contents, with an accompanying decrease in the nitrogen content.

phosphorus show abnormally high crude ash, potash and nitrogen contents, with but slightly decreased phosphorus content.

potassium show abnormally high calcium, magnesium and phosphorus contents, and strikingly low potassium content.

Oats

A crop of oats was grown after the first crop of tobacco in 1928 on soils 223 to 246. Nitrogen was then used in but one combination, the LNPK treatment. There had been a marked difference in the nutrient removal by the tobacco, and in the absence of nitrogen fertilization the growth of oats was practically in inverse proportion to the size of the previous tobacco crop. The data for soil 227 is typical:

Treatment	Tobacco gms. per pot dry wt.	Oats gms. per pot green wt.
O	1.53	111.5
P	17.58	68.5
PK	22.79	75.0
L	4.08	63.0
LP	1.17	69.0
LK	7.17	64.0
LPK	14.53	47.5
LNPK	15.23	118.0

For this reason it would be impossible to show any definite responses to lime, phosphorus and potassium. In all cases there was a very marked response to nitrogen and the growth of the untreated check plots was higher for 15 of the 24 soils than on the LPK treatments.

After obtaining these results, in subsequent trials nitrogen was added to all pots except the PK and LPK combinations. Oats was again grown in 1930 on soils 310 to 327 after a crop of sweet peppers. Again, in spite of the addition of nitrogen, diminished growth of the previous crop was the most important factor in producing increased oats yields in all cases except where there was a direct comparison between treatments without nitrogen and those with nitrogen. The only exception was the highly phosphorus-deficient soil No. 327, where the oats was almost a complete failure on treatments that omitted phosphorus.

On the basis of these results it appears that under greenhouse conditions oats is a valuable crop to show nitrogen deficiencies of Connecticut soils, but is much less sensitive to lack of other nutrients, except in extreme cases.

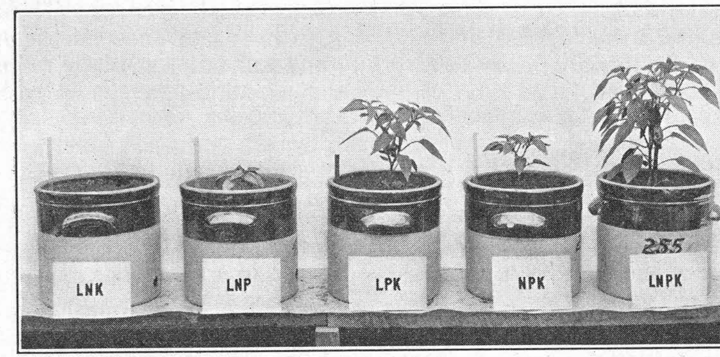


FIGURE 67. Sweet peppers in greenhouse pots of Gloucester fine sandy loam from typical unfertilized hay field in Eastern Highland, showing marked response of this vegetable to lime (L), phosphorus (P), potassium (K) and nitrogen (N).

Sweet Peppers

This crop has been grown in 1930 on greenhouse soils 310 to 327 and in .0001-acre concrete soil frames on Cheshire sandy loam at New Haven and a Wethersfield loam at Mount Carmel. The results have not been fully tabulated, but this crop is evidently an excellent one for use in indicating the nutrient deficiencies of the soils of this state. Figure 67 shows the typical growth on some of the treatments for one of the soils studied in 1930.

Preliminary observations indicate that peppers do well on most soils that are less acid than about 5 pH, but are seriously injured by more acid conditions, especially on soils that show any appreciable amounts of soluble aluminum or manganese. The crop is less sensitive than tobacco to moderate phosphorus deficiencies, but is unable to set fruit on the more extremely phosphorus-deficient soils. On every soil the crop did very poorly without fertilizer potassium. This was also the case with nitrogen, although to a slightly smaller degree.

Carrots

This crop has been grown on soils 58 and 223 to 232. On only three of these soils, Nos. 224, 226 and 227, was there a significant response to nitrogen. However, this was prior to the adoption of the pot-leaching technique. Only four of the soils, Nos. 224, 226, 227 and 232, failed to show good response to phosphorus. These soils were the highest of the group in available phosphorus, as shown by the laboratory test. Only one soil failed to show gains for potassium. The crop was a practical failure except on soils less acid than 5.8 pH.

Other Crops

No other crops were grown on more than three different soils. The following table shows the percentage yields for these crops without the various nutrients, as grown in greenhouse pots or concrete soil frames.

TABLE XXXII. COMPARATIVE YIELDS ON TREATMENTS OMITTING THE VARIOUS NUTRIENTS.

(Percentages, with LNPK Yield = 100.)

Crop	Soil No.	Without lime	Without nitrogen	Without phosphorus	Without potassium
Sweet corn	60	50	80	30	75
	344	75	59	94	95
	346	84	58	80	81
Spinach	344	1	32	18	91
	346	84	58	80	81
Beets	58	100[1]	65	83	36
	344	0[1]	70	90	56
Onions	344	5	77	76	32
Tomatoes	344	88	59	28	96
Celery	344	0	79	26	71

[1] Soils 58 and 344 tested 6.2 and 4.8 pH respectively.

GENERAL SUMMARY

The results of the investigations of the Soils Department of this Station, which contribute to a better understanding of the physical and chemical character of Connecticut soils with respect to their suitability for crop production, their natural nutrient deficiencies, and the responses of important crops to lime and fertilizer applications, are brought together in this bulletin.

A number of terms used in soil description are defined to enable the writer to give a clearer picture of the prevailing soil conditions of the state. The effects of rock material, glaciation, climate, drainage, erosion, clearing and cultivation in producing soil differencies are also briefly discussed.

The chief differences between Connecticut soils as a group and those of other regions of the United States are explained on the basis of climatic effects in soil formation acting more slowly than usual on a rather resistant type of rock material which was almost completely disturbed during the glacial epoch.

The topographic features of the state are important in relation to soil distribution. The Eastern and Western Highlands; the Limestone Valley area within the Western Highland; the Central Lowland with included areas of trap-rock ridges; each presents a different range of soil conditions.

The more important characteristics of the groups of predominating soil types are briefly discussed, and a colored map showing the approximate location of the main areas of soils of these groups is appended to this bulletin. For practical purposes 19 groups are necessary in order to indicate soil differences of major significance.

A "key" is presented which shows the basis for classification of the soils of the state into soil series and types, depending upon color, texture, structure and arrangement of the various horizons of the soil profile and their relationships to parent rock, mode of deposition of the parent soil material, topography, drainage conditions and the occurrence of stones or boulders. Such a classification enumerates 50 named soil series, comprising 176 types and phases. A detailed soil map of the state would picture at least this number of distinct soils.

In order to show any relationships that may exist between the more important of the above soil types and the present use of the land for crops, pasture and woodland, 15 areas well distributed over the state were carefully mapped as to soil and land cover. This was supplemented by soil and farm plan maps of 190 dairy farms in eight towns of the Eastern Highland.

The present use of an area of a given soil depends not only upon the inherent quality of the soil, but upon its relation to areas of other better or poorer soils, both on the farm and in the town as a whole.

The physical factors of soil type are apparently of paramount importance in determining the present adjustment of land use to soil. These factors are: stoniness; degree and diversity of slope; texture and structure of the soil and subsoil; character of the underlying material (boulder till, gravel, sand or clay); water-holding capacity and drainage conditions of the soil.

The major groups of soil are briefly discussed with reference to the leading agricultural enterprises: dairying, orcharding, small fruits, vegetables, potatoes, tobacco, alfalfa, grass hay, corn, pasture and forest.

An estimate of the present distribution of land use of the major soil types of the state is presented.

A tabulation of the soil series occurring on the 190 dairy farms in eastern Connecticut shows a considerable degree of selection of certain soils for productive use, with the relegation of the less-favored soils to brush pasture and woodland. Thus 44 per cent of the Charlton soils are improved, as compared to only 18 per cent of the Gloucester soils. These two soil series represented 46 per cent of the entire area included in these farms.

The chemical composition of a large number of samples of surface soil representative of the important soil types of the state, has been studied in detail with respect to the following factors: organic matter and nitrogen; total and available phosphorus; total and "replaceable" potassium; calcium and magnesium; acidity, lime requirement and their relationship to soluble aluminum and manganese.

An average acre of Connecticut surface soil contains approximately:

4,000 lbs. of nitrogen
1,800 lbs. of phosphorus
29,000 lbs. of potassium

with an acidity of 5.3 pH, requiring 2.75 tons of agricultural limestone to effect its neutralization.

As compared to the above averages, which also represent the more common conditions for soils used for general crops and mowing, the tobacco soils are lower in nitrogen, potassium and lime requirement and much higher in phosphorus. On the other hand, soils from permanent pasture fields are commonly higher in potassium and lime requirement and lower in phosphorus than the average for the state.

With respect to soil type or soil series, there are few indications of a consistent superior nutrient fertility in any case. There are some differences in nitrogen and organic content that show a relationship to soil type, as would be expected from their characteristic conditions with respect to moisture and textural class. Except in extreme cases such as the very sandy Merrimac, the very heavy

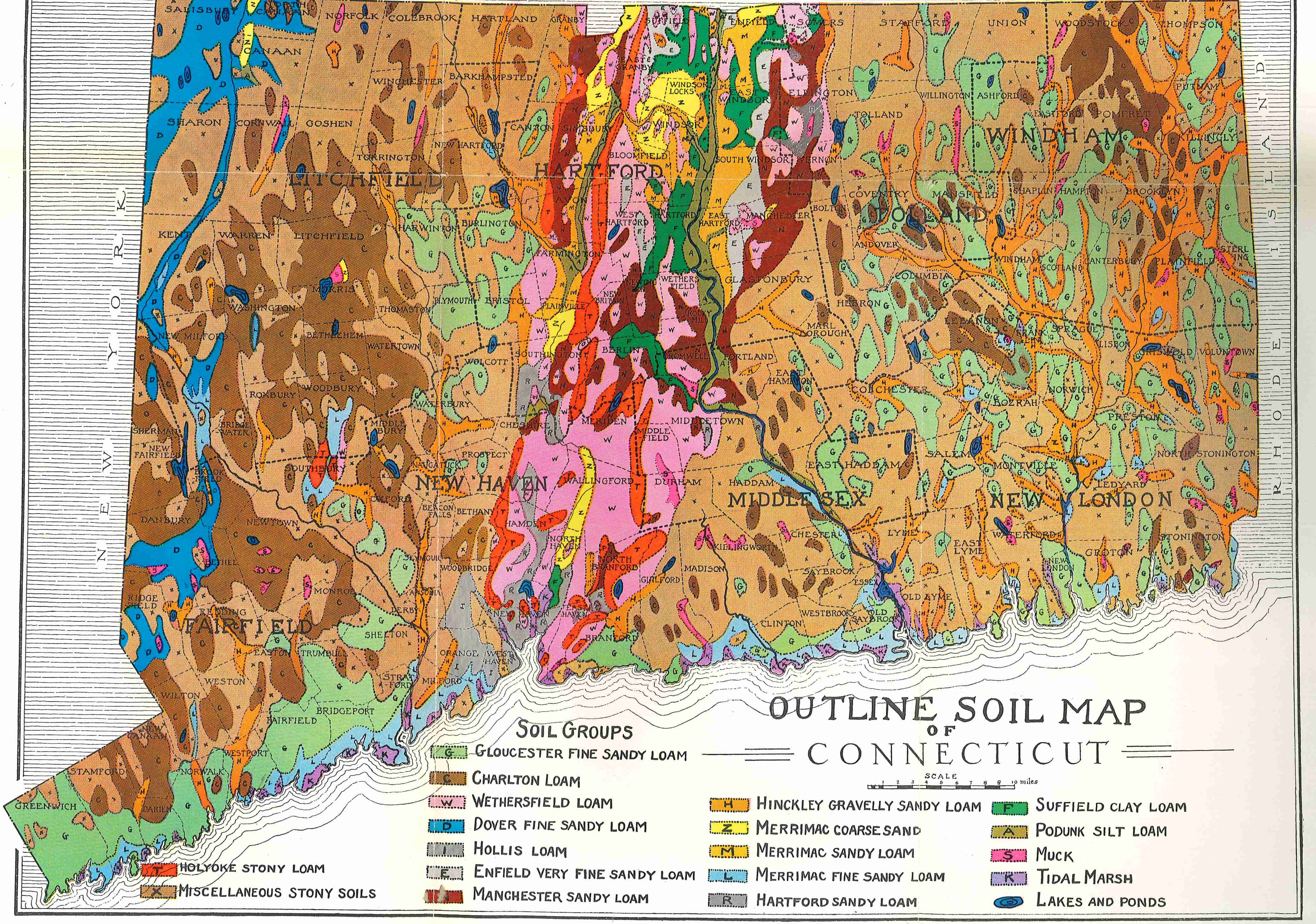
Suffield, or the poorly drained Whitman soils, under the same conditions of cultural history any one soil type of the state may show the same conditions of both total and available nutrients as any other.

A further estimate of the conditions of the prevailing soil type with respect to availability of nutrients and responses to lime, nitrogen, phosphorus and potassium, may be obtained from the results of pot experiments with 19 different soils, representing 35 soil types, and soil frames in the field representing two soil types. During the past five years the following crops have been grown on one or more of the above soils: alfalfa, lettuce, tobacco, oats, buckwheat, sweet peppers, carrots, sweet corn, spinach, beets, onions, tomatoes and celery.

The above crops vary greatly in their relative response to lime and fertilizers on the different soils. However, they all contribute to revealing the general low availability of soil nutrients and the need for lime on soils from fields that have not been heavily fertilized and limed during recent years. In general the pot and soil frame experiments show the same results as would have been predicted from the chemical studies as to soil acidity, available phosphorus, replaceable potassium and calcium, and soluble manganese and aluminum.

A greenhouse pot technique has now been adopted that permits the periodic leaching of the soil and the analysis of the leachate for such pertinent conditions as nitrate nitrogen, phosphorus, potassium, calcium, magnesium, aluminum and manganese. In the future it is hoped that this will furnish a more complete knowledge of the actual nutrient status of soils under investigation.

The greenhouse pot experiments have failed to show differences in the available nutrient supply of the soil, which are characteristic of soil types, except in the case of the naturally less-acid Dover soil. This is in accordance with the results of chemical studies. However, under field conditions, soils of two different types may be expected to show a consistent difference in capacity for economic crop production even though they are both equally deficient in plant nutrients. This is due to other limiting factors, such as poor moisture holding ability, failure to retain fertilizer applications against leaching, and unfavorable physical conditions such as irregular topography, stoniness, or excessive gravel, sand, or clay, which may exist to a greater degree on one soil than another. Both soils may need liberal fertilizer and lime applications, but on only one can the farmer obtain results that make it a profitable soil for the crop he is producing. Such factors are clearly distinguished in the classification of soil types now used in soil survey work.



OUTLINE SOIL MAP OF CONNECTICUT
SCALE
10 miles
SOIL GROUPS
G GLOUCESTER FINE SANDY LOAM
C CHARLTON LOAM
W WETHERSFIELD LOAM
D DOVER FINE SANDY LOAM
I HOLLIS LOAM
E ENFIELD VERY FINE SANDY LOAM
MANCHESTER SANDY LOAM
H HINCKLEY GRAVELLY SANDY LOAM
Z MERRIMAC COARSE SAND
M MERRIMAC SANDY LOAM
L MERRIMAC FINE SANDY LOAM
R HARTFORD SANDY LOAM
F SUFFIELD CLAY LOAM
A PODUNK SILT LOAM
S MUCK
K TIDAL MARSH
LAKES AND PONDS
T HOLYOKE STONY LOAM
X MISCELLANEOUS STONY SOILS
NEW YORK
RHODE ISLAND
LITCHFIELD
HARTFORD
TOLLAND
WINDHAM
FAIRFIELD
NEW HAVEN
MIDDLESEX
NEW LONDON

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FOR THE YEAR ENDING OCTOBER 31, 1929

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CIRCULARS 68 TO 72

Circular 68[1] January 15, 1930

THE EUROPEAN CORN BORER QUARANTINE AND CLEAN-UP REGULATIONS

W. E. BRITTON

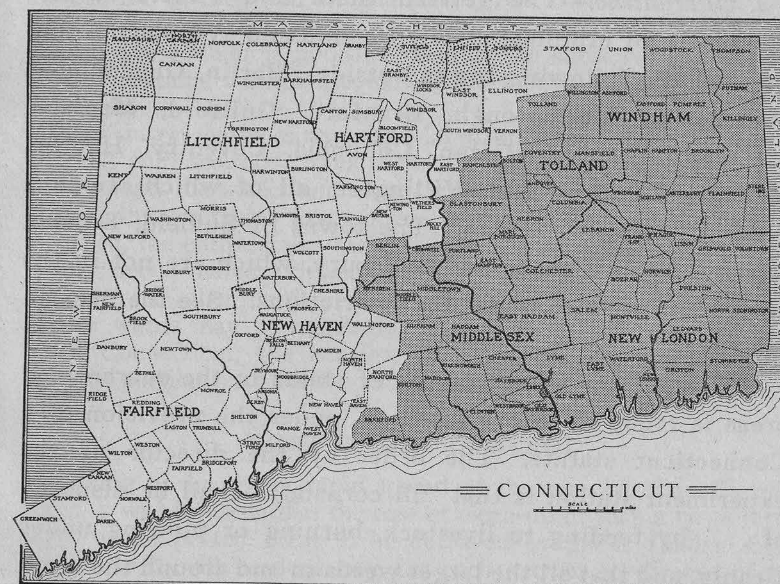

FIGURE 1. Map of Connecticut showing area under State and Federal quarantine on account of European corn borer. Shaded portion at right represents the two-generation area, and is part of the larger infestation extending over Rhode Island, eastern Massachusetts, New Hampshire and southeastern Maine. Lighter shaded portions in northwestern and north central part of the State represent the one-generation area, and are part of the large infestation of western Massachusetts, New York and westward.

Connecticut Agricultural Experiment Station

New Haven

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[1] This publication is a continuation of the series known as BULLETINS OF IMMEDIATE INFORMATION, which hereafter will be called CIRCULARS.

WHAT THE GROWER SHOULD KNOW

1. *Infestation.*—The European corn borer has spread over nearly half of Connecticut. Strict control methods must be practiced by the grower, or profit from corn growing will soon be impossible.

2. *Quarantine.*—The revised State and Federal orders include all of Middlesex, New London and Windham Counties and the following towns outside: Berlin, Glastonbury, Manchester, Marlborough, Branford, Guilford, Madison, Meriden, Andover, Bolton, Columbia, Coventry, Hebron, Mansfield, Tolland and Willington, all of which are in a generally infested region. The towns of Suffield, Enfield, Somers, North Canaan and Salisbury, which are not in the large area, are also under the restrictions. See the map on the cover.

3. *Control law.*—Destruction of stalks in the quarantined areas is required before April 10, under the provision of a Connecticut statute. The order by the director of the experiment station is that "all cornstalks shall be disposed of .... by feeding to livestock, burning or plowing under cleanly, and that all the larger weeds in and around the cornfields be likewise destroyed." *Violators are subject to fine.*

4. *Shipment.*—No corn on the ear may be shipped out of the restricted area and in the summer months all celery, green beans in the pod, beets with tops and rhubarb must be certified by inspectors.

5. *Inspection service.*—Those who have produce to be certified should apply to H. N. Bartley, Federal agent, 22 Elizabeth Street, South Norwalk, or to local agents soon to be announced.

THE EUROPEAN CORN BORER QUARANTINE AND CLEAN-UP REGULATIONS

The European corn borer, *Pyrausta nubilalis* Hubn., is a serious pest of corn, which also attacks certain vegetable and flowering plants. The insect is now present over nearly half the area of Connecticut and corn growers must soon practice cultural methods of control or they will be unable to grow corn at a profit. As new quarantine and control regulations have recently been established, this circular is published to give the latest regulations, but it also contains a brief account of the European corn borer and its injury.

This insect has a dirty white larva an inch or less in length, marked with scattered black dots. It prefers corn and it tunnels all through the stalks and ears. Breaking over of the tassels is one of the symptoms first noticed by the grower. When heavily infested, the entire stalks break down, and nearby celery, rhubarb, bean, beet, dahlia, chrysanthemum, gladiolus, aster, cosmos, zinnia, and other cultivated herbaceous plants and many of the larger weeds may be attacked.

In Connecticut, the heaviest infestations occur in the southeastern portion near the Rhode Island line.

COMPULSORY CONTROL

Owing to the recent rapid spread of the corn borer in Connecticut, it was foreseen that the cost of clean-up in such a large territory would be too great to be defrayed by public funds. Consequently it will be necessary for each grower to dispose of his own corn stalks and stubble. A certain proportion of growers will do this voluntarily for their own benefit, but others will not do so except under pressure. In order to make it possible to clean up all fields, the General Assembly of 1929 enacted the following law:

Public Acts of 1929

CHAPTER 171

AN ACT CONCERNING THE CONTROL OF THE EUROPEAN CORN BORER

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. The director of the Connecticut Agricultural Experiment Station shall issue and publish orders, rules and regulations which shall be effective in any town or portion thereof which shall have been quarantined on account of the European corn borer as provided by chapter 31 of the public acts of 1927, which orders, rules and regulations may require that each owner, tenant or manager of land on which corn of any kind has been grown shall, not later than December first of the year of its growth, plow or cause to be plowed the field in which it was grown, so as to bury the stubble to a depth of at least six inches, or pull up and destroy such stubble or cause it to be pulled up and destroyed by burning, and each person having in his possession corn stalks shall, not later than April tenth of the year following that of their growth, completely dispose of such corn stalks by using them as fodder or by burning them, and shall destroy, or cause to be destroyed, on or before April tenth of each year, all weeds in such areas as may be designated by the director of the Connecticut Agricultural Experiment Station.

SEC. 2. Any person who shall violate any provision of this act or any order, rule or regulation issued by authority of any such provision shall be fined not more than one hundred dollars.

Approved June 3, 1929.

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

CLEAN-UP ORDER

Pursuant to the provisions of Chapter 171, Public Acts of 1929, I, William L. Slate, Director of the Connecticut Agricultural Experiment Station, do hereby issue orders, rules and regulations as follows: That in the quarantined area all corn stalks shall be disposed of on or before April 10, by feeding to live stock, burning or plowing under cleanly, and that all of the larger weeds in and around the corn fields be likewise destroyed.

Effective January 15, 1930.

WILLIAM L. SLATE,
Director.

CULTURAL CONTROL METHODS

The following practices must be carried out by all growers if it is desired to hold the European corn borer in check. Otherwise, it may be impossible to grow corn at a profit after the State becomes thoroughly infested:

1. *Corn stalks should be cut* just as early as possible after maturity and put in the silo or fed out to cattle. When fed out, uneaten portions of stalks should be destroyed. If allowed to stand, such stalks furnish a favorable shelter for borers.

2. *If the stalk is cut close to the surface* of the ground, very few borers will be contained in the stubble. If it is cut 6-12 inches high, the stubble may furnish enough borers to ruin the crop the following year, and such stubble should be plowed under cleanly, or pulled and burned.

3. *Corn stalks which are not cut* and used for silage or fodder should be burned in the field or cleanly plowed under. The larger weeds in the fields and around the margins should also be burned.

4. *By clean plowing in the fall,* a large percentage of the second-brood borers are killed in the winter. Fall plowing is somewhat less effective against the single-brooded borers, but against both one-generation and two-generation borers, early spring plowing (in April) is beneficial, especially if all debris is covered deeply. There are now plows and attachments to facilitate the clean plowing under of standing corn stalks, and your county agent can advise you regarding them.

5. *Small patches of sweet corn* in back yard gardens can perhaps be pulled and burned to best advantage. If not cleaned up, such places will produce enough borers to infest the entire countryside.

QUARANTINE

After due notice and a public hearing at the station January 7, 1930, the following quarantine order was issued, effective January 15, 1930. This is in accord with Federal Quarantine No. 43, as revised and effective December 16, 1929.

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

Quarantine Order No. 24

CONCERNING THE EUROPEAN CORN BORER

The fact has been determined that the European corn borer, *Pyrausta nubilalis* Hubn., has spread to such an extent as to make it necessary to extend the area restricted by State Quarantine Order No. 21, effective March 15, 1929, and likewise to bring it into conformity with Federal Quarantine No. 43, as revised, effective December 16, 1929. A public hearing was held at the Connecticut Agricultural Experiment Station, New Haven, on Tuesday, January 7, 1930, at 2 o'clock P. M., as provided in Chapter 31, Public Acts of 1927.

Now, therefore, I, William L. Slate, Director of the Connecticut Agricultural Experiment Station, under authority granted by Chapter 31, Public Acts of 1927, do hereby proclaim the following areas (including towns affected by Quarantine Order No. 21) to be under quarantine and subject to the restrictions and regulations made a part of Federal Quarantine No. 43, as revised and effective December 16, 1929.

Regulated Areas

Two-Generation area:—All towns, boroughs and cities in Middlesex, New London and Windham Counties; Berlin, Glastonbury, Manchester and Marlborough in Hartford County; Branford, Guilford, Madison and Meriden in New Haven County; Andover, Bolton, Columbia, Coventry, Hebron, Mansfield, Tolland and Willington in Tolland County.

One-Generation area:—The towns of Enfield and Suffield in Hartford County; Somers in Tolland County; North Canaan and Salisbury in Litchfield County.

Movement of Restricted Plants

Until further notice unless accompanied by a certificate or permit issued by an authorized inspector of the Connecticut Agricultural Experiment Station or Federal Plant Quarantine and Control Administration, the following plants and plant materials cannot be allowed movement from the restricted areas to points outside or from the two-generation area into the one-generation area or from the one-generation area into the two-generation area: corn, broom corn, sorghum and sudan grass, including all parts of leaves and stalks throughout the year; from the two-generation area, all cut flowers and entire plants of chrysanthemum, aster, cosmos, zinnia, hollyhock, gladiolus and dahlia (except gladiolus and dahlia bulbs without stems) throughout the year; for the period between June 1 and December 31, all celery, green beans in the pod, beets with tops, rhubarb, oat and rye straw as such or when used as packing.

Shelled corn must bear a certificate or permit that the corn is clean (except that packages of shelled corn weighing 25 pounds or less to the shipment may be sent without certificate or permit).

This order shall take effect January 15, 1930.

William L. Slate,
Director.

Approved:
John H. Trumbull,
Governor.

SUMMARY OF REGULATIONS

For the guidance of growers and shippers, the regulations about moving crops from the quarantined area (see Figure 1) to the free area are given below:

Movement Not Allowed

Applies Throughout the Year: Corn on the ear, either green or dry, corn stalks, broom corn, sorghum and sudan grass, including all parts of leaves and stems. Inspections and permits refused.

Movement Allowed with Certificates

Applies Throughout the Year: From the two-generation area all cut flowers and entire plants of aster, chrysanthemum, cosmos, dahlia, gladiolus, hollyhock, and zinnia must be inspected and certified for shipment. (No restrictions on gladiolus and dahlia bulbs without stems.)

Applies from June 1 to December 31: All celery, green beans in the pod, beets with tops, rhubarb, oat and rye straw as such or when used as packing must be inspected and certified. (No restrictions from January 1-May 31).

Shelled Dry Corn: Quantities of 25 pounds or less without restrictions. Larger quantities must bear permit or certificate showing that corn is clean and free from pieces of cobs and stalks throughout the year.

For further information about the European corn borer apply to:

W. E. Britton, Connecticut Agricultural Experiment Station, New Haven, Conn. In charge of State regulatory work.

H. N. Bartley, 22 Elizabeth St., South Norwalk, Conn. In charge of Federal control work.

Requests for inspection and certification should be made to Mr. Bartley or to local inspectors soon to be announced.

Connecticut Agricultural Experiment Station
New Haven

EUROPEAN BLACK CURRANTS OUTLAWED

J. E. Riley, Jr.

CHAPTER 172 OF THE PUBLIC ACTS OF 1929

Section 1. Any person who shall grow, plant, propagate, cultivate, sell, transport or possess any plant, root or cutting of the European black currant, or Ribes nigrum, shall be fined not less than five dollars nor more than twenty-five dollars.

Sec. 2. The director of the Connecticut Agricultural Experiment Station is authorized to seize and destroy any plants, roots or cuttings of said European black currant found in the state.

The foregoing law became effective July 1, 1929. It was enacted for the purpose of protecting the white pines of Connecticut from the white pine blister rust, a fungous disease parasitic on white pines and all species of currants and gooseberries.

The European black currants, *Ribes nigrum* L., are especially susceptible to blister rust infection. They have been known to take infection at distances up to 100 miles or more from diseased pines. When infected, these currants can transmit the rust to trees a mile away. They act as the chief agent in the long distance spread and local establishment of the rust and are, therefore, a special menace to the white pines.

DESTRUCTIVENESS OF THE BLISTER RUST

The white pine blister rust has all the destructiveness of the chestnut blight, which has destroyed the chestnut. The rust accomplishes its results more slowly and is consequently less spectacular. Young white pine trees are quickly killed and soon disappear from the forest, thus preventing a natural perpetuation of the white pine as a forest crop. This destruction of white pine reproduction constitutes the most serious aspect of the blister rust menace and is the one least likely to be observed. Older trees when infected may live from five to twenty years or longer depending upon the number and location of the infections, but ultimately they are killed.

NATURE OF THE FUNGUS

The blister rust is not an insect nor a worm. It is one of the lowest forms of plant life and belongs to a group called fungi. Some fungi, like the molds found on jelly or bread, live on dead plant material. Other fungi, like the chestnut blight, exist on live plants and are called parasites. Certain parasites, such as the wheat rust and the white pine blister rust, require two host plants upon which to complete their life cycle. They belong to a group of parasitic fungi called rusts.

HOW THE DISEASE SPREADS

The rust spreads between white pines and currants and gooseberries by means of seed-like-bodies called spores. Three years or more after the rust attacks the white pine, it produces orange-yellow blisters on the infected bark, which, when broken, liberate the spores. These are carried by the wind long distances and on coming in contact with the under side of currant and gooseberry leaves under favorable atmospheric conditions they germinate. The rust then grows into the leaf and soon produces the typical rust spots on its under side. These spots produce the spores that spread the disease during the summer on currants and gooseberries. Later in the summer, this same fungous growth forms brown horn-like projections, visible on the underside of the leaves. These horn-like projections produce the spores that infect white pine in the fall.

The disease cannot spread directly from pine to pine. The fact that it must spend part of its life on currant or gooseberry plants makes it possible to control the disease by eradicating these plants in the vicinity of white pine.

HOW TO CONTROL THE RUST

As previously stated, spores from the European black currant may spread the rust to white pine a mile distant. Spores from other currants and gooseberries do not ordinarily spread the rust to pine more than 900 feet from the diseased bush. Therefore practical protection is given a stand of white pine by destroying all currants and gooseberries, both wild and cultivated, within 900 feet of the trees and the European black currants within one mile.

HOW TO TELL THE EUROPEAN BLACK CURRANT

The European and American black currants may be distinguished from all other cultivated currants by the amber-colored resin dots on the under side of the leaves. No other cultivated currant leaf has them. The two cultivated black currants may be distinguished from each other as follows:

European Black Current *Ribes nigrum*	American Black Currant *Ribes amercianum*
1. Resin dots on under side of leaves only.	1. Resin dots on both sides of leaves. A magnifying glass may sometimes be necessary to see them on the under surface.
2. Branches and twigs are round.	2. Branches and twigs are angular or ridged.
3. Leaves and stems have a strong, disagreeable, spicy odor when crushed.	3. Leaves and stems do not have strong, disagreeable odor when crushed.
4. Fruit smooth, black, pungent, somewhat musky.	4. Fruit smooth and black but not pungent or musky.
5. Flowers, greenish or whitish, saucer-shaped or open bell-shaped; racimes nodding, short, 5 to 10 flowers.	5. Flowers, greenish-white or yellowish, cylindrical-bell-shaped; racimes pendulous, many flowered.

REMEMBER

The cultivation of the European black currant within the State is prohibited by law and it is a misdemeanor to have it in your possession.

The State is now carrying on blister rust control through the removal of all currant and gooseberry plants within infecting distance of white pine. Your willing coöperation in the elimination of the European black currant will greatly assist in this work.

For further information on the white pine blister rust and its control, write the Forestry Department, Connecticut Agricultural Experiment Station, New Haven.

NURSERY SANITATION ZONES

White Pine Blister Rust Control

J. E. RILEY, JR.

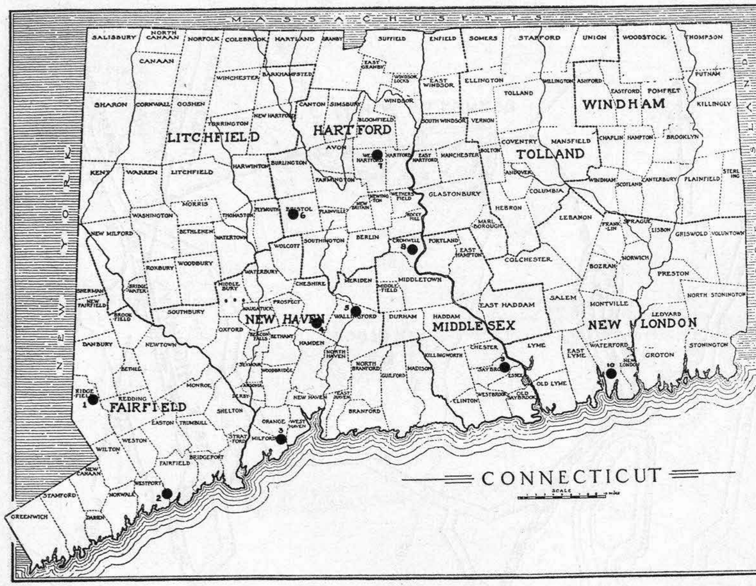

FIGURE 2. Map of Connecticut. Black dots indicate location of Nursery Sanitation Zones, within which no currants or gooseberries may be grown.

Connecticut Agricultural Experiment Station
New Haven

NURSERY SANITATION ZONES

White Pine Blister Rust Control

J. E. Riley, Jr.

At present there are no state or federal regulations requiring the nurseries that grow white pine to establish and maintain Sanitation Zones unless they wish to qualify for interstate shipment of white pines. The Connecticut Agricultural Experiment Station,

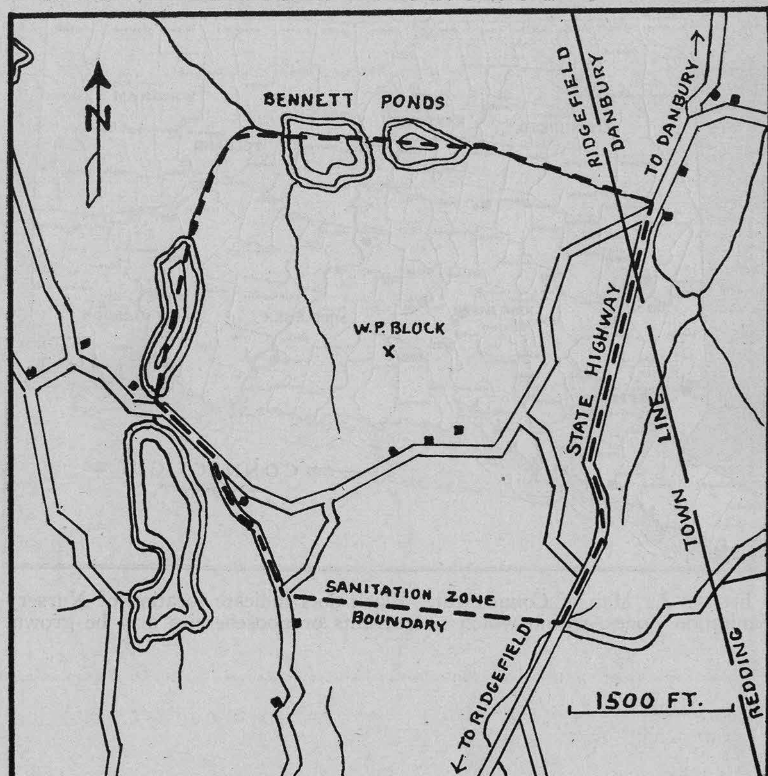

Figure 3. Map of sections of towns of Ridgefield, Danbury and Redding. Dotted line surrounds area within which no Ribes may be grown. Outpost Nurseries.

however, wishes to encourage the establishment of such zones around those nurseries doing an appreciable volume of white pine business, as a step in the control of the white pine blister

rust and as a protection to the nurseries themselves and to the purchasers of white pine ornamental and reforesting stock. The Forestry Department of the Station will coöperate with the nurserymen in the establishment of such zones and will assume full responsibility for their maintenance with the financial help of the coöperating nurseries.

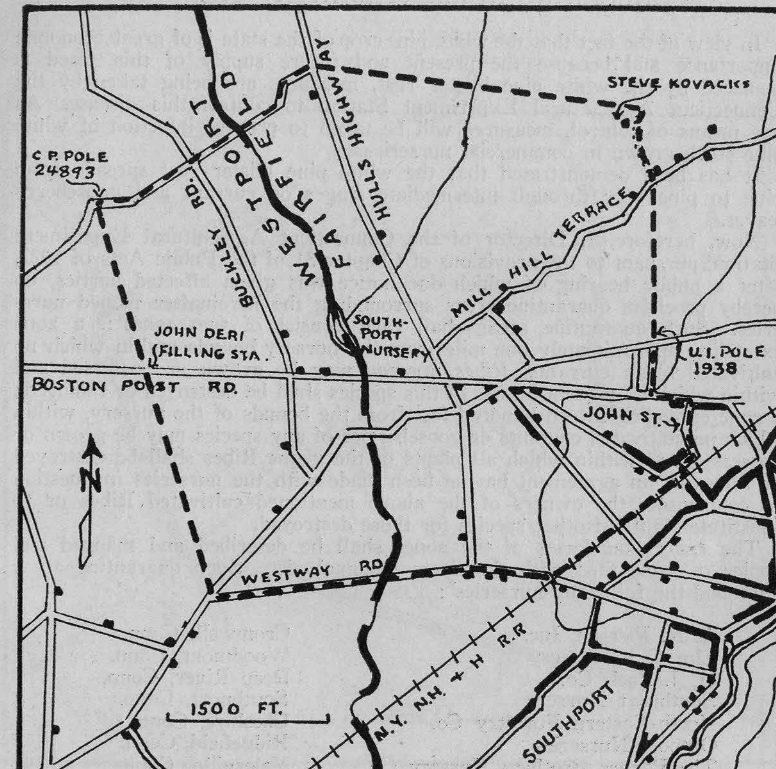

Figure 4. Map of sections of towns of Fairfield and Westport. Dotted line surrounds area within which no Ribes may be grown.

Ten nurseries have established such zones, the location of which are shown on the state map by black dots. The boundaries of these Sanitation Zones are indicated by the dotted lines on the section maps. No currant or gooseberry plants may be grown within these areas.

QUARANTINE ORDER

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

Quarantine Order No. 17

CONCERNING NURSERY SANITATION ZONES

In view of the fact that the white pine crop of the state is of great economic importance and because the present and future supply of this wood is menaced by the white pine blister rust, measures are being taken by the Connecticut Agricultural Experiment Station to control this disease. As one means of control, measures will be taken to prevent infection of white pine stock grown in commercial nurseries.

It has been demonstrated that the white pine blister rust spreads from pine to pine only through intermediate stages on currant and gooseberry leaves.

Now, herefore, I, Director of the Connecticut Agricultural Experiment Station, pursuant to the provisions of Chapter 31 of the Public Acts of 1927, after a public hearing of which due notice was given affected parties, do hereby proclaim quarantine areas surrounding the hereinafter named nurseries. Such quarantine areas shall each consist of two zones[1]; a zone extending approximately one mile from the nursery bounds within which no cultivated black currants, *Ribes nigrum,* may be grown or possessed and within which all present bushes of this species shall be destroyed or removed; a zone extending fifteen hundred feet from the bounds of the nursery, within which no cultivated currants or gooseberries of any species may be grown or possessed and within which all plants of the genus Ribes shall be destroyed or removed, an agreement having been made with the nurseries in question to compensate the owners of the above mentioned cultivated Ribes or to substitute plants of other species for those destroyed.

The exact boundaries of the zones shall be described and mapped and copies of same filed with the State Entomologist. Such quarantine areas surround the following nurseries[2]:

A. N. Pierson, Inc.	Cromwell, Conn.
Elm City Nursery	Woodmont, Conn.
H. J. Zack Co.	Deep River, Conn.
Southport Nursery	Southport, Conn.
North-Eastern Forestry Co.	Cheshire, Conn.
Outpost Nurseries	Ridgefield, Conn.
The Barnes Brothers Nursery Co.	Yalesville, Conn.
Verkade's Nursery	Waterford, Conn.
Sierman's Nursery	W. Hartford, Conn.

This quarantine order becomes effective October 1, 1928.

WILLIAM L. SLATE,
Director.

JOHN H. TRUMBULL,
Governor.

[1] Since the placing of this quarantine a state law, quoted later in this bulletin, has banned the European black currant throughout the State.

[2] A sanitation zone is being established at the Bristol Nursery, Bristol, Conn., but has not yet been officially declared.

THE WHITE PINE BLISTER RUST

The white pine blister rust, *Cronartium ribicola* Fisch, is a destructive fungus that lives part of its life on the leaves of currant and gooseberry plants and the rest of its life in the bark of white or five-needled pines. It reproduces itself by means of seed-like bodies called spores, which are carried by the wind from plant to plant. These spores are of three kinds. Those produced

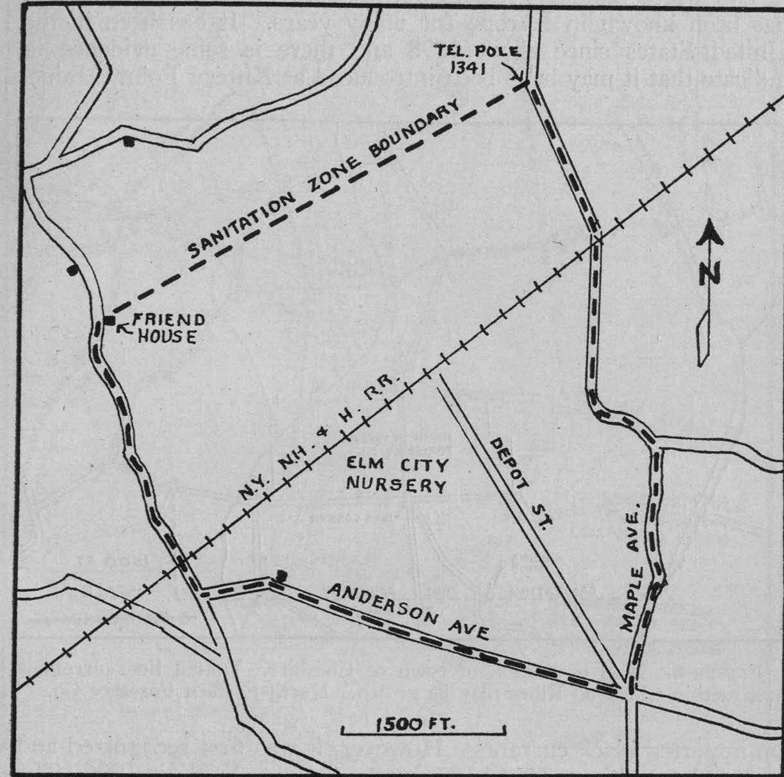

FIGURE 5. Map of sections of towns of Milford and Orange. Dotted line surrounds area within which no Ribes may be grown. Elm City Nursery.

in the orange-yellow blisters of diseased white pines carry the rust to leaves of currants and gooseberries in the spring and early summer. The spores from the rust-colored spots on the under side of infected currant and gooseberry leaves carry the disease during the summer to other currant and gooseberry leaves. From late June until the leaves drop in the fall the fungus develops brown, hair-like projections on the under side of the diseased leaves. These outgrowths produce the spores that infect white pines, thus completing the life cycle of the fungus. The white pine blister rust cannot spread directly from tree to tree, therefore it may be controlled through the elimination of all currants and gooseberries within infecting distance of white pines.

History

The white pine blister rust is probably of Asiatic origin and has been known in Europe for many years. It has been in the United States since about 1898 and there is some evidence to indicate that it may have been introduced at Kittery Point, Maine,

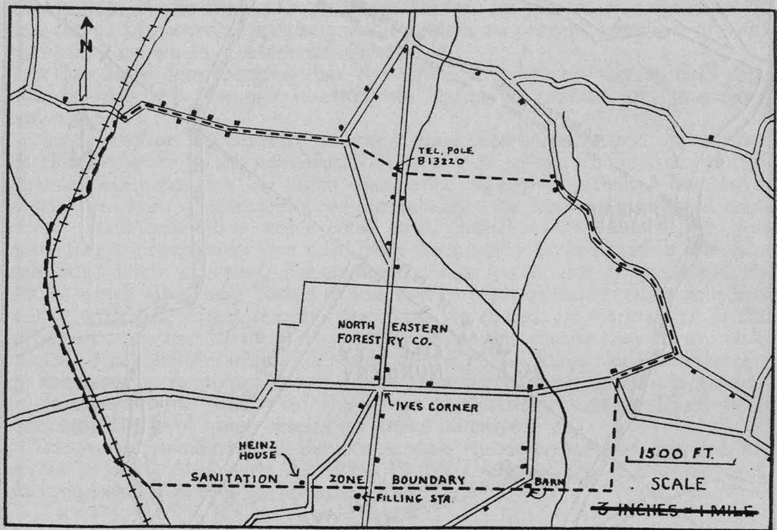

FIGURE 6. Map of section of town of Cheshire. Dotted line surrounds area within which no RIbes may be grown. North-Eastern Forestry Co.

on imported black currants. However, it was first recognized and reported on cultivated black currants at Geneva, N. Y., in 1906. The rust was brought into this country and widely distributed throughout New England and New York on white pine nursery stock before the enactment of the Federal Quarantine Act in 1912. The Connecticut Agricultural Experiment Station identified it on some imported nursery stock being planted at Wilton, Conn., in 1909.

Distribution

The rust is now present in New England, New York, Pennsylvania, New Jersey, Michigan, Minnesota, Wisconsin, Washington, Oregon, Idaho and Montana. In Connecticut it can be found

generally distributed on Ribes throughout the state. It is very common on white pines in northern Litchfield county; it is more or less prevalent on pines throughout the natural white pine sections of northern Connecticut, and is occasionally found on pines in the rest of the state.

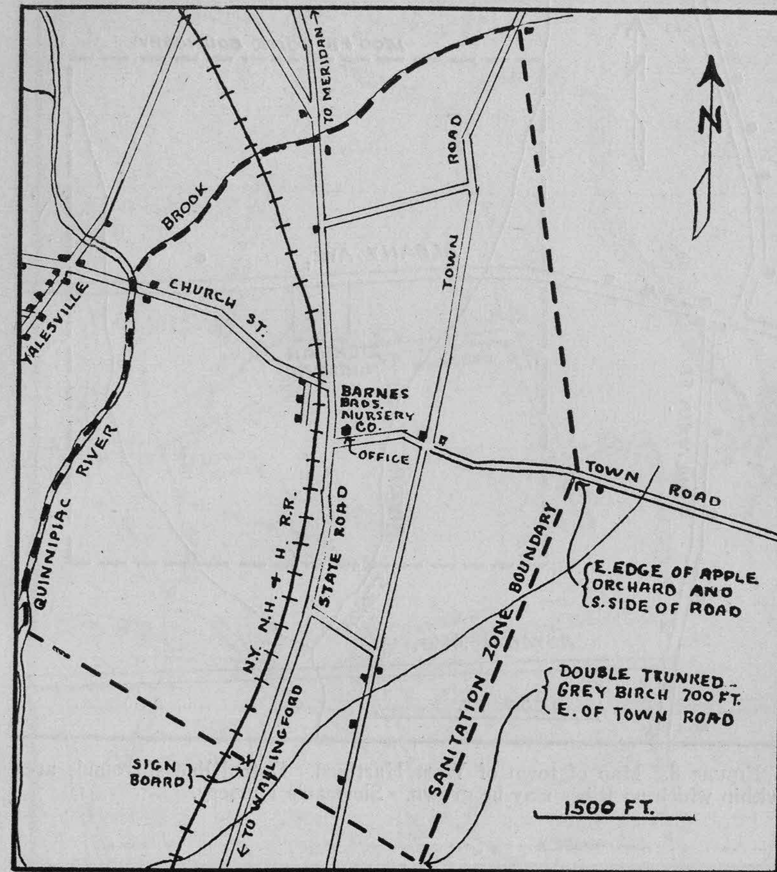

FIGURE 7. Map of section of town of Wallingford. Dotted line surrounds area within which no Ribes may be grown. Barnes Brothers Nursery Co.

Destructive Possibilities

The white pine blister rust has all the destructive potentialities of the chestnut blight, although it accomplishes its results more slowly and consequently less spectacularly. White pine is one of Connecticut's most valuable forest tree species and one highly valued for ornamental purposes. The insurance, therefore, of disease free nursery stock is of economic importance that far outweighs the commercial importance of currants and gooseberries.

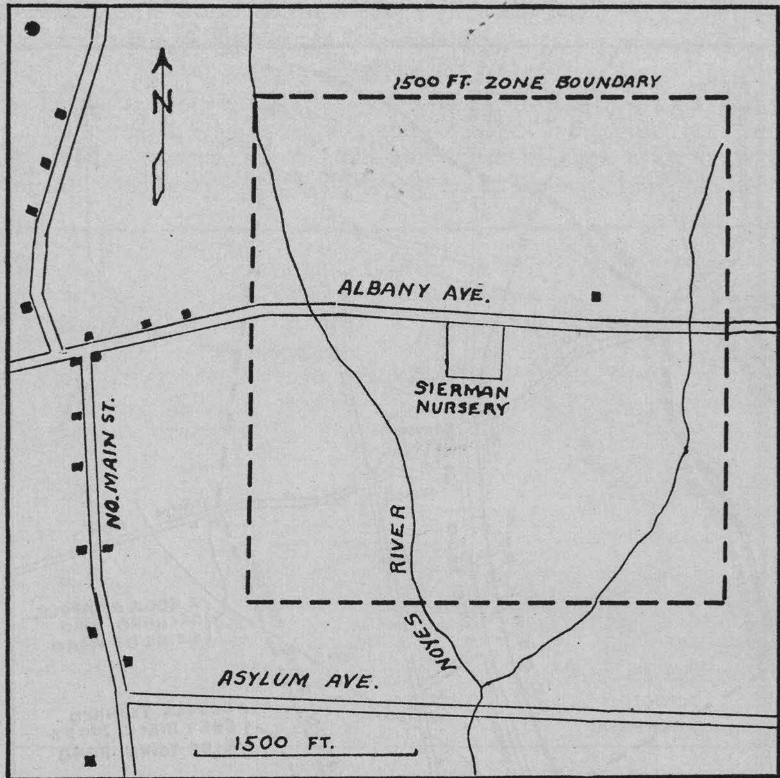

FIGURE 8. Map of town of West Hartford. Dotted line surrounds area within which no Ribes may be grown. Sierman's Nursery.

REGULATIONS

The interstate movement of white pines and of currant and gooseberry plants is prohibited by Federal Quarantine 63,[1] except in compliance with its very stringent regulations.

[1] A copy of this quarantine order may be obtained from the Plant Federal Quarantine and Control Administration, United States Department of Agriculture, Washington, D. C. A digest of those parts of the order that apply to shipments from Connecticut is being prepared and may be had by writing to the State Agricultural Experiment Station, New Haven.

State regulations make the distribution within Connecticut, of Connecticut nursery grown white pine stock, legal only under permit from the State Nursery Inspector. Nursery stock showing a serious disease, such as the white pine blister rust, is destroyed. This inspection, however, does not in itself guarantee

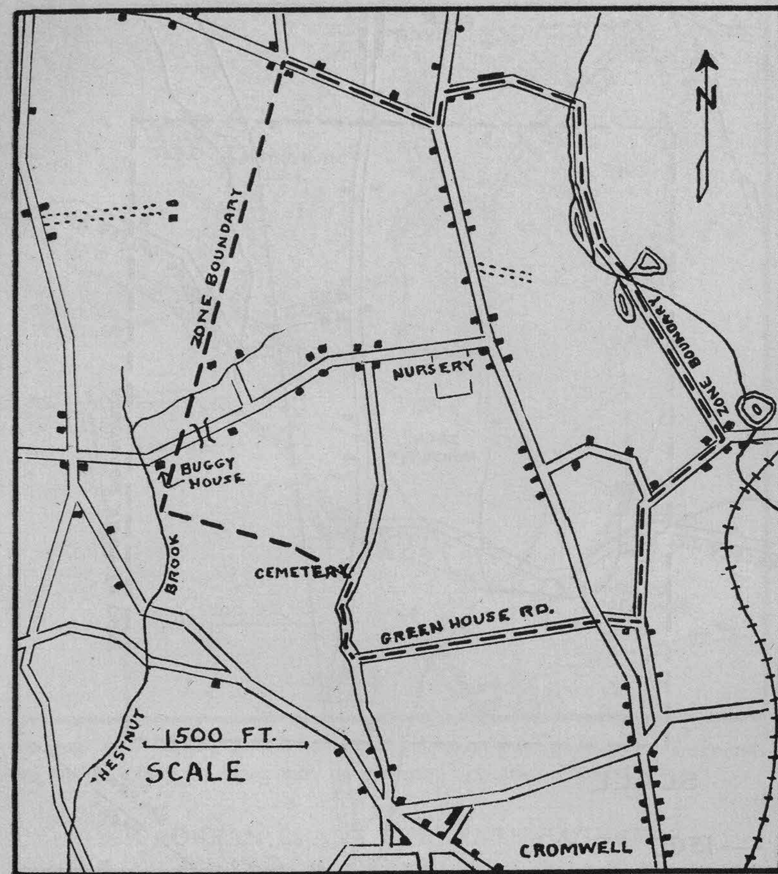

FIGURE 9. Map of section of town of Cromwell. Dotted line surrounds area within which no Ribes may be grown. A. N. Pierson, Inc.

that the white pine stock is free from disease when shipped, because it is impossible in many cases to recognize the disease by field inspection until two or more years after the rust has been in the tree. Therefore the only assurance the purchaser of such stock has that it is free from this disease is when it has been grown from seed in a Ribes-free control area.

In view of the facts that infection on pine may take place over a distance of one mile from diseased European black currants, *Ribes nigrum,* and 900 feet, under rare conditions possibly over greater distances, from other Ribes, the control area or sanitation zone must extend 1,500 feet from the block in which the white

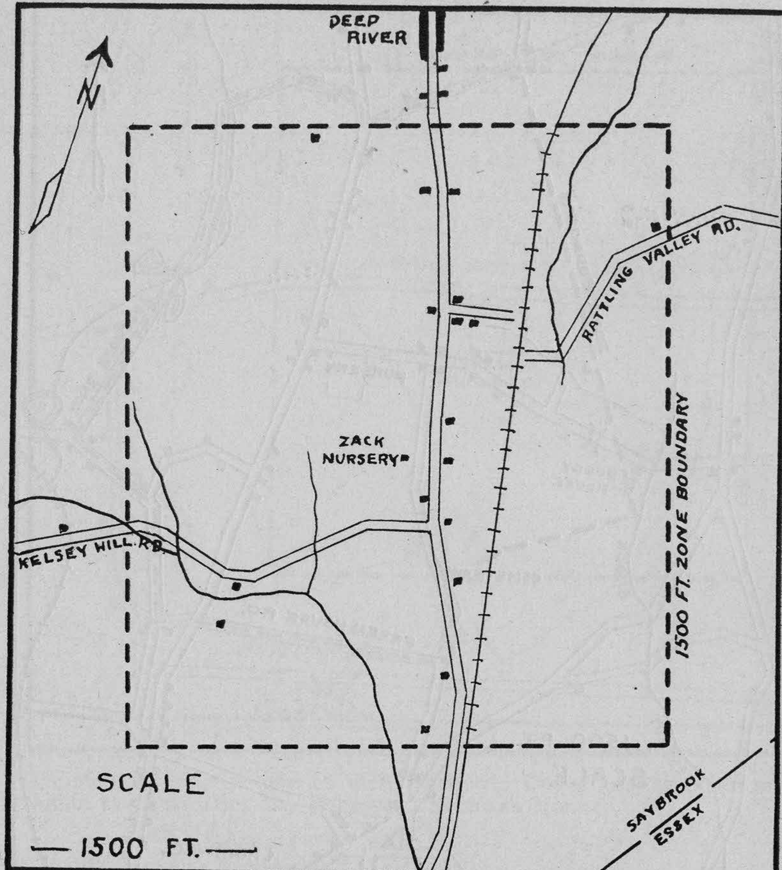

FIGURE 10. Map of section of town of Saybrook. Dotted line surrounds area within which no Ribes may be grown. H. J. Zack Co.

pine is grown. Compliance with the mile zone requirement that pertains to the elimination of European black currants in the vicinity should offer no difficulties, owing to the fact that the state law completely prohibits the harboring of this species anywhere in the state. State Quarantine Order No. 17 establishes such zones around certain coöperating nurseries. Future quaran-

tine orders may establish additional zones at other nurseries that wish to coöperate with the Station in this matter.

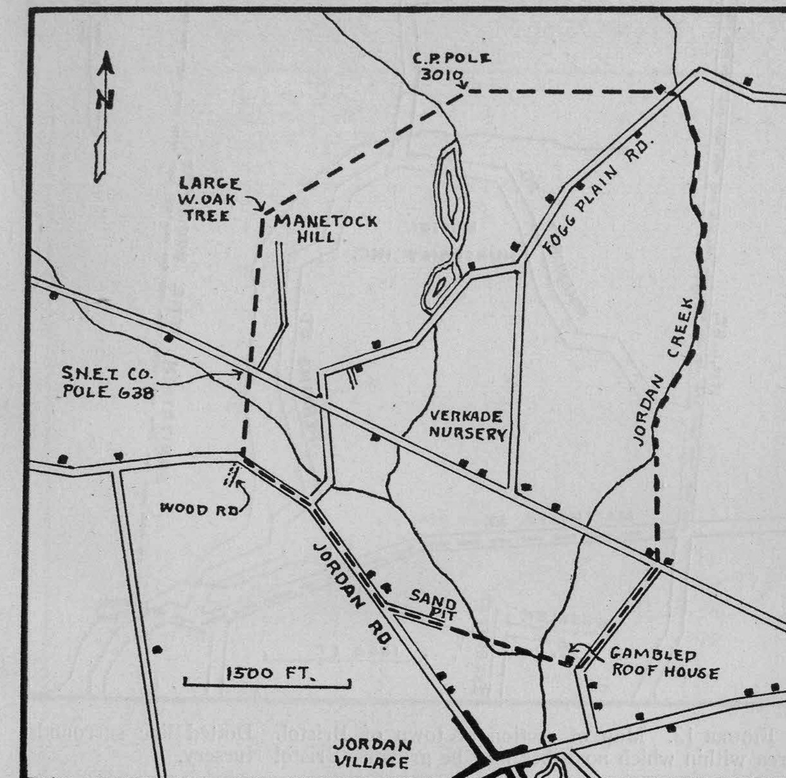

FIGURE 11. Map of section of town of Waterford. Dotted line surrounds area within which no Ribes may be grown. Verkade's Nursery.

EUROPEAN BLACK CURRANTS BANNED

On July 1, 1929, a European black currant law became effective outlawing this species of currant in Connecticut. It will be found in Chapter 172 of the Public Acts of 1929. The text is as follows:

SECTION 1. Any person who shall grow, plant, propagate, cultivate, sell, transport, or possess any plant, root or cutting of the European black currant, or *Ribes nigrum,* shall be fined not less than five dollars nor more than twenty-five dollars.

SEC. 2. The Director of the Connecticut Agricultural Experiment Station is authorized to seize and destroy any plants, roots or cuttings of said European black currant found in the state.

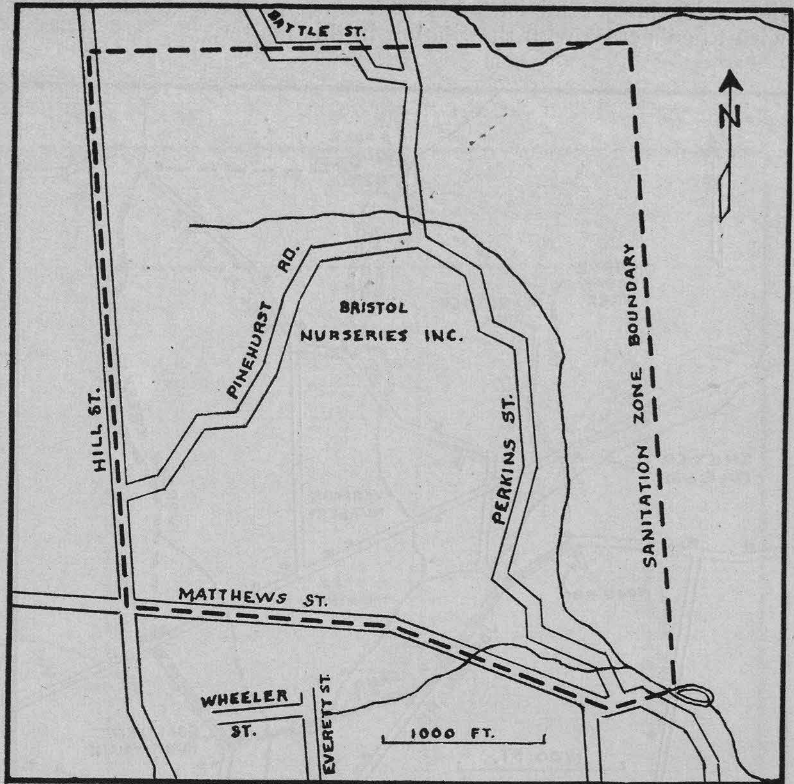

FIGURE 12. Map of section of town of Bristol. Dotted line surrounds area within which no Ribes may be grown. Bristol Nursery.

For information not given in this leaflet concerning the white pine blister rust and its control or the coöperative establishment of Nursery Sanitation Zones, write to:

W. O. FILLEY, Forester, Connecticut Agricultural Experiment Station, 125 Huntington Street, New Haven, Conn.

For information as to quarantines, nursery inspections, and shipping permits, consult:

W. E. BRITTON, State Entomologist, Connecticut Agricultural Experiment Station, 125 Huntington Street, New Haven, Conn.

Circular 71 July 15, 1930

Connecticut Agricultural Experiment Station

New Haven

REGULATIONS CONCERNING THE TRANSPORTATION OF NURSERY STOCK IN THE UNITED STATES AND CANADA

Compiled by W. E. Britton, State Entomologist

At the present time nearly every State in the Union has laws or regulations in regard to the inspection, certification and transportation of nursery stock. These all have one object in view, namely, the control of plant pests. But conditions are not uniform throughout the United States, and each State has established such requirements as seem to give it the best protection, with the result that there are many different regulations.

This situation assumes a serious aspect to the nurserymen who may wish to fill orders received from eighteen or twenty or more different States. In order to tabulate and bring together these varying regulations in convenient form for the use of Connecticut nurserymen, this bulletin has been prepared. It should be understood that it presents only a brief digest in each case, and if any points are not clear, the nurseryman should write to the officer in charge of inspection in that State for more information.

In addition to the various State laws and regulations, there are several Federal quarantines regulating the shipment of nursery stock. A digest of these has been included in this bulletin, together with the regulations of the District of Columbia and of the Dominion of Canada.

FEDERAL QUARANTINES

The following Federal quarantines concern the shipment of nursery stock:

White pine blister rust. Quarantine No. 63 regulates the interstate movement throughout the United States of five-leafed

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Note—Third revision of Bulletin of Immediate Information 51, October 1, 1925.

pines and currant and gooseberry plants. However, the following comments relate only to the application of the regulations to the New England States and New York. Shippers in other States should consult the quarantine for full information as to restrictions applying to such States.

Five-leafed pines may not be moved interstate from the area composed of the New England States and New York except that movement to the States of New Jersey, Pennsylvania, Wisconsin, Michigan and Minnesota may be authorized of pines grown from seed under Federal permit in accordance with certain specified conditions as to Ribes-free environs and freedom from white pine blister rust. Such shipments must be accompanied by Federal permit and comply also with Regulation 2 (a).

Five-leafed pines may be shipped from one State to another *within* the area composed of the New England States and New York on compliance with Regulation 2 (a) requiring that each container is plainly marked to show the names and addresses of the consignor and of the consignee, and has attached to the outside thereof a valid State nursery inspection certificate of the State from which the shipment is made. Shipments may not be made into any State having a legally established control area unless a control-area permit shall have been issued therefor by an inspector designated to act for the Plant Quarantine and Control Administration in such State, and each container of such pines shall bear such permit affixed on the outside thereof. With the exception of Vermont, all the New England States, New York, Michigan and Idaho, have established control areas. Applications for permit should be made to the State officials whose names appear on later pages at the close of the abstract of regulations of the State concerned.

All currant and gooseberry plants other than cultivated red and white and mountain currants and cultivated gooseberry plants are prohibited movement out of Connecticut or any other State designated as infected with white pine blister rust. Cultivated red and white and mountain currants and cultivated gooseberry plants may be shipped out of the infected States on compliance with Regulation 4 requiring—

(1) That the container is plainly marked to show the names and addresses of the consignor and of the consignee and has attached to the outside a valid State nursery inspection certificate of the State from which the shipment is made.

(2) That each such shipment moved interstate into any State having a legally established blister-rust control area shall bear on the outside of the container a control-area permit (Form 415) issued by an inspector designated to act for the Plant Quarantine and Control Administration in such State. (For list of such States see previous paragraph.)

(3) That the plants may be shipped only during the period from September 20 to May 15.

(4) "That if shipped in the fall, the said plants are defoliated, (*i.e.*, without leaves); and, if shipped in the spring, they are free from leaves of the previous season's growth: *Provided,* that if shipped in the spring after April 15, the said plants shall be completely dormant.

(5) "That, before shipment they have been completely immersed (except the roots) in a solution consisting of one part of concentrated lime-sulfur solution testing not less than 32° Baume to eight parts of water by volume, the dilute solution to test not less than 4.5° Baume. Such lime-sulfur dip shall be plainly visible on said plants and be easily detectable by odor, the judgment of the inspector to be final as to adequacy of the dip and as to the condition of the plants as to dormancy and defoliation.

(6) "That the container shall be plainly marked to show that currant and gooseberry plants are contained therein."

Narcissus bulbs. Quarantine No. 62 provides that all varieties of narcissus bulbs may be shipped interstate only after inspection (and treatment if found infested) and certification in the State where grown. Each crate, box, or other container must bear a Federal shipping certificate authorizing interstate movement and such certificate shall remain and continue as a condition of any reshipment of such bulbs in original containers. "Certified narcissus bulbs taken from crates or other original containers for reshipment interstate in smaller lots shall have securely attached to each container a tag or label signed by the shipper thereof reading as follows: 'The undersigned certifies that the narcissus bulbs contained herein were taken from a shipment of narcissus bulbs certified by the Plant Quarantine and Control Administration under Notice of Quarantine No. 62.' "

Black stem rust of grains. Quarantine No. 38, as amended, prohibits the movement from Connecticut of the common barberry and its horticultural varieties (not including the Japanese barberry) and certain other species of Berberis and Mahonia to any of the following States: Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin and Wyoming.

European corn borer. Quarantine No. 43 (sixth revision) prohibits, except as provided in the rules and regulations supplemental thereto, the interstate movement of host plants of the borer (which include some herbaceous perennials) from the two-generation area including parts of Connecticut, Maine, Massachusetts, New Hampshire, the entire State of Rhode Island, and Fisher's Island, N. Y.

Gipsy moth and brown-tail moth. Quarantine No. 45 regulates the interstate shipment of all nursery stock, forest products, stone and quarry products from the infested area in the New England States, and from the generally infested to the lightly infested areas within those States. Nursery stock must be inspected and certified by Federal inspectors.

Japanese beetle. Quarantine No. 48 (revised) regulates the interstate movement of all nursery stock and other materials from the regulated areas to or through outside points or from the generally infested to the lightly infested areas. The regulated areas include the States of New Jersey and Connecticut, the District of Columbia, and certain parts of Massachusetts, New York, Delaware, Pennsylvania, Maryland and Virginia. Nursery stock must be inspected and certified by Federal inspectors.

Satin moth. Quarantine No. 53, as revised, prohibits the interstate shipment from the infested areas in Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, Connecticut and Washington to outside points, of all species and varieties of willow and poplar trees or parts thereof capable of propagation.

Woodgate rust. Quarantine No. 65 prohibits the interstate movement from the regulated area in the State of New York of trees, branches, limbs, or twigs of Scotch pine, Canary Island pine, slash pine, Japanese red pine, Corsican pine, stone pine, western yellow pine, Monterey pine, loblolly pine, or Jersey pine, or of any variety thereof, or of any species or variety of hard pine hereafter found to be susceptible to the Woodgate rust.

Mediterranean fruit fly. The regulations supplemental to Quarantine No. 68, as at present, June, 1930, in effect, prohibit, except as provided therein, the reshipment or transportation from the noninfested States, including Connecticut, of Florida host fruits and vegetables, and railway cars and other vehicles and containers that have originated in and been moved from Florida or any other State that may hereafter be found infested.

For further information regarding Federal quarantines and regulations address: Plant Quarantine and Control Administration, U. S. Department of Agriculture, Washington, D. C.

DISTRICT OF COLUMBIA

Each package of nursery stock (including herbaceous plants and bulbs but not including cut flowers or seeds, except foreign-grown tree seeds) entering the District must bear a valid certificate of inspection, must be marked "plants," with name and address of both consignor and consignee. No package shall be delivered to the consignee until authorized by the inspector of the Plant Quarantine and Control Administration.

Plant Quarantine and Control Administration, Washington, D. C.

DOMINION OF CANADA

Nursery stock and all plants for ornamental purposes, propagation or cropping, from the United States, can enter Canada only after permits (and official labels, if to be sent by mail) have been procured from the Secretary, Destructive Insect and Pest Act Advisory Board, Ottawa, Canada. Applications must specify quantity, kind, value, origin and destination of stock, name and address of consignor, consignee, the customs port, and whether to be shipped by mail, express, or freight. The importer will furnish the permit number to the shipper, and this number must be on every container, together with certificate of inspection issued at time of packing, original to accompany way-bill with copy on containers, and signed by an authorized official of the state or country where the stock originated, and the name and address of both consignor and consignee, and a declaration of kind and quantity of the stock. The following are designated as ports of importation:

Halifax, N. S.	Windsor, Ont.
Saint John, N. B.	Winnipeg, Man.
Montreal, Que.	Estevan, Sask.
Niagara Falls, Ont.	Vancouver, B. C.
Ottawa, Ont.	

Mail shipments may enter the ports named above and also Toronto, Ont.

Quarantines prohibit the entrance of conifers from New England; all five-leafed pines; all chestnut (*Castanea dentata*), and chinquapin (*Castanea pumila*), including hybrids and horticultural varieties; all currants and gooseberries, except commercial varieties of gooseberries, red and white currants cultivated for their edible fruits only; European buckthorn and all varieties of rust barberry (*Berberis vulgaris*); all varieties of Corylus into British Columbia from the States of Montana, Wyoming, Colorado, New Mexico, and all other states eastward; all peach nursery stock into British Columbia from Wisconsin, Illinois, Missouri, Arkansas, Texas, and all other states eastward to the Atlantic Ocean.

L. S. McLaine, *Secretary, Destructive Insect and Pest Act Advisory Board,* Department of Agriculture, Ottawa, Canada.

POSTAL REGULATIONS REGARDING NURSERY STOCK SHIPPED BY PARCEL POST

The United States Postal Laws and Regulations, Section 467, paragraph 2, governing the mailing of plants and plant products, reads as follows:

"Nursery stock, including all field-grown florists' stock, trees, shrubs, vines, cuttings, grafts, scions, buds, fruit pits and other seeds of fruit and ornamental trees or shrubs, and other plants and plant products for propagation, except field, vegetable and flower seeds, bedding plants and other herbaceous plants, bulbs and roots, may be admitted to the mails only when accompanied with a certificate from a State or Government inspector to the effect that the nursery or premises from which such nursery stock is shipped has been inspected within a year and found free from injurious insects, and plant diseases, and the parcel containing such nursery stock is plainly marked to show the nature of the contents and the name and address of the sender."

STATE REGULATIONS

Filing of Certificates in Other States

In order to ship nursery stock into the following States, it is necessary to file duplicate inspection certificates:

Alabama	Maryland	Ohio
Arkansas	Massachusetts	Oklahoma
Connecticut	Michigan	Pennsylvania
Florida	Minnesota	South Carolina
Georgia	Mississippi	South Dakota
Idaho	Missouri	Tennessee
Illinois	Nebraska	Texas
Indiana	New Mexico	Utah
Iowa	New York	Virginia
Kentucky	North Carolina	Wisconsin
Louisiana	North Dakota	Wyoming

Filing of Bonds

Bonds are required in the following States:

Arkansas	$1,000.00	Montana	$1,000.00
Georgia	1,000.00	Oklahoma	1,000.00
Idaho	5,000.00	Utah	500.00

Tennessee requires a bond of $5,000 where trees are planted by outside nurserymen under contract to prune and spray for a period of years.

Payment of Fees

The payment of fees is required for registration in certain States, as follows:

State	Registration fee	Agent's fee	State	Registration fee	Agent's fee
Alabama	$10.00	$1.00	New Mexico	$5.00	
	(Dealers)—10.00		Ohio	5.00	$1.00
Arkansas	5.00	1.00	Oklahoma	5.00	
Georgia	5.00	1.00	Oregon	15.00	1.00
Idaho	10.00	1.00	South Dakota	1.00	1.00
Indiana	1.00	1.00	Texas	5.00	
Kentucky	5.00	5.00	Virginia	10.00	1.00
Maine	5.00		Washington	5.00	1.00
Michigan	5.00			(Dealers)—15.00	
Missouri	5.00		West Virginia	20.00	
Montana	25.00[1]		Wyoming	15.00	
Nebraska		1.00			

[1] Covering all Montana agents. Agents for unlicensed nurseries must pay annual fee of $10 and file bond of $1,000. Inspection fees, $10 per car lot, smaller lots in proportion. Unlicensed nurseries, 10 per cent of invoice price, with minimum of 50 cents per package.

Fumigation

All deciduous nursery stock subject to the attack of San José scale must be fumigated with hydrocyanic acid gas and labeled with a certificate or affidavit stating that this has been done, before it will be allowed to enter the following States:

Florida[1]	Mississippi	Tennessee
Maryland	South Carolina	Utah
Michigan[1]		

State Tags

State tags are required and will be furnished at the shippers' expense, by the following States:

Alabama	New Mexico	Virginia
Arkansas	North Carolina	West Virginia
Florida	South Carolina	Wisconsin
Louisiana	Texas[2]	Wyoming
Mississippi		

Special Inspection and Certification of Raspberry Plants

In an attempt to control mosaic and allied diseases of raspberry plants, certain states require two summer inspections: one in June, and the other a month later, and after all mosaic plants discovered at the first inspection have been removed. If the plants are then free from mosaic diseases, a certificate to that effect may be granted. The following states require this special inspection and certification for shipping raspberry plants:

Kansas	Minnesota	Vermont
Michigan	New York	Wisconsin

Requirements of Various States

Alabama. Nurserymen in other States wishing to ship stock into Alabama must obtain an Alabama license by filing a signed copy of inspection certificate, with fee of $10. Each package of nursery stock entering the State must bear an Alabama tag, which is furnished at cost. Dealers must register, file list of all nurseries from which they purchase stock, pay fee of $10 and obtain

[1] Fumigate all host plants of San José scale with hydrocyanic acid gas, at the standard dosage, or thoroughly scrub in a solution of fish oil soap at a dilution of one pound of soap to three gallons of water immediately before shipment into Florida. Such stock entering Michigan must bear certificate of fumigation.

[2] Texas requires tags showing an exact copy of the Texas permit but the shipper must have them printed from the original certificate.

a dealer's certificate. An agent's certificate (cost $1.00) must be obtained through the principal for each agent selling nursery stock in Alabama. Nursery stock infested with San José scale, new peach scale, woolly aphis, brown-tail moth, gipsy moth, crown gall, black knot, citrus canker, peach yellows, pear blight, apple blotch, root nematode, peach borer, grape phylloxera or nut grass, must not be sold in Alabama.

B. P. LIVINGSTON, *Chief, Division of Plant Industry,* Montgomery, Ala.

Arizona. All nursery stock and plant products entering Arizona through the United States mails or transported in any manner shall be prominently labeled, showing (a) name and address of consignor; (b) name and address of consignee; (c) certificate of inspection; (d) locality where grown, and (e) contents of shipment. Common carriers shall not deliver to consignee any shipment of nursery stock or plant products until inspected by the State Entomologist or his agent and a certificate of release issued in each case to the common carrier and to the consignee. Postmasters are required to forward all parcels of nursery stock or plant products to the nearest Post Office Inspection Station, and cannot forward from these stations to point of destination any parcel of nursery stock or plant products unless accompanied by an inspected plant shipment tag.

Quarantines prohibit the entrance of: Olive nursery stock and olive root cuttings from all other States and foreign countries; peach, nectarine or apricot trees or cuttings, grafts, scions, buds or pits, or trees budded or grafted upon peach stock from Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, Ohio, Indiana, Michigan, Illinois, West Virginia, Tennessee, North Carolina, Arkansas, Nevada, Florida, Mississippi, Kentucky, and Ontario, Can., and any other section in which peach yellows or rosette are known to exist; peach, nectarine, almond, apricot, plum, cherry, chokecherry, quince, pear, and apple trees or plants or parts thereof including the fresh fruits, and all barrels, boxes, baskets or other containers that have been used to hold the same from the States of Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Indiana, Louisiana, Maryland, Mississippi, North Carolina, New Jersey, New York, Ohio, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia, and the District of Columbia on account of the Oriental fruit moth; pecan, hickory and Japanese walnut trees, cuttings, grafts, scions and buds from all outside sources, with the exception of California, on account of the pecan leaf case-bearer.

O. C. BARTLETT, *State Entomologist,* Box 1857, Phoenix, Ariz.

Arkansas. In order to ship nursery stock into Arkansas, it is necessary (1) to file a nursery inspection certificate, pay a fee of $1.00 and secure a permit-certificate, and (2) every shipment into the State must bear a copy of the permit-certificate with the chief inspector's facsimile signature, and tags must be purchased of the chief inspector.

Out-of-state nurserymen having agents or representatives soliciting orders, or doing other nursery business in Arkansas, must (1) file a bond of $1,000, (2) pay $5.00 for a license to do business in the State, and (3) pay $1.00 for a license for each agent in the State.

Quarantines prohibit entrance of chestnut trees from all States east of the Mississippi River, Iowa and Nebraska.

P. H. MILLAR, *Chief Inspector,* Little Rock, Ark.

California. All shipments of nursery stock, plants, seeds, etc., made into the State of California must be marked in a conspicuous manner and place with the name and address of the shipper, the name and address of the consignee, and a statement of the contents of each package; also the name of the country, state, or territory where the contents were grown.

Of several state quarantines, the following are of interest to shippers to California:

Quarantine Order No. 1 (new series) prohibits the entry into California of citrus fruits, all varieties and species of citrus plants and parts thereof, including buds and scions.

Quarantine Order No. 2 (new series) prohibits the entry into California of all chestnut and chinquapin trees, plants, grafts, cuttings, or scions thereof from all states and districts east of and including the States of Montana, Wyoming, Colorado, and New Mexico, on account of chestnut bark disease.

Quarantine Order No. 3 (new series) prohibits the entry into California of all varieties and species, including the flowering forms of peach, nectarine, almond, apricot, plum, cherry, chokecherry, quince, pear, and apple trees and plants, and fresh fruits thereof, from the States of New York, Connecticut, New Jersey, Ohio, Pennsylvania, Maryland, Delaware, Kentucky, West Virginia, Virginia, Tennessee, North Carolina, South Carolina, Florida, Georgia, Alabama, Mississippi, Louisiana, Arkansas, Texas, Indiana, Illinois and the District of Columbia; also States of Massachusetts, Michigan, Rhode Island, and Province of Ontario, Canada, on account of the Oriental fruit moth.

Quarantine Order No. 4 (new series) prohibits the entry into California of all trees, plants, grafts, cuttings, or scions of all species and varieties of the cultivated filbert or hazelnut and American wild hazel (*Corylus americana*) from all states and districts east of and including the States of Montana, Wyoming, Colorado, and New Mexico, on account of Eastern filbert blight.

Quarantine Order No. 12 (new series) prohibits the entry into California of all varieties and species of hickory, pecan, and walnut trees (Hicoria sp. and Juglans sp.) and parts thereof, including grafts, cuttings or scions from all states east of and including the States of Montana, Wyoming, Colorado, and New Mexico, on account of the pecan leaf case bearer and the pecan nut case bearer.

Quarantine Order No. 14 (new series) prohibits the entry into California of all hop sets, hop roots, and hop cuttings from all States in the United States except the State of Oregon.

Quarantine Circular No. 1 (new series) prohibits the entry into California of peach, nectarine, or apricot trees or cuttings, grafts, scions, buds, or pits of such trees; or any trees budded or grafted upon peach stock or roots that have been in a district where the disease known as contagious peach rosette is known to exist. The States known to be infected are as follows: Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Delaware, Maryland, Pennsylvania, West Virginia, Virginia, North Carolina, Tennessee, Kentucky, Mississippi, Ohio, Michigan, Indiana, Arkansas, Florida, South Carolina, Georgia, Alabama, Oklahoma, District of Columbia, and the Province of Ontario in Canada.

Quarantine Circular No. 6 (new series) provides that grapevines or cuttings will be admitted if free from Phylloxera, subject to hot water treatment upon arrival.

A. C. Fleury, *Senior Quarantine Supervisor,* Sacramento, Cal.

Colorado. Each package of nursery stock entering the State must bear a certificate of inspection signed by a duly authorized inspector in the State from which it was shipped. On arrival, shipments are turned over to the County Inspector, who, in turn, if they pass inspection, releases them to the consignee.

Quarantines prohibit the entrance of the common barberry.

C. P. Gillette, *State Entomologist,* Fort Collins, Colo.

Connecticut. Nurseries are inspected annually and nurserymen and dealers must register; nurserymen receive registration and inspection certificates, and dealers receive permits. Out-of-state nurserymen must make application and file signed copies of their valid inspection certificates and receive permits before shipping stock into the State. All stock entering the State must be accompanied by both certificate and permit, and all stock transported within the State must be accompanied by either a certificate or by a permit, and transportation companies are subject to prosecution for accepting shipments without valid certificates or permits. Nursery stock imported from foreign countries must be held unopened until inspector arrives. Inspectors have authority to inspect any stock at destination.

Quarantines regulate the shipment of all nursery stock and forest products, on account of the gipsy moth, satin moth, Japanese beetle, and European corn borer.

W. E. Britton, *State Entomologist,* New Haven, Conn.

Delaware. Each shipment of nursery stock entering the State must be accompanied by a copy of the nursery inspection certificate, and all stock must conform to the Federal rules and regulations.

Ralph C. Wilson, *Secretary,* State Board of Agriculture, Dover, Del.

Florida. Each nurseryman shall (1) file with the Nursery Inspector, Gainesville, Fla., a copy of his certificate of inspection, personally signed by the proper official of his State, and make application for permit tags on a form supplied by the Nursery Inspector; (2) secure Florida permit tags (price list furnished); (3) attach one, and only one, Florida permit tag to each package, box or bundle of nursery stock[1] shipped into Florida. In club orders, one permit tag should be attached to each individual order, and one permit tag attached to the package containing the individual orders; (4) each permit tag is serially numbered. An invoice showing the name and address of consignor, name and address of consignee, kind and amount of nursery stock in the shipment and number of the permit tag attached to the shipment should be mailed the Nursery Inspector, Gainesville, on the day the shipment is made. An invoice is required for each individual order in a club order and also for the package containing the individual orders; (5) return all spoiled or mutilated permit tags to the Nursery Inspector for cancellation; (6) return all unused permit tags when the same become void; (7) fumigate all host plants of San José scale with hydrocyanic acid gas, at the standard dosage, or thoroughly scrub in a solution of fish oil soap at a dilution of one pound of soap to three gallons of water, immediately before shipment into Florida. (8) Plants showing root knot, hairy root, crown gall, or any especially injurious insect or disease will not be permitted entry into the State of Florida. (9) All citrus trees and parts thereof are prohibited entry into the State of Florida from all other states and countries.

Nursery Inspector, State Plant Board, Gainesville, Fla.

Georgia. Each nurseryman, dealer, agent, salesman or solicitor must apply to the State Board of Entomology, giving (1) the name and location of the nursery, and (2) the approximate acreage

[1] Strawberry plants, palms and woody perennials. Soft bodied herbaceous plants are not classed as nursery stock.

and kinds of stock grown, and receive from the Board a license; annual fee for nurserymen and dealers is $5.00; annual fee for each agent, salesman or solicitor, $1.00. Where a sale amounts to $100 or more, a duplicate of the complete invoice (without price) must be filed with the State Board of Entomology, within 30 days of shipment, with the name and address of the salesman and of the purchaser, and name and quality of all nursery stock sold in the State or for delivery in the State.

All nurserymen, corporations, firms or individuals selling or offering to sell nursery stock in Georgia must file with the Board of Entomology, and maintain for three years, a bond of $1,000 made out to the Secretary of the Georgia State Board of Entomology.

Quarantines prohibit shipment into the State of all five-leafed pines, currants and gooseberries and all nursery stock from sections of states where Japanese camphor scale is present. Shipments of plants from areas infested by the Japanese beetle, European corn borer, gipsy moth and brown-tail moth are admitted only in strict accordance with the requirements of the Federal quarantine.

M. S. Yeomans, *State Entomologist,* State Board of Entomology, Atlanta, Ga.

Idaho. No person, firm or corporation shall import or sell nursery stock by agents within the State without first applying to the Department of Agriculture, filing a bond for $5,000 and obtaining an annual license by paying a fee of $10. All shipments into the State must show name of shipper, locality where grown, variety of nursery stock and an official certificate of fumigation from the State where the stock was grown. Imported trees are fumigated before distribution, and all nursery stock shipped into the State must be inspected upon arrival at the expense of the consignee. Each nursery firm doing business in the State must annually pay an additional $1.00 for each agent. Duplicate certificates should be filed.

State quarantines exclude the entrance of all five-leafed pine, currant, gooseberry, peach, nectarine, prune, almond or other trees worked on peach stock and all pits, cuttings, buds or scions grown in a district where peach yellows or other detrimental diseases exist.

Permits for entry must be secured from the Bureau of Plant Industry and accompany the shipment before any currants or gooseberries can be shipped into the State. The eight northern counties are designated as a blister rust control area from which currants, gooseberries and five-leafed pines are excluded.

M. L. Dean, *Director, Bureau of Plant Industry,* Boise, Idaho.

Illinois. Outside nurserymen and dealers in nursery stock wishing to ship nursery stock into Illinois or to solicit business in Illinois, are required to send to the Chief Plant Inspector a duplicate copy of their certificate of inspection signed in ink by their state inspector. Those employing agents are required to apply to the Chief Plant Inspector for a permit to employ agents in Illinois and for a permit for each agent as soon as he is employed. Agent's permits are renewable annually after July 1.

All nursery stock entering the State must bear a valid State or Federal certificate of inspection, the names and addresses of the consignor and the consignee, and a statement of the nature of the stock.

If stock arrives without certificate it must be destroyed or held by the transportation company until released or inspected by the Department of Agriculture and all expenses incurred by such inspection have been paid.

A State quarantine prohibits shipment of all species and varieties of the genus Castanea from the New England States, Alabama, Delaware, Georgia, Kentucky, Maryland, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia and West Virginia into Illinois.

Stock shipped into Illinois in violation of a State or a Federal quarantine is destroyed or returned to the consignor or otherwise disposed of at the discretion of the department.

P. A. Glenn, *Chief Plant Inspector,* Division of Plant Industry, Urbana, Ill.

Indiana. Nursery stock entering or shipped within the State must bear an official inspection certificate and give the names of both the consignor and the consignee. All out-of-state nurseries must file with the State Entomologist a copy of their valid inspection certificate, pay $1.00, and obtain a license good for one year from date of issue, before shipping stock into the State. Each dealer and agent selling or soliciting sales of nursery stock in Indiana must pay $1.00, and obtain a license from the State Entomologist.

Frank N. Wallace, *State Entomologist,* Department of Conservation, Indianapolis, Ind.

Iowa. Copy of inspection certificate must be filed with and approved by the State Entomologist, and must accompany each shipment into the State.

Quarantine against the European corn borer prohibits all the usual host plants entering the State from the infested areas in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, Ohio, and Michigan.

Carl J. Drake, *State Entomologist,* Ames, Iowa.

Kansas. Nurseries are inspected annually and all certificates and dealers' permits expire on June 1 following date of issue. Nursery stock from other states must be accompanied by a recognized certificate of inspection, and may be inspected in transit or at destination; if found infested, stock may be returned to consignor at his expense, treated or otherwise disposed of, as the inspector may direct.

Nurserymen both within or outside the State who sell nursery stock at retail through agents in Kansas shall file a list of such agents with addresses; said agents shall carry with them at all times, credentials of appointment from the nurseries which they represent and copies of inspection certificates issued to said nurseries.

All raspberry plants entering the State must be certified as being free from all diseases of the virus type, except so-called "mild mosaic" of black and purple raspberries, after two inspections the preceding growing season, with an interval of 30 days between inspections. Duplicate certificates of other states must be filed.

W. R. MARTIN, *Secretary, Entomological Commission,* Topeka, Kans.

Kentucky. Kentucky nurseries are inspected annually and certificates are issued when stock is found free from dangerous pests. All nurserymen, resident or non-resident, must file annually, credentials at this office and if in good standing receive a permit on payment of a fee of $5.00.

Agents and dealers must file credentials annually, including names of "nurseries, nurserymen, or persons represented," and on payment of a fee of $5.00 are issued a permit. Agents while soliciting orders must carry their permits to show prospective buyers, county officials, or agents of the State Entomologist, on demand. Quarantines are provided for.

W. A. PRICE, *State Entomologist,* Lexington, Ky.

Louisiana. Before shipping nursery stock into Louisiana, application must be made to the Entomologist for permit, by filing copy of valid certificate and order for certificate tags, accompanied by money to pay for them (price on application). The Louisiana tag and the inspection certificate of the State where the stock was grown must both accompany each shipment. The invoice stub of each permit tag must be filed with the Entomologist once a week, showing the number and varieties of plants shipped.

W. E. ANDERSON, *State Entomologist,* Department of Agriculture, Baton Rouge, La.

Maine. All individuals or firms selling or soliciting sales of nursery stock that they have not grown shall annually obtain a license from the State Horticulturist by paying a fee of $5.00. All stock entering the State shall bear on each box or package a valid inspection certificate; such stock may be inspected at destination and if found infested with dangerous pests may be destroyed or returned to the consignor.

Quarantine prohibits entrance of currant or gooseberry plants. Five-leafed pines cannot enter without a permit from the Forest Commissioner.

ROBERT F. CHANDLER, *State Horticulturist,* Augusta, Me.

Maryland. Nurseries are inspected twice each year. Nursery stock coming from blocks that show evidence of San José scale must be hand-inspected to eliminate visibly infested stock, and the rest fumigated before shipment. Shipments entering the State must bear certificates of inspection, besides names of consignor and consignee. Duplicate certificate should be filed with the State Entomologist.

Quarantines prohibit the shipment of five-leafed pines, currants and gooseberries from New York, the New England States, Pennsylvania, New Jersey, Michigan, Wisconsin, Minnesota and Washington; also into the non-infested counties of Maryland, of any nursery stock of peach or sweet cherry from areas infested with the Oriental peach moth.

ERNEST N. CORY, *State Entomologist,* College Park, Md.

Massachusetts. All growers and agents who sell nursery stock for delivery within the State must have a grower's certificate or an agent's license, and a copy of such certificate or license must accompany each car, box or package of stock shipped or delivered. Agents must apply to Director, Division of Plant Pest Control, Boston, Mass., and file list of nursery firms from which they purchase stock before receiving agent's license. Authority is granted to inspect at destination all stock entering the State, and if found infested it may be destroyed, treated, or returned to the consignor at his expense.

Quarantines prohibit Ribes from entering the State except under permit.

R. H. ALLEN, *Director, Division of Plant Pest Control,* 136 State House, Boston, Mass.

Michigan. All nurseries are inspected annually. Each out-of-state nurseryman who sells in Michigan through personal representatives must file a certified copy of his original certificate, and pay a fee of $5.00 to obtain a license permitting him to ship stock into the State. Each shipment must bear an exact copy of the inspection certificate issued in the state from which the stock was shipped, names and addresses of both consignor and consignee, and a statement showing the general nature of the contents. Out-of-state nurserymen wishing to sell nursery stock in Michigan through catalogue must file copies of their original certificates of inspection. All nursery stock entering the State, except conifers and herbaceous plants, subject to the attack of San José scale must be fumigated with hydrocyanic acid gas in the usual manner and must bear a certificate from the shipper that such fumigation has been given.

The law and quarantine regulations prohibit the entrance of all barberries subject to the attack of black stem rust of grains; all chestnut trees; all trees and plants from areas infested by the Japanese beetle and European corn borer, except in compliance with Federal regulations; all raspberries unless bearing certificates that the plants have been properly inspected for virus diseases, as under Rules and Regulations No. 273. Currants and gooseberries shipped into Michigan must be accompanied by a control area permit issued by the Commissioner of Agriculture.

E. C. MANDENBURG, *In Charge of Orchard and Nursery Inspection,* Department of Agriculture, Lansing, Mich.

Minnesota. All shipments must be accompanied by a valid certificate of inspection on the outside of each package. A copy of this certificate must be filed with the state inspector before nursery stock is shipped into the State. No filing fee is required. A license is not required for agents or salesmen.

Minnesota Quarantine No. 5 prohibits the entry of alfalfa hay and other hay of all kinds and cereal straw if grown or stored in the State of Utah and certain portions of the States of Idaho, Colorado, Nevada, California, Oregon, and Wyoming, on account of the alfalfa weevil.

Minnesota Quarantine No. 6 requires that all raspberry plants shipped into Minnesota must be accompanied by a valid certificate showing that the plants have been inspected and found apparently free from mosaic and other virus diseases. A special affidavit signed by the shipper may be accepted in lieu of such certificate on each package.

The term "nursery stock" includes all wild and cultivated trees, shrubs, perennial vines, small fruit plants, perennial roots, rhizomes, herbaceous perennials, cuttings, buds, grafts and scions for or capable of propagation. A certificate of inspection is not required for greenhouse or house-grown plants, bedding plants, herbaceous annuals, vegetable plants, bulbs, corms and tubers.

All nursery stock for shipment into Minnesota must comply with the requirements of quarantines promulgated by the Federal Plant Quarantine and Control Administration.

A. G. RUGGLES, *State Entomologist,* University Farm, St. Paul, Minn.

Mississippi. Each package of nursery stock shipped into Mississippi must have attached to it a Mississippi permit tag and a certificate issued by the state inspection official of the state where grown. Also, there must be a statement or tag on each shipment showing the name and address of both consignee and consignor, the general nature and quantity of the contents, and the name of the locality where grown. The permit tags may be obtained at actual cost from the nursery inspector, at the Agricultural and Mechanical College, Miss., after a satisfactory certificate of inspection issued by the duly authorized state official has been filed with him. The proprietor or manager of the nursery or greenhouse must sign and file with the plant board an agreement with reference to complying with the Mississippi law in shipping nursery stock into Mississippi.

All plants capable of defoliation must be defoliated.

Plants infected with root knot (caused by nematodes), crown gall or showing any insect pest or disease or markings thereof, must not be shipped into Mississippi.

Each agent or salesman representing nursery firms is required to register with and obtain an agent's certificate from the nursery inspector before selling, delivering, or taking orders for nursery stock in Mississippi. Stock shipped to nursery agents for delivery in Mississippi must be packed in individual packages, and each of these accompanied by a Mississippi permit tag.

Each permit tag has an invoice stub with carbonized sheet attached. On using a Mississippi permit tag, the nurseryman must immediately mail to the nursery inspector, the Agricultural and Mechanical College, Miss., the invoice stub for that tag (with carbonized sheet attached and filled in) showing the name and address of the consignee and an itemized list of plants in the shipment.

Mutilated, spoiled, and unused permit tags must be returned to the Mississippi nursery inspector. All permit tags remaining on hand at the close of the season must be returned.

A circular explaining the requirements in more detail will be sent, on request to—

GEORGE F. ARNOLD, *Nursery Inspector,* Agricultural and Mechanical College, Miss.

Missouri. Outside nurseries must file necessary papers including certificate and apply for a permit certificate which will be issued on payment of a $5.00 fee. All agents or salesmen must apply for agent's certificate. Each package of nursery stock entering the State must bear the names of both consignor and consignee, statement of contents, and a certificate showing that the stock therein contained has been inspected where grown by a duly authorized inspector and found to be apparently free from dangerously injurious insect pests and plant diseases. Transportation companies are not permitted to deliver nursery stock unless so labeled.

K. C. SULLIVAN, *Plant Commissioner,* Jefferson City, Mo.

Montana. All nursery stock entering the State must be unpacked and inspected at one of the following designated quarantine stations: Billings, Butte, Miles City, Missoula, Sanders or Fairview. All shipments entering the State are subject to inspection with fees as follows: licensed nurseries, car lots, $10, smaller lots proportionate; unlicensed nurseries, ten per cent of invoice price shipment with minimum of 50 cents per package. Notice of shipment including list of stock and names of transportation company, consignor and consignee must be sent to the Chief, Division of Horticulture, Missoula, Mont., five days before shipment.

Nurserymen are required to pay an annual fee of $25 and file a bond of $1,000 in favor of the State of Montana; this includes licenses for all Montana agents. Agents for unlicensed nurseries must pay an annual fee of $10 and file bonds of $1,000.

Quarantines prohibit the entrance of the common barberry, black currant, five-leafed pine and currant and gooseberry plants.

GEORGE L. KNIGHT, *Chief, Division of Horticulture,* Missoula, Mont.

Nebraska. Non-resident nurserymen, dealers, or other persons wishing to ship nursery stock into Nebraska must file a duplicate certified copy of their original certificate with the State Department of Agriculture. If this certificate is approved by the Department of Agriculture, they will be issued a permit allowing them to ship nursery stock into this State during the period that such original certificate issued by the State in which they reside or are doing business is in force. No fee is charged for the non-resident dealer's or nurseryman's permit. Each shipment of nursery stock coming into the State must be plainly and legibly marked in a conspicuous place with a statement showing: (a) the name and address of the consignor; (b) the name and address of the consignee; (c) the general nature of the contents; (d) the name of locality where grown; and (e) a certificate of inspection from the proper official of the state, territory, district or country from which it was shipped. All agents selling nursery stock or soliciting orders for nursery stock for any nurseryman or dealer located either within or without the State of Nebraska shall be required to secure and carry an agent's permit. The fee for this permit is $1.00.

Any prohibited insect pest or plant disease, plant product or other substance or thing, brought into the State in violation of any regulation of the State Department of Agriculture or any Federal Quarantine, shall at the expense of the owner be either destroyed, returned to the consignor, or otherwise disposed of as the Department of Agriculture may direct.

H. J. McLAUGHLIN, *Secretary;* L. M. GATES, *Inspector,* State Department of Agriculture, Lincoln, Neb.

Nevada. All nursery stock entering the State must bear on each car, bale, or package a copy of a valid official inspection certificate, and names of consignor and consignee. Transportation companies shall not deliver nursery stock lacking such certificate.

Quarantine prohibits entry of any pine trees, currant or gooseberry plants or cuttings from east of the Mississippi River or from foreign countries, and of fruit trees, and fresh fruits and their boxes or containers, from any States infested by the Oriental fruit moth.

GEORGE G. SCHWEIS, *Director, Division of Plant Industry,* 7 Cladianos Building, Reno, Nev.

New Hampshire. All nursery stock entering this State must bear on each container a copy of a valid inspection certificate.

Quarantines prohibit the entrance of currants or gooseberries into any part of the State, except an area in the northernmost part of the State, beginning with the towns of Stratford, Odell, Millsfield and Errol; require permit for importation of any five-leafed pines, and special certificate from state of origin, in accordance with Federal regulations; prohibit entry of plants susceptible to attack by the European corn borer, the gipsy moth, and the browntail moth from infested regions into uninfested territory, except with proper certificate; prohibit entry of plants susceptible to attack of the satin moth from infested regions into uninfested territory.

W. C. O'KANE, *Deputy Commissioner of Agriculture,* Durham, N. H.

New Jersey. Shipments into the State must be accompanied by a certificate of inspection of current date, or copy thereof, attached to each car or parcel, together with a statement from the shipper that the stock therein is a part of the stock inspected, and stating whether such stock has been fumigated with hydrocyanic gas. It shall be the duty of all carriers to refuse for transportation within the State all stock not accompanied by a certificate of inspection. All stock coming into the State may be detained for examination, wherever found, by the Chief of the Bureau of Statistics and Inspection, and if found to be infested with any insects or plant diseases, injurious or liable to become so, will be destroyed.

It shall be the duty of every nurseryman, or other person who imports plant material of any kind from without the State, and every transportation company or other carrier for hire that brings plant material from without the State for delivery to any person, persons, firm, or corporation within the State, to notify the Chief of the Bureau of Statistics and Inspection of such shipment prior to, or within 24 hours after, its arrival. Such notice shall state the kind, the quantity of plant material, the name and address of the shipper, the date of shipment, and if from a foreign country, the name of the country or district in which the shipment originated, the port of entry, and the approximate date of arrival at said port. If the Bureau Chief has any reason to suspect the presence of a dangerous pest, he may order the examination of every package of such material, in transit or at the point of delivery, and shall not authorize its acceptance or delivery until he is satisfied that no dangerous pest is present.

HARRY B. WEISS, *Chief, Bureau of Statistics and Inspection,* State Department of Agriculture, Trenton, N. J.

New Mexico. Nurserymen in other States desiring to ship nursery stock into New Mexico must each file a copy of their certificate of inspection signed with pen by the proper official, with a filing fee of $5.00, and secure a permit-certificate bearing the facsimile signature of the Deputy Inspector, which must accompany each shipment of nursery stock into the State. With each permit-certificate granted, 100 tags will be supplied free of charge. Additional tags may be purchased at the following prices:

50 tags......$1.00	200 tags......$2.00
100 tags...... 1.25	500 tags...... 4.25

The following quarantines affect the shipment of nursery stock: Quarantine No. 7, white pines and Ribes; Quarantine No. 8, nursery stock, farm products, and forage crops.

R. F. CRAWFORD, *Plant Quarantine and Regulatory Office,* State College, N. M.

New York. Nursery stock cannot enter the State or be moved within the State unless a valid certificate is attached issued by the New York State Department of Agriculture and Markets, or by the State in which the shipment originated. Transportation companies and all persons bringing nursery stock into the State from other States, must send notice to the Department of Agriculture and Markets. Blanks will be furnished for such notices. An exact copy of the certificate must be attached to each package sent by mail. Stock received from abroad or from other States unaccompanied by a valid certificate of inspection must not be unpacked or distributed until after inspection or release by the Department of Agriculture and Markets.

Quarantines prohibit the entrance of five-leafed pine trees into the State except when such shipments comply with Federal Quarantine 63; also of Christmas trees and woody greens from New England except from those areas lightly or not infested by gipsy moth (Federal certificates must accompany shipments from the lightly infested area); of raspberry plants unless apparently free from mosaic diseases and are so certified after two inspections and the removal of all diseased plants, as is practiced in New York State. Currants and gooseberries cannot be grown in certain pine-growing areas of the State and permits must be obtained to ship them into the State. Name and address of consignee must be given in application.

B. D. VAN BUREN, *Director, Bureau of Plant Industry,* Department of Agriculture and Markets, Albany, N. Y.

North Carolina. Nursery stock may enter the State only when shipments bear North Carolina official permit tags, which will be supplied at cost on request, and the filing of a duplicate inspection certificate.

Quarantines prohibit the entrance of five-leafed pines and Ribes except in accordance with Federal regulations.

R. W. LEIBY, *Entomologist,* State Department of Agriculture, Raleigh, N. C.

North Dakota. Nursery stock entering the State must bear inspection certificates. Every person employing agents or salesmen or who solicits for the sale of nursery stock, must file a duplicate inspection certificate.

DIRECTOR, *North Dakota Agricultural Experiment Station,* Agricultural College, N. D.

Ohio. Out-of-state nurserymen must file copies of their inspection certificates and obtain an Ohio certificate permitting them to solicit orders for nursery stock. Each dealer within or without the State shall obtain annually a dealer's certificate, by furnishing an affidavit that he will buy and sell only inspected stock and will maintain with the Secretary of Agriculture a list of all sources from which he obtains nursery stock. Each affidavit shall be accompanied by a fee of $5.00. All agents soliciting orders for nursery stock shall file annually a statement that he will sell only inspected stock, and pay a fee of $1.00. He shall carry an agent's certificate and a copy of the certificate held by his principal.

Each shipment entering the State shall be accompanied by a tag or poster giving an exact copy of the valid certificate. Altered certificates are prohibited.

Quarantines prohibit the entrance or shipment within the State of the common barberry and its horticultural varieties, and the common host plants of the European corn borer.

E. C. Cotton, *Chief, Division of Plant Industry,* Department of Agriculture, Columbus, Ohio.

Oklahoma. Nursery stock entering the State must bear on each package of each shipment an inspection certificate. Nurserymen must each file a duplicate copy of their valid inspection certificate, and furnish a surety bond of $1,000 in favor of the State Board of Agriculture. A permit will be issued on payment of the fee of $5.00, and a copy of this permit must be attached to all shipments entering the State of Oklahoma.

All dealers within or outside the State must attach to each package of each shipment a copy of the dealer's certificate issued to them by the Board of Agriculture.

R. E. Montgomery, *State Nursery Inspector,* Oklahoma City, Okla.

Oregon. Shipments of nursery stock entering the State must be plainly marked, with names and addresses of both consignor and consignee, name of state, territory, or country where grown, and nature of contents. All shipments are inspected, and the unlicensed sale or distribution of nursery stock is unlawful. Nurserymen must apply for license and pay a fee of $15. The fee for an agent, solicitor, or salesman is $1.00.

Quarantines prohibit the entrance of grape vines; all species and varieties of chestnut and chinquapin; all hazel and filbert trees, plants, cuttings, and scions from the Eastern states; all species and varieties, including the flowering forms of peach, almond, nectarine, apricot, plum, cherry, quince, pear, and apple trees or parts thereof from the Eastern states.

Charles A. Cole, *Secretary,* State Board of Horticulture, Portland, Ore.

Pennsylvania. Each nurseryman from outside of the State must file with the Director of the Bureau of Plant Industry a duplicate copy of his valid inspection certificate, signed in person by the state inspection official in charge, and supply a statement giving the exact acreage of nursery stock he is growing, as well as the acreage being grown for him under contract. Upon compliance with these regulations a certificate is issued that must be received before stock is shipped into the State. Dealers are granted certificates on application and receipt of a statement from each that he will buy stock only from nurseries holding valid certificates of inspection. Agents soliciting for the sale of nursery stock in the State must obtain and carry agents' duplicate certificates. All shipments of nursery stock entering the State will be rejected unless accompanied by certificates of inspection.

Interstate quarantines regulate the entrance of Ribes, five-leafed pines, all barberry plants except Japanese barberry, and shipments of Christmas trees or woody greenery from the gipsy moth districts of New England and Canada.

R. H. Bell, *Director, Bureau of Plant Industry,* Harrisburg, Pa.

Rhode Island. All stock entering the State must bear a valid official certificate of inspection, but is subject to further inspection and may be destroyed or returned to the consignor if found infested. Agents must obtain agents' licenses, on stating where they expect to purchase their stock.

Five-leafed pines and Ribes can be shipped into the State or planted in certain parts of the State only on permission. Planting of black currant and flowering currant is prohibited.

A. E. Stene, *State Entomologist,* State House, Providence, R. I.

South Carolina. Each package of nursery stock entering the State must bear a permit tag of the South Carolina State Crop Pest Commission, which may be obtained at cost by filing a duplicate certificate of inspection and fumigation.

Quarantines prohibit the entrance of five-leafed pines, currants, gooseberries and all host plants of the European corn borer except when shipped in conformity with Federal regulations. Citrus stock is allowed to enter only by special permit. Fumigation of host plants of San José scale is required.

South Carolina State Crop Pest Commission, Clemson College, S. C.

South Dakota. Out-of-state dealers may obtain certificates permitting them to solicit and fill orders in the State, by filing with the Secretary of Agriculture a certified copy of their official inspection certificates and by paying a fee of $1.00 each. All agents shall likewise obtain and carry agents' certificates bearing copies of the certificates held by their principals, and paying fees of $1.00 each.

Quarantines prohibit the entrance of all five-leafed pines and Ribes; of all poplars and willows from areas infested by the satin moth; all host plants of the European corn borer.

Frank D. Kriebs, *Secretary of Agriculture,* Pierre, S. D.; R. W. Vance, *Nursery Inspector,* Brookings, S. D.

Tennessee. Out-of-state nurseries must file duplicate inspection certificates and the following agreement regarding fumigation:

"We, the undersigned, agree to fumigate with hydrocyanic acid gas, according to the required strength, all nursery stock subject to attack from San José scale and other dangerous insect pests. We also agree to attach a fumigation tag to each and every shipment going into the State of Tennessee."

Every shipment must bear a valid inspection certificate and a fumigation tag, and failure to comply with these requirements subjects the stock to confiscation.

Nursery agents and dealers must file sworn statements on official Tennessee blanks, which will be supplied. Each agent operating in Tennessee, and each dealer or jobber, is required to secure a license.

Nurserymen selling trees under contract to prune and spray the same for a period of years are required to take out a bond of $5,000 before selling trees under such special contract.

State quarantines prohibit the entrance of all varieties of barberry, except *Berberis thunbergii;* and all varieties of chestnut and chinquapin from all States where the chestnut blight occurs. Other restrictions apply to the Japanese beetle, the European corn borer, gipsy moth, sweet potato weevil and pink bollworm of cotton. Peach and pecan seedlings are allowed entrance only by special permit for experimental purposes.

G. M. Bentley, *State Entomologist and Plant Pathologist,* Knoxville, Tenn.

Texas. Nurserymen, florists, and others who desire to make shipments of nursery stock into Texas, should apply to the State Department of Agriculture, Austin, Texas, for a Texas permit. The application should be accompanied by a certified copy of certificate of inspection from the state inspector of the state in which the stock to be shipped is located, together with a registration fee of $5.00. The fee must be remitted in the form of postoffice money order, cashier's check, or bank draft. It will also be necessary for the applicant to sign an agreement to comply with the Texas regulations. The proper form for this signature will be sent upon request. Permits are issued annually and expire August 31 of each year. This general certificate does not cover citrus nursery stock. Any individual desiring to make shipments of citrus nursery stock into the State should communicate directly with the Commissioner of Agriculture.

All shipments of nursery or floral stock originating outside of the state must bear shipping tags showing the exact copy of certificate of inspection from the state inspector of the State in which the shipments originate; and in addition thereto must have tags showing the exact copy of the Texas permit. The Department of Agriculture does not furnish the Texas permit tags, and the shipper should have them printed from the original certificate. Common carriers are prohibited by law from releasing shipments of nursery stock that are untagged in accordance with these regulations.

Nurserymen and florists of all States who ship nursery and floral stock into Texas are requested to file with the Department of Agriculture a copy of invoice or memorandum of each and

every shipment of stock made into the State, giving the date, consignor, consignee, and a list of stock shipped. The price need not be given.

Those intending to ship orange and citrus seed of all kinds into Texas must furnish the Texas department with a certified statement from their state plant board that the seed was gathered from citrus-canker-free territory, and also an affidavit that the seeds to be shipped were treated in a corrosive sublimate solution of a strength of one to 1,000.

Agents or dealers operating in Texas for nurserymen and florists outside of the State must procure proper credentials from the nurserymen they represent. The form for this credential approved by the Commissioner of Agriculture is furnished free of charge. Each agent or dealer must be prepared to present such credentials at all times.

Dealers are classed as nurserymen and are required to take out permits. Greenhouses and greenhouse plants are included for inspection by the Texas laws.

J. S. Woodward, *Chief Nursery Inspector,* Department of Agriculture, Austin, Texas.

Utah. Out-of-state nurserymen must file with the Board of Agriculture a valid official inspection certificate and names of their agents in Utah, and obtain (without fee) an annual license; file a bond for $500 that they will comply with the law and to cover cost of inspection, fumigation, or destruction of stock shipped into the State or sold by their agents. Agents and salesmen representing out-of-state firms must carry proper credentials.

All nursery stock entering the State must bear a valid official inspection certificate and an official certificate that the shipment has been given a cyanide fumigation for 45 minutes at the rate of one ounce to each 100 cubic feet of enclosed space. Also a notice of each shipment giving duplicate invoice, list of contents, date, and names of both consignor and consignee must be mailed to the State Agricultural Inspector. Any out-of-state shipment not bearing the proper license and certificate tags will be placed in quarantine and inspected and disinfected at the owner's expense.

F. E. Stephens, *State Agricultural Inspector,* State Board of Agriculture, Salt Lake City, Utah.

Vermont. All nursery stock entering the State must bear valid official inspection certificates and the names and post office addresses of both consignor and consignee.

Quarantines restrict the free movement of raspberry plants on account of mosaic, leaf roll and rosette, hosts of the European corn borer, and all uninspected and non-nursery grown trees and forest products on account of the gipsy and brown-tail moths.

M. B. Cummings, *State Nursery Inspector,* Burlington, Vt.

Virginia. All nurseries must file valid inspection certificates with the State Entomologist for the current season and pay a registration fee of $10 for principals; duplicates for agents' use, $1.00 each. Checks should be made payable to the *Treasurer of Virginia.* Official state tags purchased from the State Entomologist must accompany each package of stock entering the State. Registration certificates expire annually on August 31.

Christmas greens originating in the States of Maine, New Hampshire, Massachusetts, Vermont, Connecticut and Rhode Island are prohibited on account of the gipsy and brown-tail moths, unless each shipment is accompanied by a certificate showing that it has been inspected officially and found to be free from such pests. Japanese beetle quarantine covers several small areas and conforms with the Federal quarantine.

G. T. French, *State Entomologist,* Department of Agriculture, Room 1112, State Office Building, Richmond, Va.

Washington. No person, firm or corporation shall sell, solicit sales, or distribute nursery stock except berry plants, without first obtaining a license to do so from the Director of Agriculture. The license fee is $5.00 for nurserymen who grow all the stock they sell, $15 for other nurserymen, dealers, brokers and landscape architects, and $1.00 for agents, salesmen and solicitors. All licenses expire July 1. All nursery stock entering the State shall have contents, names and addresses of consignor and consignee, and name of state, territory, or country where the stock was grown, plainly marked on each car, box, bale or package. The State is divided into eleven horticultural districts with an inspector-at-large in charge of each district. Notice must be sent to one of these inspectors of any shipments arriving without the proper license certificate or labels, and the said inspectors are authorized to inspect such shipments and charge such fees as may be fixed by the Director of Agriculture.

Quarantines prohibit the entrance of five-leafed pines, currants, gooseberries, chestnut, chinquapin, hazel, filbert, and carriers of the European corn borer, peach yellows, and Oriental fruit moth.

George E. Harter, *Supervisor of Horticulture,* Olympia, Wash.

West Virginia. All nursery stock entering the State must bear a valid certificate of inspection and a West Virginia permit tag. No nursery stock shall be sold, offered for sale or delivered, without first obtaining from the Commissioner of Agriculture a certificate of registration; annual fee, $20.

W. E. Rumsey, *State Entomologist,* Morgantown, W. Va.

Wisconsin. Each out-of-state nurseryman must file a valid certificate of inspection and obtain a State license before shipping stock into the State. Each car, or package, must bear certificate tags. Each agent selling nursery stock in the State must carry an agent's duplicate certificate bearing the same number and date as that of his principal. No fees are charged except for resident nurserymen.

Quarantines prohibit entrance of all five-leafed pines and all barberry bushes, except Japanese barberry, and host plants of European corn borer from infested areas; nursery stock from gipsy moth infested areas except under Federal certificate; cranberry plants; raspberry plants unless certified to a special inspection for virus diseases.

E. L. Chambers, *State Entomologist,* Madison, Wis.

Wyoming. Each out-of-state nurseryman must file a valid certificate of inspection and deposit a fee of $15 and receive a license valid until the following July 1. Authorized shipping tags are furnished at cost, and carriers are forbidden to deliver unless each shipment bears such a tag.

Quarantines prohibit entrance of all five-leafed pines, currants and gooseberries.

A. G. Stephens, *State Department of Agriculture,* Cheyenne, Wyo.

OFFICERS IN CHARGE OF INSPECTION AND QUARANTINE SERVICE

Alabama ....B. P. Livingston, Chief, Division of Plant Industry, Montgomery, Ala.
Arizona ....O. C. Bartlett, State Entomologist, Phoenix, Ariz.
Arkansas ....P. H. Millar, Chief Inspector, Little Rock, Ark.
California ....A. C. Fleury, Senior Quarantine Supervisor, Sacramento, Cal.
Colorado ....C. P. Gillette, State Entomologist, Fort Collins, Colo.
Connecticut ......W. E. Britton, State Entomologist, New Haven, Conn.
Delaware ....Ralph C. Wilson, Secretary, State Board of Agriculture, Dover, Del.
Florida ....Nursery Inspector, State Plant Board, Gainesville, Fla.
Georgia ....M. S. Yeomans, State Entomologist, Atlanta, Ga.
Idaho ....M. L. Dean, Director, Bureau of Plant Industry, Boise, Idaho.
Illinois ....P. A. Glenn, Chief Inspector, Division of Plant Industry, Urbana, Ill.
Indiana ....Frank N. Wallace, State Entomologist, Indianapolis, Ind.
Iowa ....Carl J. Drake, State Entomologist, Ames, Iowa.
Kansas ....W. R. Martin, Secretary, Entomological Commission, Topeka, Kans.
Kentucky ....W. A. Price, State Entomologist, Lexington, Ky.
Louisiana ....W. E. Anderson, State Entomologist, Baton Rouge, La.
Maine ....Robert F. Chandler, State Horticulturist, Augusta, Me.
Maryland ....E. N. Cory, State Entomologist, College Park, Md.
Massachusetts ....R. H. Allen, Director, Division of Plant Pest Control, State House, Boston, Mass.
Michigan ....E. C. Mandenberg, In Charge of Orchard and Nursery Inspection, Department of Agriculture, Lansing, Mich.
Minnesota ....A. G. Ruggles, State Entomologist, University Farm, St. Paul, Minn.
Mississippi ......Geo. F. Arnold, Nursery Inspector, Agricultural College, Miss.
Missouri ....K. C. Sullivan, Plant Commissioner, Jefferson City, Mo.
Montana ....George L. Knight, Chief Division of Horticulture, Missoula, Mont.
Nebraska ....H. J. McLaughlin, Secretary; L. M. Gates, Inspector, State Department of Agriculture, Lincoln, Nebr.
Nevada ....George G. Schweis, Director, Division of Plant Industry, 7 Cladianos Building, Reno, Nev.
New Hampshire ..W. C. O'Kane, Deputy Commissioner of Agriculture, Durham, N. H.
New Jersey ......Harry B. Weiss, Chief, Bureau of Statistics and Inspection, State Department of Agriculture, Trenton, N. J.
New Mexico .....R. F. Crawford, Plant Quarantine and Regulatory Office, State College, N. Mex.
New York ....B. D. Van Buren, Director, Bureau of Plant Industry, Department of Agriculture and Markets, Albany, N. Y.
North Carolina ..R. W. Leiby, Entomologist, State Department of Agriculture, Raleigh, N. C.
North Dakota ....Director, Experiment Station, Agricultural College, N. D.
Ohio ....E. C. Cotton, Chief, Division of Plant Industry, Department of Agriculture, Columbus, O.
Oklahoma ....R. E. Montgomery, State Nursery Inspector, Oklahoma City, Okla.
Oregon ....Charles A. Cole, Secretary, State Board of Horticulture, Portland, Ore.
Pennsylvania .....R. H. Bell, Director, Bureau of Plant Industry, Harrisburg, Pa.
Rhode Island .....A. E. Stene, State Entomologist, State House, Providence, R. I.
South Carolina ...South Carolina State Crop Pest Commission, Clemson College, S. C.
South Dakota ....Frank D. Kriebs, Secretary of Agriculture, Pierre, S. D.
R. W. Vance, Nursery Inspector, Brookings, S. D.
Tennessee ....G. M. Bentley, State Entomologist and Plant Pathologist, Knoxville, Tenn.
Texas ....J. S. Woodward, Chief Nursery Inspector, Department of Agriculture, Austin, Tex.
Utah ....F. E. Stephens, State Agricultural Inspector, State Board of Agriculture, Salt Lake City, Utah.
Vermont ....M. B. Cummings, State Nursery Inspector, Burlington, Vt.
Virginia ....G. T. French, State Entomologist, Richmond, Va.
Washington ......George E. Harter, Supervisor of Horticulture, Olympia, Wash.
West Virginia ....W. E. Rumsey, State Entomologist, Morgantown, W. Va.
Wisconsin ....E. L. Chambers, State Entomologist, Madison, Wis.
Wyoming ....A. G. Stephens, State Department of Agriculture, Cheyenne, Wyo.
Federal Quarantines and District of Columbia ...Plant Quarantine and Control Administration, U. S. Department of Agriculture, Washington, D. C.
Dominion of Canada ....L. S. McLaine, Secretary, Destructive Insect and Pest Act Advisory Board, Department of Agriculture, Ottawa, Can.

Circular 72 July 15, 1930

Connecticut Agricultural Experiment Station

New Haven

QUARANTINE REGULATIONS AFFECTING THE TRANSPORTATION OF NURSERY STOCK IN CONNECTICUT

W. E. Britton

Six pests in Connecticut are now the subjects of State quarantines and five of them are covered by Federal quarantines which nearly coincide with the State quarantines. As each of these quarantines affects in some measure the shipment and transportation of nursery stock between points within Connecticut or to points outside the State, every nurseryman should be familiar with their chief provisions and requirements. This circular has been prepared to supply this information in simplified form for the convenience of Connecticut nurserymen.

Present State Quarantines

Pest	State quarantine	Federal quarantine	Remarks
Gipsy moth..........	14	45	State and Federal quarantines coincide.
Satin moth..........	19	53	" " " " "
European corn borer..	24	43	" " " " "
Japanese beetle......	20	48	Federal quarantine covers entire State. State quarantine covers generally infested area.
Asiatic beetle........	22	..	No Federal quarantine. State quarantine on small areas in New Haven and West Haven.
White pine blister rust ..	*	63	Entire State covered by Federal quarantine.

* State quarantines exist only around ten nurseries attempting to grow white pines. See Circular 70.

In all except the satin moth quarantine, special certificates are required, and the following pages show where to apply for inspection and certification. The Federal satin moth quarantine prohibits transporting or shipping poplar and willows outside of the quarantined area. The maps show the areas now under quarantine.

GIPSY MOTH

The gipsy moth quarantine, State and Federal, covers the eastern two-thirds of the State and includes two areas, known as generally infested and lightly infested, as shown on the

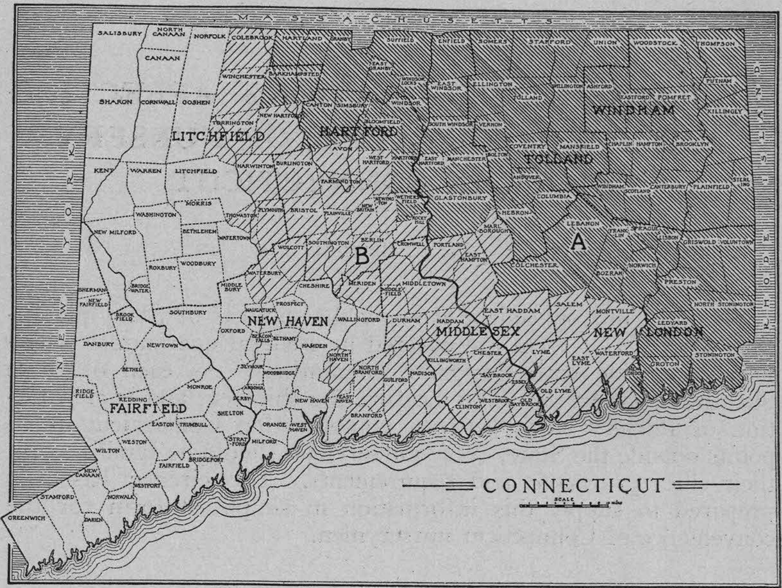

FIGURE 13. Map of Connecticut showing present quarantined areas. A, generally infested; B, lightly infested.

accompanying map, Figure 13. All shipments of woody field grown nursery stock to be moved from the generally infested area into the lightly infested area and from both areas into the free area must have a special gipsy moth inspection and certificate. For the most part, these inspections are made and the certificates granted by Federal inspectors in immediate charge of Dr. J. N. Summers, 408 Atlantic Ave., Boston, Mass. The inspectors working in Connecticut are as follows:

W. H. SHINKWIN, Box 260, telephone 46, Westfield, Mass., covers the towns of *Suffield, Windsor* and *Windsor Locks,* in Hartford County.

C. M. EMERSON, Box 109, telephone 8-1119, Hartford, remainder of *Hartford County, Middlesex County,* all towns in *Litchfield* and *New Haven Counties* under quarantine, *Colchester, Lyme* and *Old Lyme* in New London County and *Somers, Ellington, Bolton* and *Hebron* in Tolland County.

W. J. AHEARN, Box 63, telephone 4388, Westerly, R. I., the towns of *East Lyme, Waterford, New London, Stonington* and *North Stonington.*

J. F. KEOUGH, 54 Moulton Court, telephone 1395, Willimantic, *Windham County* and the remaining towns in *New London* and *Tolland Counties.*

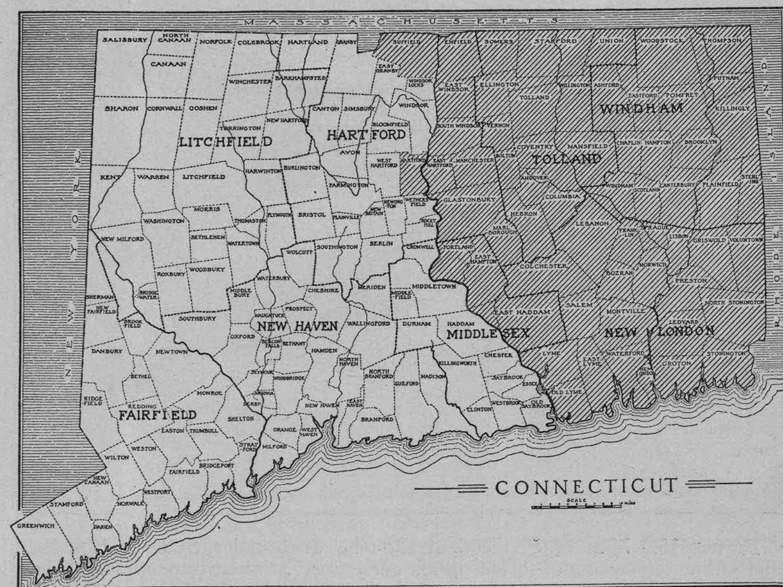

FIGURE 14. Map of Connecticut. Shaded portion is now under State and Federal quarantine on account of the satin moth.

SATIN MOTH

The satin moth caterpillars feed upon willow and poplar and pass the winter in inconspicuous cases in the crevices of the bark. On account of the great difficulty in detecting the presence of these cases, such stock will not be certified. The accompanying map, Figure 14, shows that the area quarantined includes all towns in Connecticut east of the Connecticut River and the towns of Hartford and Suffield west of the river. As other towns have been found infested, the quarantined area will probably soon be extended. Willow and poplar trees are not allowed to move out of this area.

EUROPEAN CORN BORER

This quarantine concerns nurserymen in that all cut flowers and entire plants of chrysanthemum, hollyhock, aster, cosmos, zinnia,

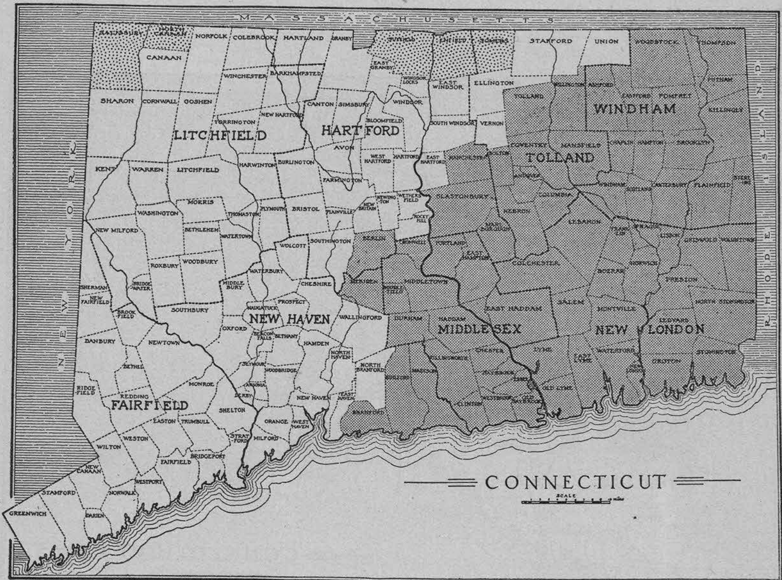

FIGURE 15. Map of Connecticut showing area under State and Federal quarantine on account of European corn borer. Shaded portion at right represents the two-generation area, and is part of the larger infestation extending over Rhode Island, eastern Massachusetts, New Hampshire and southwestern Maine. Lighter shaded portions in northwestern and north central part of the State represent the one-generation area, and are part of the large infestation of western Massachusetts, New York and westward.

gladiolus and dahlia, except gladiolus and dahlia bulbs without stems, must have certificates throughout the year in order to be moved from the two-generation area in eastern Connecticut, shown on the accompanying map, Figure 15.

For inspections and special certificates, apply to T. M. CANNON, 225 Trumbull St., telephone 6-1202, Hartford.

JAPANESE BEETLE

The entire State is now under Federal quarantine on account of this insect, and all shipments of nursery stock going into the free area must bear special certificates. A double row of towns along the coast in Fairfield and New Haven Counties as far east as the Branford line are under State quarantine and the same territory is designated in the Federal quarantine as the "generally infested area." Certificates are required on shipments to other towns in the State, called the "lightly infested area." See Figure 16.

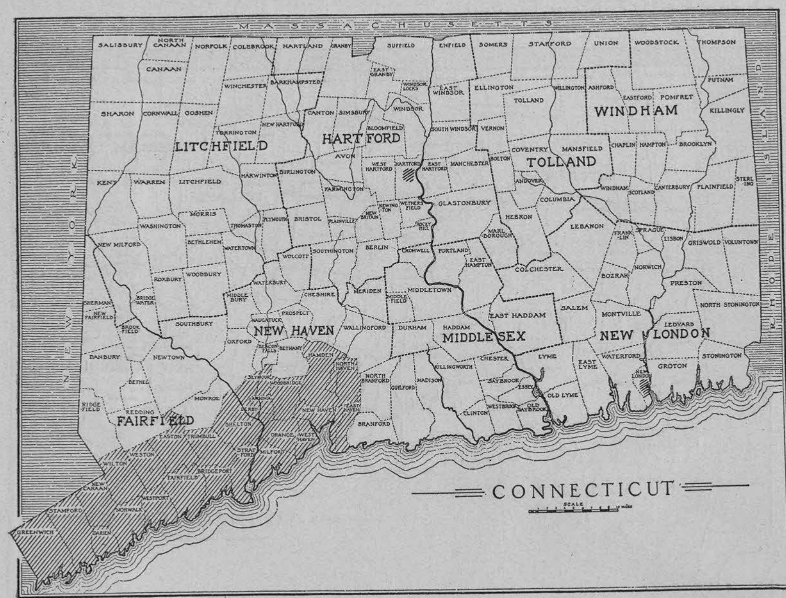

FIGURE 16. Map of Connecticut. Shaded areas indicate territory quarantined by the State on account of the Japanese beetle, and designated as the "generally infested area" in the Federal quarantine. Rest of the State is the "lightly infested area."

For inspections and certificates apply to J. PETER JOHNSON, Pierpont Building, telephone Derby 2974, Shelton, Conn.

ASIATIC BEETLE

The Federal quarantine against this insect has now been removed, but the State quarantine is still maintained on the following areas in New Haven and West Haven:

Westville area: Bounded by Whalley Avenue, Blake Street, Fitch Street, Dyer Street, Crescent Street, Whalley Avenue, Ellsworth Avenue, Derby Avenue, Boulevard, Oak Street, Forest Road, Florence

Avenue from a point about 400 feet west of Forest Road in a straight line northward to West Prospect Street to Whalley Avenue, and all territory within these boundaries, being partly in New Haven and partly in West Haven.

West Haven area: Bounded by Center Street, New Haven Harbor, Jones Street and in a straight line to Atwater Street and Campbell Avenue.

All nursery stock sent out of these areas must bear certificates.

For inspection and certificates, apply to W. E. BRITTON, *State Entomologist,* Connecticut Agricultural Experiment Station, telephone 5-6192, New Haven.

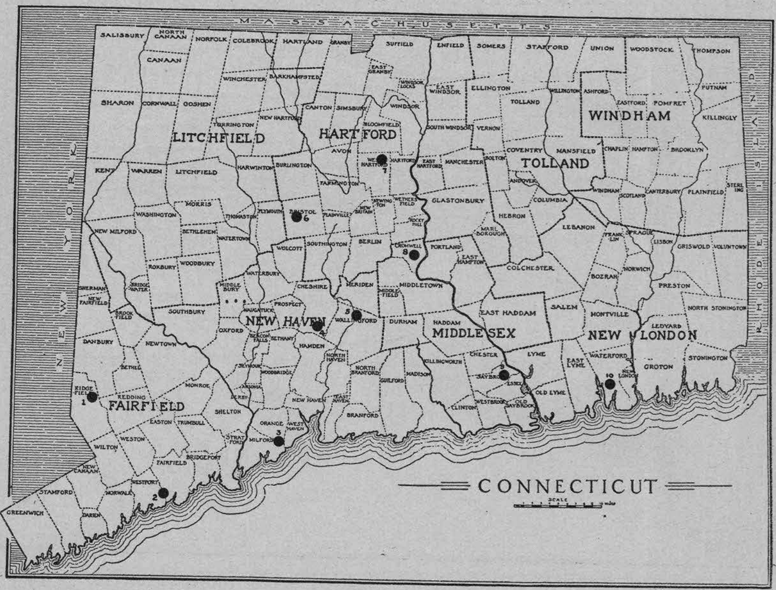

FIGURE 17. Map of Connecticut. Black dots indicate location of Nursery Sanitation Zones, within which no currants or gooseberries may be grown.

WHITE PINE BLISTER RUST

Connecticut has legally established control areas around ten nurseries so that five-leafed pines can be grown in blister rust free areas, the location of which are shown on the map, Figure 17. Five-leafed pines may be shipped out of the New England States and New York only when grown from seed in an area declared officially to be free from Ribes. Federal Quarantine 63 has recently been revised to permit the shipment of five-leafed pines anywhere within the region including the New England states and New York, but before this can be done, it is necessary to procure

control area permits (Federal form 415) for the shipment of Ribes and five-leafed pines. The European black currant is outlawed and no permits will be issued for this species.

For control area permits in Connecticut give name and address of consignee, with number of plants of each variety, and apply to W. E. BRITTON, *State Entomologist,* Agricultural Experiment Station, telephone 5-6192, New Haven.

For inspections of Ribes and pines to determine blister rust conditions and for the establishment of Ribes free areas, apply to J. E. RILEY, JR., Agricultural Experiment Station, telephone 5-6192, New Haven.